



STATE OF
MINNESOTA
DEPARTMENT OF NATURAL RESOURCES



DNR INFORMATION
(612) 296-6157

500 LAFAYETTE ROAD • ST. PAUL, MINNESOTA • 55155-40 25

January 8, 1990

Dear concerned citizen:

Enclosed are the plans for wildlife species and native prairies in Minnesota. These plans follow the same format as those for our fish management program that were released in July of 1987. The plans were developed by our natural resource managers and reviewed by all of the divisions of the Department of Natural Resources. Commissioner Alexander and I would like you to review and comment on them.

Establishing goals and objectives, identifying the problems that stand in the way of obtaining the objectives, and the strategies to address the problems is a part of our planned management system, done in partnership with you, the shareholders in the great state of Minnesota. Planning, as put forth in these documents, is extremely important for the survival of our fish, wildlife and native plant resources.

The plans were written by resource professionals, among whom there was dissension at times, just as there is in any diverse group tackling such a large job. Now we need help from you, or the group you represent, in reviewing the plans. You have a special knowledge and understanding that we need to be sure we are on the right track. Good management direction at this time will assure the well being of these natural treasures for future generations and set the direction for resource management under the Reinvest In Minnesota and Environmental Trust Fund programs.

We don't expect everyone, or every group, to read and comment on all of the plans. Pick one, or a few that really interest you, or your group, and let us have your ideas. The comment period extends from now until July 1, 1990. Each comment will be reviewed individually and the plans changed as needed.

Please use the form at the end of each plan or send a letter with your comments to the Fish and Wildlife Planning Team, Ecological Services, Box 25, 500 Lafayette Road, St. Paul MN 55155-4025 . Comments are still being accepted on the plans for fish management that were distributed in the summer of 1987.

You may obtain additional copies of specific fish, wildlife or native plant plans by writing to the above address or you may call 296-6175 from the Twin Cities area or 1-800-652-9747 from greater Minnesota and ask for the Department of Natural Resources.

The fish plans are numbered from 1 to 15 and the wildlife plans are numbered consecutively from 16 to 37 and then skip to number 51. The gap from 37 to 51 will contain plans relating to habitats that are currently being written and reviewed by department staff. Plan number 51, for sandhill crane, was added after the numbering guideline was in place because of public interest. The plan for elk, number 19 in the series, will be released later in 1990. Write or call the planning team if you want a copy of the elk plan when it becomes available.

Thanks to each of you for taking an active part in this important planning process. By commenting on these plans you help us identify the important issues facing fish, wildlife and native plant resources and provide your insight into their management. With this type of teamwork we can be made fully aware of each others insights, concerns and expectations regarding our natural resources.

Yours truly,



Larry Shannon, PhD
Director
Division of Fish and Wildlife

file: wildl plan intro 6



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Larry Shannon, PhD
Director
Division of Fish and Wildlife

file: wildl plan intro 6

ECOLOGICAL SERVICES
MINNESOTA DIVISION OF FISH & WILDLIFE

500 Lafayette Road
St. Paul MN 55155-4025
612-296-2835

Date: January 8, 1990

To: Recipients of Volume 2, Draft Long Range Planning Documents

From: Fish and Wildlife Planning Team

Subject: Volume 2, Long Range Planning Documents

This package contains the public review drafts of the long range planning documents for wildlife and native plant management by the Division of Fish and Wildlife, Minnesota Department of Natural Resources. Similar plans for fisheries were distributed in 1987, along with the notebook "Volume 1, Draft Long Range Planning Documents." This issue, "Volume 2, Draft Long Range Planning Documents" contains the preliminary drafts of the management plans for wildlife and native plants. After review and comment by everyone concerned, the plans will be revised and prepared for implementation.

To cover changes in personnel, mailing addresses and the like, this package contains some materials of a general nature that were included with the fish plans in 1987. In addition to the plans, there is a letter from Director Shannon, definitions of terms used in the planning process and a map of the regional wildlife administrative boundaries that are referred to in many of the plans. Dividers for the wildlife and native plant plans were sent with Volume 1.

Questions regarding the planning documents or the planning process can be addressed to:

Fish and Wildlife Planning Team
Minnesota Department of Natural Resources
500 Lafayette Road
St. Paul MN 55155-4025

or by telephone at 612-296-4835.

Additional copies of individual plans are available from the planning team.

file: vol 2 plan memo



PREFACE

The Department of Natural Resources cannot afford to be complacent about the quality of Minnesota's biological environment. We have been entrusted with managing vital natural resources for the benefit of all Minnesotans, now and in the future. We must anticipate that future and plan appropriately for the stewardship of Minnesota's natural heritage.

This document is a representation of the Department's vision of the future for fish, wildlife, and native plant resource management. We foresee a variety of opportunities for improving our management and encouraging more enjoyment of these resources in the future. With the continuing support of our citizens and dedication of our professional managers, the Department of Natural Resources will be able to fulfill its mission and reach its goals for the management of Minnesota's fish, wildlife, and native plant resources.



Joseph N. Alexander
Commissioner
Minnesota Department of Natural Resources



FOREWORD

The new comprehensive planning process being developed by the Minnesota Department of Natural Resources, within its Division of Fish and Wildlife, represents a major step toward improving state agency operations. The planning process will improve the identification of resource management priorities, the allocation of organizational resources, and the evaluation of management effectiveness. The process also will expand opportunities for public participation in fish, wildlife, and native plant resource management.

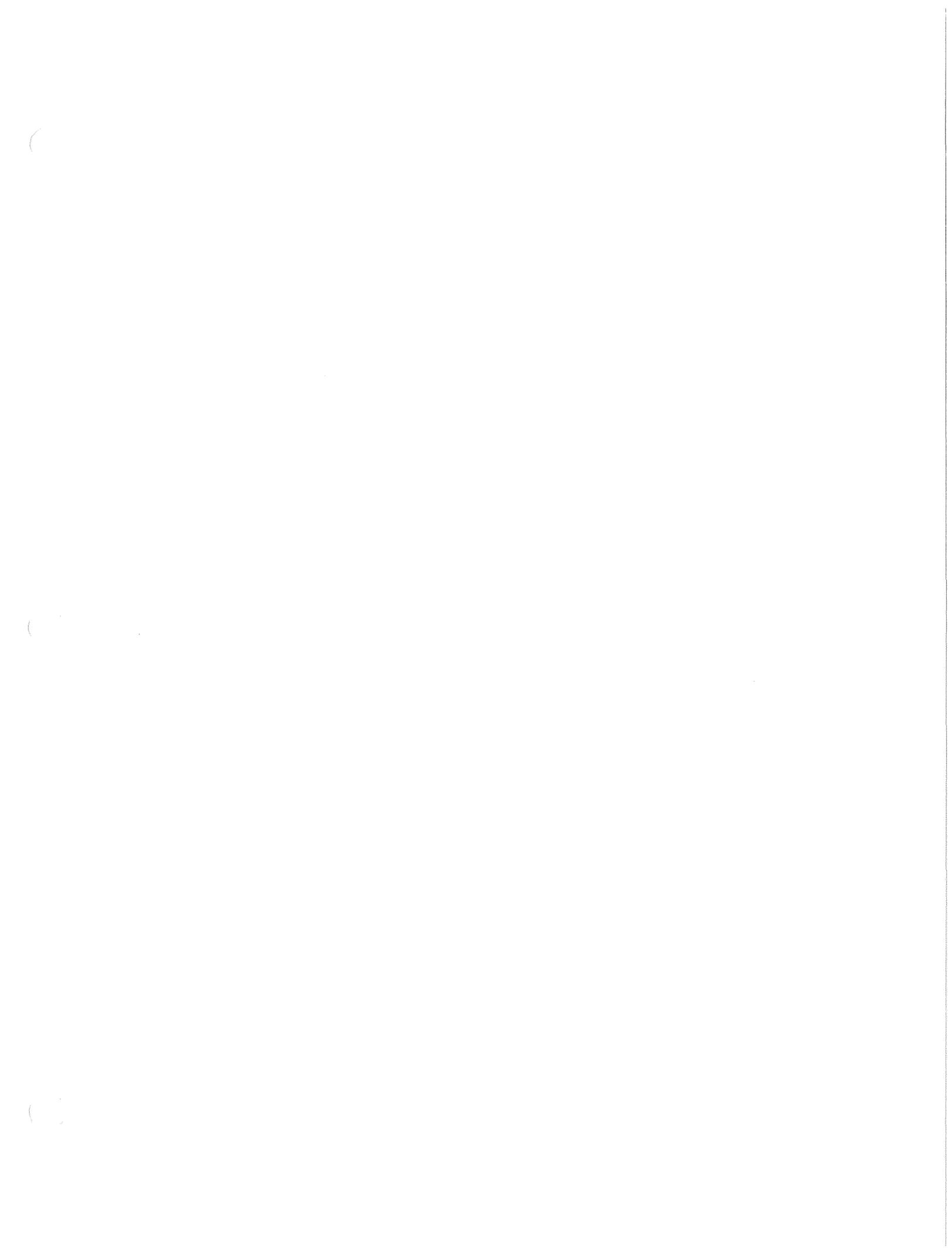
Strategic planning is a crucial element in the new comprehensive planning process. It focuses attention on the future and helps clarify the direction for fish, wildlife, and native plant resource management. By anticipating the future, we can capitalize on opportunities to improve our management and expand public enjoyment of Minnesota's bountiful natural resources.

This document presents the results of the initial strategic planning effort. Many individuals contributed time and energy to developing this Strategic Plan. We appreciate their efforts and encourage them to continue thinking strategically.

We look forward to the challenges ahead.



Larry R. Shannon, Ph.D.
Director
Division of Fish and Wildlife
Minnesota Department of Natural Resources



Acknowledgements

The Minnesota Legislature, through the Legislative Commission on Minnesota Resources, has been instrumental in supporting the development of a new comprehensive planning process within the Division of Fish and Wildlife, Minnesota Department of Natural Resources. The Division and the Department gratefully acknowledge their support.

The U.S. Department of the Interior, through the Fish and Wildlife Service, also has provided substantial support for developing the comprehensive planning process. The Fish and Wildlife Service has provided an experienced planning consultant to help with initiating the process. In addition, the Service has provided funds for reimbursement of some planning costs under their Federal Aid program. The Division and the Department gratefully acknowledge their support.

A special acknowledgement is extended to Spencer Amend, the planning consultant from the Western Energy and Land Use Team, U.S. Fish and Wildlife Service. His enthusiasm and dedication have been an inspiration. His insights and experience have been invaluable. The Division and the Department gratefully acknowledge Spencer's contributions.

Many interested citizens have reached out to become a part of the Division's new planning process. Their involvement is vital. The Division and the Department appreciate their concern and their contribution to the planning process, and encourage their continued participation.

Many individuals within the Division and the Department have contributed time and energy to this new planning effort. Their continued dedication and commitment will ensure the success of this process. The leadership of the Division and the Department recognize and appreciate the quality and excellence of DNR personnel.

This document has been developed and printed pursuant to Chapter 13, Section 31, Subdivision G, Laws of Minnesota for 1985 First Special Session.

Funding for the Fish and Wildlife Comprehensive Planning Project has been provided by:

Legislative Commission on Minnesota Resources (LCMR);

Federal Aid for the Restoration of Sport Fisheries and Wildlife Project FW-10-P, and:

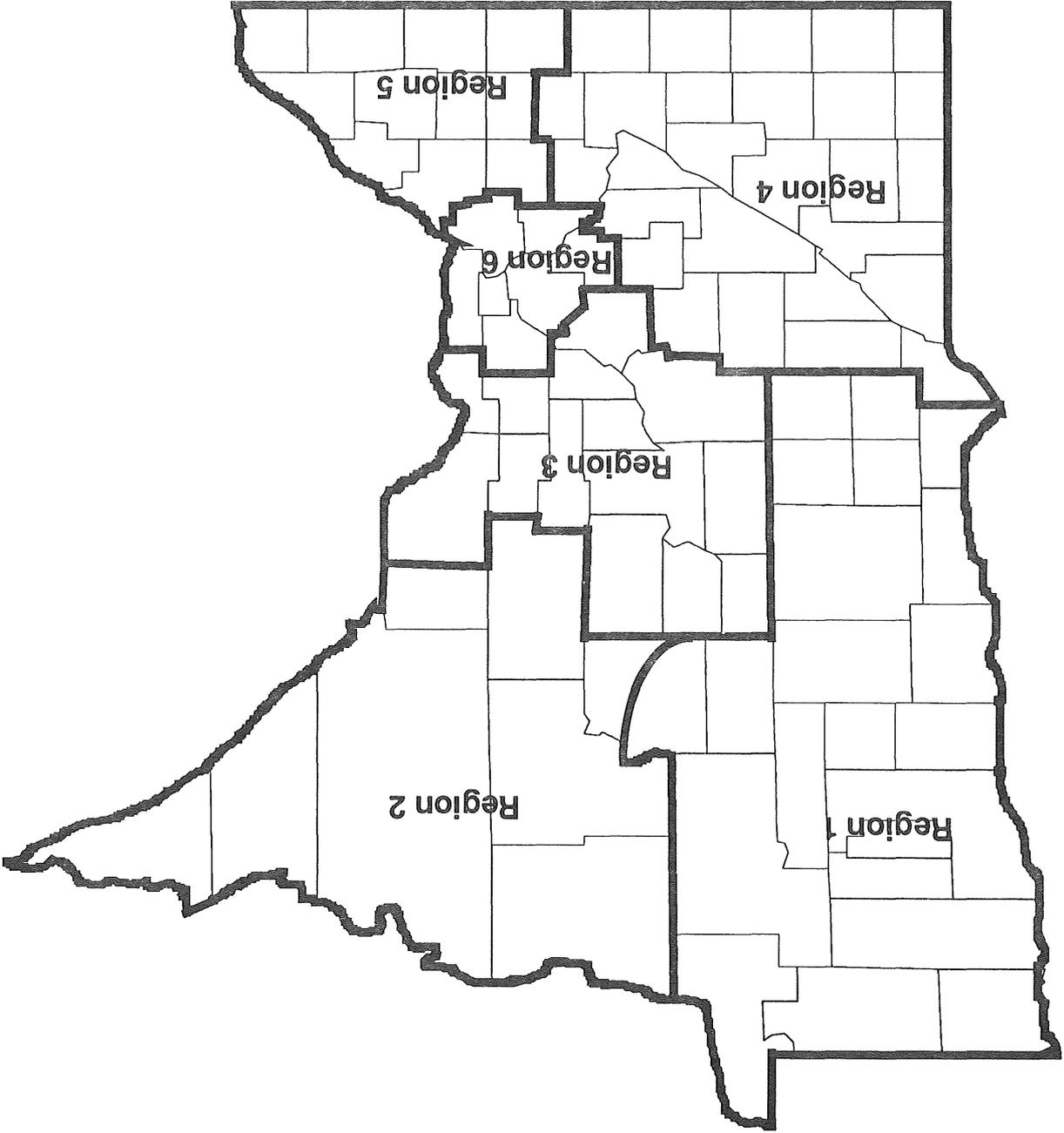
Division of Fish and Wildlife, Minnesota Department of Natural Resources.

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Administrative regions for the Section of Wildlife, 1985.
Minnesota Department of Natural Resources.



16. Black Bear

Black bears (Ursus americanus) once occupied much of Minnesota, including some isolated woodlands within the prairie. In northwestern Minnesota, black bears apparently coexisted with grizzlies until the early 1800s. Grizzlies have since been extirpated; and agricultural, industrial and urban encroachment has reduced the range of the black bear. Today these bears inhabit the northern third of Minnesota (Figure 16-1); their primary range encompassing approximately 30,000 square miles.

The black bear is the only big game animal that once occurred throughout the continental United States and Canadian provinces. Today it is found in 40 states, 9 provinces and 2 territories, although populations in many of the areas are small and isolated. Bears are hunted in 28 states, but only 20 states have an annual harvest of more than 50 bears. The number of bears taken by sport hunters in Minnesota is exceeded in only 5 other states.

MANAGEMENT HISTORY

Until recently, bears in Minnesota were regarded mainly as a nuisance. The first legislation protecting bears, no hunting from March 1 to October 15 was passed in 1917, but was repealed in 1919. Various restrictions on hunting and trapping bears were applied and subsequently rescinded from 1923 to 1943. In 1945 a bounty was established on bears.

During the following 5 years, more than 1,700 bears were killed for bounty. By the early 1960s, the average bounty kill had dropped to 7 bears per year. This decrease is attributable to changes in bounty laws, from a bounty on all bears to a county option on only those doing damage. All wild animal bounties paid by the state in Minnesota were discontinued in 1965.

In 1954 bears were protected in extreme northeastern Minnesota because of their value as a tourist attraction. Bear hunting was legal there only during the fall deer seasons for hunters possessing a deer hunting license. Deer hunters killed an average of 146 bears annually, statewide, from 1956 to 1970.

In 1971 the Minnesota state legislature established bear as a big game animal and authorized a hunting season and license. Since then, the bear season has run from early September through mid- or late October. Bear could be taken on a deer license during the November firearms deer seasons until 1979, and could be taken on a deer bow and arrow license during part of the archery season until 1980. Bear hunting on a deer license was discontinued as an effort to reduce the total harvest.

During the 1970s, bear harvests during the firearms deer season remained fairly constant with an average of 141, but harvests during the bear season steadily increased. In 1981, 11,429 bear hunting licenses were issued and 1,359 bears were registered. The actual harvest, adjusted for noncompliance in registration, was probably near 1,800, of which more than 50% were females. The high harvest and high percentage of females taken in 1981 was believed excessive and the eight-fold increase in hunters from 1971 to 1981 was cause for concern.

RESOURCE MANAGEMENT

Various restrictions on bear hunting were implemented in 1981, such as a later opening date, a shorter season in

the northeast, a shorter baiting period before the season and an increased minimum hunting distance from dumps. These measures failed to curtail the harvest to an acceptable level. To reduce the number of hunters, a limited permit system was authorized by the state legislature and instituted by the Minnesota Department of Natural Resources in 1982.

Five bear management units were established, and the quota of hunting permits allocated in each unit was determined from estimates of bear density, sustainable harvest rate and hunting success in each area. This system remains in effect, although the 5 management units were subdivided into 8 in 1986 to better control hunter distribution. These areas might be modified further so that more hunting effort can be directed to underutilized areas and areas with persistently high levels of nuisance activity. Hunting effort also can be reduced in areas where bear numbers are low.

This permit system is an effective means for managing bears in Minnesota, but it requires reliable information regarding trends in bear numbers, rates of reproduction, rates and causes of nonhunting mortality, numbers of hunters and hunting success. Research and surveys are necessary to obtain this information. Two intensive research projects utilizing radio-telemetry have been used to investigate the population dynamics of bears. One, conducted under the auspices of the University of Minnesota and the U.S. Forest Service, obtained data from bears on the Canadian Shield in northeastern Minnesota. The other, being conducted by the Minnesota Department of Natural Resources, is obtaining population data from an area in north-central Minnesota. The Minnesota Department of Natural Resources employs several surveys to gain a broader perspective on bear abundance, distribution and population trends.

Minnesota Department of Natural Resources
radio-telemetry study and statewide surveys also examine

bear habitat use. The results of these investigations will be used to make recommendations regarding land use practices to improve the quality of bear habitat. Presently there is little effort directed at managing habitat in Minnesota explicitly for bears, but the extensive manipulations that improve habitat for white-tailed deer likely create more favorable bear habitat.

Habitat improvement for bears is considered unnecessary by many people who consider bears a nuisance and would like to see fewer of them. However, habitat improvement could reduce nuisance activity by increasing the abundance and diversity of natural foods for bears. Better habitat would also increase bear reproduction, enabling more bears to be harvested.

Nuisance Bear Management

When the availability of natural foods is low, bears are attracted to human-related sources of food, where they frighten people and sometimes cause damage to property. Shortages of natural bear foods, especially berries and nuts, are more common in Minnesota than in most other states. Such food shortages are neither predictable nor preventable and may be highly localized. Many people living in areas occupied by bears do not properly dispose of their garbage or protect crops and livestock. These practices attract bears that may damage their property.

Bear nuisance activity can be alleviated by removing or protecting the human-related sources of food attractive to bears or by removing the offending bears. During high nuisance years, Minnesota Department of Natural Resources conservation officers and wildlife managers may spend nearly 4,000 hours and drive more than 25,000 miles to investigate nuisance bear activity and to trap and relocate nuisance bears.

Although considerable effort is directed at moving nuisance bears, there are no restrictions on killing bears to protect private property. Each year many nuisance bears are killed because they damage property or are perceived as a threat to property or people. In recent years, more nuisance bears were killed in Minnesota (100 to 350 reported annually) than in any other state. At least 80% of the nuisance bears destroyed are killed by private citizens.

The high nuisance kill is attributable largely to the following; 1) expansion of seasonal residential development in many areas with bear populations, 2) the lack of effort in protecting property from bears, 3) the perception people have that bears are inherently dangerous, 4) a shortage of traps and manpower for translocating nuisance bears, 5) an ineffective system for using licensed hunters to harvest nuisance bears and 6) a high density of bears in some areas.

RESOURCE ANALYSIS

Supply

It is difficult to estimate the number of bears in a large forested area. Based on telemetry studies, bear density in northeast and northcentral Minnesota is about 1 bear per 2.5-3.0 square miles. Extrapolating these results to other parts of the state and adjusting for differences in habitat, the population, excluding cubs, within the primary range is estimated at about 8,000 bears. The number of bears estimated to occupy each Department of Natural Resources management unit is shown in Table 16-1.

Since instituting the hunting license quota in 1982, the state bear population seems to be increasing. Hunting success and the number of bears killed per hunter-day have increased markedly. Improved hunting methods and variations in natural food availability may have contributed to the

increased harvest, but the cause was most likely the increasing number of bears. The increase in bear density from 1982 to 1985 was documented on the Minnesota Department of Natural Resources bear study area.

Table 16-1. Bear populations by Bear Management Unit

Bear management unit	Area (sq. mi.)	1986 Estimated bear population	1992 Objectives	
			Bear sq. mi.	Bear Population
11	971	140	1/8	120
12	1,958	510	1/4	490
13	2,249	470	1/5	450
21	6,877	2,060	1/3.5	1,970
22	1,485	210	1/5	300
31	4,643	1,250	1/4	1,160
40	7,733	1,230	1/6	1,290
50	5,593	1,730	1/4	1,400
Total	31,509	7,700	-	7,130

Source: Minnesota Department of Natural Resources

The harvestable supply of bears depends on rate of recruitment, rate of nonhunting mortality and the number of bears compared to the number desired. If the number present in an area equals the number desired, the harvest should equal recruitment minus nonhunting mortality; this varies from 10 to 20% of the population, depending on the area. If the number present exceeds the number desired, as it appears to be in some management units (Table 16-2), harvest levels should be higher.

Ideally, the bear population should be monitored annually using a statewide survey. At present, however, harvest data provides the only means for assessing fluctuations in bear abundance on a statewide basis. Inferences made from harvest data need to be verified.

Table 16-2. Number of bear licenses applied for and issued since institution of the quota system in 1982, with resulting harvests.

Year	Applications	Licenses issued	Registered harvest	Percent hunter success
1982	9,260	1,921	392	24
1983	13,617	3,471	1,038	35
1984	17,886	3,500	919	31
1985	22,954	3,948	1,340	40
1986	20,694	4,188	1,427	40

Source: Minnesota Department of Natural Resources

Intensive radio-telemetry studies provide the only accurate means of estimating bear density. As noted earlier, two such studies have been conducted, one in northeastern Minnesota and another ongoing study by the Minnesota Department of Natural Resources in the northcentral part of the state, an area considered typical of prime bear range. Financial resources are not adequate to establish similar study areas elsewhere in the bear range.

Other population information, such as productivity and sex-age specific mortality, is obtained from the telemetry studies. Statewide collections of teeth from harvested and nuisance bears provide additional data on mortality. Currently, there is no effort to collect female reproductive tracts, which would greatly increase our understanding of productivity. Such a collection has not been initiated because of personnel limitations.

An assessment of bear numbers and productivity should include an evaluation of the extent and quality of available habitat. Presently, the outer limits of the primary and secondary range have been delineated-based on the boundaries

of the forest, the distribution of the harvest and observations of bears or bear sign by wildlife managers. These range limits need to be refined and scattered islands of bear habitat should be located and mapped. Until the quality and quantity of bear range is determined, it will not be possible to monitor changes in the amount of habitat available to bears.

Because present estimates of bear density, productivity and habitat availability may be inaccurate, it is difficult to establish objectives for bear density in each management unit. Better data will refine these objectives, but there will always be differences of opinion among the public regarding the maximum number of bears that can be tolerated in any given area.

Demand

The demand for bear hunting licenses greatly exceeds the number of hunting permits allocated each year. Since 1982, when the permit system began, the number of applicants for a bear hunting license has more than doubled (Table 16-2). Although the quota has been increased, only one-fifth or less of the applicants in recent years received a license to hunt.

About 60% of the hunters apply for the southern 2 permit areas closest to the Twin Cities, but less than 45% of the permits are allocated to these areas. Thus, although greater preference is accrued each time a hunter applies for a permit but does not get selected, almost half the applicants applying for the southern 2 permit areas for the second time do not get a permit. In contrast, virtually all second time applicants for the northern permit areas are selected provided they do not apply to hunt with others having a lower level of preference and many first-year applicants are successful.

Presently, bear hunting is permitted only in the fall, although there is increasing interest in hunting during the spring. In states and countries where spring hunting is permitted, lactating females are about 6% of the kill. The result is orphaned cubs that are unable to survive on their own. This has caused public outrage in some states, forcing discontinuance of the spring hunt. In other states, and especially in Canada, spring bear hunting is more publicly acceptable.

The Minnesota Department of Natural Resources has authority to allow spring bear hunting but has not done so because of the potential orphaned cub issue. There has been no effort directed toward 1) ascertaining the public attitude on this issue, 2) investigating ways of minimizing the number of cubs orphaned during a spring hunt, or 3) examining means of dealing with orphaned cubs in a publicly acceptable way.

There is varied public sentiment regarding the ways in which bears are hunted. In Minnesota, hunters may use bait, but state law prohibits the use of dogs to pursue bears. Many people regard hunting with hounds as more ethical than using bait, but hound hunting is not permitted in Minnesota. Minnesota hunters using dogs usually go to Wisconsin, Michigan or Ontario.

Population Utilization

The public image of black bears in Minnesota has changed dramatically, from an unwelcome pest to a valued big game animal. Fifteen years ago only 43 bears were killed and registered. However, the unregistered harvest was probably high, because the season was the first of its kind in Minnesota. Since then, registered harvests have climbed to over 1,000. Surveys conducted by the Minnesota Department of Natural Resources indicate that virtually all Minnesota hunters consume the meat of their bear, and at

least 87% make use of the hide and other parts.

The increased demand for bear hunting in Minnesota has increased Minnesota Department of Natural Resources management responsibility. The present quota system for bear hunting licenses enables careful regulation of resource utilization by hunters. Research and statewide monitoring of the population is unexcelled by any other state. However, the variable nature of food resources for bears in Minnesota, as well as the persistent attitude by many Minnesotans that bears are at fault for seeking readily available sources of human-related food, creates challenging management problems.

RESOURCE VALUE

Under the current permit system, bear hunting license sales have been limited to about 4,000 annually, of which about 100 are purchased by nonresidents. At \$25 per resident and \$150 per nonresident, income from license sales totals nearly \$100,000. The average bear hunter spends about 6 days hunting. Motels, restaurants and service stations derive income from bear hunters.

Bears are also a tourist attraction in northern Minnesota. Many tourists and some local residents enjoy seeing bears. The economic and recreational value of viewing bears is difficult to determine.

On the other hand, damage caused by bears averages about \$30,000 per year. Wildlife personnel spend an additional \$100,000 per year to obtain data needed to manage bears. The long-term benefits from this research will be accrued in recreational activity, diminished nuisance activity, greater appreciative benefits that result from increased understanding and a solid data base for making management decisions.

Long range planning for black bear

SERVICE: Conservation of black bear populations for their intrinsic and ecological values.

PRODUCT: Opportunities for appreciation and use of black bears.

GOAL: Manage the black bear population at a level that yields maximum recreational benefit without causing intolerable nuisance activity.

OBJECTIVE 1: Manage bear numbers within management units as shown in Table 16-1.

PROBLEM 1. The limitation of some information reduces management effectiveness.

STRATEGY A. Expand habitat and population studies.

STRATEGY B. Collect additional biological information from nuisance kills, car kills and harvested bears.

STRATEGY C. Develop and implement techniques for assessing population trends.

STRATEGY D. Develop and implement techniques for assessing quantity and quality of bear habitat.

PROBLEM 2. Some bears cause damage or are a nuisance.

STRATEGY A. Develop a policy that identifies intolerable levels of nuisance activity and establishes guidelines for dealing with nuisance bears.

STRATEGY B. Provide information to the public on ways to minimize damage and nuisance activities.

STRATEGY C. Reduce bear population density in areas of chronic nuisance.

STRATEGY D. Allow licensed hunters to harvest nuisance bears prior to the regular season.

STRATEGY E. Develop and implement techniques for reducing nuisance problems.

PROBLEM 3. Critical habitats may not be effectively protected and managed.

STRATEGY A. Protect and manage critical food sources.

STRATEGY B. Develop and implement bear habitat management guidelines.

STRATEGY C. Promote land management practices that improve habitat quality such as small oak plantings to provide a fall food source.

OBJECTIVE 2: Within the primary bear range, distribute hunting opportunity to provide a minimum of 15% annual hunter success rate.

PROBLEM 1. The annual demand for bear hunting is greater than the number of permits that can be issued based on the bear population.

STRATEGY A. Establish annual harvest quotas for each management unit.

Strategy B. Continue to allocate annual permits through a hunter preference system.

STRATEGY C. Develop and implement regulations to provide more hunting opportunities consistent with population objectives.

PROBLEM 2. The high nuisance kill reduces allowable take by recreational hunting.

STRATEGY A. Combine recreational hunting with nuisance animal management by allowing licensed hunters to harvest nuisance bears before the season.

STRATEGY B. Increase efforts to relocate or in other ways discourage nuisance bears.

MINNESOTA DEPARTMENT OF NATURAL RESOURCES
Division of Fish and Wildlife
500 Lafayette Road
St. Paul MN 55155-4025

FISH, WILDLIFE & NATIVE PLANT RESOURCES
LONG RANGE PLAN

The Division of Fish and Wildlife is inviting comments from individuals and organizations on the Long Range Plans for the management of fish, wildlife and native plant resources. Use this form, or write us a letter, telling us how we can improve the plan (or plans) you have reviewed.

Plan Name: _____

Comments: _____

Your name: _____

Address: _____

Are these the official comments of this organization? __Yes __No

Organization: _____

Thank you for your comments.

To mail: fold & seal with tape, or place in envelope.

-----fold here-----

1st Class
Postage
required

FISH & WILDLIFE PLANNING TEAM
Minnesota Department of Natural Resources
500 Lafayette Road
St. Paul MN 55155-4025

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17. Moose

The moose (Alces alces) is the largest mammal in Minnesota. Before the state's European settlement, moose were found north and east of a line extending from Pine County to the state's northwest corner. Following settlement, moose numbers declined and the moose range receded to a small portion of northern Minnesota. Since the 1930s, moose numbers have gradually increased and 2 disjunct populations have formed, one in the northeastern boreal forest and the other in the northwestern transition zone (Figure 17-1). Moose numbers in both populations had increased sufficiently by 1971 so that a biennial moose season could be established. Since then, more than 6,500 moose have been harvested.

RESOURCE MANAGEMENT

The moose in the northwest differ from those in the northeast in body size, antler size and in the types of habitat that they use. Land use patterns, vegetation and human density also differ between the two areas; this results in differences in the problems associated with effective moose management. To distinguish these differences, the northeast and northwest moose populations are discussed individually.

Northeast Moose

The northeast moose range occurs primarily on the

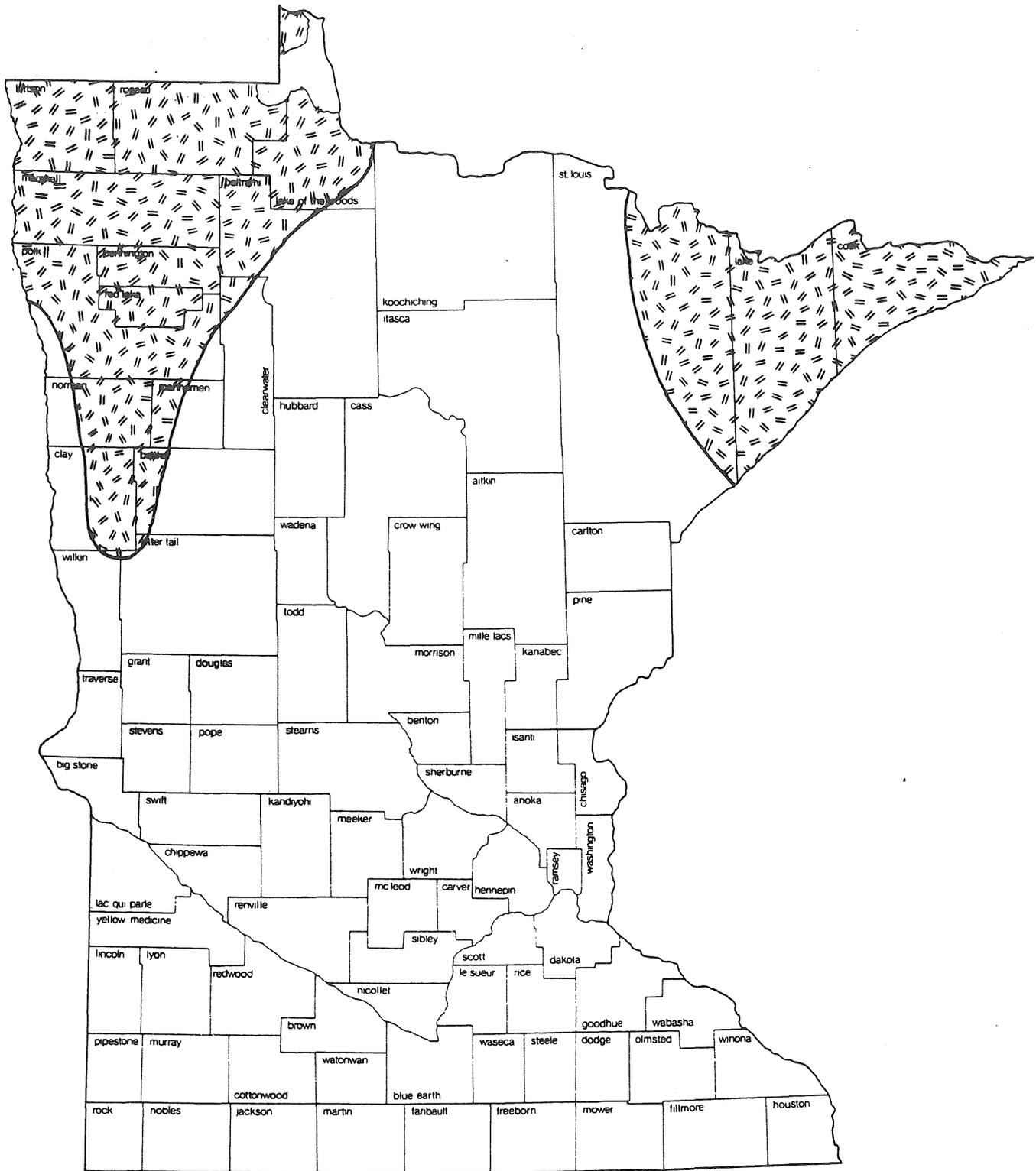


Figure 17-1. Minnesota moose range in 1986. (Source: Minnesota Department of Natural Resources)

Canadian Shield area of Minnesota (Figure 17-1). The primary range includes approximately 4,800 square miles, with an average moose density of slightly over 1 moose per square mile. Moose are occasionally found to the west and south of the primary range, but the average density on this secondary range is less than 5 moose per 100 square miles. Approximately 75% of the primary range is publicly owned.

Following the decline and subsequent low population levels early in this century, moose increased in relative abundance by the 1960s. Prior to the opening of moose hunting in 1971, the northeast population was estimated to contain at least 2,600 animals. Since that time, this population has continued to increase and in 1986 was estimated at 6,500 (Table 17-1).

Table 17-1. Estimated winter moose populations in northern Minnesota.

Year	Northeast	Northwest Forest**	Northwest Prairie**	Northwest Combined**
1962-63	3059 (1165)*			
1963-64	2379 (1163)			
1964-65	2395 (951)			
1965-66	No Census			
1966-67	3357 (1427)			
1967-68	No Census			
1968-69	1872 (732)			
1969-70	No Census			
1970-71	2631 (989)			1993 (628)
1971-72	2993 (982)			2367 (639)
1972-73	1663 (449)			3144 (550)
1973-74	2207 (783)			2671 (534)
1974-75	2179 (455)			3539 (1044)
1975-76	2399 (653)			2415 (505)
1976-77	3469 (1405)			3582 (1247)
1977-78	1385 (368)			2515 (619)
1978-79	4450 (1064)			2158 (464)
1979-80	4492 (1011)			2808 (604)
1980-81	4742 (1157)			3294 (639)
1981-82	4986 (1117)			3402 (592)
1982-83	5182 (1114)	497 (249)	3893 (1024)	4390
1983-84	4178 (1195)	507 (246)	3889 (712)	4396
1984-85	4791 (1289)	519 (125)	3742 (464)	4261
1985-86	6558 (3160)	389 (83)	3272 (474)	3661

* 90% Confidence interval in parentheses

** Units identified in 1982-83. Previously censused as Northwest.

Source: Minnesota Department of Natural Resources

Moose habitat in the northeast is northern boreal forest interspersed with lakes, streams and marshes. Only small areas have been cleared for agriculture. Extensive logging in the late 1800s and early 1900s and forest fires in the 1920s and 1930s converted much of the mature conifer forest to young stands of aspen, birch and upland brush. Reduction in logging activity and prevention of forest fires, necessitated by human development, have resulted in a gradual decrease in the quantity and quality of moose habitat. The timber harvest previously recycled only a small portion of the forest; however, market condition forecasts have improved recently, so more of the forest area may be logged, improving the quality of moose habitat in the northeast.

The carrying capacity, or maximum number of moose that this range can support, is probably determined by habitat quality. The growth rate of the population, however, is controlled by a variety of other factors. The biennial harvest, for example, has removed up to 9% of the estimated fall moose population in past years. Continued population growth since the legalization of moose hunting indicate that the harvest is not limiting the population. The high success rates experienced by hunters, however, indicate that moose are relatively easy to locate and it would be possible to overharvest them. Poaching undoubtedly does occur, but the magnitude of this problem is unknown.

Predation by gray wolves and black bear on moose calves has been implicated as an important source of mortality in areas outside of Minnesota. The importance of predation on moose in Minnesota has yet to be determined. Infection by the meningeal brainworm (Parelaphostrongylus tenuis) is fatal to moose and may be an important source of mortality. White-tailed deer harbor this parasite with no ill effects. The infection rate of moose may be linked to deer density.

Northwest Moose

The northwest moose range encompasses much of the bed of glacial Lake Agassiz and includes almost 9,000 square miles of northwestern Minnesota (Figure 17-2). Most of the northwest moose range is composed of a mosaic of agricultural lands interspersed with woodlots, wetlands and brushlands. The northeast corner of this range is an ecological gradient from agricultural lands to boreal forest. Because of differences in cover types, land use and human density, the northwest moose range has been divided into two populations, northwest prairie and northwest forest.

Northwest Prairie

The range of the northwest prairie moose population occurs primarily in Kittson, Marshall, Pennington and western Roseau counties and extends southward along the eastern ridges of glacial Lake Agassiz to Otter Tail County (Figure 17-1). The primary range includes approximately 6,800 square miles. Almost two-thirds of this area is intensively farmed and does not represent moose habitat. On the actual moose habitat, the density is more than 1 moose per square mile. More than 90% of the primary moose range is privately owned.

Moose were extirpated during settlement, but in the 1950s, moose immigrated from northern Beltrami and Lake of the Woods counties. By 1960, moose were common in central Marshall and eastern Kittson counties and have since extended their range south and west. Moose now occupy most of the suitable habitat and expansion continues in the southern portion of the range and into adjacent areas of North Dakota and Manitoba. The moose population has remained relatively stable since 1980 (Table 17-1 and Figure 17-3).

Presettlement vegetation in this area was predominantly

Northwest Prairie

Survey Area

Northwest Forest

Survey Area

Northeast

Survey Area

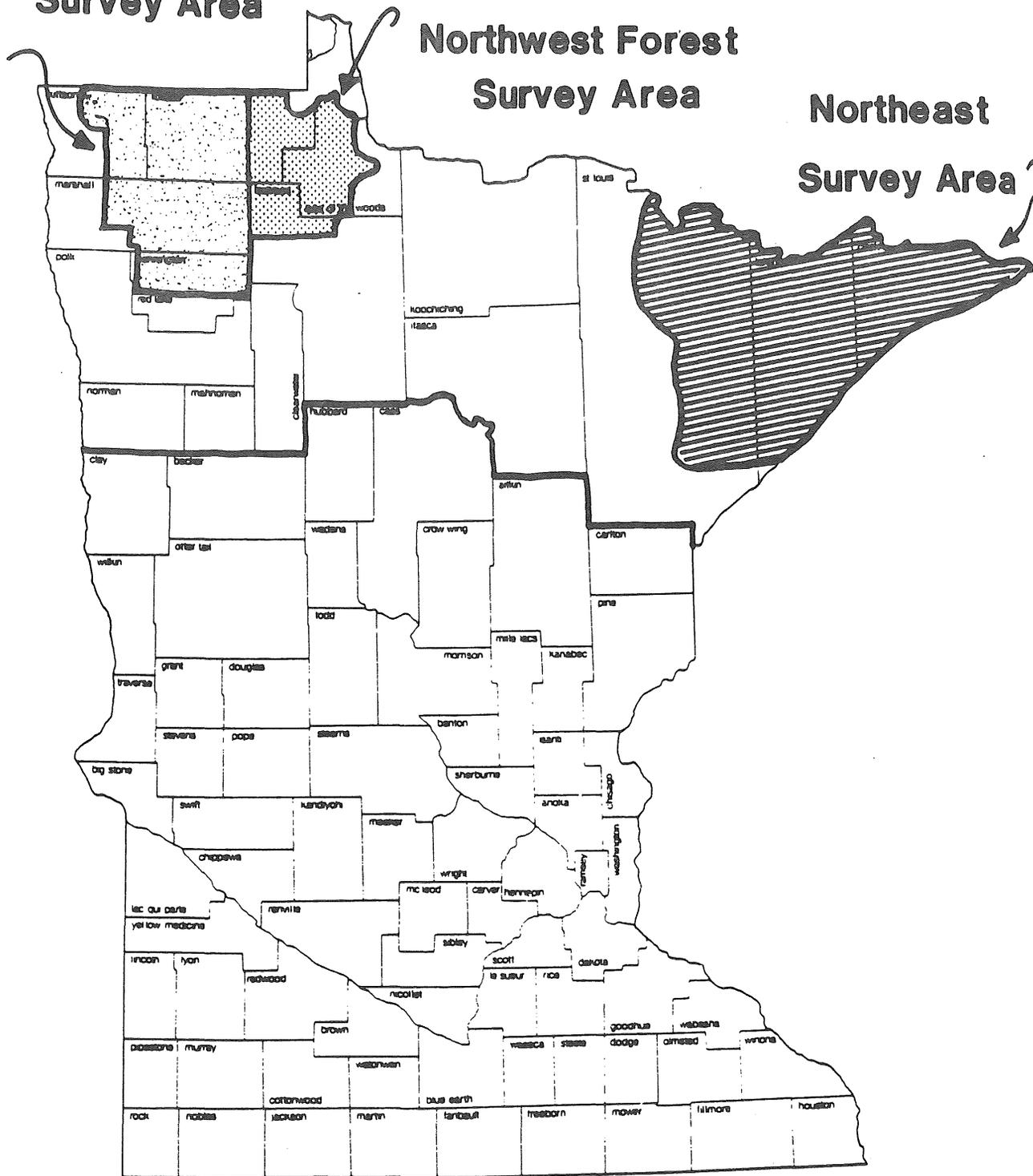


Figure 17-2. Approximate boundaries of aerial moose survey. (Source: Minnesota Department of Natural Resources)

Moose Trends in Minnesota

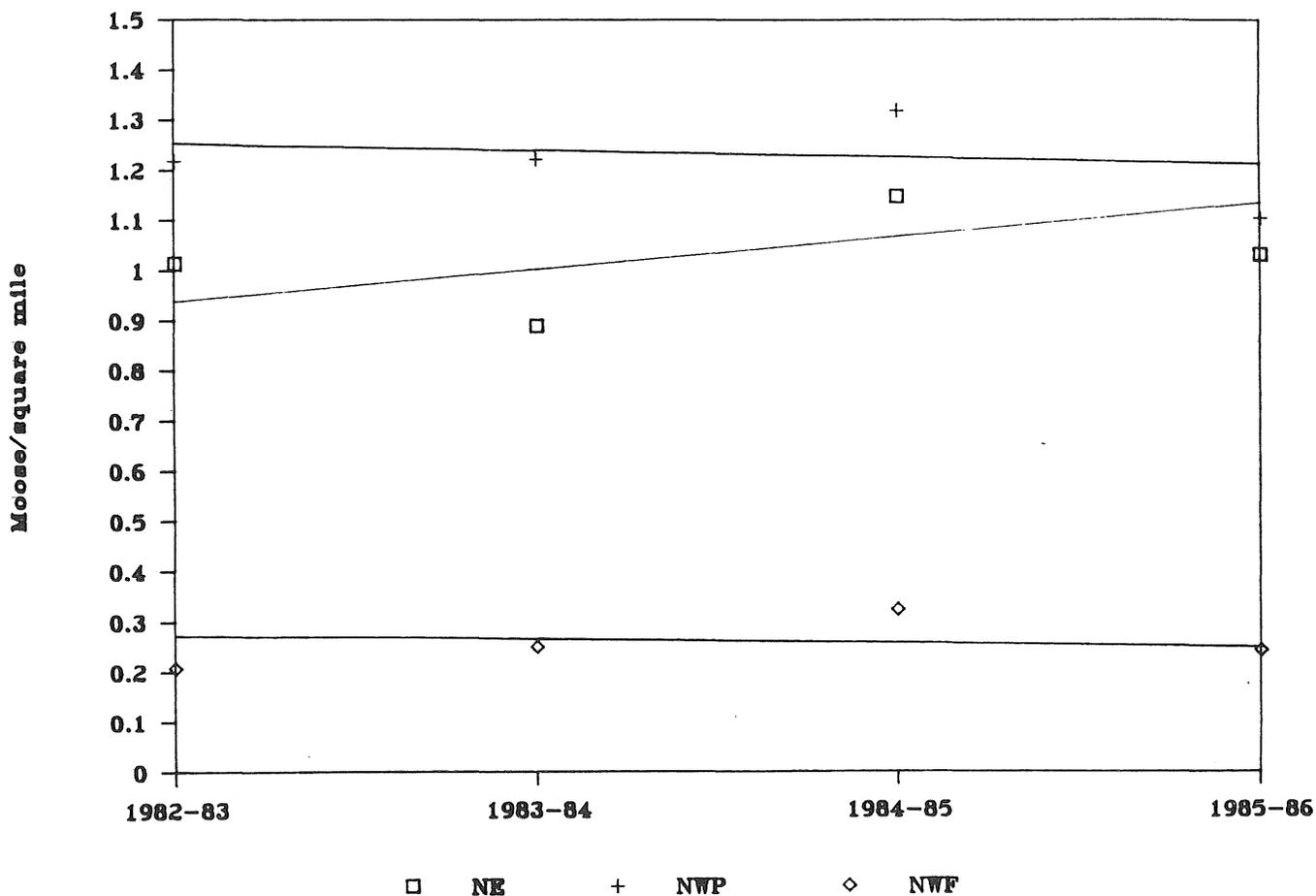


Figure 17-3. Moose trends in Minnesota. (Source: Minnesota Department of Natural Resources)

prairie, aspen parkland and deciduous forest. Agricultural development eliminated nearly 95% of the original moose habitat on this range, so moose are now found on the remaining brushland tracts that normally have little potential for agricultural development.

The most important moose habitat in the northwest prairie consists of wetlands, brushlands and off-site aspen, but northern hardwoods are also used. Little conifer cover exists and there is no indication that winter cover is a limiting factor. Agricultural lands adjacent to brushland habitat are used, moose sometimes cause extensive damage to the crops.

Most of the brush and aspen habitat that remains in the northwest prairie has a history of frequent disturbances, usually by wildfire, which has maintained the quality of habitat. Moose density is limited primarily by the quantity of habitat. As this habitat is cleared for agricultural development, the carrying capacity for moose is reduced.

The growth of the northwest prairie population is primarily controlled by the biennial hunting season. In past years, hunting has removed up to 18% of the estimated population. Net productivity is higher than elsewhere in Minnesota and few predators are capable of killing them. Infection with brainworm has been documented in northwestern moose, but despite relatively high white-tailed deer densities, mortality associated with this disease appears low.

Northwest Forest

The range of the northwest forest moose population occurs primarily in northern Beltrami, Lake of the Woods and eastern Roseau counties (Figure 17-1). The primary range includes approximately 1,800 square miles with an average density of less than 0.25 moose per square mile. Nearly 70% of the primary range is publicly owned and 6% is owned by

the Red Lake Tribe of Chippewa Indians.

Little is known about the history of the moose population in the northwest forest, except that it acted as a refuge when moose were extirpated from other areas. Moose densities probably increased slowly in the 1930s and 1940s after the Resettlement Administration moved homesteaders out of the area. During the 1950s this was the main moose range in the northwest. Records indicate that moose densities have probably been low over the last 10 to 20 years and recent surveys indicate a population of less than 500 moose (Table 17-1).

Vegetation in the northwest forest represents a transition from agricultural lands to boreal forests. Much of the area consists of aspen-willow brushlands, bog and lowland conifer. Forest fires and logging converted much of the area to ideal moose habitat early in the century, but natural succession and the prevention and control of forest fires necessitated by human settlement and the forest industry have resulted in a gradual decline in the quantity and quality of browse. Previously, distance from markets and lack of demand for aspen reduced the amount of habitat improved through timber harvesting; however, timber market conditions have significantly changed, increasing the possibility that habitat will be improved through timber harvesting.

The carrying capacity of the northwest forest is probably lower than other Minnesota moose ranges. Net productivity has been less than half of that observed in the northwest prairie. The 1985 harvest was less than 2% of the estimated population yet the population has not increased.

Indians harvest moose on lands owned by the Red Lake Tribe, but the number of moose harvested has never been documented. As in the northeast, predation occurs but its importance has yet to be determined.

RESOURCE ANALYSIS

The number of moose in Minnesota has increased dramatically in the 15 years since hunting was legalized. In the northeast, moose numbers have almost doubled, and in the northwest prairie, the population has expanded its range south and west. It is unlikely, however, that moose numbers will increase as dramatically in the next 10 years. In the northeast, the carrying capacity has been declining because of forest succession. Moose numbers may increase in excess of 6,000 animals if the harvest is maintained at past levels. In the northwest prairie, however, the quantity of moose habitat is limited and it is unlikely that this population will increase substantially, unless harvests are reduced. In the northwest forest, habitat quality is declining and the population does not appear to be solely limited by the legal harvest. Unless there are major changes in the habitat, this population will probably remain stable.

The demand for the limited number of moose permits has consistently been greater than the supply. Over the last four seasons, there has been an average of over 19,000 applications submitted while an average of only 1,000 permits were available (Table 17-2). Of the applicants receiving permits, over 80% have been successful in harvesting a moose (Table 17-3). Because of the vulnerability of the moose populations to overharvest, the demand for moose permits will probably always exceed the supply.

RESOURCE VALUE

There is scant data regarding the economics of consumptive and non-consumptive use of moose. The most direct value comes from license sales. In 1985, for example, a total of 1,068 moose permits were issued at \$140 each, generating almost \$150,000 for the Game and Fish Fund.

Table 17-2. Moose season data, 1971-1985. Moose seasons have been held in Minnesota in alternative years since 1971.

	1971	1973	1975	1977	1979	1981	1983	1985
Licenses available	400	520	750	930	685	980	1,296	1,068
Applications	9,264	13,560	15,792	16,586	19,023	20,063	17,754	20,500
Chance for license	1 in 23	1 in 26	1 in 20	1 in 18	1 in 28	1 in 26	1 in 14	1 in 19
Moose taken	374	460	576	841	561	764	1,179	968
Party success	97%	88%	90%	90%	82%	87%	91%	91%

Table 17-3. Number of permits issued and party success for moose hunters in Minnesota, 1971-1985.

Year	Northwest			Northeast		
	Number of permits issued	Number of moose harvested	% Party success	Number of permits issued	Number of moose harvested	% Party success
1971	250	240	96	150	134	89
1973	335	306	91	185	159	86
1975	475	449	94	275	227	82
1977	630	598	95	300	243	81
1979	416	330	79	290	237	82
1981	505	455	90	375	309	82
1983	780	737	95	523	442	85
1985	768	718	94	300	250	83

Indirect income from the biennial moose hunt also contributes an important role in the economy of many small towns throughout the moose range. Motels, restaurants, gas stations and meat processors all receive additional income during the moose season. According to the 1980 U.S. Fish and Wildlife survey on hunting and fishing in 1979, big game hunters in Minnesota spent an average of \$89 on food, lodging and transportation. Using these data for the 1985 hunt (1,068 permits and 4 hunters per permit) moose hunters contributed over \$380,000 to local economies in the 3 moose ranges.

Indirect income was also generated throughout the state through the purchase of sporting arms, ammunition and other equipment. In 1979, hunters spent an average of \$76 for equipment associated with big game hunting. Using this figure for the 1985 season, moose hunters spent an additional \$325,000 in preparation for hunting.

Direct and indirect income derived from moose hunting totals over \$850,000. This figure represents only the minimal value of moose, however, because it doesn't take into account the value and enjoyment derived from moose by people whose moose encounters are incidental to other activities.

Long range planning for moose

PRODUCT: Moose populations for their ecological value and opportunities for use and appreciation.

GOAL: Manage the moose resource at a level that yields maximum recreational benefits within acceptable public and environmental limits.

OBJECTIVE 1. Achieve the following winter moose populations by 1992:

<u>Survey Area</u>	<u>Moose Population</u>	
	<u>1986</u>	<u>1992</u>
Northeast	5000	6000
Northwest forest	400	500
Northwest prairie	3300	3800

PROBLEM 1. Habitat carrying capacity is changing because of forest succession, intensive agriculture and conflicting land uses.

STRATEGY A. Establish designated moose management units.

STRATEGY B. Designate suitable undedicated Minnesota Department of Natural Resources administered state-owned lands as wildlife management areas and provide for permanent protection of other critical habitats.

STRATEGY C. Develop and implement moose habitat guidelines, expand habitat enhancement efforts with other land management agencies and emphasize

the Minnesota Forest Resource Plan.

STRATEGY D. Increase direct habitat management efforts through established management techniques.

STRATEGY E. Encourage local, state and federal government officials to develop farm program regulations that increase and improve habitat.

STRATEGY F. Strengthen the environmental review and mitigation processes.

STRATEGY G. Increase information to land management personnel regarding moose habitat requirements and management techniques.

PROBLEM 2. The limitations of some information reduces management effectiveness.

STRATEGY A. Continue research and refinement of techniques for estimating moose populations and setting harvest objectives.

STRATEGY B. Initiate research on population dynamics focusing on productivity and nonhunting mortality.

STRATEGY C. Conduct research on effects of forestry practices on moose.

STRATEGY D. Investigate economic and recreational values of moose populations.

PROBLEM 3. Parelaphostrongylus tenuis, a common parasite of white-tailed deer, is fatal in moose.

STRATEGY A. Develop and implement deer density guidelines within primary moose ranges necessary to minimize effectiveness of P. tenuis.

PROBLEM 4. Moose occasionally cause damage to crops and property.

STRATEGY A. Establish a moose depredation policy.

STRATEGY B. Determine extent and economic significance of property and crop damage.

STRATEGY C. Investigate techniques to prevent or alleviate damage and depredation.

STRATEGY D. Work with road authorities to identify safety problems.

OBJECTIVE 2. Harvest 900-1,200 moose every 2 years.

PROBLEM 1. Demand for moose exceeds supply.

STRATEGY A. Increase moose population through habitat management and permit allocation.

STRATEGY B. Evaluate hunting regulations that would reduce success rate and allow increased numbers of hunters.

PROBLEM 2. Some hunters lack knowledge of harvest techniques and ethical behavior.

STRATEGY A. Expand and improve hunter orientation sessions.

PROBLEM 3. Insufficient coordination and differing viewpoints between the Minnesota Department of Natural Resources and some tribal governments complicates management.

STRATEGY A. Enter into agreements with the Red Lake Chippewa Tribe and bands of the Minnesota Chippewa Tribe involved with moose management.

STRATEGY B. Ensure that properly designated tribal representatives receive current population, harvest and habitat management information.

STRATEGY C. Provide technical assistance and management recommendations to tribal governing bodies when requested.

OBJECTIVE 3. Provide additional opportunities for use and appreciation of moose by 1992.

PROBLEM 1. People are unaware of recreational opportunities.

STRATEGY A. Increase information and education efforts and promote tourism.

PROBLEM 2. There is insufficient information on types and levels of use.

STRATEGY A. Survey and monitor current types and levels of use.

STRATEGY B. Determine use levels that maximize recreation while protecting the moose resource.



FISH AND WILDLIFE PLANNING TEAM
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FISH, WILDLIFE & NATIVE PLANT RESOURCES
LONG RANGE PLAN COMMENTS

The Division of Fish and Wildlife is inviting comments from individuals and organizations on the long range plans for the management of fish, wildlife and native plant resources. Use this form, or write us a letter, telling us how we can improve the plan or plans you have reviewed.

Plan Name: _____

Comments: _____

Your name: _____

Address: _____

Are these the official comments of an organization? Yes No

Organization: _____

To mail: fold & seal with tape or place in envelope.

Thank you for taking the time to review the plan and providing your comments.

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18. White-tailed Deer

The white-tailed deer (Odocoileus virginianus) is a highly adaptable animal found throughout much of North America. It thrives in habitats ranging from the boreal forests of the north to the arid deserts of the southwest. Throughout this range, the whitetail is an important game animal and has universal aesthetic appeal. The whitetail is hunted in 45 states and 8 provinces where, in 1982, more than 12 million deer hunters harvested nearly 3 million of them. Minnesota ranks 10th nationwide in the number of white-tailed deer harvested.

The white-tailed deer is Minnesota's most important big game animal. It inhabits every county in Minnesota, from the agricultural lands of the southwest to the forests of the northeast. The spring population, before fawns are born, is over 600,000 and increases to almost 1 million before the fall hunting season.

Deer were not so widespread in Minnesota when European settlement began. Before 1860, deer were most common in the hardwood forests of central and southeastern Minnesota and were comparatively rare in forests north and east of the Mississippi River. Subsequent logging of the pine forests and burning of the slash produced a lush growth of shrubs and young trees that provided ideal deer habitat. By 1920, deer had become fairly common throughout northern Minnesota. At the same time, farming and subsistence hunting had virtually eliminated deer from the prairie area.

During the past 40 years, deer populations throughout the state have fluctuated in response to changing habitat, winter severity and overhunting. These factors, especially the latter two, caused the statewide deer population to plummet in the late 1960s. Since 1976, the population has increased steadily. The deer population is currently at its highest level in at least 30 years, primarily due to better harvest management.

RESOURCE MANAGEMENT

Population Management

Management of the whitetail in Minnesota began in 1858 with the establishment of a 5-month deer hunting season. Hunting was allowed for both males and females, including fawns. Subsequent management consisted primarily of requiring a hunting license, shortening or closing the season or reducing the bag limit. In an effort to distribute the harvest, hunting zones were established in 1946, but it remained difficult to control the harvest without closing the season.

Beginning in 1973, hunting was restricted to antlered bucks with a limited number of antlerless permits available in most areas. Altering the number of antlerless permits within an area allowed better harvest control and age and sex manipulation of the population.

White-tailed deer are managed directly through population management and, indirectly, through habitat management.

Habitat Management

Habitat management for deer first became significant in the late 1960s. Special appropriations were sporadically available to fund the inventory and maintenance of forest openings, create timber access roads, promote timber sales,

increase the cutting of overgrown browse and provide food plots in farmland areas. In 1977, a surcharge was added to the deer license to fund ongoing habitat management projects.

RESOURCE ANALYSIS

The density of white-tailed deer varies across the state according to human density, land use and habitat quality. The highest densities occur in northcentral Minnesota, where spring populations often average 15 to 20 deer per square mile. The density drops to an estimated 5 deer per square mile or less in the extreme northeast in areas of perennially deep snow, poor habitat and high moose and gray wolf populations. In southern and western portions of Minnesota, where the amount of woods and swamp is limited, densities are less than 2 deer per square mile. In the transition area between farmland and forest, the density is 4 to 6 deer per square mile.

Winter's Effect

Whitetailed deer populations throughout Minnesota are the most stressed in winter when severe winter weather may have a devastating effect. In the northern forested areas, heavy snowfall in early November and December and retention of snow late into March and April may cause starvation. In addition, high mortality may occur among newborn fawns after a severe winter. In the agricultural areas, deer have greater access to food plots and waste grains and starvation is rare except in late born fawns, or during years of severe snow crusting or extensive fall plowing. Productivity in farmland areas, however, declines following severe winters because of a decrease in the proportion of fawns that breed. Winter cover, which softens the effect of severe winter weather, is critical to deer throughout the state.

Habitat quality may ultimately determine the upper limit for a deer population, but this limit is seldom attained. Minnesota's climate is characterized by periodic severe winters, and it is this winter weather, along with hunting, that determines the actual density. Gray wolf predation on deer populations is significant in some portions of Minnesota and may be important in determining deer density in local areas. The wolf, however, is a threatened species under federal jurisdiction, so the state may not reduce wolf numbers. Sport hunting affects deer densities and can be used to control both deer numbers and the sex and age structure of populations.

Management of deer populations in Minnesota differs across the state depending on local conditions. Winter mortality in the northern forests is independent of deer density, and deer numbers can be halved after 2 or 3 consecutive severe winters. Winter severity is unpredictable, and management in forested areas attempts to maintain the most productive age classes in the population. Thus, in a series of mild winters, the deer population increases gradually and in years of severe winters a good breeding stock is maintained.

Deer populations in the agricultural areas are more productive and less susceptible to winter weather. These herds are in direct competition with the farmers for crops and in some areas constitute a hazard to motorists. Therefore, deer populations in farm areas are managed at a much lower density than those in forested areas.

Because of winter's effect on deer numbers, it is very difficult to project future deer density. Each year a 45% probability exists that the winter will be severe enough to cause winter mortality. If severe winters alternate, the deer population will probably remain at current levels or increase slightly. Two or more consecutive severe winters will probably cause the population to decrease.

Deer populations in urban areas present special problems. The mosaic of woodlots, farmlands, parks and residential areas at the urban fringe provides good deer habitat. The absence of natural predators and deer hunting have allowed deer populations to expand enough to cause depredations on crops, shrubbery, gardens and present hazards on the roads in urban areas. Local ordinances restrict or prohibit hunting, making deer population control in these areas very difficult.

Hunter's and Nonhunter's Effect

White-tailed deer have been managed primarily to satisfy the hunting public. Deer hunting is increasingly popular; 290,000 hunters in 1964 grew to over 485,000 in 1986 (Figure 18-1). Hunter-based management, however, is consistent with the needs of the nonhunting public. Nonhunters are less concerned about absolute deer density as long as viable populations are maintained so they can view and enjoy them. Hunters, however, often want higher population densities to increase their probability of seeing and bagging deer. In most cases, deer densities acceptable to hunters are acceptable to nonhunters.

The number of people that hunt deer each year is dependent on the likelihood that they will harvest a deer. The percent of success depends primarily on the size of the deer population. In the last 8 years, the number of Minnesota residents who have purchased deer licenses has steadily increased (Figure 18-1). This has occurred during a period when the deer population and the number of antlerless permits have increased, and the overall rate of success has increased as well. If the deer population continues to increase, the upward trend in deer hunters will probably continue. Conversely, if the deer population decreases or the number of antlerless permits is reduced, the number of deer hunters will probably decline.

RESOURCE VALUE

Income from recreation activities associated with white-tailed deer is important to Minnesota's economy, as well as to the budget of the Division of Fish and Wildlife. Deer license receipts to the Game and Fish Fund rose from approximately \$3.5 million in 1979 to \$7 million in 1984. Besides providing a significant portion of the Department of Natural Resources overall wildlife management dollars, license receipts form the core of the deer habitat improvement program. From 1977 to 1983, by legislative action, 1 dollar from each license was dedicated to deer habitat improvement, resulting in annual appropriations of nearly \$400,000. In 1984, another dollar was added, which increased the amount available for habitat improvement.

The most identifiable contribution to the state's economy from white-tailed deer is hunter expenditures. The average Minnesota deer hunter spent \$76 per year on sporting arms, ammunition and equipment in 1979. The total expenditures for these items in 1979 were \$22.7 million. Because of an increasing number of hunters and inflation, this figure rose to \$29.3 million in 1984. Similarly, expenditures for food, lodging, and transportation rose from \$26.6 million in 1979 to \$34.3 million in 1984, based on spending by each hunter of \$89 per season. Total direct expenditures by deer hunters in Minnesota, license fees excluded, rose from \$49.3 million in 1979 to \$63.5 million in 1984.

Substantial amounts are spent each year in Minnesota by those engaged in non-hunting recreational activities associated with white-tailed deer. A conservative estimate is derived by considering only those state recreationists taking a trip of at least 1 mile for the primary purpose of observing, photographing and feeding wildlife, and who actually saw, photographed or fed deer. The 307,000 participants who spend an average of \$133 per year on travel and equipment in pursuit of this activity spent a total of

ESTIMATED DEER AND HUNTER NUMBERS

Statewide

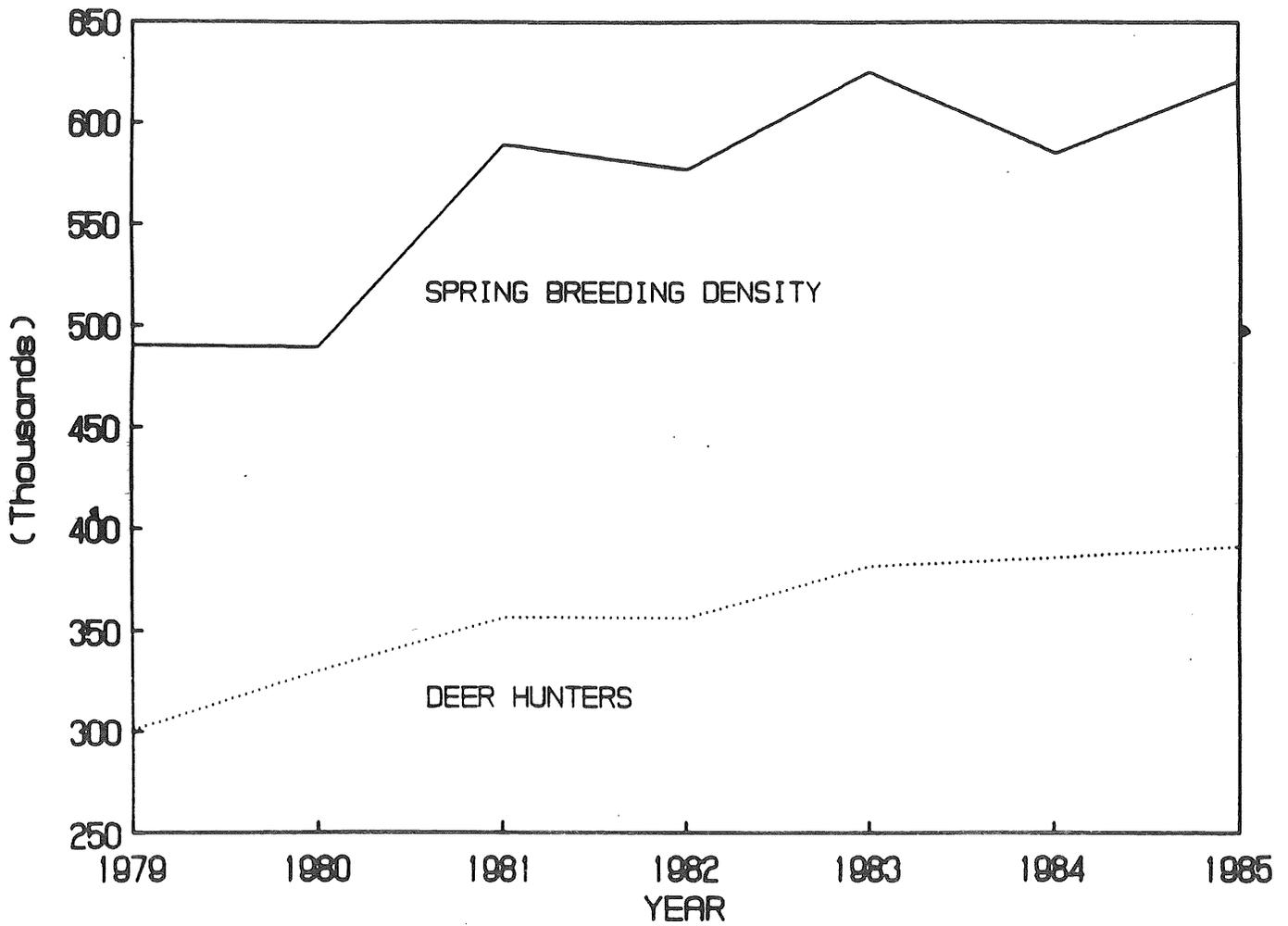


Figure 18-1. Estimated number of deer and deer hunters in Minnesota, 1979-1985.

\$40.8 million in 1984.

When hunting and non-hunting expenditures are combined, direct expenditures by people pursuing recreation opportunities associated primarily with white-tailed deer totaled \$104 million in 1984. Economists suggest that an additional \$3 to \$4 is generated for every dollar spent on an activity. Using the \$3 figure suggests recreation associated primarily with white-tailed deer in Minnesota generates over \$400 million per year.

The above figures do not include any consideration for the value and enjoyment derived from white-tailed deer by the vast majority of Minnesotans whose encounters with deer are incidental to other activities.

Long range planning for white-tailed deer

PRODUCT: White-tailed deer for their ecological value and opportunities for use and appreciation.

GOAL: Manage the deer resource at a level that yields maximum recreational benefits within acceptable public and environmental limits.

OBJECTIVE 1: Manage populations within management units (Figure 18-2) as shown in Table 18-1, and in other areas maintain populations within acceptable public and environmental limits through 1992.

PROBLEM 1. The carrying capacity of deer habitat is changing because of forest succession, intensive agriculture and conflicting land uses.

STRATEGY A. Expand habitat enhancement efforts with land management agencies by emphasizing the Minnesota Forest Resource Plan and the Forest-Wildlife Habitat Guidelines.

STRATEGY B. Increase direct habitat management efforts through established management techniques.

- STRATEGY C. Encourage federal, state and local government officials to develop farm program regulations that increase and improve deer habitat.

STRATEGY D. Provide for permanent protection and maintenance of critical deer habitats.

Table 18-1. Deer density objectives by deer management unit. Density values represent the spring breeding population in hunted areas prior to fawning.

Deer management unit	1986 Density (deer/sq. mi.)	Objective (deer/sq. mi.)
Rainy River West	11.3	10-15
Rainy River Central	10.8	10-15
Rainy River East	15.7	15-20
Superior West	19.3	15-20
Superior Central	14.6	10-15
Superior East	5.0	3-8
Itasca Northwest	16.2	15-20
Itasca Southwest	15.5	15-20
Itasca Northeast	15.8	15-20
Itasca Southeast	16.3	10-15
Bemidji	13.4	10-15
Leech Lake Indian Reservation	9.6	10-15
Mille Lacs West	13.4	10-15
Mille Lacs Central	13.9	10-15
Mille Lacs East	11.2	10-15
White Earth Indian Reservation *	10.2	10-15
Red River	2.6	1-3
Agassiz	5.7	5-6
Big Woods North	4.7	2-5
Big Woods Central	6.8	6-7
Big Woods Twin Cities	2.4	2-3
Big Woods Southeast	8.4	7-8
Prairie North	1.7	1-2
Prairie River	2.6	2-3
Prairie Southwest	2.0	1-2
Prairie Southeast	2.1	1-2

* Eastern half of reservation only

STRATEGY E. Intensify and expand habitat management programs on public and private lands.

STRATEGY F. Increase information to land management personnel regarding deer habitat requirements and management techniques.

STRATEGY G. Develop mitigation criteria for loss of critical deer habitat.

STRATEGY H. Strengthen the environmental review process.

PROBLEM 2. Deer mortality through hunting, predation and winter's effect can impact population levels.

STRATEGY A. Adjust antlerless quotas to maintain populations within density objectives (Table 18-1).

STRATEGY B. Continue research on the impact of predation on deer populations.

STRATEGY C. Develop research to better understand the relationship between deer mortality and winter weather.

STRATEGY D. Continue efforts to curtail illegal taking of white-tailed deer through enhanced enforcement and continued refinement of hunting regulations.

PROBLEM 3. There is inadequate information on population dynamics, habitat requirements and the

economic and recreational values of deer; which reduces management effectiveness.

STRATEGY A. Continue research and refinement of techniques for estimating deer populations and harvest.

STRATEGY B. Continue research on population dynamics, focusing on non-hunting mortality.

STRATEGY C. Expand research on the manipulation of habitat composition.

STRATEGY D. Determine the most cost-effective and efficient habitat management techniques.

STRATEGY E. Accelerate the forest habitat compartment analysis and evaluate the accuracy and usefulness of the technique.

STRATEGY F. Determine economic impacts--positive and negative--and aesthetic values of deer populations.

PROBLEM 4. Deer sometimes cause property or habitat damage, are traffic hazards or become too numerous in some areas.

STRATEGY A. Establish management guidelines on deer depredation.

STRATEGY B. Implement population reduction techniques when necessary and feasible.

STRATEGY C. Develop methods to assess deer damage.

STRATEGY D. Assist local units of government in developing and implementing deer population management strategies.

STRATEGY E. Research additional damage abatement techniques.

STRATEGY F. Educate the public about the need to control deer populations and methods to reduce or prevent deer problems.

STRATEGY G. Work with road authorities to locate problem areas and reduce deer-vehicle collisions.

PROBLEM 5. Artificial feeding of deer can create nuisance situations, divert management funds, increase productivity of local unhunted populations or be harmful to individual deer.

STRATEGY A. Develop and implement management guidelines on deer feeding.

STRATEGY B. Evaluate the effectiveness of feeding deer as a management strategy.

STRATEGY C. Inform and educate the public about positive and negative aspects of feeding deer.

OBJECTIVE 2. Set annual deer hunting seasons that provide hunting opportunity for 500,000 hunters with a 15-50% success rate through 1992.

PROBLEM 1. Allowable harvest in some areas is not adequate to meet the demand for sport hunting opportunity.

STRATEGY A. Increase the deer population through deer habitat management and permit allocation.

STRATEGY B. Redistribute hunting pressure through permit incentives and public information.

PROBLEM 2. Restricted hunter access in some areas prevents sufficient harvest limits hunting opportunity.

STRATEGY A. Develop programs to enhance deer hunter/landowner relations.

STRATEGY B. Acquire additional public hunting land in agricultural areas.

STRATEGY C. Open refuge areas to hunting when necessary to control populations.

STRATEGY D. Provide access to public land.

PROBLEM 3. Poor behavior on the part of some hunters and trespassing on private land complicates management.

STRATEGY A. Expand the Advanced Hunter Education Program.

STRATEGY B. Increase information and education concerning hunter ethics, trespassing and land owners' rights.

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Division of Fish and Wildlife
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St. Paul MN 55155-4025

FISH, WILDLIFE & NATIVE PLANT RESOURCES
LONG RANGE PLAN COMMENTS

The Division of Fish and Wildlife is inviting comments from individuals and organizations on the long range plans for the management of fish, wildlife and native plant resources. Use this form, or write us a letter, telling us how we can improve the plan or plans you have reviewed.

Plan Name: _____

Comments: _____

Your name: _____

Address: _____

Are these the official comments of an organization? Yes No

Organization: _____

To mail: fold & seal with tape or place in envelope.

Thank you for taking the time to review the plan and providing your comments.

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FISH & WILDLIFE PLANNING TEAM
Section of Ecological Services
Minnesota Department of Natural Resources
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20. Furbearers

The term furbearers in this chapter includes all wild, native Minnesota mammals commonly taken by trappers or hunters for their fur. Although these species have other value, it is the furbearing aspect that makes their management different. This working definition excludes rabbits, hares, and squirrels, even though they are considered "furbearing animals" under Minnesota Statute. It also excludes the gray wolf, which is classified as a threatened species in Minnesota by both the state and federal governments; but it includes coyotes, skunks and weasels, which are classified as "unprotected animals" by Minnesota Statute.

Minnesota has one of the nation's most diverse and abundant furbearing mammal populations. It includes 1 marsupial, the opossum; 2 rodents, beaver and muskrat and 16 carnivores. The carnivores include 2 members of the cat family; bobcat and lynx; 3 members of the dog family, red fox, gray fox and coyote, 1 member of the raccoon family, raccoon; and, 10 members of the weasel family; least weasel, short-tailed weasel, long-tailed weasel, badger, mink, otter, fisher, pine marten, striped skunk, and spotted skunk.

National fur harvest figures for the period 1970 to 1983 show that Minnesota is ranked first nationally in the harvest of beaver, red fox, mink and weasels, and is second in the harvest of badger, fisher, muskrat and striped skunk.

Furbearers were used by Minnesota Indians as a source of

clothing and food for thousands of years preceding European settlers. Beginning in the late 1600s and continuing into the nineteenth century, the trapping and trading of fur provided the economic stimulus for Minnesota's exploration and settlement.

The period from 1655 to 1867 was an era of highly competitive and totally unregulated exploitation of Minnesota's furbearer resource. The prevailing view was that wildlife would be eliminated as more area became settled and little or no thought was given to conservation. Highly sought species such as beaver and otter were nearly eliminated in much of the state.

RESOURCE MANAGEMENT

The first law pertaining to wildlife in the Territory of Minnesota was the imposition of a bounty on gray wolves and coyotes in 1849. The bounty did not end until 1965 and in some years included gray fox, red fox, bobcat and lynx.

The first law providing furbearers some protection--passed by the Minnesota legislature in 1867--prohibited taking muskrat, mink or otter between May 1 and November 15. Salaried game wardens were authorized in 1891 and the first resident trapping license was established in 1919. It was not until the Minnesota Department of Conservation, forerunner to the Department of Natural Resources, was formed in 1931, that seasons were determined annually. The Minnesota Department of Natural Resources initiated harvest and fur price surveys in 1930 and later established population trend surveys such as muskrat house counts in the 1940s, aerial beaver surveys in the 1950s and scent-post surveys in the 1970s.

Uncontrolled logging increased forest fires while land-clearing, plowing of the prairie and wetland drainage caused dramatic habitat changes detrimental to furbearers. The importance of habitat protection and management took years to be recognized.

Habitat changes and elimination of the gray wolf from much of southern and western Minnesota caused small carnivores to increase. These included red and gray foxes, striped and spotted skunks and opossum. Coyotes declined in areas developed for agriculture, but increased in northern areas that were freed of wolves.

Species dependent on mature northern coniferous forest, such as marten and fisher declined drastically and have only recently shown substantial increases accompanying forest succession and maturation. Species that favor early successional forests have, with protection, increased and may even surpass their population at the time of earliest European settlement.

Current management of furbearers involves monitoring populations and harvest, establishing necessary regulations, managing habitats and conducting research. The Minnesota Department of Natural Resources, Division of Enforcement enforces laws and regulations related to furbearers and habitats and assists in resolving furbearer damage and nuisance complaints.

RESOURCE ANALYSIS

Furbearer populations are extremely difficult and expensive to estimate accurately because most animals are elusive, and some, nocturnal. For most furbearer species, hunting and trapping is largely self-limiting -- the effort necessary to take additional animals exceeds the benefit long before the population has seriously declined.

Populations must be closely monitored for species that occur in relatively low densities, that have low productivity, or are highly desirable, such as the fisher, bobcat, lynx, marten and otter. These also require strict harvest regulations and law enforcement.

Some species are highly prolific, such as muskrats, highly elusive, fox and coyote or simply in low demand, as

are the skunks. Seasons are established primarily to confine harvests to the period of the year that furs are most valuable and to provide protection when young are reared. Although demand often exceeds supply, the intensity of use generally falls off as the return per unit of effort drops. Also, these species possess the population resiliency to compensate for trapping and hunting mortality.

Furbearer demand is highly influenced by prevailing fur prices. Licensed trappers in Minnesota increased dramatically when fur prices escalated in the 1970s. Since 1980 trapper numbers have stayed relatively high and hunter numbers have been variable despite generally lower prices.

RESOURCE VALUE

Furbearing mammals are an ecological, recreational, economic and aesthetic asset to Minnesotans.

Ecological Value

Furbearing mammals have ecological value because they are native fauna of Minnesota. Herbivorous species like muskrat and beaver profoundly influence aquatic habitats for other wildlife species. As primary consumers, they are a food source for species at higher levels in the food chain.

The carnivorous and omnivorous species prey on or scavenge other animals, and often play a significant role in determining the composition of wildlife communities. Both predator and prey have evolved together, with the result that predation tends to be largely self-limiting and does not endanger the survival of the prey.

Restricted habitat and highly altered wildlife communities can result in predation that does significantly affect some prey populations. High predator populations may conflict with other wildlife species management, particularly for some ground-nesting birds.

Human value judgements about predation vary widely, and

whether any particular type or act of predation represents a positive, negative or neutral value depends upon the individual making that judgement.

Recreational Value

Recreational values include trapping, hunting and observing or photographing furbearers or their sign. Only trapping and hunting recreation have been measured. Preliminary estimates indicate that furbearers annually provide 350,000 recreation days to 17,000 trappers and about 260,000 recreation days to 27,000 hunters in Minnesota (Table 20-1).

Viewing, photographing, or feeding furbearers has not been specifically measured, but it is likely much lower than for most other wildlife groups because of the furbearers' secretive and nocturnal habits. The presence of furbearers, and of their houses, dens, tracks, and vocalizations undoubtedly adds to the outdoor experiences of many people, but it is unlikely that these experiences are the primary objective of many outdoor users.

There is a high degree of overlap in participation in hunting, fishing, trapping and nonconsumptive wildlife activities as observing, photography and feeding. An estimated 84% of hunters and fishermen also participate in nonconsumptive activities, and 43% of all nonconsumptive users participate in hunting or fishing. Most nonconsumptive usage is likely from people who also trap or hunt furbearers because these people possess the specialized knowledge and skill necessary to locate, identify and interpret furbearer signs.

Economic Value

The furbearers' economic value is positive and negative: the fur value and furbearer-associated recreation are positive, the furbearers' damage to property is negative.

The annual value of hunting and trapping in Minnesota since 1965 has ranged from \$1.1 to \$20.8 million; for the

Table 20-1. Furbearer trapping and hunting pressure by Department of Natural Resources Region, 1982-83

	Region						Total
	1	2	3	4	5	6	
Trappers:							
Number	3,600	3,300	2,700	4,200	2,400	900	17,000
Percent of total	27	19	16	25	14	5	100
Trappers/square mile	0.14	0.17	0.24	0.24	0.36	0.30	0.20
Hunters:							
Number	5,300	1,900	3,400	8,400	6,700	1,400	27,000
Percent of total	20	7	13	31	25	5	100
Hunters/square mile	0.21	0.10	0.30	0.48	0.98	0.47	0.32

past 5 years, \$13.8 million annually. The most valued and harvested species are raccoon, muskrat, red fox, mink and beaver (Figures 20-1 and 20-2). Since nearly all fur originating in Minnesota is eventually sold outside of the state, it causes a direct infusion of money into the state's economy.

The most significant damage is caused by beaver, although coyotes, muskrats, raccoons, and other furbearers also cause some damage or localized nuisances. The total economic loss cannot be accurately estimated, but it ranges in the hundreds of thousands of dollars annually. However, furbearers' positive economic value far outweighs the negative, and the costs of damage prevention and control are small compared to the total value returned.

Aesthetic Value

Many Minnesotans seek to view furbearers directly or through their sign; many others partake of these values vicariously through magazines, movies and television. Yet, others appreciate an existence value that comes just from knowing that an animal exists in its native habitat, even though they may never see it.

Nineteen species of furbearers are covered in this plan. The goals, objectives, problems and strategies for furbearers are given after the species narrative.

OPOSSUM

An adult opossum (Opossum d'Amérique) is about the size of a house cat, and resembles a cream- or gray-colored rat with a pointed snout and a long, prehensile, naked tail. It is the only native North American marsupial.

When the United States was first settled by Europeans, the opossum's northern range ended in Ohio. By the late 1920s, its northward range expansion extended into Minnesota, where it has become relatively common, especially in the

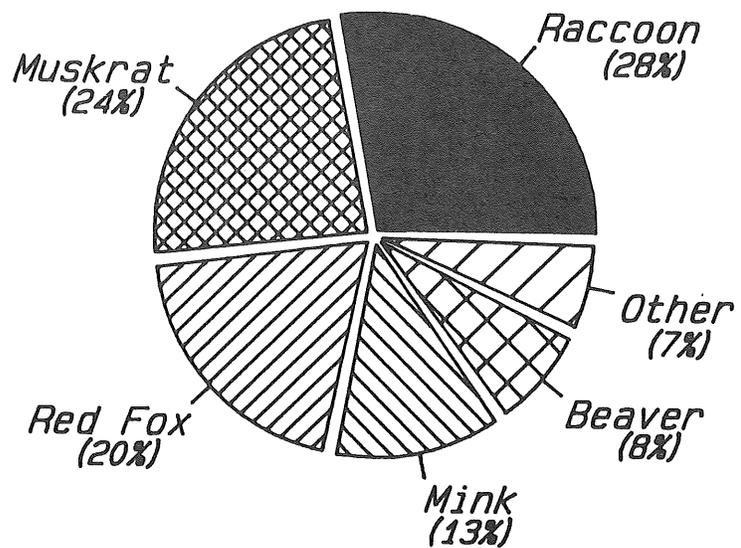


Figure 20-1. Minnesota fur value 1979 to 1984.

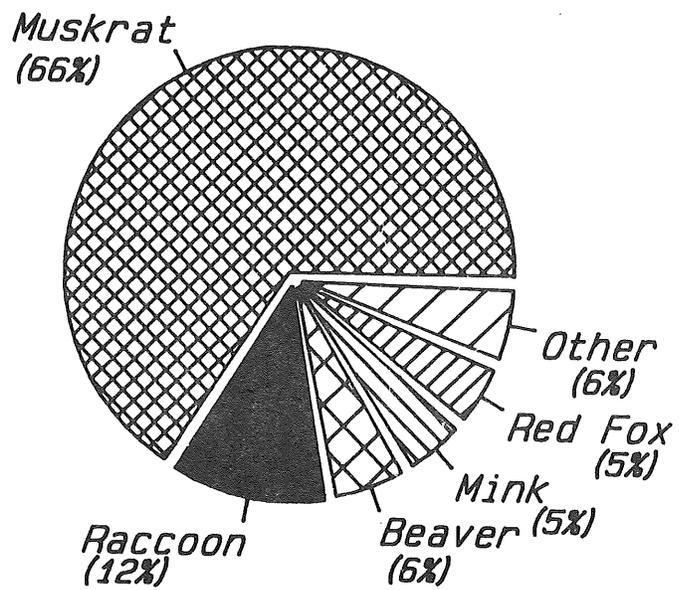


Figure 20-2. Minnesota fur harvest 1979 to 1984.

southern region. Records exist of opossum as far north as Norman, Cass and St. Louis counties. Studies indicate that their northern distribution coincides with a winter severity limit of 70 days of enforced inactivity.

Opossums prefer deciduous woodlands with streams, but can be found in marsh, forested, grassland, agricultural and suburban habitats. They need access to surface water and winter dens. The average life-span for an opossum is about 1 year.

RESOURCE MANAGEMENT

Winter weather is probably the major mortality factor of opossum in Minnesota. Predation by dogs and great horned owls and collisions with motor vehicles are undoubtedly contributing factors. Evidence indicates that neither trapping nor hunting is a major source of mortality.

Opossums were unprotected until hunting and trapping seasons were established in 1985. There are currently no limits on the number that may be taken, trapping and hunting occur from late October to the end of February.

RESOURCE ANALYSIS

Minnesota lacks current population information on opossums. Numbers probably fluctuate with winter severity. Mild winters during the early 1970s apparently allowed opossum populations to reach record levels. The severe winters of 1977-78 and 1978-79 caused their decline.

Despite winter weather, the opossum adapts to many habitats. It prefers streambank habitat which, in southern Minnesota, continues to decline in quantity and quality.

Trapper survey data since 1976 indicates that about 5 percent of all licensed trappers, approximately 1,000 annually, trapped opossum. From 1941 to 1973, the average annual harvest was 400. The harvest from 1974 to 1984 was approximately 1,900 per year. The peak harvest of 4,000 in

1976 corresponds with the national harvest peak of 1.1 million the same year. Although the regional opossum harvest is almost equally split between Regions 4 and 5, the harvest per trapper is higher in Region 5. The harvest of opossum in remaining regions is insignificant.

Pelt prices remained around \$.50 for many years until the improved fur market of the 1970s. The value peaked at \$2.50 per pelt in 1980. Recent values are in the range of \$.75 to \$1.

RESOURCE VALUE

Opossums are hunted and trapped primarily for their fur, although they are eaten in many regions of the United States. The fur is dyed and plucked to resemble more expensive furs or is used in its natural state, most commonly as trim. In Minnesota, most opossums are taken incidentally to other furbearers.

Opossums are seldom seen by the public because of their nocturnal habits. Since they are omnivorous feeders and notorious for scavaging carrion and garbage, they are commonly killed on roads by vehicles. They are well-known for their habit of "playing dead," a nervous shock reaction, when faced with an inescapable threat situation. Occasionally, they may kill poultry or prey on game animals or birds, but their impact is considered negligible.

BEAVER

The beaver (Castor canadensis) is North America's largest rodent, characterized by powerfully developed bones and muscles, a broadly flattened tail, and a dense coat of waterproof underfur covered by coarse guard hairs. Well-adapted to its semi-aquatic existence, it thrives throughout Minnesota streams, rivers, flowages, ditches,

impoundments, large and small lakes or any seepage that has adequate flow for damming.

As early as 1655, the first French fur traders reached what is now Minnesota, seeking immensely popular beaver skins. By 1775, the beaver trade in Minnesota reached its peak; by 1800 there were signs that beaver populations were diminishing. The early beaver trade essentially ended in Minnesota with the demise of the American Fur Company in 1842.

At first, beaver were trapped year-round, primarily in the summer. There were no trapping seasons and no limits. This excessive, uncontrolled harvest was the major factor that nearly caused extirpation of the beaver in Minnesota. Early efforts by the Hudson Bay Company to protect the beaver population were unsuccessful because of heavy competition.

RESOURCE MANAGEMENT

The first restricted season for beaver trapping in Minnesota was established in 1875 and eventually the season was closed in 1903. Although some nuisance permits were issued beginning in 1919, the season was not reopened until 1939. Relatively small spring season limits per trapper were in effect from 1939 until 1976. Fall seasons with no limits were initiated in 1977.

Early reports state that beaver were originally scarce on streams on the North Shore of Lake Superior where coniferous forests predominated. Lumbering and fires later produced extensive stands of aspen, making the area suitable for beaver. With protection after the turn of the century, beaver increased dramatically. Beaver populations are now at their highest levels in modern history, possibly exceeding population levels at the height of the great fur trade era.

RESOURCE ANALYSIS

Beaver are censused by aircraft on 24 watershed or transect routes in the forested areas of northern Minnesota.

Seven of the routes have been flown since 1957. Three northern regions have had increasing beaver populations since 1957 (Figure 20-3). The results of the census for Region 1 have been above the long-term mean for the past 11 years. Region 2 has been above the long-term mean for the past 12 years, and Region 3 has been above the long-term mean for the past 4 years.

The harvest is influenced by many factors, such as the number of trappers, season dates, season length, size and location of areas open to taking beaver, limit of beaver allowed per license, weather and trapping conditions, price of pelts and activity or availability of more experienced trappers.

RESOURCE VALUE

Beaver create ponds that provide seasonal habitat for waterfowl, deer, moose, otter and numerous other species, including many species of fish. These ponds also conserve spring runoff and ensure more constant stream flow, diminished floods, soil conservation and water table maintenance. Silted-in beaver ponds may become fertile meadows, fields and eventually forestland. Beaver are also important as prey for gray wolves, a threatened species in Minnesota. Their dams, houses and cuttings are recreational assets that have high aesthetic value.

Beaver trapping seasons have provided trapping recreation annually since 1939, except for 3 years. Beaver trappers range from 1,600 to 8,500 per year, averaging 3,800. Annual harvests have ranged from 4,000 to 128,000, averaging 26,000. The individual pelt value has varied from a low of \$7.80 to a high of \$48.00, averaging \$15.58. Since 1976, an average of 5,100 beaver trappers have harvested an average of 56,000 beaver annually with an average pelt value of \$16.35 for a total pelt value of \$916,000 annually (Figure 20-4). All of these figures are higher than the long-term averages.

Economic Value of the Fur Resource to Hunters and Trappers, 1930-1984 (nominal and real dollars)

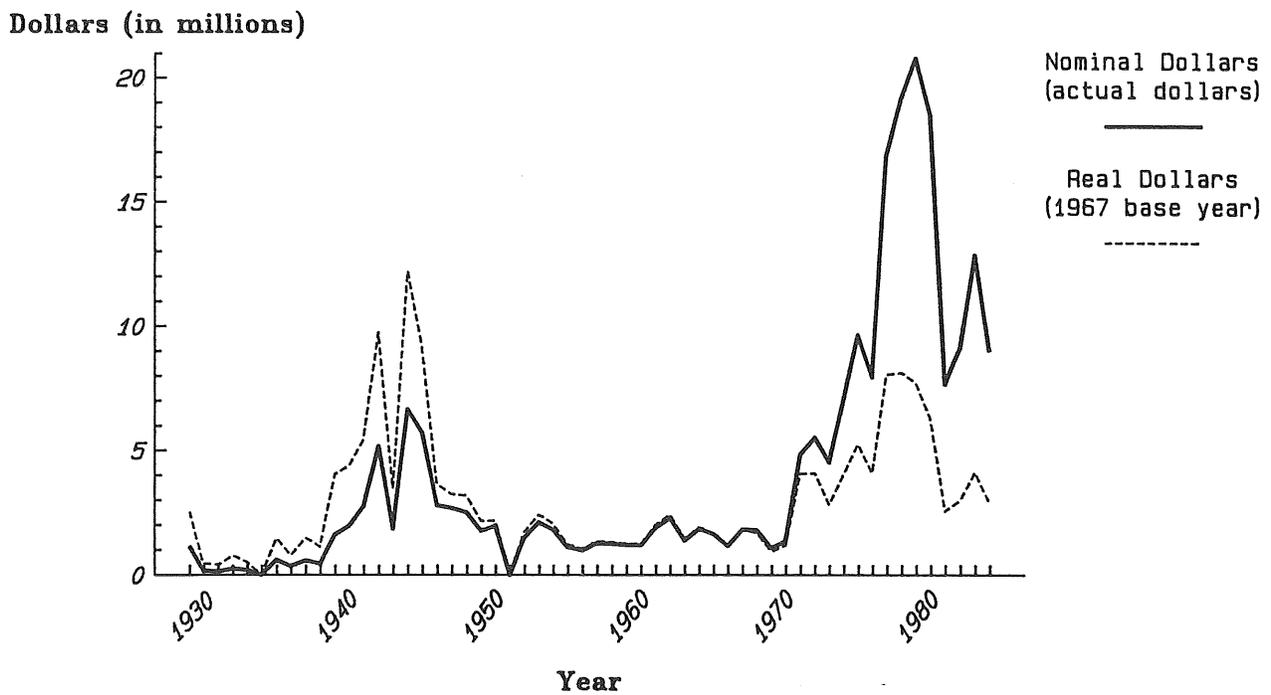


Figure 20-3. Value of Minnesota's fur resource to hunters and trappers, 1930-1984 (Nominal and real dollars--1967 base year)

BEAVER

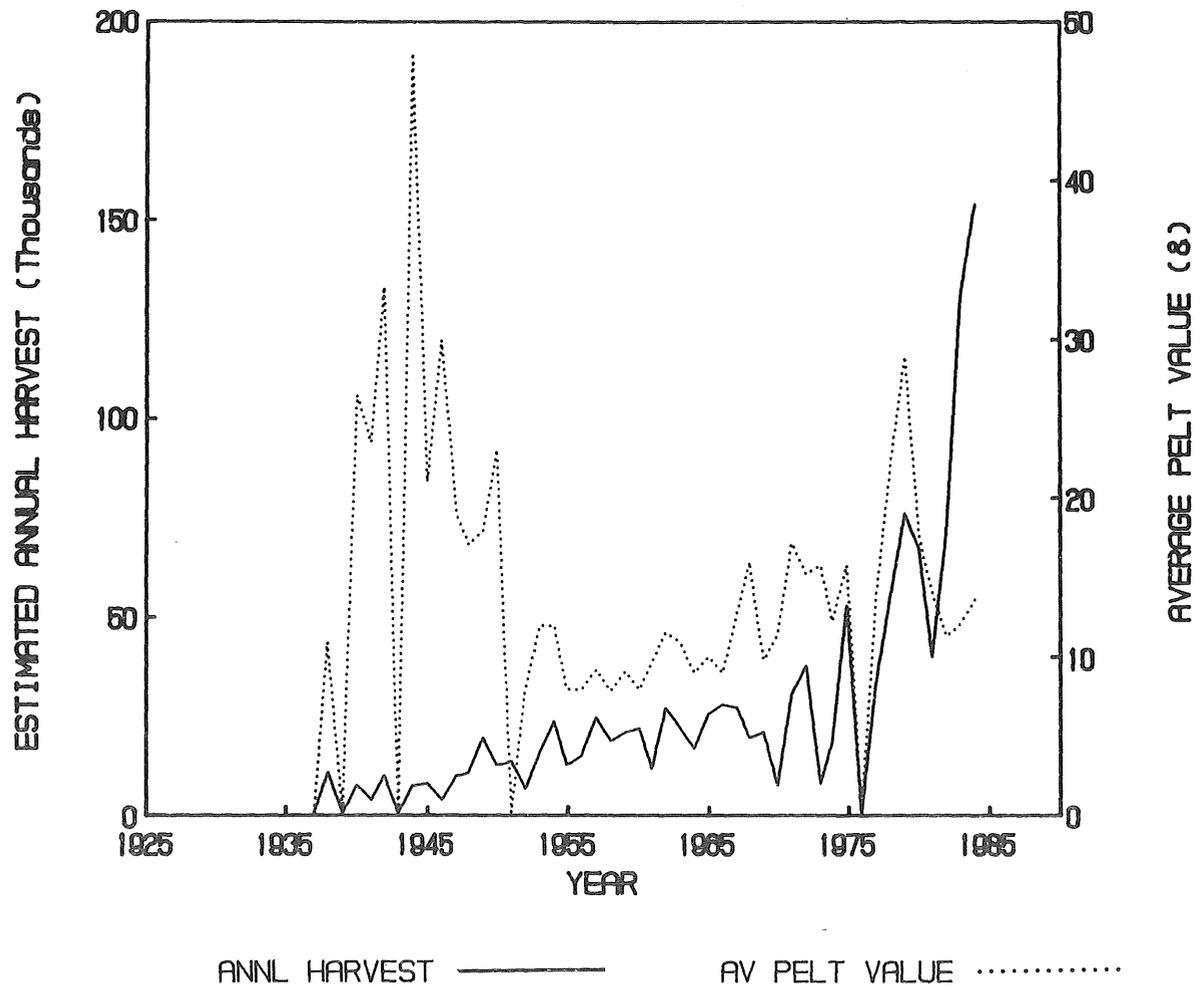


Figure 20-4. Minnesota beaver harvest and pelt value.

Beaver activities can also have negative economic impact, particularly when their impoundments flood fields, block drainage ditches, undermine roads or flood lakeshore property. Beaver are often detrimental to trout because their ponds allow siltation of spawning areas and warming of water temperatures. In counties where forest and farmland are interspersed, nuisance beaver present the biggest problems.

Despite their beneficial aspects, beaver are currently the number one wildlife species in damage and nuisance complaints. State statutes allow property owners to control nuisance beaver, and conservation officers are authorized to issue permits for their removal. From 1919 to 1947, an average of 761 beaver were taken annually under such permits. Approximately 7,000 beaver were removed by permit trappers in 1980.

MUSKRAT

The muskrat (Ondatra zibethicus) is a 1- to 3-pound rodent closely related to the meadow mouse. It is an important component of wetland communities in the United States and Canada. The muskrat lives in lakes, marshes, streams and rivers, wherever sufficient water depths and emergent vegetation are present.

Muskrats are primarily vegetarians, feeding on the roots, shoots, stems, leaves, tubers and bulbs of aquatic plants or shoreline vegetation. Cattails are their most important food and construction material, but they also feed on bulrush, arrowhead, smartweed, sedges, wild rice and various pondweeds. At times they will supplement their plant diet with crustaceans, frogs or carrion. Muskrats live either in bank burrows or in houses built of plants and mud.

RESOURCE MANAGEMENT

Extensive loss of wetlands has had a detrimental impact on muskrat populations, particularly in southern and western Minnesota. Muskrat populations have generally declined as a result of this agricultural-related drainage and development, although phosphorous-rich runoff has increased emergent vegetation growth that provides muskrats with food in the remaining ponds. Low fertility and plant growth rates in northern marshes are an important limiting factor to muskrat populations. Increased turbidity of the water from silt, wind and rough fish activity reduces vegetation growth that muskrats need.

Where primary management objectives are for both waterfowl and muskrats, an ideal marsh consists of an equal mix of open water and emergent vegetation, well interspersed. Small openings created by muskrat provide open water areas attractive to dabbling ducks and wading birds, but extensive open marsh areas associated with high populations create open-water conditions detrimental to both dabbling ducks and muskrats. Water-level management and the encouragement of high muskrat harvests can help prevent muskrat overpopulations and extensive emergent vegetation loss.

Muskrats first received protection in Minnesota in 1867, when the legislature closed the season from May through mid-November. Winter and spring, or spring-only seasons existed until 1942, when a December season was initiated. Early November or late October openers and December closure in 1956 were initiated. That basic season design has continued for the past 30 years.

From 1909 to 1912 and from 1949 to 1962, in-house trapping for muskrats was prohibited. However, studies demonstrated that in-house trapping was not detrimental to muskrat populations and it has been legal since 1963.

Fall and early winter seasons resulted in higher trapping success and better pelt quality than spring seasons. Opening dates were split for north and south trapping zones 9

times from 1956 to 1984, with 2-week-earlier openers in the north zones. Zone boundaries have varied. These zones were established to circumvent earlier freezes in the north and later fur primeness in the south.

RESOURCE ANALYSIS

Many muskrat survey methods have been tried, including actual muskrat counts at twilight, auto transects of muskrat houses seen near roads, aerial counts of houses and stream burrow surveys. Other indicators of population status have included carcass examinations to determine litter sizes.

Muskrat house densities in good marsh habitat may average as high as 5 per acre, although in less fertile marshes densities are often less than 0.5 houses/acre.

Several studies have documented that muskrat numbers in good habitat are only slightly influenced by trapping. Overtrapping is almost never a problem. The greatest difficulty seems to be maintaining high enough trapping pressure to reduce excessive vegetation damage. Muskrat populations are regulated mainly by weather, emergent plant growth and disease.

Generally, the optimum harvest level is 70 to 75% of the fall population. Throughout most of Minnesota, this level of harvest is seldom reached. Muskrats readily disperse from low-quality or overpopulated habitats, and repopulate suitable habitat areas depleted from drought or other catastrophic factors. Studies conducted in southwestern Minnesota showed no difference in recovery rates of trapped and untrapped populations following a drought.

A summary of muskrat harvests for the 1984-85 season by regions is given in Table 20-2. Since 1976, approximately 11,600 trappers have trapped an average of 696,000 muskrats annually. About 70% of all trappers trap muskrats, and the average trapper catches 60 to 75 muskrats per year. Fur prices have varied greatly in the past 10 years, ranging from an average of \$5.90 in 1979 to an average of \$2.20 in 1982 (Figure 20-5). Since 1979, the value of the annual muskrat fur harvest has averaged \$3.6 million.

Table 20-2. Average muskrat trapping harvests by Department of Natural Resources Regions, 1984-85

Region	Number of trappers	% of statewide total	Harvest	% of statewide total	Average # muskrats per trapper
1	2,085	16.5	126,907	13.4	61
2	2,484	19.7	80,182	8.4	32
3	1,881	14.9	129,657	13.7	69
4	3,565	28.2	438,861	46.2	123
5	1,969	15.6	146,167	15.4	74
6	646	5.1	27,923	2.9	43
Statewide	12,630	100.0%	949,697	100.0%	75

RESOURCE VALUE

The muskrat is one of Minnesota's most important resources for its fur and trapper recreation value. Although not specifically measured, muskrats probably provide more trapping recreation days than any other single species.

The muskrats' feeding and house-building activities directly influence the distribution of emergent vegetation in marshes. Their houses and burrows also serve as den sites, nesting, or resting areas for other wetland wildlife species--including mammals, birds, reptiles and amphibians. As primary consumers, muskrats serve as an important food source for many carnivorous mammals and birds.

Muskrats sometimes cause damage, particularly when their burrowing activities undermine dikes, roads, earthen dams or lakeshore property. Muskrats also may occasionally plug field tiles and small culverts. Although muskrats are abundant and signs of their activities are readily observed, they are not as highly regarded aesthetically as some other furbearer species.

MUSKRAT

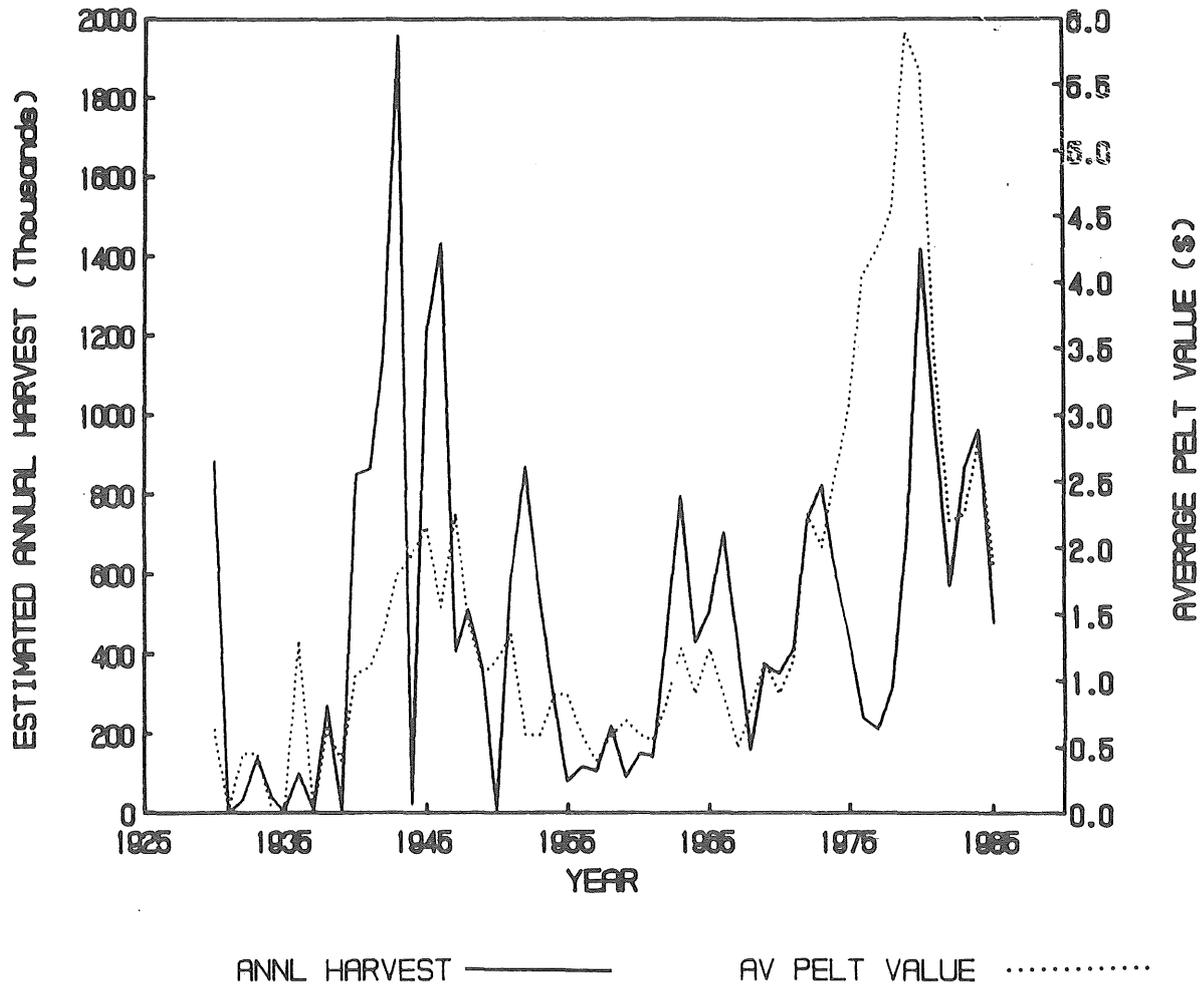


Figure 20-5. Minnesota muskrat harvest and pelt values.

RED FOX

The red fox (Vulpes vulpes) is a medium-sized predator belonging to the dog family. It is common throughout Minnesota, although its densities are lower in heavily forested areas and areas with established coyote populations. It often hunts along open fields, fence lines and grassy openings where small mammals are abundant.

Red fox prey primarily on mice, rabbits and ground squirrels. They also prey on ground-nesting birds and their eggs, and will eat insects, fruits and berries.

RESOURCE MANAGEMENT

Red fox populations in Minnesota have fluctuated widely. From the early 1800s to 1900, they were widespread but not numerous. They were scarce in unbroken forests, but they expanded into lands cleared for agriculture. By the late 1800s, fox became extremely scarce and remained at low levels until the early 1930s.

From the 1930s into the 1940s, fox numbers increased substantially and pelt prices dropped. In 1939, a bounty was authorized for red fox, and from 12,000 to 50,000 red foxes were harvested annually until bounty payments on predators were eliminated in 1965. Since the mid-1940s, fox numbers have remained relatively high and have gradually increased, despite rapidly rising pelt prices in the 1960s and 1970s.

Red fox were unprotected and could be taken year-round until 1977, when both red and gray foxes were legally protected. Hunting and trapping seasons were established with no bag limit. Since 1977, the season length has varied from 91 to 132 days per year.

RESOURCE ANALYSIS

Red fox populations remain high and have been increasing

under intensified land use and harvest pressure. With protection during the pup-rearing season, they have demonstrated the ability to maintain high population levels despite harvests of 60,000 to 90,000 per year. With a high reproductive rate, adaptable diet, and minimal habitat requirements, red fox numbers are expected to remain high. One unknown factor at present is the effect that expanding coyote populations will have on red fox populations.

Every region in the state sustains a fox harvest, highest in the west and south. Annual red fox harvests have ranged from about 100 in 1932 to approximately 90,000 in 1981. From 1975 to 1984, an average of 66,000 red foxes were taken annually. This is higher than any other 10-year period.

The nonconsumptive demand for red fox is important but difficult to measure. Current high fox populations should be more than sufficient to meet foreseeable nonconsumptive demands.

There are demands to reduce fox numbers in some locations. With their ability to suppress game bird and waterfowl populations in areas of limited habitat, some game managers and hunters are seeking to reduce fox numbers on intensively managed nesting areas.

RESOURCE VALUE

Red fox are an important component of Minnesota wildlife communities, serving as a predator of rodents, birds and small mammals. To a lesser extent, they are also scavengers and carrion eaters. Because they prey on ground nesting birds and eggs, red foxes can conflict with attempts to increase ground nesting bird populations.

Red fox provide recreation for nearly 6,000 trappers and 10,000 hunters annually. Red fox fur is also a valuable resource. Estimated value of the statewide annual harvest of red fox in recent years has varied from \$1.8 to \$4.6

million. Red fox pelt values have varied as demand for long-haired furs has fluctuated. In the 1800s, fox pelts commonly brought 50 cents. Values climbed from less than \$1 around 1900 to over \$30 in 1930. In the depression years of the 1930s, the value of long-haired fur plummeted. There was a slight rise in the 1940s but through the 1950s fox pelts were often valueless. In the 1960s, there was a slow but steady increase in value, and this continued until 1978, when it peaked at over \$70. Since then values have dropped to below \$30 in 1984.

GRAY FOX

The gray fox (Urocyon cinereoargenteus) differs from the red fox in having a definite gray color on its back, reddish legs and a black-tipped tail. It weighs from 5 to 12 pounds.

It is a native species found in 45 of the 48 contiguous states, exclusive of the northern Rocky Mountains. It is most common in the deciduous forests of southeast and central Minnesota, although it has been found throughout the state.

Gray fox habitat is similar to red foxes in that it prefers a diversity of fields and woods rather than a large tract of homogeneous habitat. The basic difference is that gray foxes prefer woodlands more than red foxes. Gray foxes readily climb trees whereas red foxes do not. Food habits are similar to those of red foxes.

RESOURCE MANAGEMENT

Although Minnesota lacks information on gray fox populations, densities as high as 3 to 4 per square mile have been reported in Wisconsin. What impact an expanding coyote range is having on the gray fox population is unknown, although reports of coyote-killed gray fox are not uncommon. Both gray and red foxes are susceptible to rabies and distemper, but the gray fox appears to be immune to the sarcoptic mange that decimated red fox populations in the early 1970s.

Gray foxes were classified as unprotected animals and could be taken at any time until 1977, when a season was established for all foxes. A bounty existed for gray fox from 1931 until 1965. Bounty payments of up to \$5 per fox were split equally between the state and counties. There are currently no limits on the number that may be taken. Hunting and trapping seasons run concurrently from late October to the end of February.

Gray foxes are important carnivores of Minnesota's eastern deciduous woodlands, feeding on a variety of small mammals, birds, insects and plant material. Although once viewed as a harmful predator, the damage that gray foxes cause is relatively insignificant and is largely confined to unprotected poultry.

RESOURCE ANALYSIS

A rough estimate of the gray fox population may be determined by examining harvest data. Population models indicate that a stable red fox population was maintained when the harvest level was 55% of the annual population. Assuming that this would also apply to gray foxes, it is probable that gray fox numbers did not exceed 16,000 to 17,000 during the bounty years, 1954 to 1965 and high pelt price years, 1974 to 1984. It would appear that gray fox populations in Minnesota cannot sustain harvests exceeding 9,000 per year.

Because gray foxes are primarily associated with woodlands, the continued loss in quantity and quality of deciduous woodland within the agricultural areas of the state will have a negative impact on their numbers.

Data available from 1976 through 1984 indicates that successful gray fox hunter numbers averaged 3,700 per year and successful trappers averaged about 1,500 per year. The average annual harvest per trapper is 2.6 and 1.6 per hunter. Approximately one-third of all fox taken by hunters is taken incidental to other hunting.

The peak harvest of gray foxes was 16,000 in 1948. From 1976-1984, annual harvests averaged 7,100, 57% of which was taken by hunters and 43% by trappers. Before 1970, there was little relationship between fur price and harvest, although since that time, fur price and harvest have been highly correlated.

The mean pelt value averaged \$2 from 1930 to 1946, and

\$.37 from 1947 to 1964. After 1973, pelt prices began to climb, until they peaked at \$45 in 1978. Current prices are in the \$20 to \$25 range.

There is little demand to reduce gray foxes because of predation problems. Nonconsumptive demand is probably relatively low, and should be met by maintaining population levels capable of sustaining consumptive demands.

RESOURCE VALUE

Gray fox provide recreational value to approximately 3,700 hunters and 1,500 trappers annually. The value of gray fox pelts taken averages \$234,000 annually.

Since gray fox are largely nocturnal, they are not seen by many people. However, the presence of their tracks in snow, or an actual sighting, enhances outdoor experiences.

COYOTE

The coyote (Canis latrans) is Minnesota's most abundant, and adaptable, large canid. Adult coyotes weigh an average 25 to 30 pounds, although large males may sometimes exceed 50 pounds. Minnesota coyotes live in forest and farmland transitional areas and occur in dense forest to open prairie.

RESOURCE MANAGEMENT

In presettlement times, the coyote was distributed statewide, but was most common in southern Minnesota. During the settlement and land clearing era, coyotes moved north and partially filled the niche vacated by gray wolves. The main range presently comprises about 40,000 square miles of northcentral Minnesota, where densities approximate 1 coyote per 2 square miles.

In the last 2 decades, coyotes have reoccupied much of their former southern and western Minnesota range. Densities in the southeast may equal those in the north; however, densities are much lower in the remainder of the farmland zone.

The coyote is among the few furbearer species that have always been unprotected in Minnesota. It was first bountied, along with gray wolves in 1849, and was bountied on a near-annual basis until bounties were repealed in 1965. Although records did not always differentiate between coyote and wolf bounties, 1,200 to 3,000 coyotes were bountied annually between 1943 and 1964. Following the elimination of bounties, increased concern over coyote depredations prompted the creation of the Directed Predator Control Program in 1969, which has paid for killing 300 to 1,000 coyotes annually in response to damage complaints.

RESOURCE ANALYSIS

Coyotes are among the most productive and adaptable large predators. The statewide pre-birth population is estimated at 20,000 to 25,000, with post-birth numbers approximating 40,000. The annual harvests of 8,000 to 12,000 (Figure 20-6) utilize 20 to 30% of the available autumn population, leaving about two-thirds of the population for reproduction and nonconsumptive human uses.

Population indices derived from annual scent post surveys indicate a relatively stable population in the forest, and much lower but gradually increasing populations in the transition and prairie zones. The variety of habitats available in these zones attests to the adaptability of coyotes. They exist wherever there is adequate prey, sufficient escape cover from humans and minimal interspecific competition from gray wolves.

The demand for coyotes depends on the user groups. Most upland game and deer hunters, fox trappers and farmers would argue that coyotes are too numerous. Most coyote hunters and trappers, waterfowl managers and coyote protectionists would prefer more coyotes. As gray wolf range gradually increases, coyotes in certain areas will be displaced by wolves. Generally, a more than adequate supply of coyotes exists to meet current and anticipated demands.

The coyote will continue to be controversial, due to livestock and poultry depredations, displacement of fox and predation on game. Recent revamping of the Directed Predator Control Program should reduce nuisance coyote problems. Previously, control take was negatively correlated with the monthly timing of complaints. During the next 6 years coyotes should not measurably reduce fox harvests; however, long-term coyote range expansion may reduce fox numbers and alter other ecosystem components.

RESOURCE VALUE

Coyotes, which are adaptable and opportunistic predators, will take whatever type of food is most readily available. Deer, most often in the form of carrion, snowshoe hares and mice are the predominate items in the coyote's diet. Small mammals, insects, fruits and berries are eaten in the summer. Established coyote populations tend to exclude red fox and coyotes in turn are displaced by established gray wolf populations.

The coyote is a valuable furbearer. Approximately equal numbers are taken by trapping and hunting. From 1975 to 1985, 7,000 to 12,000 were harvested annually. From relatively high pelt prices in the 1930s, up to \$13, prices declined to approximately \$1 until the mid 1960s. Since 1972, pelt prices have averaged \$31, and peaked at \$57 in 1978. Coyote pelt sales statewide have ranged from \$200,000 to over \$500,000 annually in the last decade.

Coyote hunters number 3,000 to 8,000 annually, and harvest about one coyote per person; coyotes are often taken incidental to hunting other species. Approximately 30,000 coyote hunter-days are expended annually. In comparison, 30,000-40,000 days of effort are expended by 1,000 to 2,000 coyote trappers annually, who average 2 to 5 coyotes each. The coyote harvests are distributed approximately 40, 20 and 40% in Department of Natural Resources Regions 1, 2 and 3, respectively, with low but increasing harvests occurring in the 3 remaining regions.

Coyotes can detrimentally affect livestock producers, particularly sheep and poultry raisers, although no total dollar figures for losses are available for Minnesota. Calculation of wildlife losses from coyote predation is even more difficult. Estimates place deer losses at 1 per coyote annually.

Coyotes also provide aesthetic benefits to nature viewers, photographers and artists, of which no attempt has been made to quantify.

COYOTE

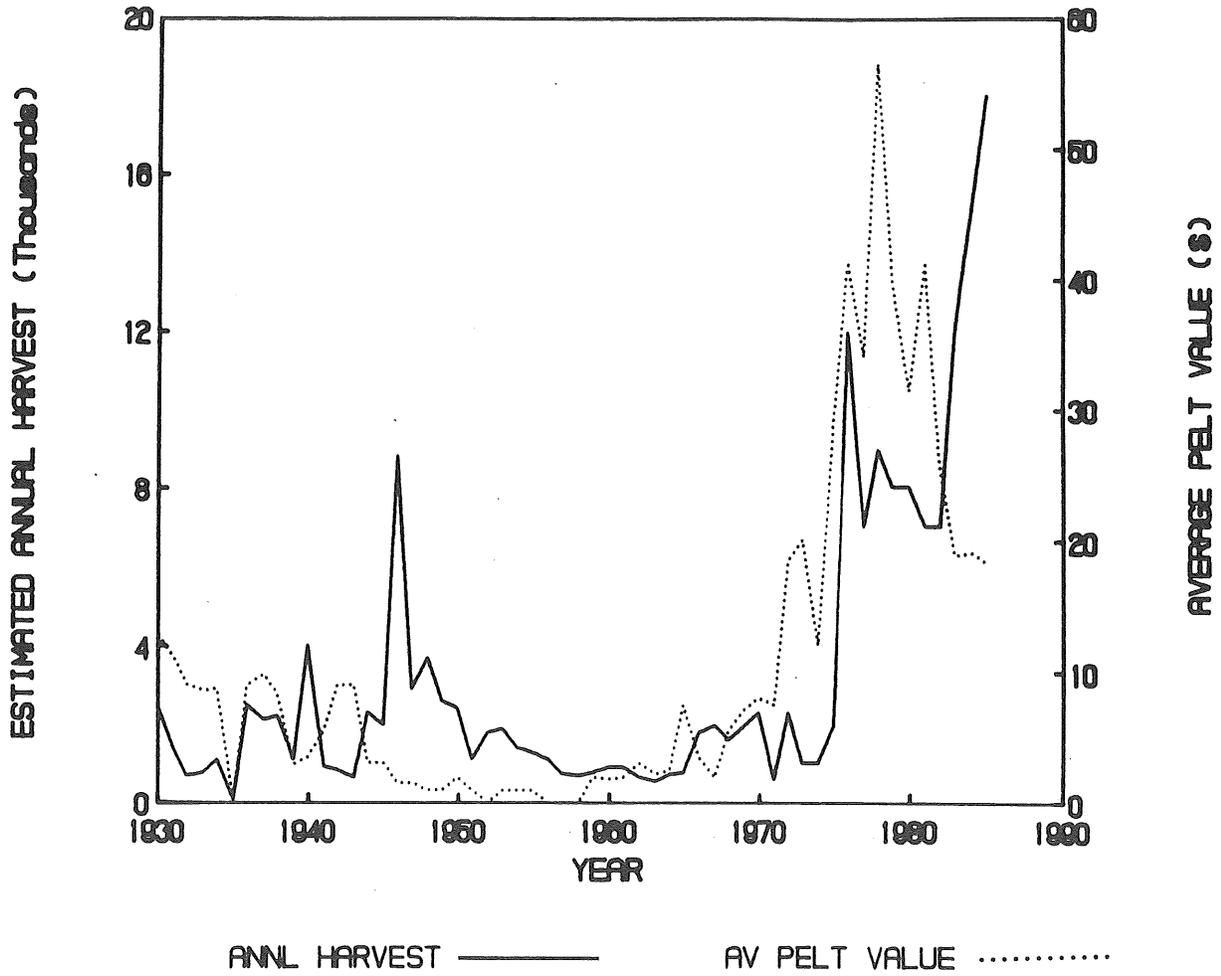


Figure 20-6. Minnesota coyote harvest and pelt value.

RACCOON

The raccoon (Procyon lotor) weighs 25 to 30 pounds and has a grizzled coat with a distinctive black mask and ringed tail. Its preferred habitats are riparian woodlands, marshes and woodlots scattered through agricultural lands. Den sites may be hollow trees, abandoned farm buildings, fox or badger holes, rock piles, field tiles or nests in cattail marshes.

Raccoons are omnivorous, eating a wide variety of vegetable and animal matter. Insects, crayfish, fruits, carrion, birds' eggs and nestlings are taken as available. In agricultural areas, corn is a major part of their diet.

Although they are not true hibernators, raccoons become inactive in cold weather, particularly if the ground is snow-covered.

RESOURCE MANAGEMENT

Raccoons were uncommon in Minnesota before 1900, except in the southeast. Since 1900, raccoon populations have expanded north and west and their numbers have increased dramatically.

The Minnesota legislature established the framework for a raccoon season in 1909, but raccoons remained without protection until the first season was set in 1917. Seasons of varying lengths were established from 1917 through 1964. From 1965 through 1974 raccoons were again unprotected. Protection was reinstated in 1975 and continues to date.

Since 1975, raccoon hunting and trapping seasons have nearly always run concurrently. Opening dates are set to coincide as nearly as possible with the onset of fur primeness. The season closing date is limited by statute to be no later than December 31.

RESOURCE ANALYSIS

Although the fur value of individual pelts remained relatively constant from 1930 through 1970, the total harvest of raccoon shows a 5-fold increase over the same period (Figure 20-7). After 1970, fur values increased dramatically, as did hunter and trapper effort, and the recent increased harvests are probably not directly proportional to populations. However, population trend surveys using scent-posts indicate that raccoon numbers have increased dramatically in the farmland zone, remained high and relatively stable in the transition zone, and have increased in the forest zone.

Raccoon population growth has been limited somewhat by wetland drainage in the farmland zone, but the animal's high adaptability has enabled it to increase. In other areas, maturation of oak woods, increased agriculture in previously forested lands, and a corresponding increase in outbuildings and corn have improved habitat conditions for raccoon.

Hunter and trapper numbers and raccoon harvest are closely correlated with fur prices (Figure 20-7). Although the number of hunters has fluctuated somewhat since 1978, the trapper numbers appear to have stabilized.

RESOURCE VALUE

Raccoons prey on or scavenge a variety of terrestrial and aquatic animals, as well as eating large amounts of plant foods. As predators, raccoons may reduce waterfowl production in some wetlands. Waterfowl managers and hunters may favor limiting raccoon numbers to increase waterfowl production, while raccoon hunters and trappers are interested in keeping numbers high.

Raccoons are economically one of Minnesota's most important furbearers. In 1981, a peak harvest of 206,000 raccoon with an estimated value of \$6.7 million represented 37 percent of the total value of all furbearers harvested

that year. From 1975 through 1983, the annual value of raccoon pelts taken has ranged from \$1.6 to \$7.2 million.

Raccoons can cause damage to field corn and sweet corn and may also raid poultry houses and garbage cans. Economic losses to individual landowners are not often large but cause frustration.

Raccoon hunting is a uniquely American tradition, and in Minnesota an estimated 11,000 to 20,000 persons hunt raccoon. Trained dogs are used to "tree" raccoons. The animals are usually taken at night by hunters using dogs and lights. Raccoons are sometimes taken during the day in the late fall and early winter from wetland areas.

Raccoon trapping provides a source of recreation and income to 9,000 to 12,000 trappers annually. Although hunters take more total raccoons than trappers, the take per individual is nearly the same for both groups.

The raccoon provides nonconsumptive recreation to hunters who are training dogs. Raccoon may be run with dogs without being taken from July 15 to October 15. The sound of dogs on trail and the sight of a raccoon in a tree provides enjoyment to these hunters.

The aesthetic value of wild raccoon is difficult to determine. Raccoons are nocturnal, but their tracks are evident in muddy stream banks and dusty road beds. Raccoons are common in many campground areas and are readily seen, but they may become a nuisance in these situations. Raccoons at bird feeders and residential garbage sites are a source of enjoyment to some and exasperation to others.

RACCOON

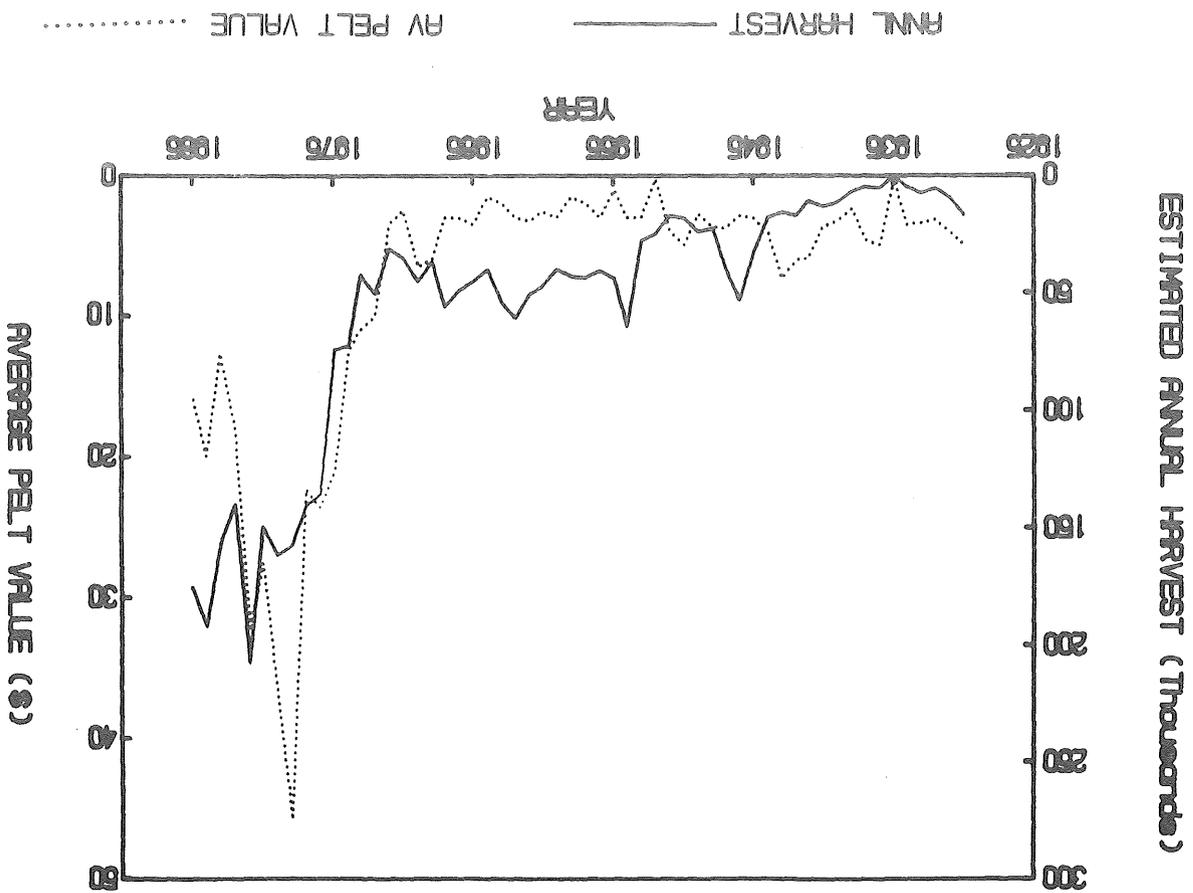


Figure 20-7. Minnesota raccoon harvest and pellet value.

FISHER

The fisher (Martes pennanti) is a fox-sized, tree dwelling member of the weasel family, resembling a very large mink. Males weigh 10 to 14 pounds, about twice the size of females. Although fisher prefer large areas of continuous forest, particularly older timber stands, they inhabit many coniferous and deciduous forest types in northern Minnesota. Prey availability, principally small mammals and carrion, is the primary limiting factor to fisher populations.

RESOURCE MANAGEMENT

Fisher occurred throughout the presettlement forested regions of Minnesota; then logging, wildfire and homesteading severely altered the forested habitats. These habitat changes, combined with unrestricted harvests, resulted in the near extirpation of fisher from the state.

In 1917 fisher received some protection and a no-limit season was established. However, growing concern over fisher scarcity prompted a complete closure of the season in 1929. Subsequent regrowth of the forests and complete legal protection enabled fisher populations in northern Minnesota to recover gradually so that complete protection was no longer necessary nor desirable.

The season was reopened in 1977. From 1977 through 1979 a 62-day trapping season was held with a limit of 3. In 1980, the season was closed because of an excessive harvest. Since 1981, an annual 10- to 17-day season has been held with a limit of 1 fisher per trapper.

RESOURCE ANALYSIS

Trappers are required to register fisher pelts. Registration includes supplying harvest date and location information and surrendering the carcass. Population

estimates and trends are calculated utilizing a population modeling process based on data derived from registration, carcass analysis and related data. Since 1977, the statewide autumn fisher population estimate has ranged from approximately 5,000 to 10,000. Maximum density is 1 fisher per 2.5 to 3 square miles.

Minnesota fisher occupy a range of approximately 38,000 square miles. Habitat suitability and human-related mortality appear to be the main factors limiting range expansion. Since 1981, harvest levels have been calculated at 8 to 15% of the population (Figure 20-8). This harvest level should allow an annual fisher harvest of 800 to 1,500, a post-harvest population of 7,000 to 10,000 and a slight 3 percent annual population growth rate. Harvest rates exceeding 17% may result in population declines.

Fisher harvest management is complicated by their vulnerability to trapping and by high trapper demand. The demand is a direct consequence of consistently high pelt prices. Trapper demand exceeds supply and is likely to do so in the future.

RESOURCE VALUE

The carnivorous fisher is an integral part of the northern forest ecosystem. Fisher are noted for their ability to prey on porcupine, but small mammals, snowshoe hares and deer carrion are much more important in their diet. Fisher are probably not a major controlling factor on any of their prey species. Bobcat populations may be limited by fisher competition.

The total value of fisher pelts is a relatively small proportion of the value of Minnesota's entire furbearer resource. Total fisher pelt values have averaged \$100,000 annually over the past 5 years. However, on a per pelt basis, the fisher consistently ranks among the most valuable

of any species in the state. Average pelt prices over the past 6 years were \$114 for females and \$84 for males.

Although pelt registration yields reliable information on numbers of successful trappers, there is no data on total numbers of individuals seeking fisher.

Since fisher are most active at night and occur in relatively low densities, the species does not lend itself well to nonconsumptive use. Tracks, the most common evidence of fisher presence, supply some viewing opportunity. Nonconsumptive demands should be satisfied by the population management scheme designed to provide consumptive demand.

FISHER

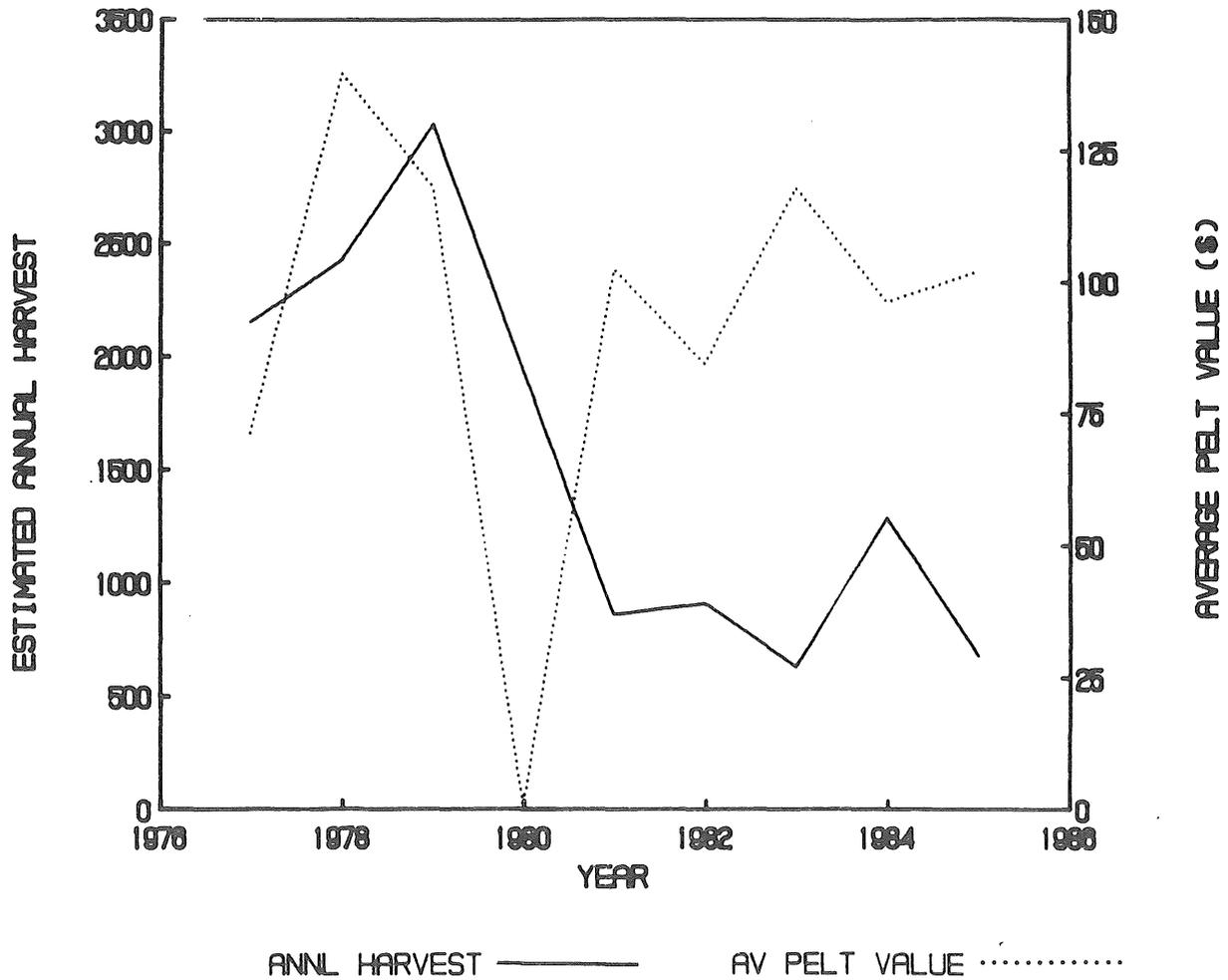


Figure 20-8. Minnesota fisher population and harvest.

PINE MARTEN

The pine marten (Martes americana) is a tree-climbing member of the weasel family weighing 1 to 2 pounds. It is mainly associated with boreal coniferous forests, although its range in North America is extensive. Martens in Minnesota are limited to coniferous forest areas in the extreme northeastern counties. Clear-cutting reduces martens for up to 15 years, but partial logging that leaves a residual stand has little effect on marten populations. The abundance of red-backed voles and meadow voles, major prey for marten, may influence habitat selection, particularly in winter.

RESOURCE MANAGEMENT

Marten were originally found as far south and west in Minnesota as Crow Wing and Polk counties, but by the 1930s they had been nearly eliminated throughout their range. Extensive logging and forest fires greatly altered the northern forest during the early decades of the 20th century. These changes also added to the decline of other boreal forest species such as woodland caribou and moose. The habitat then favored species such as deer, which was adapted to young forests and early successional stage vegetation.

Little information is available regarding early marten harvests, but there is evidence that harvests had already declined drastically by the 1890s. The last marten captured in northwestern Minnesota was taken on the Northwest Angle in 1920. Between 1920 and 1953, evidence of pine marten in Minnesota was restricted to a few reports of tracks or captures in Cook County.

Between 1953 and 1969, several captures were reported in northern St. Louis, Lake and Cook counties. In the early 1970s the marten population began increasing in Cook and

Lake counties and expanded to the south and west. Marten are now most abundant in Cook, Lake, northern St. Louis and northeastern Koochiching counties. The marten decline and recent increase parallels regulated timber harvests and effective fire prevention, which caused much of the area to again approach mature coniferous forest conditions. Deer have declined and moose and marten have increased.

In Minnesota, marten were unprotected until 1917. A 139-day season from October 15 to March 1 was held in 1917 and 1918. From 1919 to 1923, a 122-day season ran from December 1 to April 1. Marten were again unprotected from 1924 to 1928. The season was closed completely beginning in 1929 and, except for 1932 when the records do not specify, remained closed until 1985 when a 16-day season with a limit of 1 ran from November 30 to December 15 in a small portion of the marten range.

RESOURCE ANALYSIS

Marten accidentally harvested by trappers has gradually increased from 4 in 1972, 8 in 1973, about 100 in 1978, to over 200 in 1979. Since 1979, the incidental take of pine marten fluctuated between 100 and 250 per year. Carcasses from confiscated and registered marten have yielded data on sex and age ratios, productivity and survival. A snowtrack survey of marten abundance that has been conducted since 1979 in Cook County indicates a stable to increasing population in that area.

The habitat base in the present marten range is fairly stable. Timber management is unlikely to affect habitat as extensively as in the early 1900s because wildlife considerations are now an integral part of forest management.

The marten harvest will ultimately depend on range expansion. Since they are easily trapped, harvests will require careful regulation. In 1985, about 750 trappers

requested and were issued 1 marten tag each and approximately 430 marten were registered. Since there was no previous tradition of marten trapping and the limit was very low, it is expected that interest and demand for marten will increase.

RESOURCE VALUE

Marten are mainly predators of small mammals such as voles, mice, chipmunks, red squirrels, flying squirrels and snowshoe hare. They also eat eggs, insects and berries when available.

The aesthetic value of marten is high. Since marten are bold and inquisitive, many homeowners and resort operators are finding that they readily come to bird feeders and porches to feed on suet and meat scraps. Marten also sometimes provide viewing opportunity to hunters, cross-country skiers, canoeists and other outdoor users.

Marten can provide considerable trapping recreation. Since they are easily caught, beginning trappers can be successful without having the amount of skill required for more wary species. The fur value varies, but presently averages \$30 to \$40 per pelt. No major negative economic values are associated with marten. There is little predation on desired game species or domestic animals, and little or no damage caused to the environment or private property.

MINK

Wild mink (Mustela vison), of the weasel family, are an important part of aquatic communities throughout North America, except in tundra and desert regions. Their high adaptability makes them common throughout Minnesota along shoreline habitats of streams and rivers, lakes, wetlands, bogs and drainage ditches--wherever adequate food supplies and secure denning areas exist.

Mink hunt both aquatic and terrestrial prey. Common food items include mammals, fish, birds, amphibians, crustaceans, insects and reptiles. No one food item seems more important than another; however, mink abundance is often associated with muskrat abundance.

They locate their dens in muskrat bank burrows and houses, hollow trees, beaver houses and burrows. Males use many dens infrequently over a large home range, 1 to 3 miles of stream length, while females use fewer dens, 2 to 4 in winter and up to 20 dens while rearing young in summer. Female home ranges are usually smaller than males throughout the year.

RESOURCE MANAGEMENT

Trapping seasons for mink have generally opened near November 1 for the past 100 years, although seasons from 1913 to 1922 began on December 1 and mink were unprotected from 1925 to 1932. Primeness surveys in 1950 recommended that mink seasons not open before November 10. Since 1961, season length has averaged 47 days. Surveys from 1957 to 1964 indicated that 46% of the mink were taken the first week, 29% the second, 15% the third, and 10% the fourth. Seasons longer than 4 weeks had similar patterns with 10 to 15% of the mink being taken the last week. On average, 60% of the harvest is composed of males and 40%, females.

About 65% of the average 11,000 trappers harvest mink. Mink harvests average about 61,000 animals per year, fluctuate greatly, and are influenced by weather during the season, general habitat conditions, trapping pressure and mink population levels (Figure 20-9). The majority of the trappers and harvest occur in the southwest and northwest regions. The average annual mink harvest per trapper ranged from 8 in Region 1 to 4 in Regions 5 and 6 (Table 20-3).

Table 20-3. Average number of mink trappers, harvest and success, 1976 to 1984, by Minnesota Department of Natural Resources region.

	Region						Totals
	1	2	3	4	5	6	
Trappers (%)	1,950 (20)	1,850 (19)	1,400 (14)	2,550 (26)	1,550 (16)	500 (5)	9,800 (100)
Harvest (%)	14,000 (23)	12,100 (20)	11,000 (18)	16,000 (26)	6,100 (10)	1,800 (3)	61,000 (100)
Mink/ trapper	7	6	8	6	4	4	6

Loss and degradation of aquatic habitat has had a detrimental effect on mink populations throughout Minnesota, especially in the prairie and transition portions of the state. Shoreline modification of lakes, streams, rivers and wetlands has undoubtedly reduced their carrying capacity for mink. Environmental contaminants such as mercury, PCB, DDT, DDE, diieldren and others are potential hazards for mink. Accumulation of these chemicals in the food chain, especially fish flesh, could potentially result in reproductive failure or mortality in mink.

RESOURCE ANALYSIS

There is insufficient data to determine mink populations accurately. The mink harvest fluctuates greatly from year to year and shows little correlation between the number of mink harvested and the average price received per pelt. If trapping pressure is relatively constant, harvest levels can be used to monitor population trends. The extent to which trapping mortality influences population levels, however, remains unknown.

Approximately 61,000 mink were trapped annually in Minnesota from 1976 through 1984 (Figure 20-9). An indirect population estimate, assuming a 20% harvest rate, yields an average annual population of about 300,000 mink statewide.

RESOURCE VALUE

Mink are important predators in aquatic and terrestrial communities. Because they commonly switch their hunting strategies to take advantage of abundant or highly vulnerable prey, they seldom depress prey populations. Mink predation on ground-nesting birds such as waterfowl may sometimes be conflicting with other wildlife management objectives.

Mink are best known for their valuable fur. There is much variation in mink in North America due to different temperatures, latitudes and diversity of their habitats. Environmental effects on fur quality appear to influence the mink more so than other animals, such as diet, aquatic alkalinity system and the shade quantity. Males are about one-third larger than females and are about twice as valuable to the trapper.

Minnesota's average annual mink harvest of 50,000 from 1970 to 1984 is the nation's highest. From 1976 thru 1984, pelt values averaged \$31 for males and \$14 for females. The total annual value is slightly over \$1 million. Although

MINK

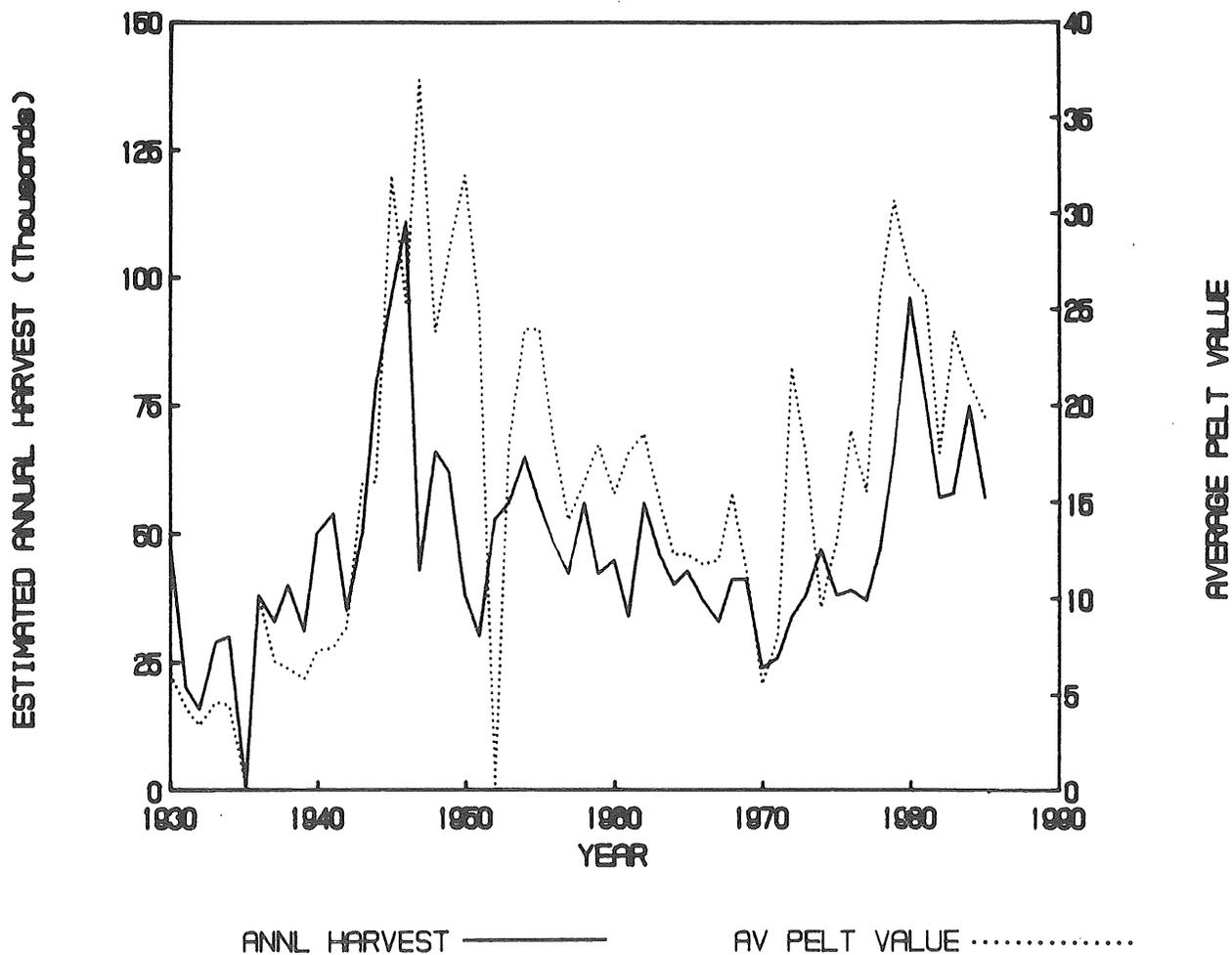


Figure 20-9. Minnesota mink harvest and pelt value.

production of ranch mink greatly surpasses wild mink harvests, each has unique markets and demand.

Mink infrequently prey on poultry. They are also occasionally pests around game farms.

Because of their secretive and largely nocturnal habits, mink are seldom observed, although their tracks and other sign are readily identifiable to the skilled observer. Nonconsumptive recreational or aesthetic values of mink have not been measured.

WEASELS

Three species of weasel inhabit Minnesota. The short-tailed weasel (Mustela erminea), or ermine, is a medium-sized weasel and is the most widespread weasel in North America. It lives in lowland, woodland and meadow environments, avoiding dense coniferous forests.

The long-tailed weasel (Mustela frenata) is the largest weasel and has a more southerly distribution. Long-tailed weasels are found from southern Canada to Mexico and into northern South America; they favor brushland, open timber, field borders and grassy areas near aquatic habitat.

The least weasel (Mustela nivalis) is the smallest carnivore in Minnesota. Distributed throughout Canada and the upper midwestern states, it is uncommon throughout this range and is not an important furbearer.

RESOURCE MANAGEMENT

Weasels have always been unprotected in Minnesota. The market demand for white winter fur determines the weasel harvest. For 20 years the long-tailed and short-tailed weasels were grouped in the harvest summary, and combined harvests averaged 87,000 and peaked at 253,000 in 1930. Longtail harvests have been below 10,000 since 1953, and ermine harvests have been below 10,000 since 1960.

Weasels benefit from management directed at ruffed grouse and deer. Habitat destruction as a result of intensive agricultural practices, urbanization and industrial development is offset to a very small degree through the small wetland acquisition program of both the state and federal government and private sectors.

RESOURCE ANALYSIS

There is insufficient data to determine weasel population levels, habitat conditions or adequate harvest

levels accurately. Very little specific information is available on weasels.

The combined harvest of ermine and longtails is about 5,300 animals (Tables 20-4, 20-5). Slightly more than half the harvest of ermine occurs in Region 2 and one-third of the trappers reside in that region (Table 20-4). Slightly more than half the harvest of longtails occurs in Region 1, which has 43% of the trappers (Table 20-5).

Table 20-4. Average annual short-tailed weasel (ermine) harvest, trappers and success by Department of Natural Resources Region, 1976-1984.

	Region						Total
	1	2	3	4	5	6	
Harvest	700	1800	800	100	0	200	3600
(%)	20	51	22	2	0	5	100
Trappers	350	450	300	100	0	100	1300
(%)	26	36	22	8	0	8	100
Ermine Trapper	2	4	3	1	0	2	3

Table 20-5. Average long-tailed weasel harvest, trappers and success by Department of Natural Resources Region, 1976-1984.

	Region						Total
	1	2	3	4	5	6	
Harvest	500	1100	350	tr.	-	-	1950
(%)	24	57	17	1	-	-	99
Trappers	250	430	250	70	0	0	1000
(%)	25	43	25	7	0	0	100
Long Tail Weasel Trapper	2	3	1	tr.	0	0	2

The supply of weasels probably exceeds the demand. Recent estimates indicate that 8% of the trappers

pursue ermine and 6% pursue longtails. The lack of reliable information precludes a quantified statement of supply and demand for both ermine and long-tailed weasels.

RESOURCE VALUE

All 3 species of weasels are commonly considered assets because they destroy large numbers of rodents, especially rats and mice. Fifty to 80% of their diet consists of small mammals. In the absence of preferred foods, the weasel will switch to alternate prey such as cottontail rabbits, insects, birds and eggs.

Occasional local damage has been associated with weasels. Poultry and other domestic fowl are taken opportunistically or during a dearth of common prey species. Surplus killing and caching of food occurs when weasels discover a locally abundant food source. Unused food is stored and utilized during times of scarcity.

Aside from their value in control of rodent populations, the white winter pelage of northern weasels is valued in the fur trade as ermine. The long-tail pelage is quite short and slightly cottony. Most winter long-tailed weasel pelts are used in their natural color. The short-tail pelage is longer, denser and creamy white to yellowish. Short-tail pelts are frequently dyed.

The average annual short-tailed weasel harvest in Minnesota was 3,600 from 1976 to 1984. Ermine reportedly averaged 50 cents per pelt. The total value of the annual ermine harvest approaches \$2,200.

The average annual long-tailed weasel harvest in Minnesota was 2,000 from 1976 to 1984. The reported average price per pelt for this same period was 89 cents. The total value of the annual long-tailed weasel harvest is about \$1,900. The two species combined have an average harvest value of just over \$4,000.

BADGER

The badger (Taxidea taxus) is a large member of the weasel family. Its wide flattened body has short, powerful legs equipped with large claws for digging. The North American badger occurs in 25 states, 5 Canadian provinces and most of northern Mexico. It prefers open grasslands where burrowing rodents are common.

RESOURCE MANAGEMENT

Originally an animal of prairies and open grasslands, badgers increased in eastern and northern Minnesota when forests were cleared for pastures and hayfields that supported pocket gophers and ground squirrels. Badgers were unprotected until the season was closed in 1940 for 3 years. Badger seasons were established from 1943 through 1964 and then the badger again became unprotected. Protected status with regulated seasons was reinstated in 1979. Presently, badgers are harvested from late October through February with no restrictions on harvest numbers. A hunting season was established on badgers in 1980 that runs concurrent with the trapping season.

RESOURCE ANALYSIS

Very little information is available on the present status of Minnesota badger populations. Badger are very difficult to census because of low densities, uneven distribution and inadequate census techniques. The primary badger range in Minnesota is approximately 60,000 square miles. Distribution within this range is related to the amount of grassland and the density of prey base.

As with other furbearers, badger harvest and hunter/trapper numbers have fluctuated with fur prices, indicating that supply was probably adequate to meet the harvest demand. Since the record harvest of 8,000 animals

in 1980, harvests have declined steadily with pelt prices, while badger hunter and trapper numbers have remained at an annual average of 3,000.

Relatively low productivity and declining habitat, coupled with increased demand as a result of high fur prices, could provide the potential for overharvest. However, it is not known at what harvest level this is most likely to occur.

Nocturnal habits generally limit nonconsumptive demand of the badger. This demand should be met by management practices that perpetuate populations capable of sustaining hunting and trapping demands.

RESOURCE VALUE

Badgers prey on rodents by digging them out of their burrows. These rodents include ground squirrels, pocket gophers, voles, mice, occasional small birds, reptiles, amphibians and insects. The badger's major contribution to Minnesota's ecology may be its role in controlling these potential pest populations. Its value in this regard far outweighs the sometimes inconvenient placement of its own burrows.

Historically, the badger's pelt has not been an important fur resource. During the 40 years from 1930 to 1970, harvests and fur value were relatively low. However, during the 1970s and into the 1980s, demand for long-haired furs increased dramatically, with a peak harvest in 1980 of 8,000 animals with an estimated value of \$150,000.

The badger is quite easily trapped or cornered by hounds and is not highly prized for its recreation potential. However, badgers have some aesthetic appeal due to their unique behavior, low visibility as a nocturnal predator and reputation for tenacious defense.

SPOTTED SKUNK

The spotted skunk (Spilogale gracilis) or "civet cat", is a member of the weasel family. It is characterized by conspicuous black and white markings that warn of its ability to spray a pungent, acrid fluid.

Spotted skunks are closely associated with agriculture and, in particular, the buildings and grain bins of small farms where rats and mice are abundant. They also eat many insects, reptiles, carrion, birds, eggs, fruits and vegetables. Most dens are under wood piles, old buildings or other shelters where litters of 4 to 6 young are born.

RESOURCE MANAGEMENT

Migrating from the southern plains, spotted skunks were first reported from Minnesota in 1892 and were found throughout the state by the mid-1930s. Spotted skunk populations in Minnesota peaked in the 1940s, then declined drastically. The decline is probably related to the increase in row crops, "clean" farming practices, destruction of old buildings and fence rows, improved grain storage and rodent control and the increased use of insecticides. Presently, spotted skunks are classified as a species of special concern in Minnesota and are rarely found in the southern half of the state.

The present trend toward continuous row cropping and destruction of old farm sites has drastically reduced the habitat and prey base needed by the spotted skunks on the edge of its range. The principal range of spotted skunks in southern Minnesota encompasses approximately 16,500 square miles but the distribution and density of civets within the range is probably very spotty.

Management of the spotted skunk has not been distinguished from the striped skunk and has been limited to regulating trapping seasons and monitoring harvest. The

first season, running from mid-October to March, was established in 1923. A 195-day season was in effect until 1935, then reduced to 133 days and finally eliminated in 1949. At present, the spotted skunk remains unprotected in Minnesota.

Estimated annual harvests of spotted skunks rose steadily during the first 10 years record were kept, reaching a peak harvest of 19,000 in 1946. The following year only 2,700 were reported taken, indicating a rapid decline in the population. Since 1948, annual harvests have remained below 2,000 in spite of record high pelt prices in the late 1970s.

RESOURCE ANALYSIS

No census data is currently available for spotted skunks because of low densities and inadequate census techniques. Harvest data probably does not reflect short-term population trends. However, the fact that harvests remained low even though pelt prices increased to over \$7 in the late 1970s indicates that the low population does not meet harvest demand at this time.

The number of trappers that harvest spotted skunks has been less than 1,000 annually since 1976, and the harvest has been less than 1,000 animals annually. Due to the small sample size, exact harvest numbers cannot be calculated from trapper surveys (Table 20-6).

RESOURCE VALUE

The spotted skunk is an efficient predator on insect and rodent pests, providing a valuable service to Minnesota's farm community during the early 1900s. Because this animal occasionally harbors the rabies virus, however, civets were often destroyed as pests. The extirpation of the spotted skunk would be an unfortunate loss to the species diversity and ecology of Minnesota's farmland

wildlife community.

Since 1950, the spotted skunk's low population has not provided Minnesota trappers and hunters with significant recreation. Most spotted skunk harvest occurs incidentally in traps set for other furbearers. Even though pelt prices have been high in recent years, the small harvest and relatively low value of pelts total less than \$10,000 annually.

Table 20-6. Distribution of estimated annual spotted skunk harvest among Minnesota Department of Natural Resources regions.

	Region					
	1	2	3	4	5	6
Percent in region	0.5	2	18	77	2	0.5

Source: Minnesota Department of Natural Resources

STRIPED SKUNKS

The striped skunk (Mephitis mephitis) is a cat-sized North American member of the weasel family occurring throughout southern Canada, the United States and extreme northern Mexico. It is black except for a thin white stripe on the forehead and 2 highly variable white stripes forking from the head that serve as a warning of its musk spraying defense mechanism.

Striped skunks occupy a variety of habitats, but are not common in continuous forests or lowlands where the water table is close to the surface. Their favored prey includes insects, small rodents, amphibians, carrion, plant material and occasional ground-nesting birds or their eggs. Fence rows and grasslands are preferred as undisturbed den sites and the trend in farming practices toward larger farms with fewer fences may limit skunk densities in some areas.

RESOURCE MANAGEMENT

Historically, skunk populations in the midwest have fluctuated drastically, most likely affected by winter starvation or disease. In Minnesota, striped skunks are the major wildlife host for rabies.

Striped skunk management in Minnesota has been limited to regulating trapping seasons, estimating the harvest and monitoring population trends. A skunk harvest season from mid-October through February was established in 1923. A 195-day season was in effect until 1935, when the season was reduced to 133 days and finally eliminated in 1949. Presently the striped skunk remains unprotected in Minnesota.

Estimated trapper harvests, recorded since 1930, show harvest trends that closely parallel fur prices, indicating that skunk populations have generally exceeded trapping demands.

RESOURCE ANALYSIS

Trend indices since 1976 from May roadside wildlife counts and fall predator scent post surveys indicate that skunk populations fluctuate periodically. While actual population numbers are not known, trends show a decline in the population in 1978 for unknown reasons, with a gradual recovery over the last 5 years.

Skunks are most often associated with cultivated areas. Their primary range encompasses 73,000 square miles. Recent trends toward modern "clean" farms and larger fields with fewer fence rows probably result in loss of skunk habitat.

Harvests tend to follow fur prices. This pattern indicates that populations are probably adequate to meet the demand of the fur industry in most years. Since most skunk harvest occurs while trapping for other species, the number of trappers specifically seeking skunks is difficult to assess. An average of 5,000 trappers have reported harvesting an average of 41,000 skunks annually since 1976 (Table 20-7).

Table 20-7. Striped skunk range, mean estimated harvest and mean estimated trapper numbers in Minnesota by Department of Natural Resources Regions, 1976 to 1984.

Region	Range (sq. miles)		Average annual harvest	Average number trappers
	Primary	Peripheral		
1	23,696		12,628	1,095
2	11,896	6,454	1,476	515
3	10,613		6,355	720
4	17,115		15,047	1,775
5	6,736		4,346	585
6	2,819		1,148	310
Totals	72,876	6,454	41,000	5,000

In Minnesota's prime waterfowl production areas, high skunk populations are probably not controlled by trapper harvests and considerable predation on ground-nesting birds and eggs occurs. This predation is primarily in acres that contain small and isolated areas of habitat with a high proportion of edge. This high predation may be alleviated to some extent by land use policy that creates and preserves larger blocks of nesting habitat or by predator management programs.

RESOURCE VALUE

Skunks often occur in high densities and are significant predators on crop-destroying rodents and insects. While they are an interesting member of our native fauna, they occasionally raid hen houses and prey on ground-nesting bird eggs. The disagreeable odor produced by skunks and their tendency to carry rabies results in a low perceived value of skunks by many landowners and much of the public. As a consequence, many skunks are destroyed as pests.

Striped skunks are easily caught and are most often taken incidentally in traps set for other terrestrial furbearers. The striped skunk is not considered a challenging game species, and mishandling of the animal in traps often results in the discharge of musk and decreased fur value. Although pelt prices have never been high for striped skunks, the total Minnesota fur value peaked in 1980 at \$250,000. Recently, a market has developed for skunk essence, or scent.

RIVER OTTER

River otter (Lutra canadensis), semi-aquatic members of the weasel family, regularly occur in favorable water habitats throughout north-central Minnesota. Otter were recently reintroduced in the Minnesota River Valley in extreme western Minnesota.

Otters have large home ranges which may cover many miles of shoreline or stream courses. Otter dens are frequently located in abandoned beaver houses, burrows, logjams or hollow logs. These playful creatures are very adept at catching small fish and minnows. Although rough fish constitute most of their diet, they also eat crayfish, frogs, turtles, muskrats and small reptiles.

RESOURCE MANAGEMENT

Otter first received some protection in 1867, but by the early 1900s, Minnesota's otter had been nearly extirpated. They were provided total legal protection from 1917 to 1943. Less than 100 otters were taken annually during intermittent seasons from 1944 to 1952 and from 1954 to 1971 the take varied from 200 to 550. Since 1971, the annual harvest has varied from 200 to 1,200. Season limits per trapper have ranged from 1 to 3 since 1944.

Otter pelts were registered from 1943 to 1973 and from 1977 to the present. Voluntary carcass collections commenced in 1978 and mandatory otter carcass surrender began in 1981. Carcass examinations combined with harvest and other data have provided information sufficient to develop a computer population model. The past and potential effects of harvest and nonharvest mortality on Minnesota's otter population can be evaluated using this model.

The otter harvest seems dependent upon pelt value, trapping conditions and the intensity of beaver trapping. Because many otter are captured incidentally in sets made for beaver, the length and timing of the beaver season have a considerable impact on otter.

RESOURCE ANALYSIS

In Minnesota, the primary otter range comprises 38,000 square miles of northern boreal and deciduous coniferous forest interspersed with numerous streams, lakes and wetlands. The 1980s population estimate within this zone is about 7,000 otter and outside of this zone there are an estimated 1,000 animals. These estimates are based on computer population models.

From 1980 to 1984, 300 to 600 trappers took an average annual harvest of 585 otter (Table 20-8).

Table 20-8. Average number of otter harvested by Department of Natural Resources Region, 1980 to 1984.

Region	1	2	3	Total
Harvest (No. of otter)	135	370	80	585

With current season limitations and relatively stable fur prices, otter harvest is well below the supply. Currently, only about 8% of the total otter population is trapped and registered annually. At this low rate of harvest, a 5% annual increase in the population is projected.

RESOURCE VALUE

Otter are probably one of the most aesthetically valuable furbearers in Minnesota. Many people enjoy viewing their snow or mud slides or watching them dive and feed. Noted for their curiosity and playfulness, otter cause little conflict with men and other animals, only occasionally causing problems in fish hatcheries. There is some evidence of competition with mink, but this relationship is poorly understood.

Trappers receive from \$30,000 to \$50,000 annually from the sale of otter pelts. The number of recreation days provided to trappers, viewers or photographers by the presence of otter has not been measured.

BOBCAT

The bobcat (Lynx rufus) is the most abundant native cat species in Minnesota. It prefers heavy brush areas in and around lowland conifer stands such as white cedar, black spruce or tamarack. The snowshoe hare is its primary food, although deer are also important.

RESOURCE MANAGEMENT

The bobcat's present range encompasses some 30,000 square miles of north-central Minnesota, a remnant of a larger range which, in the early 1900s, included the forested basins of the Minnesota, lower Mississippi, and other large river systems. Few bobcats reside in extreme northeastern Minnesota, which represents the northern-most extremes of the bobcat's range in North America.

Bobcats were bountied from 1951 until all bounties ended in 1965; they remained unprotected until receiving game status in 1977. From 500 to approximately 1,700 bobcats were bountied annually from 1951 to 1965.

Bobcat fur harvests were slightly lower than bounty records through 1964. From 1944 to 1955, trapping and hunting harvests ranged from 800 to 3,100 bobcats annually and averaged 1,800. Harvests gradually declined and from 1965 to 1976, averaged about 100 annually. Since mandatory pelt registration commenced in 1977, bobcats taken each year have averaged 241. To comply with the Convention on International Trade in Endangered Species' requirements for population data, mandatory carcass surrender of bobcats by trappers was begun in 1981.

RESOURCE ANALYSIS

Bobcat population trends are one of the most difficult to obtain because of low densities. The annual scent-post survey indices from 1976 to 1985 vary from 2 in 1980 to 14 in 1981 and 1982. These indices were not correlated with

harvests during that same period. Although neither scent posts nor harvest appear to depict short-term population trends, harvest data since the late 1930s suggests an 80 to 90% population decline begun in the 1950s and continued until the late 1960s, followed by relatively stable populations since 1973 (Figure 20-10). Harvests since 1973 are approximately 25% of the prevailing level of the 1940s, when up to 3,100 bobcats were taken annually.

The population decline was likely from habitat loss caused by large-scale white cedar cutting in the post-World War II era, and unregulated harvests. The population stability in recent years is largely from regulated harvests and minimal habitat loss.

Data from population modeling, radio telemetry and carcass examinations suggest a population of 1,600 to 1,900, or approximately 1 bobcat per 17 square miles of total bobcat range. Harvests take an estimated 12 to 16% of the population annually; overharvest occurs at 20% or higher.

Because of the bobcat's low densities, unique valuable fur and aesthetic appeal, demand exceeds supply. Bobcat populations are dependent on adequate prey, which in turn depends on suitable habitat. Future abundance of bobcats depends on maintaining or increasing the extent of white cedar and other winter habitats and continued and perhaps more restrictive harvest regulations.

RESOURCE VALUE

Bobcat predation on wild game and domestic animals is often controversial. Snowshoe hare, the main food item, varies from 21% to 58% of bobcat stomach contents in winter. White-tailed deer, a more stable food item, averaged 30% occurrence. Bobcat predation on deer is documented in Minnesota, but its extent is unknown. Likewise, bobcat predation on domestic stock, usually poultry, is unknown, but is likely slight.

Bobcat pelts are highly valued. Like many species, bobcat pelts received relatively high prices in the early 1940s, \$11 to \$13, and low prices, \$1 to \$3, until the mid-1960s. Values rose dramatically in the early 1970s and peaked in 1978 at \$164. Pelts averaged \$87 during 1974 to 1984. Total bobcat pelt sales constitute less than 1% of total pelt sales, but they are an important local commodity.

Few people actively trap and hunt bobcats. About 20% of the bobcats are taken incidentally to hunting and trapping for other species. The number of persons attempting to hunt and trap bobcats is unknown; however, trapping accounts for 85% of the bobcats taken. Hunters using hounds take 80% of the total bobcats taken by hunting. They average 3 bobcats per person, compared to less than 2 per trapper. Although bobcat season has historically been open statewide, fewer than 1 per year since 1977 has been taken outside of the main range. The bobcat harvest has been 18, 67 and 15% in Regions 1, 2 and 3, respectively, since 1977.

Because bobcats are secretive, seldom vocal, generally nocturnal and sparsely distributed, they provide little opportunity for aesthetic enjoyment. For those fortunate enough to see a bobcat in the wild, however, the experience is highly valuable.

BOBCAT

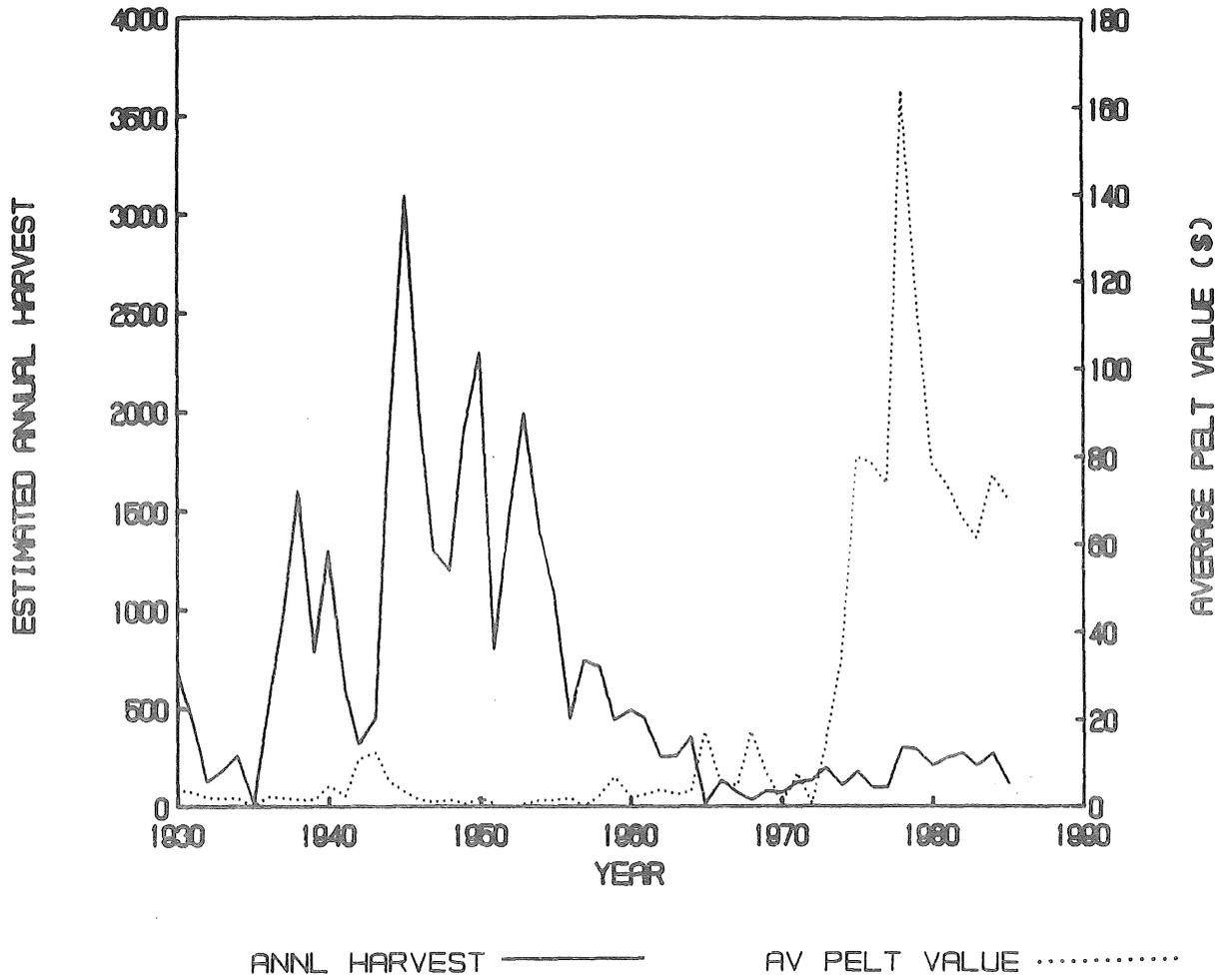


Figure 20-10. Minnesota bobcat harvest and pelt value.

LYNX

Lynx (Lynx lynx) in Minnesota occupy only the remote, largely unsettled portions of northern coniferous forest. The presence of lynx outside of the main range usually occurs during occasional large influxes from adjacent portions of Canada during cyclic high population levels.

Lynx prey on a wide variety of species, from small mammals, mice and squirrels and birds, grouse, to large ungulates as deer, calves of moose and caribou. Their primary prey is snowshoe hare.

RESOURCE MANAGEMENT

Lynx dependence on the snowshoe hare is illustrated by the correlation of lynx population peaks and declines with 10-year population cycles of snowshoe hares, with a 1- or 2-year delay. This dependence is further shown in the annual lynx harvest statistics. Since lynx are dependent on forest habitats that produce abundant snowshoe hare, timber harvesting methods that produce this habitat will also benefit lynx.

The lynx population response to habitat alteration resulting from logging and forest fires in the late 1800s and early 1900s has not been documented. It is likely that lynx did not decline as greatly as did many other boreal forest species because the habitat changes were beneficial to its major prey species, the snowshoe hare.

Although lynx seldom kill domestic livestock, a bounty was paid from 1949 until mid-1965. Lynx were unprotected in Minnesota until 1976, when they became a protected species with an open season from October 30 to December 31, and no bag limit. From 1977 to 1980, the season opened on December 1 and closed January 31, with a bag limit of 5 lynx and

bobcat in the aggregate. The 1981-82 season was open only outside the main lynx range. In 1983 the bag limit could include no more than 2 lynx, in 1984 and 1985 the lynx season was closed.

RESOURCE ANALYSIS

Lynx population data comes from annual harvest figures and examinations of carcasses. These have not provided adequate information. However, because lynx are fairly vulnerable to trapping, the low annual harvest indicates that the number of resident breeding individuals must be rather low. To what extent lynx from adjacent areas of Canada contribute to harvests during cyclic highs is unknown.

Since the take of lynx is so low, they are best considered an incidental "bonus" to hunters and trappers in pursuit of other species. The number of persons seeking lynx, in other than peak population years, is difficult to estimate.

Lynx predation is unlikely to have a significant adverse impact on other wildlife populations under normal circumstances. Predation on domestic animals will likewise be rare. There seems to be considerable public interest in maintaining a viable lynx population for its own intrinsic value.

RESOURCE VALUE

Lynx are an integral component of the northern boreal forest ecosystem and must be retained in our stewardship of these natural resources. Their population has little or no adverse impact on management of other resources. The aesthetic value of viewing a lynx may be high, but since the opportunity to do so is extremely rare, it must be thought of as a bonus rather than an activity to be pursued.

The demand for lynx by hunters and trappers is low when compared to most other species, because so few are taken except during years of major population peaks. Pelt values ranged from \$.90 in 1939 to \$60 in 1943. The pelt value peaked at \$270 in 1978. During the 1980s, pelt values have averaged \$100.

Long range planning for furbearers

PRODUCT: Furbearers for their ecological value and opportunities for use and appreciation.

GOAL: Maintain present diversity of native furbearing mammals and manage populations at optimum levels.

OBJECTIVE 1. Provide furbearer populations capable of sustaining the following levels of annual use by trappers, hunters and other users:

	<u>Trappers</u>	<u>Hunters</u>	<u>Other Users</u>
Region 1			
Users	2,500-4,500	3,700-6,900	Unknown
User days	52,000-95,000	37,000-69,000	Meet demand
Region 2			
Users	2,300-4,300	1,300-2,500	Unknown
User days	48,000-90,000	13,000-25,000	Meet demand
Region 3			
Users	1,900-3,500	2,400-4,400	Unknown
User days	40,000-73,000	24,000-44,000	Meet demand
Region 4			
Users	2,900-5,500	5,900-10,900	Unknown
User days	61,000-115,000	59,000-109,000	Meet demand
Region 5			
Users	1,700-3,100	4,700-8,700	Unknown
User days	36,000-65,000	47,000-87,000	Meet demand
Region 6			
Users	600-1,200	1,000-1,800	Unknown
User days	13,000-25,000	10,000-18,000	Meet demand
Statewide Totals			
Users	12,000-22,000	19,000-35,000	Unknown
User days	250,000-460,000	190,000-350,000	Meet demand

PROBLEM 1. Changing demand, caused primarily by fluctuating fur prices, can result in under- or over-harvests.

STRATEGY A. Implement necessary harvest regulations.

STRATEGY B. Conduct educational programs to increase the take of under-harvested furbearer species that cause nuisance or damage.

STRATEGY C. Monitor fur markets to anticipate changing demand and adjust harvest regulations as needed.

PROBLEM 2. The limitations of some information reduce management effectiveness.

STRATEGY A. Improve information about furbearer populations through trend surveys and computer modeling.

STRATEGY B. Monitor and evaluate geographic differences in furbearer populations, harvests, pelt primeness and harvest conditions.

STRATEGY C. Research furbearer ecology, population dynamics, trend indicators and limiting factors.

STRATEGY D. Improve trapper and hunter surveys to better assess the quantity and distribution of effort and impact of harvest on furbearer populations.

STRATEGY E. Measure non-harvest demand and value associated with furbearers.

PROBLEM 3. The quantity and quality of habitat is limiting some furbearer populations.

STRATEGY A. Develop and implement habitat management guidelines for certain furbearer species needing assistance.

STRATEGY B. Protect, acquire, maintain and improve habitat.

STRATEGY C. Strengthen the environmental review and mitigation processes.

PROBLEM 4. Suitable habitats for some furbearers are not occupied.

STRATEGY A: Identify suitable areas and investigate the feasibility of reintroduction.

STRATEGY B. Reintroduce or facilitate natural reestablishment where appropriate.

PROBLEM 5. Development of harvest regulations is complicated by Minnesota's diverse climates and habitats.

STRATEGY A. Develop regulations that address regional furbearer differences.

STRATEGY B. Provide information to the public about the rationale for regulations.

PROBLEM 6. Furbearer-related diseases cause problems for wildlife populations, domestic animals and humans.

STRATEGY A. Monitor furbearer-related diseases.

STRATEGY B. Maintain harvests at optimum levels to aid in reducing furbearer-related diseases.

STRATEGY C. Educate the public about furbearer-related diseases.

PROBLEM 7. The lack of knowledge on the part of some trappers leads to improper trapping techniques and unethical behavior.

STRATEGY A. Expand trapper education in cooperation with other groups.

STRATEGY B. Increase information and education concerning trapper ethics, trespassing and landowner's rights.

PROBLEM 8. Opposition to trapping and hunting complicates furbearer management.

STRATEGY A. Arrange regular meetings with furbearer interest groups to resolve differences, and channel efforts to benefit wildlife.

STRATEGY B. Provide information to the public about furbearer management.

STRATEGY C. Support efforts to improve furbearer trapping systems.

PROBLEM 9. Conflicts among hunters and trappers complicate furbearer management.

STRATEGY A. Conduct furbearer education programs to reduce abuses, misunderstandings and divisive conflicts.

STRATEGY B. Arrange regular meetings with furbearer interest groups to resolve differences and channel efforts to benefit wildlife.

PROBLEM 10. Local ordinances regulating traps and firearms complicate furbearer management.

STRATEGY A. Work with local governments for reasonable ordinances.

PROBLEM 11. Some furbearers become a nuisance or cause damage.

STRATEGY A. Educate trappers, hunters and the public about methods to reduce furbearer problems.

STRATEGY B. Develop and implement programs to prevent or reduce furbearer damage.

OPOSSUM

OBJECTIVE 1. Maintain a population capable of sustaining an annual harvest of 4,000-10,000 opossum with distribution among Department of Natural Resources regions as follows:

	Region					
	1	2	3	4	5	6
% of opossum harvest	0	0	0	40-60	40-60	1-5

PROBLEM 1. The limitations of some information reduce management effectiveness.

STRATEGY A. Update and maintain opossum distribution records.

STRATEGY B. Develop population survey techniques.

STRATEGY C. Determine limiting factors.

PROBLEM 2. Habitat is being lost by conversion to other uses.

STRATEGY A. Protect riparian woods, abandoned farmstead groves and other habitat.

STRATEGY B. Monitor trends in habitat quantity and quality.

STRATEGY C. Strengthen the environmental review and mitigation processes.

BEAVER

OBJECTIVE 1. Maintain a population capable of sustaining an annual harvest of 50,000-100,000 beaver, distributed among the Department of Natural Resources regions as follows:

	Region					
	1	2	3	4	5	6
% of beaver harvest	22-34	30-46	22-32	4-6	1-2	1-2

PROBLEM 1. Pelt prices and resulting trapping pressure can produce over- or under-harvests.

STRATEGY A. Monitor harvests, prices, population trends and trapping pressure and adjust regulations as necessary.

PROBLEM 2. Beaver can cause property damage.

STRATEGY A. Encourage more trapping harvest in problem areas through education and liberal seasons.

STRATEGY B. Research damage control and prevention techniques and apply effective methods for alleviating damage.

STRATEGY C. Provide information to the public about the values of beaver.

STRATEGY D. Develop a more comprehensive policy on nuisance beaver removal and ensure adherence to permit requirements.

PROBLEM 3. Beaver management can conflict with other natural resource management objectives.

STRATEGY A. Conduct an ecological and economic analysis of beaver value vs. other natural resources.

STRATEGY B. Improve coordination between natural resource managers.

MUSKRAT

OBJECTIVE 1. Maintain a muskrat population capable of sustaining an annual harvest of 500,000-1,500,000, with distribution among Department of Natural Resources regions as follows:

	Region					
	1	2	3	4	5	6
% of muskrat harvest	13-20	16-24	12-18	22-34	13-19	4-6

PROBLEM 1. The quantity and quality of habitat is declining.

STRATEGY A. Protect, acquire, maintain and improve habitat.

STRATEGY B. Provide information to landowners about the value of wetlands and aquatic furbearers.

STRATEGY C. Strengthen the environmental review and mitigation processes.

PROBLEM 2. Concentration of muskrat trappers on some state-owned wetlands results in preemption and competition.

STRATEGY A. Develop and implement acceptable methods of reducing conflicts.

RED FOX

OBJECTIVE 1. Maintain a red fox population capable of sustaining an annual harvest of 50,000-90,000 with a distribution among Department of Natural Resources regions as follows:

	Region					
	1	2	3	4	5	6
% of red fox harvest	21-31	6-10	13-19	27-41	10-14	4-6

PROBLEM 1. Intensive predator control programs might limit red fox populations.

STRATEGY A. Promote programs to provide secure wildlife habitat.

STRATEGY B. Evaluate the effects and costs of intensive predator control programs.

STRATEGY C. Develop and implement alternative methods for reducing predation on young and adult ground nesting birds and their eggs.

GRAY FOX

OBJECTIVE 1. Maintain a gray fox population capable of sustaining an annual harvest of 5,000-9,000, distributed among the Department of Natural Resources regions as follows:

	Region					
	1	2	3	4	5	6
% of gray fox harvest	1-2	1-3	11-17	13-19	45-65	9-13

PROBLEM 1. The limitations of some information reduces management effectiveness.

STRATEGY A. Maintain harvest and distribution records.

STRATEGY B. Monitor population trends.

STRATEGY C. Determine limiting factors.

PROBLEM 2. The quantity and quality of habitat are declining.

STRATEGY A. Protect deciduous woodlands and other habitats.

STRATEGY B. Monitor trends in habitat quantity and quality.

STRATEGY C. Strengthen the environmental review and mitigation processes.

PROBLEM 3. Fluctuation in fur prices can result in over-harvest.

STRATEGY A. Adjust harvest regulations if necessary.

COYOTE

OBJECTIVE 1. Maintain a coyote population capable of sustaining an annual harvest of 10,000-20,000, distributed among Department of Natural Resources regions as follows:

	Region					
	1	2	3	4	5	6
% of coyote harvest	35-45	18-22	35-45	2-5	2-4	1-2

PROBLEM 1. Insufficient data exists on coyote range expansion and populations.

STRATEGY A. Expand scent post surveys to include areas outside the main range.

PROBLEM 2. The coyote's controversial legal status and role as furbearer and predator complicate management.

STRATEGY A. Monitor and evaluate the Directed Predator Control Program and provide information to livestock producers, hunters, trappers and the public regarding coyote damage control.

STRATEGY B. Provide information to the public on coyote management.

RACCOON

OBJECTIVE 1. Maintain a raccoon population capable of sustaining an annual harvest of 150,000-250,000, distributed among the Department of Natural Resources regions as follows:

		Region					
		1	2	3	4	5	6
% of raccoon harvest		9-13	1-3	14-22	26-38	26-38	4-6

PROBLEM 1. High raccoon populations cause excessive crop depredation, predation and disease problems.

STRATEGY A. Seek expanded authority to increase harvest.

STRATEGY B. Provide information to the public on raccoon management and diseases.

FISHER

OBJECTIVE 1. Maintain a fisher population capable of sustaining an annual harvest of 800-1,500, distributed by Department of Natural Resources regions as follows:

	Region					
	1	2	3	4	5	6
% of fisher harvest	20-30	70-80	3-5	0	0	0

PROBLEM 1. The limitations of some information reduce management effectiveness.

STRATEGY A. Develop and implement population trend and trapper pressure surveys.

STRATEGY B. Research population dynamics and ecology and refine the population model.

PROBLEM 2. Illegal and accidental taking may reduce the population and the allowable harvest.

STRATEGY A. Implement necessary regulations and support increased enforcement.

STRATEGY B. Investigate and promote techniques that reduce accidental taking.

PINE MARTEN

OBJECTIVE 1. Maintain a pine marten population capable of sustaining an annual harvest of 700-2,100, distributed by Department of Natural Resources regions as follows:

	Region					
	1	2	3	4	5	6
% of pine marten harvest	5	95	0	0	0	0

PROBLEM 1. The limitations of some information complicate management effectiveness.

STRATEGY A. Develop and implement a population trend survey.

STRATEGY B. Monitor small mammal prey populations.

STRATEGY C. Investigate population dynamics, behavior, ecology and effects of harvest.

STRATEGY D. Investigate habitat requirements and develop management guidelines.

PROBLEM 2. Suitable habitat outside of the primary range may be unoccupied.

STRATEGY A. Identify suitable areas and investigate the feasibility of reintroduction.

STRATEGY B. Reintroduce pine marten, if feasible.

PROBLEM 3. Differential trapping pressure can result in localized under- or over-harvest.

STRATEGY A. Implement appropriate regulations and support increased enforcement.

STRATEGY B. Investigate and promote trapping techniques that reduce accidental taking.

PROBLEM 4. Regulation restricts harvest to Region 2.

STRATEGY A. Adjust regulations to allow harvest in Region 1.

MINK

OBJECTIVE 1. Maintain a mink population capable of sustaining an annual harvest of 35,000-95,000 annually, distributed among the Department of Natural Resources regions as follows:

	Region					
	1	2	3	4	5	6
% of mink harvest	20-26	18-22	16-20	23-29	9-11	2-4

PROBLEM 1. Lack of detailed population and habitat information limits management effectiveness.

STRATEGY A. Develop and implement survey methods to estimate and monitor populations and habitat.

STRATEGY B. Investigate population dynamics, behavior and effect of harvest.

PROBLEM 2. Habitat quantity and quality are declining.

STRATEGY A. Monitor environmental contaminants in mink.

STRATEGY B. Protect, acquire, maintain and improve habitat.

STRATEGY C. Provide information to the public about mink habitat.

STRATEGY D. Strengthen the environmental review and mitigation processes.

PROBLEM 3. Intensive predator control programs might limit mink populations.

STRATEGY A. Promote programs to provide secure wildlife habitat.

STRATEGY B. Evaluate the effects and costs of intensive predator control programs.

STRATEGY C. Develop and implement alternative methods for reducing predation on young and adult ground-nesting birds and their eggs.

WEASEL

OBJECTIVE 1. Maintain weasel populations capable of sustaining an annual harvest of 2,500-10,000 that is 70% ermine and 30% long-tailed, with distribution among Department of Natural Resources regions as follows:

	Region					
	1	2	3	4	5	6
Ermine % of harvest	16-24	40-60	18-26	1-3	1	4-6
Long-tailed weasel % of harvest	20-28	45-65	14-20	1-2	1	1

PROBLEM 1. The limitations of some information reduce management effectiveness.

STRATEGY A. Develop and implement population surveys.

BADGER

OBJECTIVE 1. Maintain a badger population capable of sustaining an annual harvest of 2,000-8,000, with distribution among Department of Natural Resources regions as follows:

	Region					
	1	2	3	4	5	6
% of badger harvest	22-34	7-11	6-8	26-40	18-28	1-2

PROBLEM 1. The limitations of some information reduce management options.

STRATEGY A. Investigate population dynamics, behavior, ecology, and effects of harvest.

PROBLEM 2. Habitat is being lost by conversion to other uses.

STRATEGY A. Support land use programs that have positive effects.

STRATEGY B. Strengthen the environmental review and mitigation processes.

SPOTTED SKUNK

OBJECTIVE 1. Maintain spotted skunk populations capable of sustaining an annual harvest of 300-1,000, with distribution among Department of Natural Resources regions as follows:

	Region					
	1	2	3	4	5	6
% of spotted skunk harvest	0-1	0-1	2-4	50-70	12-18	8-12

PROBLEM 1. The limitations of some information reduce management options.

STRATEGY A. Determine population status and monitor trends.

STRATEGY B. Investigate population dynamics, behavior, habitat requirements and limiting factors.

PROBLEM 2. Populations have declined significantly.

STRATEGY A. Develop and implement management guidelines.

STRATEGY B. Provide public information about management.

STRIPED SKUNK

OBJECTIVE 1. Maintain self-sustaining striped skunk populations, but reduce undesirable predation and disease problems by increasing annual harvests to 50,000-75,000, with distribution among Department of Natural Resources regions as follows:

	Region					
	1	2	3	4	5	6
% of striped skunk harvest	25-37	3-5	13-19	30-44	9-13	2-4

PROBLEM 1. Low fur prices, odor and disease problems discourage interest in trapping striped skunks.

STRATEGY A. Provide information on effectively and safely handling striped skunk carcasses and pelts and on marketing furs and essence.

STRATEGY B. Provide education about selective trapping techniques.

PROBLEM 2. There is limited data on population status and disease.

STRATEGY A. Monitor trends in populations and diseases.

RIVER OTTER

OBJECTIVE 1. Maintain a river otter population capable of sustaining an annual harvest of 800-1,500, with distribution among Department of Natural Resources regions as follows:

	Region					
	1	2	3	4	5	6
% of river otter harvest	20-35	50-75	8-12	0	0	1-3

PROBLEM 1. The limitations of some information reduces management effectiveness.

STRATEGY A. Research population dynamics, behavior, ecology and effects of harvest to refine the population model.

STRATEGY B. Develop and implement a population trend survey.

PROBLEM 2. Some suitable habitats for otter are not occupied.

STRATEGY A. Identify suitable areas and investigate the feasibility of reintroduction.

STRATEGY B. Reintroduce or facilitate natural reestablishment where appropriate.

PROBLEM 3. Otter are taken in beaver sets.

STRATEGY A. Investigate, develop and promote selective trapping techniques.

BOBCAT

OBJECTIVE 1. Maintain a bobcat population capable of sustaining a harvest of 150-400 annually, with distribution among Department of Natural Resources regions as follows:

	Region					
	1	2	3	4	5	6
% of bobcat harvest	14-22	54-80	12-18	0	0	0

PROBLEM 1. The limitations of some information reduce management effectiveness.

STRATEGY A. Research population dynamics, behavior, ecology, interspecific relationships and effects of harvest.

STRATEGY B. Develop and implement a population trend survey.

STRATEGY C. Research habitat requirements and limiting factors.

PROBLEM 2. Habitat quality and quantity have declined.

STRATEGY A. Research habitat requirements and limiting factors.

STRATEGY B. Protect, maintain and improve habitat.

STRATEGY C. Strengthen the environmental review and mitigation processes.

PROBLEM 3. Some suitable habitats for bobcat are not occupied.

STRATEGY A. Identify suitable areas and investigate the feasibility of reintroduction.

STRATEGY B. Reintroduce or facilitate natural reestablishment where appropriate.

LYNX

OBJECTIVE 1. Maintain lynx populations in ecologically suitable habitat and provide for harvest of 50-100 during peak population years, with distribution by Department of Natural Resources regions of harvest as follows:

	Region					
	1	2	3	4	5	6
% of lynx harvest	25-35	55-75	1-3	0	0	0

PROBLEM 1. The limitations of some information reduces management effectiveness.

STRATEGY A. Determine whether breeding populations exist in Minnesota and delineate area suitable for management.

STRATEGY B. Research population dynamics, behavior, ecology and critical habitat components.

PROBLEM 2. Because Minnesota's lynx population is based on the influx of the animals from Canada where they are cyclic, it fluctuates drastically.

STRATEGY A. Monitor immigrating populations.

STRATEGY B. Adjust regulations to population cycles.

PROBLEM 3. Current timber and wildlife habitat management guidelines may not give adequate consideration to lynx.

STRATEGY A. Develop and implement lynx habitat management guidelines.

FISH AND WILDLIFE PLANNING TEAM
MINNESOTA DEPARTMENT OF NATURAL RESOURCES
Division of Fish and Wildlife
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LONG RANGE PLAN COMMENTS

The Division of Fish and Wildlife is inviting comments from individuals and organizations on the long range plans for the management of fish, wildlife and native plant resources. Use this form, or write us a letter, telling us how we can improve the plan or plans you have reviewed.

Plan Name: _____

Comments: _____

Your name: _____

Address: _____

Are these the official comments of an organization? Yes No

Organization: _____

To mail: fold & seal with tape or place in envelope.

Thank you for taking the time to review the plan and providing your comments.

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21. Gray Wolf

The gray wolf (Canis lupus) has a controversial management history in Minnesota. It is currently classified by the Minnesota and federal governments as a threatened species in the state, thus it has special management and research needs. Both political and biological concerns continue to affect management decisions.

Wolves occur throughout the northern hemisphere. In North America, an estimated 25,000 exist in Canada, and 5,000 to 10,000 in Alaska. A few wolves occur in Montana, Michigan's upper peninsula and Isle Royale and Wisconsin. The largest population in the lower 48 states is found in Minnesota.

Wolves in Minnesota, C. l. lycaon, are a subspecies or geographic race whose current distribution includes parts of the eastern United States and much of southeastern Canada. As a direct result of human settlement during the past few hundred years, the range of this subspecies in the United States has been reduced to less than 5% of the original total, though it is still common throughout most of its original range in Canada. In Minnesota, distribution of wolves in the recent pre-protection era, before 1970, was limited mainly to the far north and northeastern part of the state, and wolf numbers were certainly lower than now.

Since protection, the statewide wolf population has expanded its range and increased its numbers. Though wolf numbers in northeastern Minnesota, principally the Superior

National Forest, declined in the 1970s because of a decreasing white-tailed deer population, the total statewide population has stabilized at about 1,000 to 1,200 wolves. Wolves are found throughout most of the forested portion of the state, particularly where human density and activity are low (Figure 21-1).

RESOURCE MANAGEMENT

Reduction of wolf numbers resulting from bounty payments to private citizens began in Minnesota in 1849 and continued in one form or another until 1965. In addition, wolves were taken by hunters and trappers employed by the state from 1949 to 1956. From 1969 to 1974, a directed predator control program that included the taking of wolves by designated trappers in areas of verified livestock losses was authorized by the state. It included an incentive payment of \$50 per wolf.

Under the federal Endangered Species Preservation Act of 1966, wolves were, in 1967, listed as endangered, and in 1970, protected on the Superior National Forest in northeastern Minnesota. Outside these federal lands, wolves continued to be an unprotected species until 1974, when federal and state endangered species laws classified the wolf as endangered and management of the wolf became the responsibility of the U.S. Fish and Wildlife Service.

In 1975, the U.S. Fish and Wildlife Service convened an Eastern Timber Wolf Recovery Team to develop a wolf management plan. Published in 1978, this detailed plan called for: 1) 5 management zones within the state, including a 9,800-square-mile sanctuary (Zones 1,2,3 in Figure 21-2); 2) optimum wolf population levels for each zone; 3) reestablishment of wolves in as much of the former range in the lower 48 states as possible; 4) a limited public taking of wolves outside the sanctuaries; and 5) reclassification of the wolf in Minnesota from endangered to threatened.

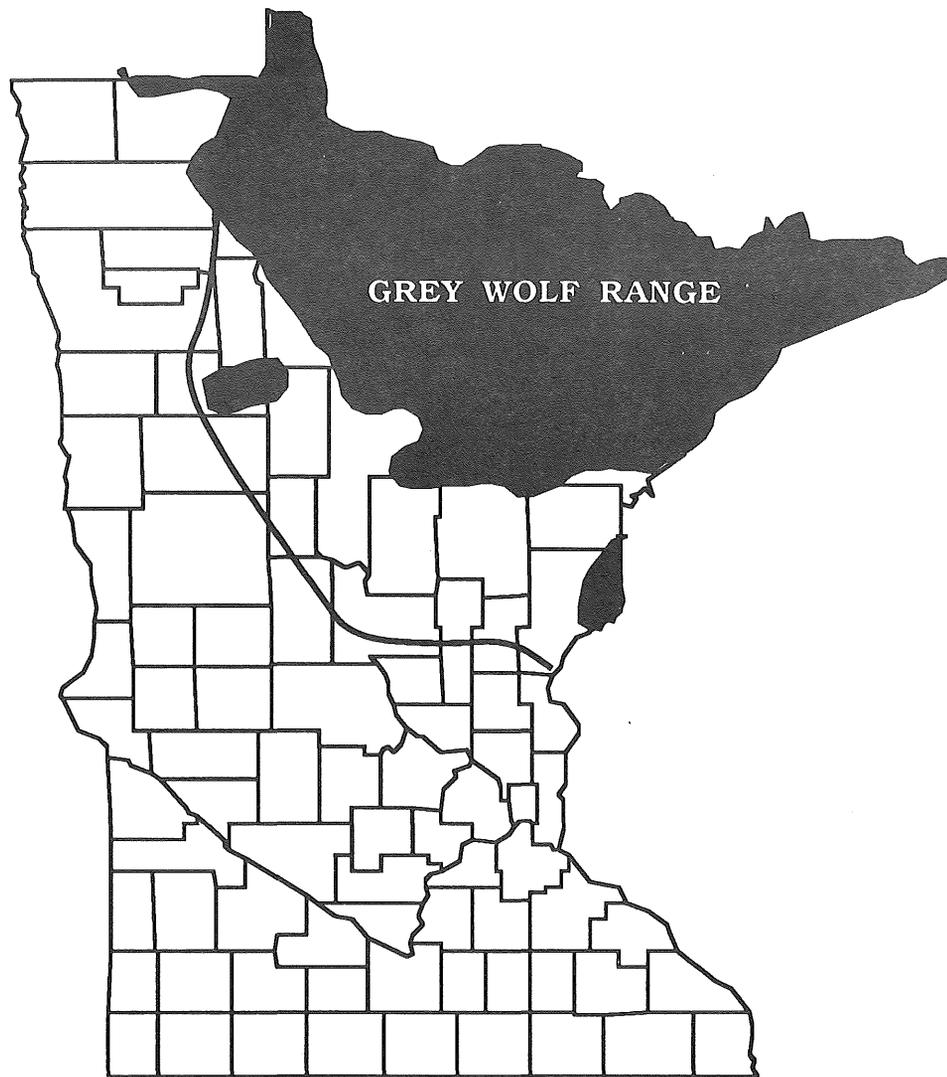
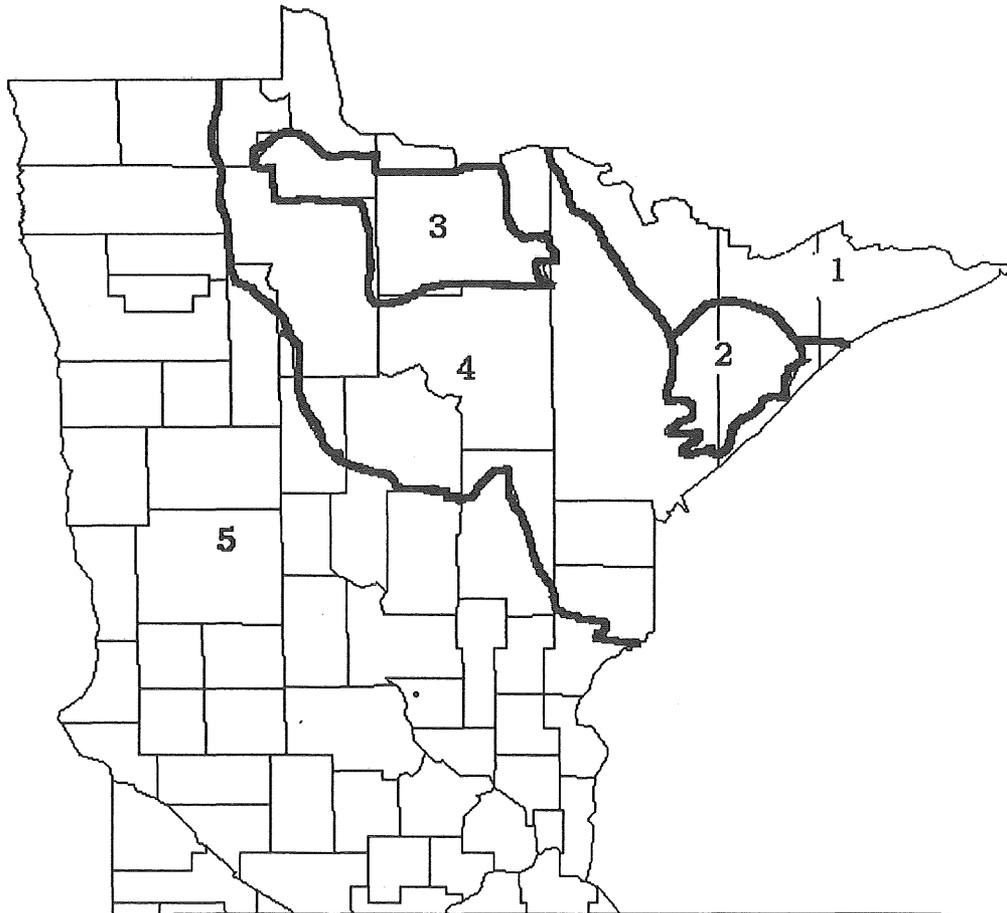


Figure 21-1. Approximate distribution of wolves in Minnesota and the southern boundary of forested area and limit of wolf habitat.



Wolf management zones:

Zone	Square Miles	Desired wolf density (square miles/wolf)
1	4,462	Fluctuate naturally
2	1,864	10
3	350	10
4	20,901	50
5	54,603	750

Figure 21-2. Wolf management zones and density goals as delineated by the Eastern Timber Wolf Recovery Team.

While the U.S. Fish and Wildlife Service did reclassify the wolf to threatened in Minnesota in 1978, which still allowed the taking of wolves by designated federal government personnel in specific circumstances, the agency did not adopt their recommendation for limited public taking outside sanctuary areas, and has yet to seriously attempt to reestablish wolves in other states. In 1974, before development of the recovery plan, the U.S. Fish and Wildlife Service introduced 4 wolves from Minnesota into the upper peninsula of Michigan, but the attempt failed because of human-caused mortality.

In 1977, the state passed legislation to pay farmers for verified livestock losses caused by wolves. In 1980, the Minnesota Department of Natural Resources prepared its own management plan, which contained many of the features of the federal recovery plan. In 1983, the U.S. Fish and Wildlife Service published a final rule that delineated new wolf regulations and procedures in Minnesota. It incorporated a variety of strategies from both the Minnesota Department of Natural Resources management plan and federal recovery team plan. The rule included provisions for the public taking of wolves in areas of recurring wolf depredation on livestock. Subsequent court litigation resulted in a determination that the public taking portion of the rule was invalid under the 1974 federal endangered species act.

Therefore, direct management of wolves in Minnesota primarily entails trapping and killing depredating wolves by the U.S. Department of Agriculture, Section of Animal Damage Control, under permit from the U.S. Fish and Wildlife Service, using guidelines modified from the Recovery Plan and by court order. The U.S. Fish and Wildlife Service also continues to conduct wolf research in the Superior National Forest. Wolf prey populations, primarily deer and moose, are manipulated through harvests regulated by the Minnesota Department of Natural Resources, and through forest habitat

management on state, federal, county and private management lands. These habitat management practices have a positive impact on wolf populations.

RESOURCE ANALYSIS

The best recent estimate of wolf numbers in Minnesota is 1,000 to 1,200. More accurate counts on small study areas are available. Expansion in the peripheral range has probably offset population declines in the northeast; overall, wolf numbers in Minnesota appear to be fairly stable.

In Minnesota, Wisconsin and Michigan, most wolf mortality is human-related. Wolves are intentionally shot by hunters, landowners and farmers, trapped or snared incidentally and hit by vehicles. Recent studies have indicated a relationship between increasing road density, an indicator of human activity, and wolf distribution. At road densities greater than about 1.0 linear mile of road per 1.0 square mile of forested habitat, few reproducing packs are able to survive. This has been incorporated into the Minnesota Department of Natural Resources Wolf-Road Density Habitat Management Guidelines.

Throughout most of Minnesota's wolf range, white-tailed deer are the major ungulate prey of wolves. In the northeast where deer densities are relatively low, some wolves prey mostly on moose. Beaver is an important spring and summer food and snowshoe hare may also be important during cyclic peaks in their population.

RESOURCE VALUE

Because of the limited distribution of gray wolves in the continental United States, as well as their predatory nature and complex social structure, they are valued by many as a unique natural resource. Wolves are also regarded as a symbol of wilderness, and simply knowing that there are areas where such animals exist is reason enough for many people to be concerned for their protection.

Because of their protected status, wolves in Minnesota cannot currently be harvested for recreation or profit. Wolves are economically important in Canada and Alaska to a relatively few individuals who trap and hunt them for fur. Pelt prices have ranged from \$50-150 during the past decade.

Wolves in Minnesota provide year-round tourism opportunities, such as field trips into wolf country to see tracks, to hear wolves howl or even to see them from aircraft. Such tourism provides much needed benefits to northern Minnesota.

Livestock depredations affect only a small portion of farmers in Minnesota, but to those farmers, losses are significant. Annually for the past 10 years, 10 to 30 farmers have had verified losses to gray wolves and have received compensation totaling about \$20,000 per year from the State Department of Agriculture.

Because gray wolves prey mainly on large ungulates, they are often perceived as being in direct competition with hunters. In some parts of Alaska, Canada and northeastern Minnesota, wolves have played a prominent role, in conjunction with a combination of other limiting factors such as severe winter weather, habitat deterioration overhunting, in population declines of large ungulates. Although studies in north-central Minnesota have indicated that wolf predation may be responsible for a small portion of deer mortality when compared to hunter kill, in northeastern Minnesota, wolves are the primary source of deer mortality.

Long range planning for gray wolf

SERVICE: Conservation of gray wolf populations for their intrinsic and ecological values.

PRODUCT: Opportunities for appreciation and use of gray wolves.

GOAL: Maintain the present gray wolf population in Minnesota, and help other states establish self-sustaining populations.

OBJECTIVE 1. Maintain a minimum population of 1,000-1,200 gray wolves in Minnesota through 1992.

PROBLEM 1. Limitations in some information reduce management effectiveness.

STRATEGY A. Develop and implement a statewide population monitoring program.

STRATEGY B. Research factors limiting populations in their peripheral range.

STRATEGY C. Develop a population model.

PROBLEM 2. Gray wolves are illegally killed.

STRATEGY A. Support more effective law enforcement.

STRATEGY B. Provide information to deer hunters, farmers, and property owners regarding the value of gray wolves.

STRATEGY C. Educate trappers about the best techniques for releasing gray wolves from traps and encourage reporting of accidentally killed animals.

STRATEGY D. Encourage compliance with Minnesota Department of Natural Resources Wolf-Road Density Habitat Management Guidelines to restrict access.

PROBLEM 3. Gray wolves are adversely affected by low prey populations.

STRATEGY A. Continue to expand prey habitat management programs and evaluate their effectiveness.

STRATEGY B. Continue to regulate harvests of deer and moose to ensure adequate numbers for sport hunting, as well as prey for wolves.

STRATEGY C. If necessary, temporarily reduce wolf numbers so that prey populations can increase and subsequently support higher gray wolf numbers.

PROBLEM 4. Gray wolves occasionally kill domestic animals.

STRATEGY A. Encourage continuation and expansion of the federal wolf depredation control program.

STRATEGY B. Strongly encourage the Minnesota Department of Agriculture to use federal depredation program criteria for compensation payments.

STRATEGY C. Encourage enforcement of livestock carcass disposal laws.

STRATEGY D. Encourage proper animal husbandry practices.

OBJECTIVE 2. Expand opportunities for recreational use and understanding of gray wolves.

PROBLEM 1. Information on recreational use is limited.

STRATEGY A. Investigate recreational uses and develop opportunities that maximize recreation while protecting the resource.

STRATEGY B. Provide information to the public on recreational opportunities and gray wolf ecology.

STRATEGY C. Support the International Wolf Center.

OBJECTIVE 3. Assist in establishing a self-sustaining gray wolf population in another state by 1992.

PROBLEM 1. The U.S. Fish and Wildlife Service has not encouraged strongly enough the transplanting of wolves and other states are unwilling to accept them.

STRATEGY A. Urge the U.S. Fish and Wildlife Service to implement the Eastern Timber Wolf Recovery Plan and reevaluate criteria for delisting the wolf in Minnesota.

STRATEGY B. Investigate legal responsibilities of

the U.S. Fish and Wildlife Service to mandate gray wolf transplants to other states.

STRATEGY C. Aid in the development of educational programs to increase the support for wolf transplant programs in other states.

PROBLEM 2. Capturing and holding wolves for transplanting is difficult.

STRATEGY A. Develop a plan to capture and hold, for a limited time, up to 10 wolves of not more than 2 to 3 family groups to be used in transplant programs.

PROBLEM 3. Natural dispersal of gray wolves into other states is limited.

STRATEGY A. Maintain an expanding population in Minnesota-Wisconsin border areas.

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22. Small Game Mammals

Although Minnesota statutes define small game mammals as "protected animals other than big game," hunters generally would include only the gray squirrel (Sciurus carolinensis), fox squirrel (Sciurus niger) and the 3 leporids in this classification--the cottontail rabbit (Sylvilagus floridanus), snowshoe hare (Lepus americanus) and jackrabbit (Lepus townsendii).

GRAY SQUIRRELS AND FOX SQUIRRELS

Gray squirrels generally occur in large tracts of deciduous forest. Fox squirrels tend to prefer small tracts of deciduous forest interspersed with open areas. Although fox and gray squirrels prefer different habitats, they have similar ecological value as consumers of nuts and seeds.

The pre-settlement distribution of forest and prairie in Minnesota (Figure 22-1) indicates that gray squirrel habitat occurred historically in the southeast, in the Big Woods (east-central), in a band west of the pineries up through the northwest and wooded riverine habitat throughout major watersheds. If oak-aspen groves are included, there were 12 million square miles of gray squirrel habitat in the mid-1800s, but fox squirrels may have been rare or absent. Lumbering and land clearing reduced the coniferous forest habitat by several million square miles and changed much of the Big Woods into a different kind of deciduous habitat. Fire protection allowed extension of successional oak and aspen communities into the prairies. Squirrels probably

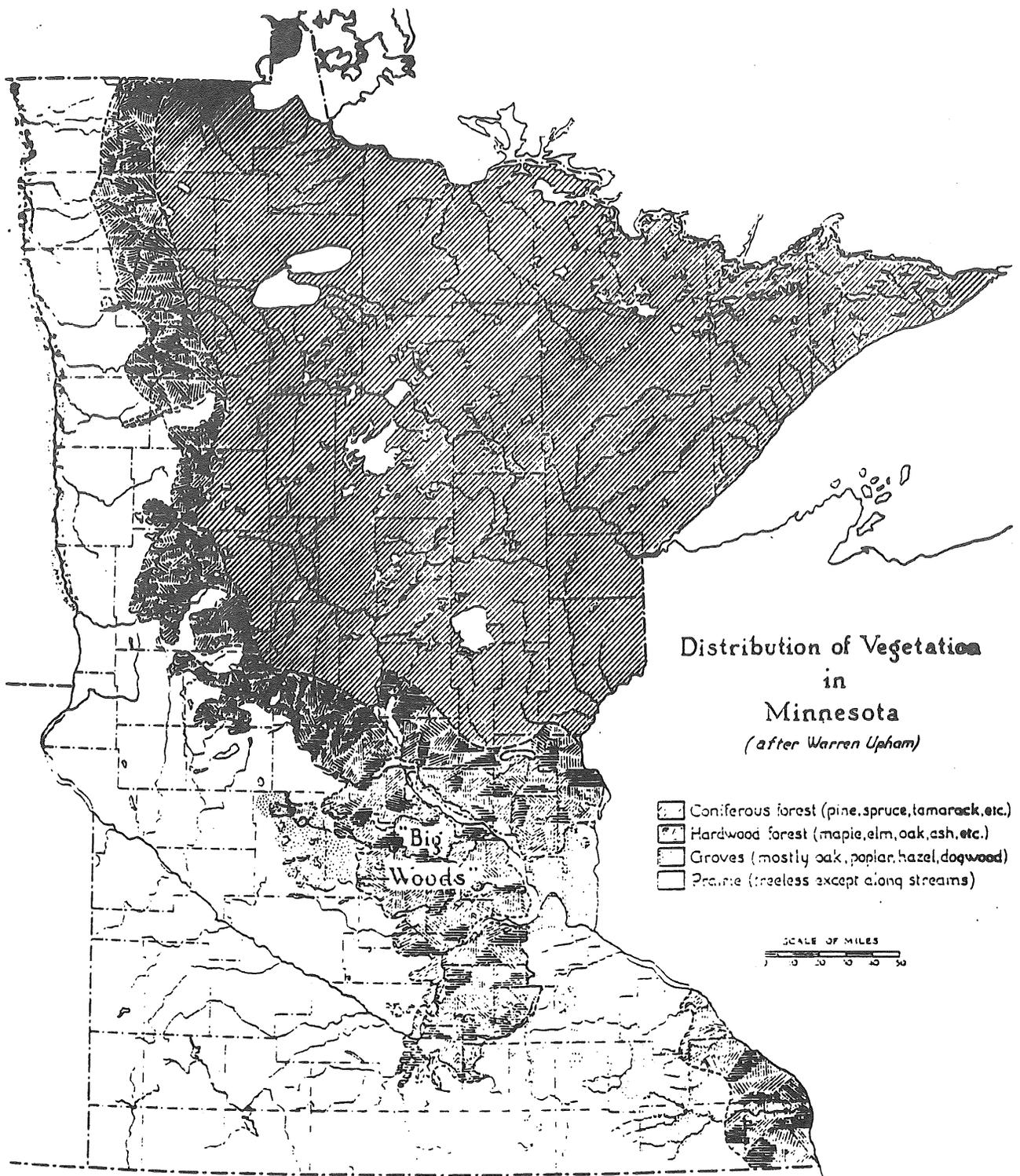


Figure 22-1. Distribution of presettlement vegetation in Minnesota. (Source: Minnesota Department of Natural Resources)

responded to these habitat changes in the following ways:

Mid-1800s: Gray squirrels decreased considerably, especially the black squirrels, a color phase of the gray, as the Big Woods diminished.

Late 1800s to early 1900s: Fox squirrels moved into the state and increased as small farms encroached on the woods, as windbreaks and tree fencelines were planted on the prairies, and as brush-lined roads provided travel lanes in the southern half of the state.

Mid-1900s: Gray squirrels increased as deciduous forests recovered from the original cutting and replaced the large pineries in the central and northcentral parts of the state.

1940s to 1960s: The ratio of gray to fox squirrels in the reported harvest decreased from nearly 3:1 to less than 2:1 because large blocks of forest declined.

1960s to 1970s: Oak wilt and Dutch elm disease and the increasing use of wood as fuel contributed to the decreasing ratio of gray to fox squirrels.

1960s to 1980s: In heavily farmed areas, consolidation of farms and obliteration of farm groves reduced fox squirrel habitat. Total squirrel habitat now could equal that of the mid-1800s.

RESOURCE MANAGEMENT

Management for fox squirrels and gray squirrels has been incidental to other target species such as the white-tailed deer. The first research on game squirrels began in 1950 with preliminary surveys by several area game managers in the southern half of the state. They made counts known as time-area or spot counts in 5 game management areas to establish an index to squirrel abundance.

Surveys of mast production, largely acorns, were conducted from 1953 to 1955 in the southeast. Squirrel studies from 1958 to 1962 included trapping and marking, on a small study area in the southeast, and reproductive tract studies on squirrels collected in central Minnesota.

Harvest information has been collected since 1941 using hunter report cards attached to small game licenses and, since 1976, mail surveys from a random sample of license buyers. This data is a useful index to actual squirrel population fluctuations (Figure 22-2).

In southern Minnesota, squirrel populations fluctuate over a period of years. Exact causes of these fluctuations are not well understood but probably result from weather and habitat changes. For instance, late spring freezing conditions, which destroy the flowers of nut-bearing trees and shrubs, have a profound effect upon squirrels, particularly gray squirrels outside the corn growing area. This loss of a major food source brings on fall emigrations and winter starvation.

Harvest Management

Fox and gray squirrels were protected from hunting within cities and within 1/4 mile of cities from 1913 to 1945. Whether this law was meant to protect city inhabitants or squirrels is not clear.

Black squirrels were protected from hunting between 1917 and 1939. The enactment of this law indicated that the phenomenon reported for Indiana, Illinois and Michigan also occurred in Minnesota; that is, the gray phase was replacing the black phase as the large dense deciduous forest was cut down.

GRAY AND FOX SQUIRREL

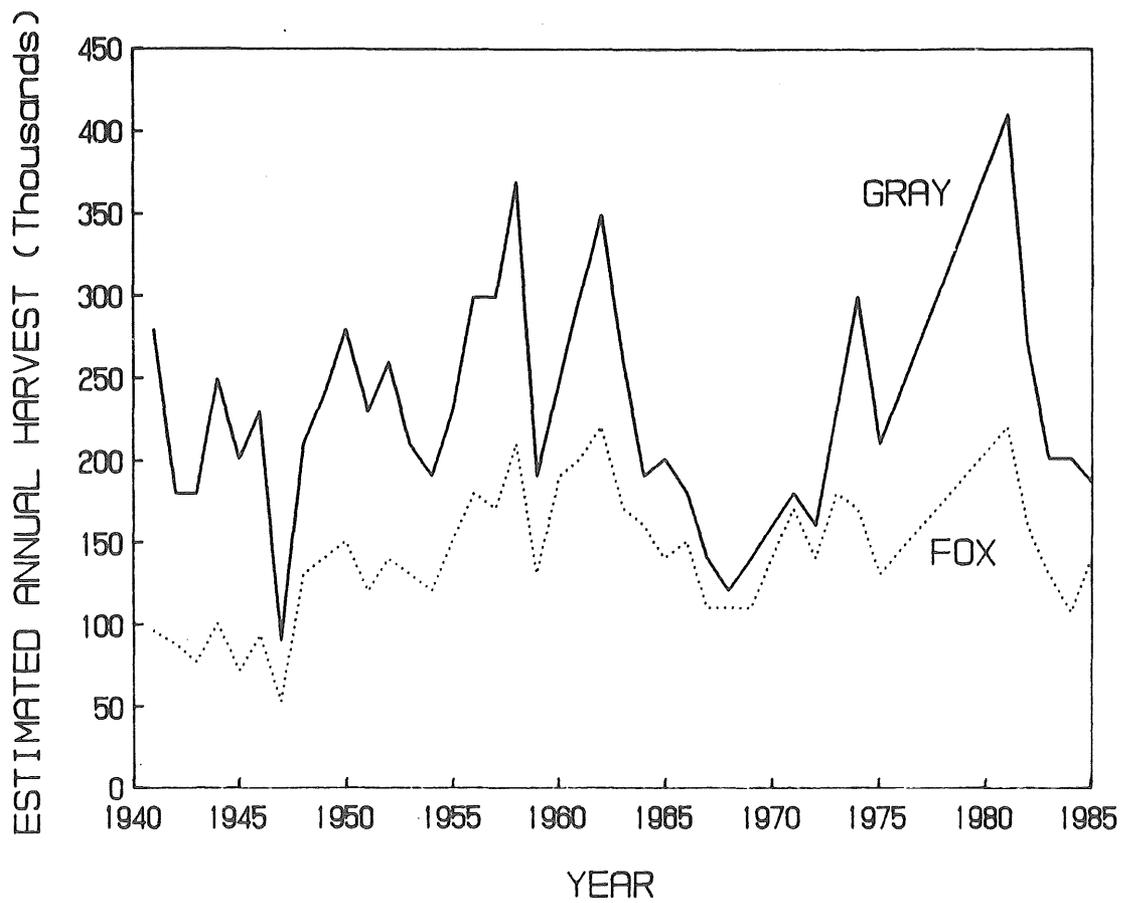


Figure 22-2. Minnesota squirrel harvests, 1940-1985.
(Source: Minnesota Department of Natural Resources)

The first squirrel hunting season was set in 1917, extending 137 days, from October 15 to March 1. Shortened after 5 years to 79 days, the season remained the same for 34 years, always ending on December 31. In 1954 the season length was set at 61 days, the shortest season on record. After that, the opening was occasionally changed, but seasons were kept approximately 90 to 110 days long. In 1981 the closing date was set ahead to the last day of February and since then the seasons have been approximately 160 days long.

Bag limits were established in 1925 at 10 daily and 15 in possession. In 1929 they were 7 and 14, and with a few exceptions they have remained the same.

During the 10-year period of 1974 to 1984, the average annual harvest of gray and fox squirrels was 482,000. The calculated take has been as high as 710,000 in 1977 and as low as 140,000 in 1947.

In 1982, a Department of Natural Resources postcard survey indicated that 53,000 hunters spent 277,000 days hunting gray squirrels and 39,000 hunters spent 220,000 days hunting fox squirrels. However, the total number of squirrel hunters is not shown by the survey. This survey began in 1979 and is used to calculate the number of hunters, take per hunter of various species or groups of game animals and estimated total harvests. Only for 1982, 1983 and 1984 is the calculation of hunter days per species available.

RESOURCE ANALYSIS

The supply of game squirrels exceeds the demands of hunters. Some calculations of available forested habitat and squirrel populations suggest that the harvest could be increased if hunters were sufficiently interested.

Approximately 13 million acres of game squirrel habitat exists. This excludes the forests of extreme northeastern Minnesota. Estimates put the population at 2.6 million to

18.4 million squirrels during the fluctuations. From such numbers, a harvest of 0.5 million to 4 million is possible.

RESOURCE VALUE

Squirrels have had periods of popularity with Minnesota hunters coinciding with the highs in squirrel populations. Although hunters tend to prefer game birds, they do take squirrels incidentally to hunting pheasant or ruffed grouse. Some people hunt squirrels exclusively. Nationwide, squirrels rank among the top game animals.

EASTERN COTTONTAIL, SNOWSHOE HARE, JACKRABBIT

The eastern cottontail rabbit is classified in the genus Sylvilagus and is a rabbit. The snowshoe hare and jackrabbit are classified in the genus Lepus and both are hares. One of the major differences between rabbits and hares is that rabbits are born with no fur and eyes closed. Hares are born with fur and eyes open. Although these species prefer different habitats, they have similar ecological value as prey for a variety of predators.

EASTERN COTTONTAIL

The eastern cottontail can be found throughout Minnesota, but is most abundant in the prairie and transition zones. In the forest zone, cottontails are limited to urban areas and forest edges.

The cottontail prefers an early to mid-successional habitat, such as grasslands, low dense shrubs, cropland edges, shelterbelts and brush piles. Cottontail habitat must include good escape cover along with food.

The primary factors affecting population levels are habitat condition and weather. Cool, wet weather during the breeding season will result in high mortality of the young. The cottontail population has decreased in Minnesota and throughout the midwest because of trends toward intensive farming and reduction in small grain production. The decrease of brushy fence lines and shelterbelts, and the increase of monotypic fields of row crops, has decreased the available habitat for the cottontail throughout its primary range.

The reproductive potential of cottontails is very high. They can produce 3 and perhaps 4 litters a year with an average of 5 per litter. This high productivity is important in hunter harvest and as a prey base for fox, coyote and the great-horned owl.

RESOURCE MANAGEMENT

The primary means of cottontail management is administration of seasons and bag limits. Cottontails were unprotected until 1939, when a hunting season was established from mid-September to late February. This framework remains in effect today. There was no daily bag limit on cottontails until 1946, when it was set at 15 a day in combination with snowshoe hares. The daily bag limit changed in number and combination with snowshoe hares and white-tailed jackrabbits until it was set at 10 a day for cottontails in 1955. The current daily bag limit is still 10 per day.

The cottontail is considered the number one game species in America, but is not a high-priority species for program funding in Minnesota. Cottontails receive significant benefit from current management programs for higher priority species. Public lands such as wildlife management areas provide much needed habitat. The development of woody cover, food plots and nesting cover for more popular species improves habitat for cottontails. The most common management for cottontails is construction of brush piles and providing information or recommendations on preventing damage to gardens, shrubbery or crops by cottontails.

RESOURCE ANALYSIS

Cottontail population levels are difficult to determine, but harvest and roadside survey data indicate a highly variable population with a cyclical pattern (Figure 22-3). Population and harvest highs have occurred in conjunction with cropland retirement programs or drought.

The hunter demand for cottontails appears to be met. The number of hunters whose primary pursuit is cottontails is assumed to be small.

RESOURCE VALUE

There are dedicated Minnesota cottontail hunters who enjoy the hunt with beagles, although most cottontails are taken incidentally to pheasant or ruffed grouse hunting.

The cottontail offers potential for more hunting recreation in urban areas than other game species. Urban areas often will support good cottontail populations and perhaps cottontails can be harvested by non-firearm methods, such as the slingshot or bow and arrow.

SNOWSHOE HARE

In the 1850s there were an estimated 29.5 million acres of snowshoe habitat in Minnesota. Most of the coniferous zone was good habitat, and suppression of fires in the aspen parkland and prairie zones began the process of improving snowshoe habitat in the areas not being cleared for farming. At some point the amount of this habitat peaked, perhaps in the 1930s when much farmland was abandoned. Approximately 160,000 acres of farmland within the snowshoe range were abandoned or fallow by 1934.

There are currently about 14.7 million acres of forested land within the snowshoe range and presumably that is the amount of snowshoe habitat in the state. Using estimated density extremes, the population of these hares could vary from lows of 0.8 - 1.5 million to highs of 35 - 70 million.

RESOURCE MANAGEMENT

The snowshoe hare was the first Minnesota animal to be studied in detail in the 1930s the objective then was to determine causes of the periodic destruction of our native game and fur animals. A research project was begun in 1928 by Dr. Robert G. Green of the University of Minnesota, Department of Biology. In 1931, this became the first

EASTERN COTTONTAIL

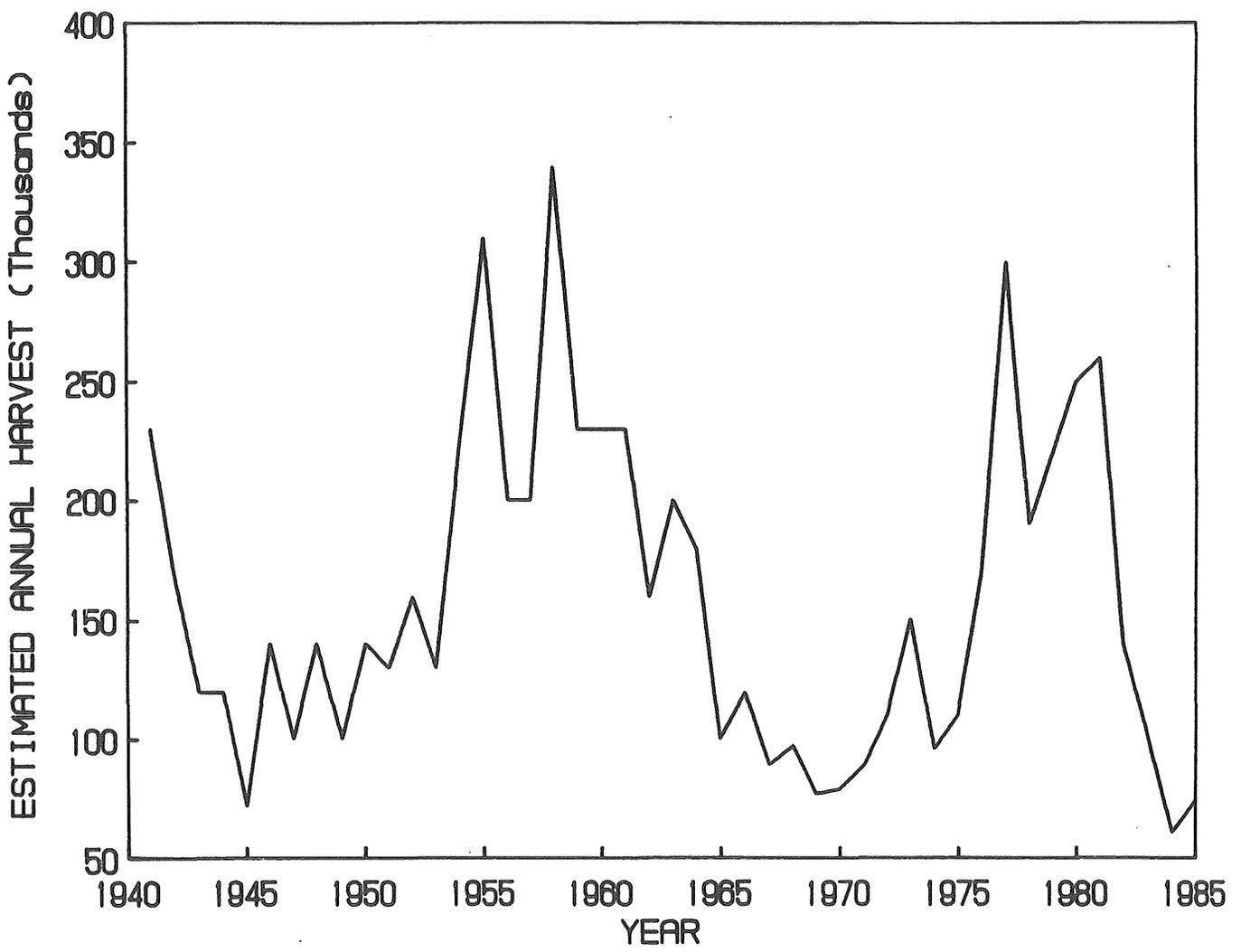


Figure 22-3. Minnesota cottontail harvest estimates, 1940-1985.

federal aid project. The Bureau of Biological Survey, forerunner of the U.S. Fish and Wildlife Service, offered \$10,000 to be matched by the Minnesota Conservation Department's Division of Game and Fish to finance Dr. Green's study under the title of "The Minnesota Wildlife Disease Investigations."

Management of the snowshoe hare has been limited to setting annual seasons and bag limits from the information gleaned from hunters and wildlife surveys.

From 1929-1975, hunter report cards were attached to hunter licenses at the time of purchase. Hunters were required by law to fill in harvest by species and return the cards to the DNR. A random mail survey since 1976 gathers similar harvest information.

Since 1974, a tally has been kept of the number of hares seen on ruffed grouse drumming routes. These figures appear to provide a good indicator of hare abundance.

HARVEST MANAGEMENT

Snowshoe hare seasons and bag limits have varied since 1919 when snowshoe hare first became protected. In that year, a 106-day season was set to run from October 15 to March 1. Snowshoe hares were unprotected again for 12 years from 1925 to 1938. Since then the season length has usually been 6 months.

There was no daily limit on snowshoe hares until 1946, when it was set at 15 per day combined with cottontails. Later it was 15 per day combined with cottontails and jackrabbits. From 1955 until 1977 the allowable take was 10. In 1978 a daily possession limit of 20 was set and has remained to this day despite the cyclic nature of the hare population.

Harvest data since 1941 shows that the lowest take, 13,000, occurred in 1967 while the highest, 290,000, occurred in 1980 (Figure 22-4). In the 10-year periods since 1941, the highest mean take was 100,500 in 1971 to

SNOWSHOE HARE

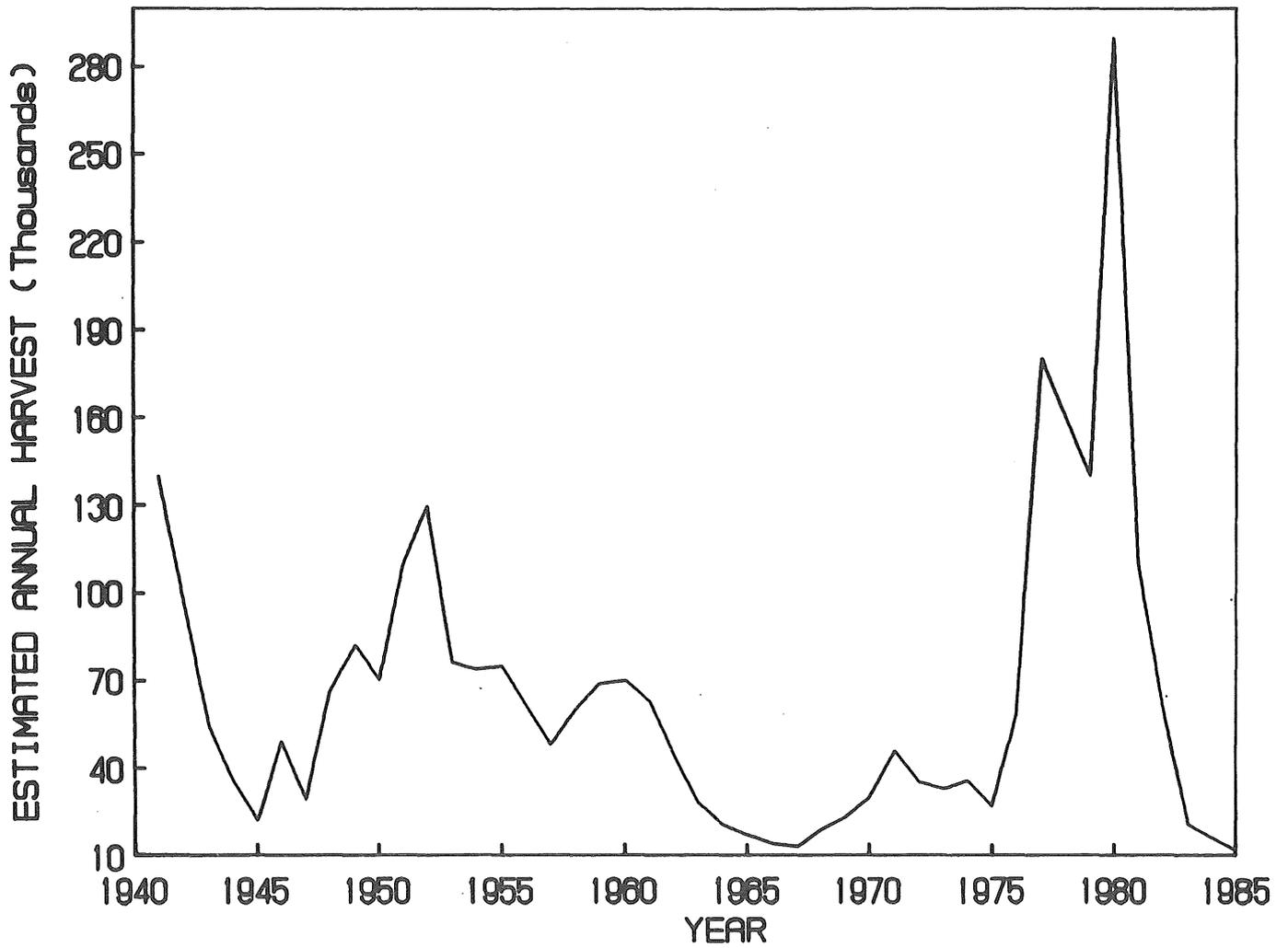


Figure 22-4. Snowshoe hare harvest in Minnesota, 1940-1985.

1980, while the lowest was 27,200 in 1961 to 1970.

The hunting harvest is related more closely to hare populations than to the number of small game licenses sold. Hunter interest in snowshoes has decreased. Low snowshoe hare populations since 1980 caused the harvest to drop severely.

Small game hunter questionnaires in 1979 to 1984 showed a continuing drop in the number of snowshoe hare hunters, from 37,000 in 1980 to 7,100 in 1984. About 5.3 trips per hunter in 1982 and 1983 dropped to 3.9 trips in 1984. The estimated take per hunter dropped from 7.8 in 1980 to 2.3 in 1983 and 1984. All these decreases are attributable to the scarcity of hares and the resulting lack of hunter interest.

In 1978 the bag limit was raised from 10 to 20. In 1984 the daily bag limit was lowered from 20 to 10. In both cases the kill decreased. High bag limits apparently have little effect on the size of the harvest.

RESOURCE VALUE

Snowshoe hares play an integral part in Minnesota's northern ecosystems. They are the prey base for several predators, most of which are also important furbearers. Its cyclic population phenomenon plays an important role in structuring plant and animal communities. It is hunted as a game animal and during periods of high population and contributes significant protein to the diets of rural Minnesotans.

WHITE-TAILED JACKRABBIT

The white-tailed jackrabbit is the largest lagomorph, usually weighing 6 to 10 pounds. This hare is brownish gray in summer and white in winter.

White-tailed jackrabbits are found in most of the transition zone and throughout the intensively farmed regions of the state. Prime habitat consists of open grasslands, although they now occur in agriculturally cropped and pastured areas with scattered, brushy fence rows. Sixty-two counties contain approximately 40,000 square miles of suitable jackrabbit habitat. The remaining 25 counties in the northeastern part of Minnesota are too heavily forested to provide the open grassland requirements of this animal. Intensive farming has degraded the majority of the prime white-tailed jackrabbit habitat in Minnesota.

This prairie hare once numbered as many as 13 per square mile, but now numbers fewer than 4 per square mile (Figure 22-5). This is a reflection of declining habitat and their relation to fox numbers, a major predator. Jackrabbits have a population cycle similar to cottontails, snowshoe hares, lynx and ruffed grouse. In some years, inclement weather such as a cold wet spring or severe winter conditions limits populations.

RESOURCE MANAGEMENT

Jackrabbit hunting seasons have varied from complete protection of the species to unprotected status and no limit to the current 165-day season. The season runs from mid-September through February with a daily limit of 20.

Current management is incidental to that for other species such as the ring-necked pheasant. Post-season hunter surveys and August roadside counts currently provide information concerning population status and hunter harvest trends. Management for pheasant habitat also improves habitat conditions for jackrabbits.

RESOURCE ANALYSIS

August roadside counts are currently used to obtain a population index of white-tailed jackrabbits. This index is based on the number of jackrabbits observed per 100 miles driven. Indices correlate well with animals harvested.

Seasonal harvests have fluctuated from highs of 140,000 jackrabbits, a credit to the Soil Bank era of the late 1950s and early 1960s, to a low of 5,000 in 1971. Hunters usually harvest approximately one-third of the total population. Survey data since 1979 indicates that 4% of those who purchase small game licenses actively pursue jackrabbits.

Hunting pressure drops considerably when jackrabbits decline. From 1981 to 1984, hunter numbers decreased from 17,000 to 6,000 as the average annual harvest dropped from 2.7 to less than 2 animals per hunter.

RESOURCE VALUE

Even though large numbers of jackrabbits are harvested incidental to pheasant hunting, there appears to be a hunting clientele that fluctuates with animal abundance. Nonconsumptive demands will be met by sustaining populations capable of meeting hunters' needs.

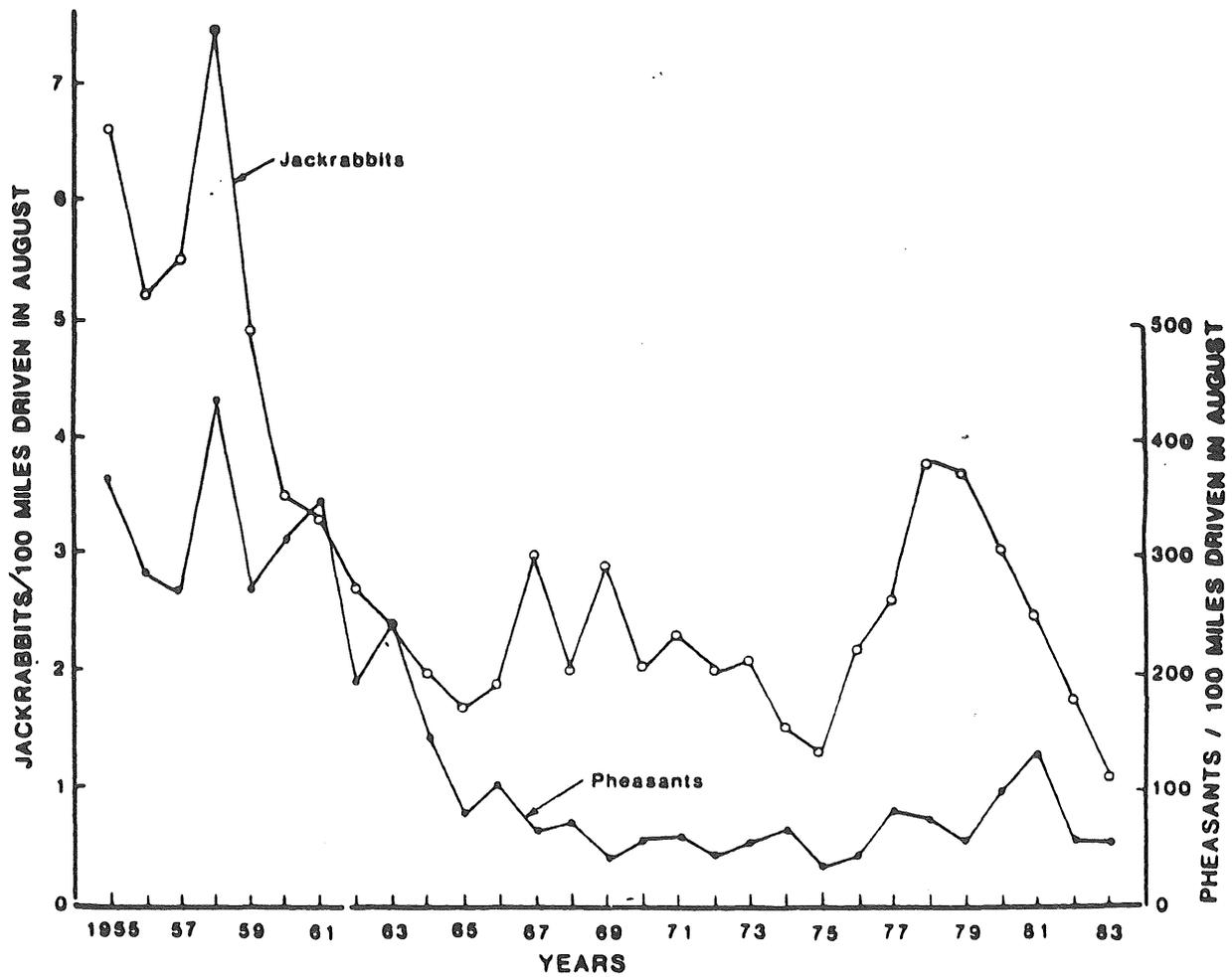


Figure 22-5. Population trend data for jackrabbit and pheasant in Minnesota, 1955-1983.

Long range planning for small game mammals

SERVICE: Conservation of small game mammal populations for their intrinsic and ecological values.

PRODUCTS: Opportunities for appreciation and use of small game mammals.

GOAL: Maintain an optimum population of each species for their recreational, ecological and intrinsic values.

OBJECTIVE 1. Provide the following recreational opportunities by 1992:

	Number of hunters	Hunter days	Annual harvest
Fox and gray squirrels	na	500,000	500,000
Cottontails	75,000	na	200,000
Snowshoe hares	na	50,000	200,000
Jackrabbits	na	75,000	38,000

PROBLEM 1. The limitation of some information reduces management effectiveness.

STRATEGY A. Maintain jackrabbit population surveys and develop techniques to measure production and status of other small game mammal populations.

STRATEGY B. Survey availability of habitat.

STRATEGY C. Develop a survey to estimate hunter demand.

STRATEGY D. Determine economic and recreational values of small game mammals.

PROBLEM 2. The quality and quantity of cottontail, snowshoe hare and jackrabbit habitat are declining.

STRATEGY A. Promote agricultural programs that provide habitat.

STRATEGY B. Promote beneficial private and public land management practices.

STRATEGY C. Expand the Roadside Management Program.

STRATEGY D. Develop and implement habitat management guidelines for public land management.

STRATEGY E. Provide information to the public about habitat management.

STRATEGY F. Protect and maintain habitat.

PROBLEM 3. The quality and quantity of squirrel habitat is declining and squirrel habitat management is often overlooked and if any is done, it is incidental to other target species.

STRATEGY A. Provide habitat management information to private forest managers, county extension agents and private landowners.

STRATEGY B. Develop and implement habitat management guidelines for public land managers.

STRATEGY C. Encourage the development of forest management plans that specifically address squirrel habitat.

PROBLEM 4. Cottontails, snowshoes and jackrabbits may be under-utilized in some areas.

STRATEGY A. Promote cottontail and jackrabbit hunting.

STRATEGY B. Promote snowshoe hare hunting when they are sufficiently numerous to interest hunters.

PROBLEM 5. Poor behavior on the part of some hunters and trespassing on private land complicate management.

STRATEGY A. Expand the Advanced Hunter Education Program.

STRATEGY B. Increase information and education concerning hunter ethics, trespassing and landowners' rights.

PROBLEM 6. Squirrels can cause nuisance and property damage.

STRATEGY A. Provide information and technical assistance to reduce problems.

FISH AND WILDLIFE PLANNING TEAM
MINNESOTA DEPARTMENT OF NATURAL RESOURCES
Division of Fish and Wildlife
500 Lafayette Road
St. Paul MN 55155-4025

FISH, WILDLIFE & NATIVE PLANT RESOURCES
LONG RANGE PLAN COMMENTS

The Division of Fish and Wildlife is inviting comments from individuals and organizations on the long range plans for the management of fish, wildlife and native plant resources. Use this form, or write us a letter, telling us how we can improve the plan or plans you have reviewed.

Plan Name: _____

Comments: _____

Your name: _____

Address: _____

Are these the official comments of an organization? Yes No

Organization: _____

To mail: fold & seal with tape or place in envelope.

Thank you for taking the time to review the plan and providing your comments.

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23. Ducks

This plan addresses the 6-year management needs of 20 species of ducks that commonly depend on habitat in Minnesota and other portions of the United States, Canada, Mexico or South America to complete their annual cycle.

This diverse, renewable resource includes: 1 perching duck, the wood duck; 8 dabbling ducks, also referred to as puddleducks, mallard, northern pintail, blackduck, blue-winged teal, green-winged teal, northern shoveler, American wigeon and gadwall; 1 stiff-tailed duck, the ruddy duck; 5 diving ducks, ring-necked duck, redhead, canvasback, greater and lesser scaup and; 5 sea ducks, common goldeneye, bufflehead, hooded merganser, common merganser and red-breasted merganser.

All duck species are afforded state protection under Minnesota statute and federal protection under the Migratory Bird Treaty Act of 1918 and later treaties.

The relative importance of ducks in Minnesota is illustrated by the fact, that nationally, Minnesota usually ranks fourth or higher in the harvest of ducks and first in the number of duck hunters.

Ducks were present in Minnesota's original avifauna in great abundance. The vast number and diversity of water bodies provided ideal habitat for breeding, their young and multitudes of migrant birds. Ducks were used by native inhabitants as a source of food and clothing ornamentation for thousands of years preceding the European exploration and settlement of the region. Settlers used the eggs and meat as important food sources.

HABITAT ALTERATION

Early settlement years in Minnesota brought on significant duck habitat modification. More than 99% of the original prairie wetlands have been drained. Statewide, 75% of the wetlands were lost to agricultural and urban development. About 1 million acres of wetlands remain in the prairie and transition zones of Minnesota. The remaining wetlands in the western prairie pothole region have been drained at the rate of about 4% annually in recent years.

The extensive fragmentation of duck habitat that accompanied settlement in Minnesota had detrimental effects on resident and migrant duck populations. Drought and declining duck populations stimulated habitat programs to complement regulatory programs already in place. Habitat programs were established that emphasized wetland protection, refuge development and some early forms of basin management, particularly in the private sector.

The American Game Protective and Propagation Association, forerunner of the Wildlife Management Institute, continued to promote new waterfowl legislation, resulting in the establishment of the Migratory Bird Conservation Act of 1929, the Duck Stamp Act of 1934, the Federal Aid to Wildlife Restoration Act of 1937 and the Small Wetlands Loan Act of 1958. This legislation provided authority and funds for the national wildlife refuge system, assistance to states for wildlife restoration and the Small Wetlands Acquisition Program.

Minnesota's "Save the Wetlands Program," initiated in 1951, was the first in North America to actively protect and preserve small wetlands over a broad area. In 1977 the State of Minnesota's Duck Stamp Act was enacted to provide funds for waterfowl habitat development.

Habitat protection efforts by the private sector have been substantial. The Minnesota Waterfowl Association, a

number of local conservation clubs, gun clubs, private citizens, Ducks Unlimited and The Nature Conservancy, have responded with their ideas, assistance and dollars.

State and federal land acquired for duck management and production comprises only about 2% of Regions 1 and 4--the primary duck producing regions of Minnesota. Effective private land management programs are essential to complement existing and future duck management programs.

Much work remains to be completed in wetland protection and management. Numerous agricultural, urban and industrial programs compete directly for wetland habitat. Present waterfowl management programs must emphasize continuing acquisition of wetland habitat, intensive basin and upland management and refined refuge development. Additional programs, such as the state and federal Water Bank Acts, state Protected Waters Act, U.S. Fish and Wildlife Service Mid-Continent Pilot Program, Wetland Tax Credits, Ducks Unlimited's North American Habitat and Matching Aid to Restore State's Habitat programs, Minnesota Lake Designation, The Nature Conservancy acquisition, North America Waterfowl Management Plan, habitat gifts, private leasing and modified agricultural programs that set aside permanent cover are welcome additions to the continuing effort to preserve, restore and manage essential wetland and upland habitat.

The habitat base has declined in quality. Recruitment of young ducks into the population has declined due to reduced nest success and survival of adult females and their young resulting from predation.

Advancing forest succession and maturation have improved the habitat situation for tree cavity nesting species such as wood duck, goldeneye, hooded merganser and common merganser. The construction and placement of duck nest boxes throughout forested regions of the state have provided additional nesting opportunities for cavity nesting ducks.

Providing secure, artificial nesting sites will continue to be an important management tool, as well as protecting natural cavities, wetlands, rivers and streams in the forest from destruction, shoreline alteration and environmental contamination.

State Regulations

Before 1871, duck management was nonexistent. This was an era of unregulated exploitation of the duck resource. The pioneering attitude was one of unlimited supply and caused the elimination of wildlife habitat and some local duck populations.

Some early settlers expressed concern about the lack of regulation. Legislation was passed in 1871 to protect waterfowl nests and in 1877 to establish a waterfowl hunting season. Minnesota hunting licenses were not required until 1889. Additional protective legislation was passed shortly thereafter and salaried game wardens were authorized in 1891. Spring shooting of waterfowl was prohibited in 1899. By 1905, the further development of Minnesota game laws prompted the president of the National Association of Audubon Societies to say the Minnesota game laws were "probably the most radical and advanced of any in force in the United States."

It was not until the formation of the Minnesota Department of Conservation in 1931 that annual seasons, habitat protection and management were incorporated into a comprehensive program. Harvest and population surveys were developed over the years as research findings were applied across a large area. Several of these surveys are currently incorporated into the present duck management program.

Federal Regulations

Most of the federal laws dealing with migratory birds were passed between 1900 and 1934. The Lacey Act of 1900

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restricted the supply of ducks to commercial markets by eliminating the interstate transportation of illegally taken waterfowl. Through the efforts of the American Game Protective and Propagation Association, forerunner of the Wildlife Management Institute, Congress bestowed the first, but tenuous, authority over migratory birds. Subsequently, Congress passed the Weeks-McLean Law of 1913 in its first assertion of federal authority to enforce regulations pertaining to migratory birds. In addition, the Minnesota legislature passed Joint Resolution #13 in 1913 urging federal protection of migratory birds.

A convention for the protection of migratory birds was signed in 1916 by the United States and Great Britain, on behalf of Canada, to protect migratory birds from "indiscriminate slaughter" by sport, market and subsistence hunters. The treaty afforded special protection to the wood duck and eider among its many far-reaching rulings.

To provide statutory authority for implementing the convention, Congress passed the Migratory Bird Treaty Act in 1918, and in doing so gave the Secretary of Agriculture broad migratory bird authority and repealed the Weeks-McLean law. The federal government later signed migratory bird protection treaties with Mexico in 1936, Japan in 1972 and the Soviet Union in 1976. Together the four treaties gave the federal government authority to protect and manage 816 species of birds. Authority for migratory bird management now rests with the Secretary of Interior.

Enforcement of the annual regulatory package by state and federal authorities is an important tool of the duck management program. Adherence to complex or simple regulations are required to meet program objectives.

RESOURCE MANAGEMENT

By necessity, migratory bird management is accomplished through a partnership between the U.S. Fish and Wildlife Service and the states. Four flyways were identified and

established in 1948: Atlantic, Mississippi, Central and Pacific; to place waterfowl management on a firmer basis. Fourteen states, including Minnesota and three Canadian provinces compose the Mississippi Flyway. Flyway councils were established in 1952 to provide advice and cooperative assistance between the states, provinces and federal governments in the management of waterfowl.

Three basic activities are pursued through this international partnership. They are: 1) habitat protection and management, 2) harvest management and 3) development of new information through research and surveys.

Most private and public habitat management has focused on protecting wetlands either through legislation, easement or purchase. Land management agencies have directed their efforts at establishing, restoring and maintaining high quality nesting cover, wetlands and migration habitat. Water level manipulation is practiced where possible to control undesirable fish population and vegetation in breeding and migration habitat. Chemical and mechanical control of fish populations has been used successfully on a limited scale in recent years.

Predator management to improve hen survival, nest success and duckling survival has many benefits to local duck populations. Methods have included construction of islands and peninsulas, barrier fences and direct removal of selected predator species. Each management practice is implemented to achieve habitats occupied near carrying capacity. Much more aggressive management is needed to meet the habitat demands of ducks.

Harvest management through the late 1960s in the Mississippi Flyway focused on harvest reduction to stockpile declining breeding populations. Population reductions due to drought, habitat deterioration and high harvest were treated with reduced season length and bag limits. When water conditions improved in the prairie pothole region, breeding duck populations increased. Hunting regulations

were adjusted annually to alter the harvest to correspond with the anticipated size of the fall flight.

Liberal views emerged in the 1970s regarding the impact of harvest on mallard populations and to some degree ducks in general. Options for special seasons, bonus birds, points, zones and split seasons to harvest underutilized species and increase opportunity continued to be offered despite declining breeding populations and occasional drought on the breeding grounds. A number of states have selected these options, but Minnesota has chosen to retain standard season length and basic bag limits with species restrictions.

Three major problems continue to plague biologists and administrators and hamper their ability to develop sound management programs. They are: 1) more information is needed to understand the mortality process, especially the role of hunting; 2) more information is needed concerning the relative roles of mortality and recruitment in determining duck population size coupled with the impact of changing land use on recruitment; and 3) understanding the cause-and-effect relationships of particular harvest strategies is poor because regulations are tailored to fit current status of breeding ducks and the predicted production.

In 1980, season length and bag limit were stabilized in the United States for 5 years to address relationships between environmental factors, hunting regulations and duck population dynamics. In Canada, the regulations were stabilized from 1979 to 1984. In the absence of changes in season length and bag limit, factors that influence harvest could perhaps be identified. Pending results of the evaluation of stable waterfowl hunting regulations and their relationship to mallard survival, Minnesota's policy of harvest restriction through season length and basic bag limits with species restrictions has remained in place.

Research and survey work maintains a vital link between harvest and habitat management. Annual information is gathered to monitor population responses to various management practices while new information is derived from numerous long-term studies to improve our knowledge and management ability.

RESOURCE ANALYSIS

Analysis of supply and demand factors influencing the duck resource requires information from international, national, state and local perspectives.

The status of breeding ducks in Minnesota and North America is presented in Table 23-1. Breeding ducks in North America are composed of 61% dabblers, 17% divers, and 22% sea ducks. In the surveyed area of Minnesota, the breeding duck index is composed of 92% dabblers, 8% divers, and less than 1% sea ducks. Duck breeding populations in surveyed areas of North America ranged from about 46 million in 1971 to approximately 31 million in 1985. Estimates of duck breeding populations in Minnesota ranged from 182,000 in 1972 to 742,000 in 1980.

The supply of ducks is influenced by habitat conditions, recruitment, annual survival and harvest rates. Ducks require wetlands for security, feeding, resting, breeding, nesting, brood rearing, molting and staging. Specific requirements vary with each species. Many agricultural practices and certain predators have a substantial negative influence on the survival of nesting hens, their eggs and young. Nest success has been reduced for certain species in many regions of the state to a level that precludes local population stability or growth.

Fall flight predictions for the nation and the Mississippi Flyway--including Minnesota--are available each August from the U.S. Fish and Wildlife Service. Estimates of fall duck populations in North America have ranged

Table 23-1. Breeding duck population status, trends and objectives for common species in surveyed areas. a/

Dabbling Ducks	Population trends <u>b/</u>					
	Status 1985		1970-1985		Objectives	
	North America	Minnesota	North America	Minnesota	North America (year 2000) <u>c/</u>	Minnesota (1992) <u>d/</u>
Mallard	5,475	219	D	I	8,700	225
Pintail	2,935	3,040	D	UKN	6,300	I
Gadwall	1,410	1,331	NC	UKN	1,600	I
Wigeon	2,506	4,422	NC	UKN	3,300	I
Green-winged teal	1,873	tr	NC	UKN	2,300	I
Blue-winged teal	3,756	264	D	NC	5,300	300
Shoveler	1,925	6,160	NC	UKN	2,100	I
Wood duck		11,465	I	I		I
Blackduck		tr				
<u>Diving ducks</u>						
Canvasback	411	1,253	NC	UKN	580	I
Redhead	706	2,485	NC	UKN	760	I
Scaup	6,232	tr	NC	NC	7,600	NC
Ring-necked		3,132	I	UKN		I
Ruddy		2,481	NC	UKN		I
<u>Sea ducks</u>						
Goldeneye		2,287		UKN		I
Bufflehead		tr		UKN		NC
Mergansers		tr		UKN		NC

a/ Surveyed area includes strata 1-50 and data from b states for North America and one-third of the state for Minnesota

b/ 1,000's of ducks--species other than mallard and blue-winged teal for Minnesota are actual expanded values uncorrected for visibility

c/ 1973-1985

d/ 1970-1979 average

tr = population less than 100

I = Increasing

NC = No change

D = Decreasing

UKN = Unknown

from 120 million in 1956 to 62 million in 1985. Gross estimates of fall resident ducks in Minnesota have ranged from about 1 million in 1972 to about 2.5 million in 1980.

In Minnesota, opportunities exist to intensively manage habitat for ducks on 42,353 acres of designated wildlife management lakes (Table 23-2), 131,304 acres of federal waterfowl production areas (Table 23-3), 132,587 acres on 7 national wildlife refuges (Table 23-4), and 513,481 acres of 997 state wildlife management areas (Table 23-5). Nesting cover is an important component of these managed lands and comprises approximately 110,000 acres in U.S. Fish and Wildlife Service ownership and some 106,000 acres of state holdings. Achieving high levels of nest success on these managed lands is an important goal for state and federal agencies.

Security of habitats is an ever increasing aspect of habitat management that affects the supply of resident and migrant ducks. Security from disturbance during the fall has an important positive influence on traditional use of migration areas and overall distribution of birds. The development of federal and state refuges is an important tool in managing the distribution and abundance of ducks, particularly in the fall. A variety of refuges are present in Minnesota that comprise about 1 million acres of secure habitat. Many large water bodies serve as security areas because their size separates birds from sources of disturbance such as motorboats. These lakes are in addition to formally established refuges. Increased recreational use has diminished the value of portions of these large water bodies as security areas and has reduced or redistributed the supply of ducks.

Harvest

Demand for ducks often exceeds their supply. For species in high demand, such as canvasback, redhead, wood duck and mallard, restrictive species regulations are

Table 23-2. Designated state wildlife management lakes by Department of Natural Resources region.

	Region						Total
	1	2	3	4	5	6	
Basins	2	1	1	15	5	2	26
Acres	4,167	2,656	2,793	26,392	5,212	1,133	42,353

Table 23-3. Acres acquired on federal waterfowl production areas by Minnesota Department of Natural Resources region.

	Region						Total
	1	2	3	4	5	6	
Wetland	31,547	---	2,947	12,325	172	---	46,991
Upland	57,638	---	5,064	21,309	302	---	84,313
Total	89,185	---	8,011	33,634	474	---	131,304

Table 23-4. Acres of national wildlife refuges by Minnesota Department of Natural Resources region.

	Region						Total
	1	2	3	4	5	6	
Wetland	53,773	7,400	12,400	3,493	26,000	2,975	106,041
Upland*	6,930	1,650	8,833	6,078	700	2,355	26,546
Total	60,703	9,050	21,253	9,571	26,700	5,330	132,587

* Potential nesting cover -- includes grasslands, native prairie and croplands.

Table 23-5. Acres acquired on state wildlife management areas by Department of Natural Resources Region (Acres x 1,000).

	Region						Total
	1	2	3	4	5	6	
Wetland	270	30	30	56	6	16	408
Upland*	50	1	5	38	9	3	105
Total	320	31	34	94	16	19	513

* Cover types exclude deciduous forest, coniferous forest and miscellaneous.

usually required to control harvest.

Hunting regulations strongly affect size and rate of duck kill. Hunting-associated mortality usually comprises half of the annual duck mortality. Sport hunters harvest 20 to 25% of the fall mallard population in an average year.

Retrieved duck harvest in North America has ranged from 11 million in 1968 to 20 million in 1972. Distribution of the total duck harvest for the years 1971 through 1984 has been 80% in the United States and 20% in Canada. One-third of the total harvest occurs in the Mississippi Flyway and 5% of U.S. harvest occurs in Minnesota.

Duck harvest in the Mississippi Flyway has ranged from 1.1 million in 1962 to 6.2 million in 1979. Minnesota duck harvest has ranged from 0.3 million in 1962 to 1.1 million in 1979. The proportion of locally reared mallards in the Minnesota harvest is estimated to be one-fourth to one-third of the total mallard harvest. Contributions of other locally reared species to the bag have not been determined. Annual harvest of individual species varies greatly across states and flyways because of weather, habitat conditions, bird distribution, hunter interest and participation, season length and bag limit.

Duck hunter participation in Minnesota, as indicated by federal duck stamp sales, has remained relatively stable from 1972 to 1984. Short-term declines of 15% are evident from 1980 to 1984. Similar trends have been reported from other upper midwestern states. Changes in hunter participation are influenced by general habitat conditions, fall flight forecasts, season length, bag limit and, to a lesser degree, increases in the price of state and federal duck stamps.

Duck harvest in Minnesota has remained relatively constant from 1972 to 1984. Short-term increases of 19% are evident from 1980 to 1984, a period of stable

bag limits and season length. About 54% of the annual duck harvest occurs in Department of Natural Resources Regions 1 and 4 (Table 23-6). Hunting effort is about 1 million hunter days per season and 51% of the effort occurs in Regions 1 and 4 (Tables 23-7 and 23-8).

No substantial change is expected in the numbers of Minnesota duck hunters or their effort within the next 6 years. Similar duck harvests are expected if season length and bag limit are not changed.

Overall demand for ducks has not been sufficiently quantified. Maintenance of duck populations that sustain harvest objectives in this plan will provide sufficient populations for viewing, photography and other uses.

Dabbling Ducks

Eight species of dabbling ducks; mallard, blue-winged teal, green-winged teal, American wigeon, gadwall, northern pintail, northern shoveler, blackduck, and 1 perching duck, the wood duck, utilize habitat in Minnesota and North America (Table 23-1). Dabbling ducks comprised 92% of the state breeding population and 75% of the average annual harvest in Minnesota from 1980 to 1984.

The highest densities of breeding dabblers in Minnesota are found in the prairie pothole region. Diverse wetland complexes provide ideal habitat for breeding birds and their young. Cyclic drought temporarily reduces productivity on a short-term basis, but it promotes long-term nutrient release in wetlands and improves productivity. Intensive agriculture, wetland destruction and predation on breeding birds reduce both short-term and long-term productivity.

Most large lake complexes provide stable breeding and migration habitat for dabbling ducks. This stable water also provides attractive breeding areas for drought-displaced dabbling ducks.

Dabbling duck breeding and migration habitat quality

1/8/90

Public Review Draft

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Table 23-6. Regional harvest distribution of ducks by order of importance in the harvest, 1980-1984.

Region	1	2	3	4	5	6
Species	% of harvest					
Dabblers	26%	6%	15%	34%	10%	8%
Mallard	29%	8%	16%	28%	10%	8%
Wood duck	21%	6%	21%	29%	11%	11%
Blue-winged teal	27%	4%	11%	42%	10%	5%
Green-winged teal	21%	6%	13%	43%	9%	7%
Wigeon	33%	5%	10%	32%	12%	7%
Gadwall	25%	2%	5%	52%	8%	5%
Pintail	32%	4%	6%	40%	11%	7%
Shoveler	21%	1%	4%	61%	8%	5%
Blackduck	13%	24%	14%	12%	27%	10%
Divers	44%	20%	13%	14%	3%	5%
Ring-necked	40%	26%	17%	7%	3%	6%
Lesser scaup	49%	19%	11%	12%	3%	4%
Redhead	51%	7%	7%	29%	3%	2%
Canvasback	44%	7%	7%	27%	4%	8%
Ruddy	35%	4%	3%	51%	1%	9%
Greater scaup	35%	22%	20%	14%	--	8%
Sea ducks	36%	23%	21%	12%	3%	5%
Bufflehead	40%	14%	20%	18%	4%	4%
Goldeneye	35%	28%	28%	5%	1%	2%
Hooded merganser	29%	38%	16%	5%	3%	8%
Common merganser	14%	43%	14%	--	--	27%
Red-breasted merganser	--	--	--	39%	--	61%

Table 23-7. Duck hunter distribution by Minnesota Department of Natural Resources region from state hunter survey.

Year	Hunters ^a (x 1000)	Region					
		1	2	3	4	5	6
1982	134	27%	15%	18%	21%	8%	12%
1983	110	25%	14%	19%	25%	9%	9%
1984	131	24%	14%	18%	26%	8%	10%
Average	125	25%	14%	18%	24%	8%	10%

^aNon resident hunters included -- approximately 1,800

Table 23-8. Distribution of duck hunter days by Minnesota Department of Natural Resources region from state hunter survey.

Year	Hunter Days (x 1000)	Region					
		1	2	3	4	5	6
1982	939	24%	15%	16%	24%	9%	12%
1983	893	24%	12%	16%	30%	10%	9%
1984	1,012	22%	13%	16%	30%	9%	11%
Average	948	23%	13%	16%	28%	9%	11%

have been reduced because of intensive agriculture, increasing rough fish populations, siltation, drainage and shoreline modification. Fragmentation of breeding habitat aggravates nest and hen losses from increased predation, thereby reducing recruitment of young birds into the population.

Mallard. The mallard (Anas platyrhynchos) is the most widely distributed and abundant duck within the United States and Canada. Continental breeding population indices average 8.4 million mallards since 1955 and range from a low of 5.4 million in 1985 to a high of 12.9 in 1958. Estimates of mallard breeding populations in Minnesota have ranged from 73,000 in 1974 to 219,000 in 1985. Since 1973 the breeding population is estimated to have grown by 7,300 birds per year.

Approximately 6.4 million mallards are harvested annually in North America--4.8 in the United States and 1.6 million in Canada. About 46% of the mallard harvest occurs in the Mississippi Flyway. Minnesota harvests about 262,000 mallards annually, or 13% of the mallard harvest in the Mississippi Flyway. The mallard is the number one bird in the Minnesota harvest.

Hunting mortality estimates for Minnesota-reared mallards remain relatively high, 61% and the proportion of these birds shot in Minnesota has averaged 57% since 1980. Hunting demand exceeds the supply, so species and sex harvest restrictions have been a fundamental part of mallard harvest management for a number of years.

Wood Duck. Wood duck (Aix sponsa) populations have improved dramatically since the early 1900s. Annual hunting seasons for wood ducks were prohibited until 1941. Population growth and westward range expansion have allowed an

increased harvest. Indirect estimates of preseason populations have ranged from 2.2 million to 3.7 million birds and the species has sustained a harvest in excess of 1 million birds annually since 1975.

Sixty percent of the national wood duck harvest occurs in the Mississippi Flyway. The wood duck is usually ranked second or third in the state harvest and approximately 136,000 are taken annually. In the past few years, Minnesota's harvest has increased by about 5,000 birds annually. Hunting mortality estimates for Minnesota's immature wood ducks have averaged 54% and the proportion of these birds shot in the state has averaged 62% since 1980.

Wood ducks are early migrants and most of the birds in the harvest are reared in Minnesota. Hunting demand exceeds the supply in most portions of the flyway. Species harvest restrictions have always been a part of wood duck management.

Blue-winged Teal. The blue-winged teal (Anas discors) is one of the most abundant ducks in North America. They are generally the first ducks to move south in the fall and the last to arrive on northern breeding areas in the spring. They winter farther south than other North American ducks.

Continental estimates of breeding populations have ranged from 6.4 million to 3.4 million and have averaged 4.9 million birds since 1955. In Minnesota, estimates of breeding populations have ranged from 102,000 to 445,000 and averaged 227,500 birds.

This species has sustained an average annual harvest of approximately 893,000 in the United States since 1980. About 66% of the harvest occurs in the Mississippi Flyway. Blue-winged teal usually rank third or fourth in the Minnesota harvest with an average annual harvest of 92,000 birds.

Freezing temperatures early in the fall can stimulate many blue-wings to move south, which reduces their avail-

ability to Minnesota hunters. Hunting demand often exceeds supply of blue-winged teal. Species restrictions have not been used in harvest management, but special early seasons in many states provide more days of duck hunting and enable additional harvest of these early migrants.

Green-winged Teal. Minnesota's smallest duck, the green-winged teal (Anas crecca), is often under-represented on aerial surveys. Large adjustments for birds missed by the aerial survey contribute to low survey reliability. Continental breeding population estimates have ranged from 2.9 million to 1.1 million and have averaged 2.1 million birds. Breeding populations in Minnesota are very low.

The average annual harvest of green-winged teal in the United States is approximately 1.3 million birds. About 36% of the total harvest occurs in the Mississippi Flyway. Green-wings usually rank sixth in the Minnesota bag with an average of 59,000 harvested annually. Species restrictions have not been used in recent years for management of green-winged teal.

American Wigeon. Since 1955, the continental breeding population of American wigeon (Anas americana) has ranged from 3.9 million to 2.2 million and averaged 3.1 million birds. The breeding population index in Minnesota has averaged slightly less than 1% of the dabbling duck breeding population from 1980 to 1984. Substantial declines in breeding wigeon have occurred on 6 northcentral Minnesota lakes in recent years.

Average annual harvests have been 722,000 birds in the United States. About 32% of the harvest occurs in the Mississippi Flyway and an average of 38,000 wigeon are shot annually in Minnesota. Species restrictions have not been used recently in harvest management of American wigeon.

Gadwall. Continental breeding population estimates for gadwall (Anas strepera) range from 2.0 million to 700,000 and have averaged 1.5 million birds since 1955. The population has been relatively stable. This species has contributed about 1% to the dabbling duck breeding population index in Minnesota from 1980 to 1984.

The average annual harvest in the United States is 794,000 birds. About 52% of the harvest occurs in the Mississippi Flyway and an average of 21,000 gadwalls are shot annually in Minnesota. Species restrictions have not been used recently in harvest management of gadwall.

Northern Pintail. The pintail (Anas acuta) ranks as the second or third most abundant puddle duck in North America. Continental breeding population estimates range from 10.1 million to 2.9 million and average 5.8 million birds since 1955. Pintails comprised about 2% of the dabbling duck breeding population index in Minnesota from 1980-1984.

Average annual harvests are approximately 841,000 birds in the United States. About 21% of the harvest occurs in the Mississippi Flyway. Minnesota harvests an average of 19,000 pintail annually. Declines in the status of pintail necessitated species restrictions within the daily bag in 1985 for the first time.

Northern Shoveler. Continental breeding population estimates for northern shovelers (Anas clypeata) range from 10.1 million to 2.9 million and average 5.8 million birds since 1955. The population has been relatively stable with cyclic fluctuations caused by drought in the principal breeding areas. Shovelers comprised about 6% of the dabbling duck breeding population index in Minnesota from 1980 to 1984.

The average annual shoveler harvest in the United

States has been 352,000 birds. About 27% of the annual harvest occurs in the Mississippi Flyway, with about 10,000 shovelers shot annually in Minnesota. Species restrictions have not been used recently in harvest management of the shoveler.

Blackduck. There are no methods at present to accurately determine the status of the breeding population of blackducks (Anas rubripes). Winter inventory data suggest an almost continuous decline of more than 40% since 1955. The reasons for this decline are unclear. Destruction of wintering habitat, hybridization with a growing population of mallards in the eastern portion of the range and no significant change in harvest rates are thought to be contributing to the overall population problem. Minnesota is in the western fringe of the blackduck breeding range. This species contributed less than 1% of the dabbling duck breeding population index in Minnesota from 1980 to 1984.

The average annual harvest of blackducks in the United States has been 265,000 birds. About 23% of the total harvest occurs in the Mississippi Flyway. Minnesota harvests about 2,500 blackducks annually. The demand is much greater than supply and species restrictions must be continued as a harvest management tool.

Diving Ducks

Five species of diving ducks: ring-necked duck, lesser and greater scaup, redhead, canvasback; and 1 stiff-tailed duck, ruddy duck, utilize habitat in Minnesota to complete portions of their annual cycle. Diving ducks traditionally utilize deep inland marshes, rivers and lakes for breeding and migration. The traditional use of key coastal bays, estuaries and offshore wintering sites is well-known. This group of ducks is less abundant than the dabblers (Table 23-1). Their population index comprised 8% of the state breeding population index from 1980 to 1984. Diving

ducks comprised 23% of the harvest in Minnesota for that same period.

The greatest densities of breeding diving ducks are found in the portions of Minnesota's prairie pothole region that retain diverse wetland complexes. Breeding canvasback, redhead and ruddy ducks frequent prairie wetlands. Breeding ring-necked ducks are currently most abundant in the wooded areas of the state with many bog lake complexes. Lesser scaup are occasional breeders in northwestern Minnesota, the primary utilization of habitat within the state is by migrant birds.

The quality of traditional diving duck breeding and migration habitat has been reduced by intensive agriculture, wetland drainage, siltation, increasing rough fish populations, shoreline modification and certain competing uses. Fragmentation of breeding habitat aggravates nest and hen losses from increased predation rates, thereby reducing recruitment of young birds into the population.

Ring-necked Duck. Breeding population indices for the ring-necked duck (Aythya collaris) indicate that continental breeding populations have fluctuated between 200,000 and 800,000. They have averaged about 500,000 birds and have increased since 1960. Ring-necks comprised about 22% of the diving duck breeding population index in Minnesota from 1980 to 1984. Breeding ring-necked ducks declined 40% on 14 northern Minnesota bog lakes from 1975 to 1985.

Average annual harvests have been 433,000 birds in the United States, with Florida and Minnesota accounting for 40% of the total harvest. The Mississippi Flyway harvests 54% of the total and Minnesota's average annual harvest is approximately 96,000 birds. Estimates of hunting mortality for locally reared birds remains high at 68% and the proportion of these birds shot in Minnesota has averaged 68% since 1980. Small samples of immature migrant ring-necked

ducks banded on a large refuge have experienced average hunting mortality rates of 79%, and the proportion of these birds shot in the state has averaged 67% since 1980. Hunting demand is greater than the supply. Species restrictions have not been a part of harvest management, but perhaps should be.

Greater and Lesser Scaup. Lesser scaup (Aythya affinis) are the most abundant diving duck in North America. Continental estimates of lesser scaup breeding populations have ranged from 8.7 million to 5.3 million and averaged 6.9 million birds since 1955. Breeding areas of the lesser scaup in Minnesota are in the southern fringe of their range and include very few birds. Greater scaup (Aythya marila) breeding populations are estimated at 500,000 birds, located principally in Alaska.

Combined average annual harvests for greater and lesser scaup are 490,000 birds in the United States. About 60% of the annual lesser scaup harvest and 29% of the greater scaup harvest occur in the Mississippi Flyway. Although hunting demand is often greater than the supply, species restrictions have not been a part of harvest management.

Redhead. Redhead (Aythya americana) continental breeding population estimates have ranged from 396,000 to 1.1 million and have averaged 716,000 birds since 1955. Redheads comprise less than 2% of the total breeding population of the 10 duck species surveyed annually. No significant populations trends have occurred over this period. Redheads comprised about 42% of the diving duck breeding population index in Minnesota from 1980 to 1984.

Average annual harvests have been 145,000 birds in the United States. About 36% of the harvest occurs in the Mississippi Flyway and Minnesota harvests about 25,000 birds annually. Estimates of hunting mortality for locally reared

birds remains high at 58% and the proportion of these birds shot in Minnesota has averaged about 61% since 1980. Hunting demand is much greater than supply and a variety of species restrictions, often relating to the status of canvasback, have been imposed on the harvest of redheads during the last 26 years.

Canvasback. The canvasback (Aythya valisineria) is the least abundant of the major North American game ducks. Its populations fluctuate widely, depending on water conditions in the principal breeding areas--the prairie potholes. Continental breeding population estimates have ranged from approximately 700,000 to 411,000 birds and have averaged 572,000 since 1955. Canvasback breeding populations compose less than 2% of the total breeding population of the 10 important duck species surveyed annually. Canvasbacks comprised about 12% of the diving duck breeding population index in Minnesota from 1980 to 1984.

The average annual harvests have been approximately 64,500 birds in the United States. About 35% of the harvest occurs in the Mississippi Flyway and Minnesota harvests about 7,000 annually. Estimates of hunting mortality for locally-reared birds remains high at 67% and the proportion of these birds shot in Minnesota has averaged 46% since 1980. Hunting demand is much greater than supply and several methods of harvest restriction have been imposed on canvasback harvest over the last 26 years.

Ruddy Duck. Ruddy duck (Oxyura jamaicensis) continental breeding population estimates have ranged from 800,000 to 258,000 and averaged 475,000 birds since 1955. Ruddy ducks comprised about 23% of the diving duck breeding population index in Minnesota from 1980 to 1984.

The average annual harvests have been approximately 55,000 birds in the United States. About 37% of the harvest

occurs in the Mississippi Flyway and Minnesota harvests about 5,000 birds annually. Supply is usually greater than hunting demand and species restrictions have not been used recently as a harvest management tool.

Sea Ducks

Five species of sea ducks that commonly utilize habitat in Minnesota to complete portions of their annual cycle are bufflehead, common goldeneye, and the hooded, common, and red-breasted mergansers. Most breed in the waters of northern forests, utilize tree cavities for nesting sites, and do not breed until their second year. Most sea ducks winter in coastal bays and estuaries, the Great Lakes and associated river systems in the northern half of the continent. This group of ducks is highly diverse yet numerically weak when compared with dabbling and diving ducks (Table 23-1). The population index comprised less than 1% of the state breeding population index from 1980 to 1984. Sea ducks comprised 3% of the harvest in Minnesota for that same period.

Traditional sea duck breeding and migration habitat has not been influenced by human activities as much as habitat for dabblers and divers. Management practices favor protection of cavity trees and protection of aquatic systems from physical alteration and environmental pollutants.

Bufflehead. Continental population estimates for breeding buffleheads (Bucephala albeola) have ranged from 360,000 to 930,000 and averaged about 585,000 birds. This species occupies breeding habitat over a vast range and is difficult to survey. Minnesota is in the southern fringe of the bufflehead range and only an occasional breeding pair utilizes habitat here.

The average annual harvest of bufflehead is approximately 130,000 birds for the United States. About 30% of the

harvest occurs in the Mississippi Flyway and Minnesota harvests about 10,500 birds annually. Hunting demand may be greater than the supply, but species restrictions have not been used recently as a harvest management tool.

Common Goldeneye. A rough index of abundance for common goldeneye ducks (Bucephala clangula) in North America is 1.25 million birds in early summer. Only limited sampling of the principal breeding range within the boreal forests is presently conducted. Goldeneyes comprised 50% of the sea duck breeding population index in Minnesota from 1980 to 1984. Hunting mortality estimates for locally reared birds is relatively high at 67% and the proportion of these birds shot in the state has averaged 58% since 1980. Though local hunting demand is high, species restrictions have not been considered as a necessary management tool.

Hooded, Common and Red-breasted Mergansers. Indirect population estimates for hooded mergansers (Lophodytes cucullatus) indicate that at least 76,000 breeding birds exist in North America. This bird is very secretive and impossible to count accurately with current methods. Minnesota's populations of hooded mergansers comprised 32% of the sea duck breeding population index from 1980 to 1984. Aerial surveys on the breeding areas of common (Lophodytes merganser) and red-breasted (Lophodytes serrator) mergansers estimate about 900,000 birds annually. Minnesota is at the southern fringe of the vast breeding areas of common and red-breasted mergansers. Little information is available on breeding populations of these 2 species, yet 18% of the sea duck breeding population index was comprised of these species from 1980 to 1984.

Average annual harvests for all three species of mergansers has totaled 90,000 in the United States. Hooded mergansers comprise two-thirds of the harvest and common and

red-breasted about one-third. About 44% of the total merganser harvest occurs in the Mississippi Flyway. Minnesota harvests about 4,000 mergansers annually, 95% of which are hooded. Vulnerability or hunting demand for hooded mergansers is higher than for other mergansers. Merganser bags are excluded from the duck bag in states with conventional seasons but included in the point total in states with the point system. In either case, hooded merganser daily limits are 1 per hunter. No species restrictions are placed on common and red-breasted merganser harvest.

RESOURCE VALUE

Ducks provide a variety of ecological values and are indicators of healthy wetland ecosystems. They are consumers of vegetation, invertebrates and minnows. Because most species have high reproductive potential and frequently reneest, they provide an abundant source of food for species higher in the food chain.

Recreational values include fall hunting, viewing and year-round photography. Ducks provide about 1 million hunter days of recreation annually in Minnesota.

Activities of duck watchers and photographers have not been measured adequately, but the presence of ducks and their unique behaviors adds to the outdoor experiences of many people. An estimated 84% of all hunters and anglers participate in nonconsumptive activities and 42% of all nonconsumptive users hunt and fish.

Ducks have positive and negative economic values. The positive economic value of duck-associated recreation is poorly evaluated in Minnesota. However, ancillary service industries such as motels, restaurants, sporting goods and ammunition dealers, transportation, service stations and commercial duck dressers clearly benefit from duck-associated recreation.

duck-associated recreation.

Aviculturists and game farms raise birds for enjoyment and economic benefit. About 423 federal permits for the sale or disposal of waterfowl are issued annually in Minnesota. The contribution of these individuals and organizations to the economy is poorly documented but is probably many thousands of dollars annually.

The negative economic impact is caused primarily by mallard ducks and a few other puddle ducks feeding on farm crops. No current estimate of economic loss caused by field-feeding ducks is available; but, statewide it has ranged from a few hundred dollars to thousands of dollars annually, depending on fall weather conditions and progress with the crop harvest.

The economic and less tangible values of ducks far outweigh the occasional damage they cause. The costs of damage prevention are likely far less than the total value of the duck resource to the state and nation.

Aesthetic values exist for ducks through viewing, photography, aviculture and vicariously through movies, television, art and magazines. Actual values have not been determined.

Although difficult to measure, ducks provide a source for scientific study by students and professionals in ornithology, ecology, wildlife science and management. Considerable scientific contributions to wildlife science and management have been made by people of universities, private research organizations and government agencies through studies of duck biology and population dynamics.

Long range planning for ducks

SERVICE: Conservation of wild duck populations for their intrinsic and ecological values.

PRODUCT: Opportunities for appreciation and use of wild ducks.

GOAL: Maintain current species diversity and distribution of duck populations and increase their numbers for maximum hunting and viewing opportunities.

OBJECTIVE 1. Provide duck populations capable of sustaining the following levels of annual use from 1986-1992:

<u>Department of Natural Resources Region</u>	<u>Hunters (x 1000)</u>	<u>Other Users</u>
1 Users	31	Unknown
User days	218	Meet Demand
2 Users	18	Unknown
User days	123	Meet Demand
3 Users	23	Unknown
User days	152	Meet Demand
4 Users	30	Unknown
User days	265	Meet Demand
5 Users	10	Unknown
User days	85	Meet Demand
6 Users	13	Unknown
User days	104	Meet Demand
State Total Users	125	Unknown
User days	948	Meet Demand

PROBLEM 1. Increased demand can cause overharvest and poor quality hunting and viewing.

STRATEGY A. Support flyway population management efforts through the development of appropriate hunting regulations and improved enforcement at state, federal and international levels.

STRATEGY B. Minimize the illegal harvest.

STRATEGY C. Evaluate demand for duck resource.

STRATEGY D. Protect, acquire, improve and maintain quality public use areas.

STRATEGY E. Educate user groups on the impact of harvest on the duck resource.

PROBLEM 2. The quality and quantity of habitat is limiting some duck populations.

STRATEGY A. Support private, state, federal and international habitat acquisition and management programs to improve the quantity, quality and distribution of breeding, migration and wintering habitats.

STRATEGY B. Improve the quantity, quality and distribution of fall security areas.

STRATEGY C. Encourage local, state, and federal government officials to develop land management programs that increase and improve duck habitat.

STRATEGY D. Provide for more effective

environmental review of publicly funded projects that degrade duck habitat.

STRATEGY E. Educate the public on effective land management for ducks.

PROBLEM 3. Limitations in some information reduce management effectiveness.

STRATEGY A. Provide for ongoing research on duck ecology, population dynamics and management.

STRATEGY B. Monitor, evaluate and predict trends in duck populations, habitats and harvests through comprehensive models.

STRATEGY C. Improve surveys to assess the quantity, distribution, effort and impact of harvest on duck populations.

STRATEGY D. Determine the economic and recreational value of ducks and their habitats.

STRATEGY E. Provide user groups and the general public with new management information.

DABBLING DUCKS: Includes 8 species of dabblers; mallard, blue-winged teal, green-winged teal, American wigeon, gadwall, northern shoveler, northern pintail, blackduck, and one perching duck; the wood duck.

OBJECTIVE 1. Maintain dabbler duck populations capable of sustaining the following average annual harvest and distribution:

Distribution and total harvest objectives for dabbling ducks by Minnesota Department of Natural Resources region.

Species	% of harvest by region						Average annual harvest (x 1000)
	1	2	3	4	5	6	
All dabblers	26%	6%	15%	34%	10%	8%	637
Mallard	29	8	16	28	10	8	262
Woodduck	21	6	21	29	11	11	136
Blue-winged teal	27	4	11	42	10	5	92
Green-winged teal	21	6	13	43	9	7	59
Wigeon	33	5	10	32	12	7	38
Gadwall	25	2	5	52	8	5	21
Pintail	32	4	6	40	11	7	19
Shoveler	21	1	4	61	8	5	10
Blackduck	13	24	14	12	27	10	1

PROBLEM 1. Demand often exceeds supply and could result in overharvest and reduced population.

STRATEGY A. Monitor population trends and harvest and adjust regulations accordingly.

PROBLEM 2. Quantity and quality of habitat limits population growth.

STRATEGY A. Improve habitat base through protection and management for unique requirements of dabbling ducks.

DIVING DUCKS: Includes 5 species of diving ducks: canvasback, redhead, lesser and greater scaup, ring-necked duck, and one stiff-tailed duck: the ruddy duck.

OBJECTIVE 1. Maintain diving duck populations capable of sustaining the following average annual harvest and distribution:

Distribution and harvest objectives for diving ducks by Minnesota Department of Natural Resources region.

Species	% of harvest by region						Average annual harvest (x 1000)
	1	2	3	4	5	6	
All divers	44%	20%	13%	14%	3%	5%	195
Ring-necked	40	26	17	7	3	6	96
Lesser scaup	49	19	11	12	3	4	62
Redhead	51	7	7	29	3	2	25
Canvasback	44	7	7	27	4	8	7
Ruddy duck	35	4	3	51	1	9	5
Greater scaup	35	22	20	14	--	8	(a)

(a) Average annual harvest total includes lesser and greater scaup.

PROBLEM 1. Demand often exceeds supply and could result in overharvest and reduced population.

STRATEGY A. Monitor population trends and harvest and adjust regulations accordingly.

PROBLEM 2. Quality and quantity of habitat limits population growth.

STRATEGY A. Improve habitat base through protection and management for unique requirements of diving ducks.

SEA DUCKS: Includes 5 species; common goldeneye, bufflehead, and the hooded, common and red-breasted mergansers.

OBJECTIVE 1. Maintain sea duck populations capable of sustaining the following average annual harvest and distribution:

Harvest and distribution objectives for diving ducks by regions of the Minnesota Department of Natural Resources region.

Species	% of harvest by region						Average annual harvest (x 1000)
	1	2	3	4	5	6	
All sea ducks	36%	23%	21%	12%	3%	5%	21
Bufflehead	40	14	20	19	4	4	10
Goldeneye	35	28	28	5	1	2	7
Hooded merganser	29	38	16	5	3	8	
Common merganser	14	43	14	--	--	27	4 ^a
Red-breasted merganser	--	--	--	39	--	61	

^aIncludes hooded, common and red breasted merganser harvest.

PROBLEM 1. Demand often exceeds supply and could result in overharvest and reduced populations.

STRATEGY A. Monitor population trends and harvest and adjust regulations accordingly.

PROBLEM 2. Quality and quantity of habitat limits population growth.

STRATEGY A. Improve habitat base through protection and management for unique requirements of sea ducks.

FISH AND WILDLIFE PLANNING TEAM
MINNESOTA DEPARTMENT OF NATURAL RESOURCES
Division of Fish and Wildlife
500 Lafayette Road
St. Paul MN 55155-4025

FISH, WILDLIFE & NATIVE PLANT RESOURCES
LONG RANGE PLAN COMMENTS

The Division of Fish and Wildlife is inviting comments from individuals and organizations on the long range plans for the management of fish, wildlife and native plant resources. Use this form, or write us a letter, telling us how we can improve the plan or plans you have reviewed.

Plan Name: _____

Comments: _____

Your name: _____

Address: _____

Are these the official comments of an organization? Yes No

Organization: _____

To mail: fold & seal with tape or place in envelope.

Thank you for taking the time to review the plan and providing your comments.

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Minnesota Department of Natural Resources
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24. Geese

Several races of Canada geese (Branta canadensis), the lesser snow goose (Chen caerulescens caerulescens) and the white-fronted goose (Chen anser albifrons) occur in Minnesota. Canada geese are regular spring and fall migrants and the giant Canada goose (B. c. maxima) has now repopulated much of its original breeding range. Lesser snow geese are regular migrants, but numbers in Minnesota are highly variable. The white-fronted goose is an uncommon migrant in spring and fall. All three species have state protection under Minnesota Statutes, Subdivisions and federal protection under the Migratory Bird Treaty Act of 1918.

RESOURCE MANAGEMENT

Minnesota's early settlers profoundly influenced goose numbers in the state. Prior to the first state waterfowl season, September 1 to May 15, 1877; and the first daily bag limits of 25 waterfowl in 1891, resident Canada geese had been steadily reduced by egg gathering and unregulated hunting. By 1930, they were nearly extirpated as drainage of prairie-marsh breeding areas was accelerated because of the state's agricultural expansion. Many state and federal laws restricting hunting methods, season length and bag limits were implemented during the next 2 decades. Recently, state and federal laws, policies and programs to protect wetlands have been established.

Migrant Canada and snow goose populations were also low and dispersed in the state because of the lack of refuge areas. The settlers, however, had set the stage for modern goose management by converting the native prairies to corn, soybean and wheat fields. These crops now provide high quality foods that attract and hold migrant geese when refuge areas are provided.

Releases of giant Canada geese at many locations by federal, state and private groups have reestablished breeding flocks. Populations established from captive flocks at Lac qui Parle, Talcott Lake, Thief Lake and Roseau River Wildlife Management Areas were originally intended to attract migrant Canada geese. In combination with increased goose numbers and refuge development, these efforts have been highly successful. Captive flocks at other wildlife management areas have not attracted significant numbers of migrating geese.

Many geese in the Rochester-Interlake population are winter residents in the city of Rochester. The Rochester-Interlake population probably originated when several captive flocks of Canada geese in the Rochester area began to attract migrating geese into the city. The construction of a municipal power plant in 1948 on Silver Lake provided open water in winter. This development, coupled with a statutory game refuge, fostered an over-wintering flock. In 1962, Harold Hanson of the Illinois Natural History Survey identified the Rochester birds as giant Canada geese, a subspecies that was considered extinct. The peak fall populations of giant Canada geese have increased from 500 in 1948-49 to more than 30,000 in recent years. The Rochester-Interlake population has become a local attraction for viewing and hunting.

In 1951 the 4 flyway councils--Pacific, Central, Mississippi, and Atlantic--were formed by the state game and fish directors to coordinate waterfowl management with the U.S. Fish and Wildlife Service. The basic regulatory philosophy was to protect breeding birds, divide the harvest equitably among

hunters and match the harvest with the harvestable surplus of birds without reducing breeding populations. The Minnesota Department of Natural Resources became an active member of the Mississippi Flyway Council and its affiliated Technical Section.

Minnesota has consistently cooperated with the Mississippi Flyway council in developing strategies to manage goose populations and in distributing the harvest and refuge management equitably among the member states. Major goose management areas in Minnesota have been established at the Roseau River, Thief Lake, Lac qui Parle and Talcott Lake Wildlife Management Areas. These areas were established in full cooperation with the flyway council to provide feeding and resting areas primarily for the Eastern Prairie Population of Canada geese. Other major goose concentrations occur on the Agassiz, Tamarac, Rice Lake, Sherburne, Big Stone and Upper Mississippi River National Wildlife Refuges.

Annual harvest of all geese in Minnesota has steadily increased from about 3,100 in the 1920s and 1930s to an average of 85,000 in the years 1981 to 1985. More Canada geese than snow geese have been harvested since 1969. Minnesota's harvest of Canada geese has been the second highest state total in the United States in recent years. In response to flyway concerns, the Minnesota Department of Natural Resources and U.S. Fish and Wildlife Service established a goose hunting zone and Canada goose harvest quota around the Lac qui Parle Wildlife Management Area in 1975.

Since 1960, the snow goose harvest has averaged about 12,000 birds annually, but has ranged from fewer than 5,000 to more than 35,000. The white-fronted goose harvest has always been low and variable.

A policy for Canada goose management in Minnesota was established by the Division of Fish and Wildlife in 1968. The goal was to preserve and foster this resource of wild geese in

such a way as to provide the greatest value to the people of Minnesota. This was to be achieved by 1) perpetuating widespread distribution of migrant geese in the state, 2) emphasizing quality hunting of geese in natural surroundings without undue regimentation of hunters, and 3) establishing breeding and wintering flocks where suitable conditions exist.

This policy was designed to distribute hunting and viewing opportunities as widely as possible in the state. Coordination with Mississippi Flyway Council objectives and the avoidance of federal harvest quotas have been stressed. Harvest associated with major goose management areas was to be limited to 50% or less of the state total. Objectives for peak populations and total harvest from any single wildlife management area were set at 20,000 and 2,000 respectively. Both guidelines were increased for the Lac qui Parle Wildlife Management Area in 1976, but are presently outdated.

Expansion of breeding birds from state and federal release sites, combined with efforts of numerous individuals and clubs, has repopulated much of the suitable goose habitat in the state. Populations are now high enough in some locations to be a nuisance to crops, lakefront property owners, golf courses and airports.

The Minnesota Department of Natural Resources, U.S. Fish and Wildlife Service and University of Minnesota are currently developing ways to control problems caused by geese. A population control program in the 7-county metro area consists of trapping adult and young geese to reduce populations to locally tolerable levels. This is done at the request of and with support from municipal governments. Elsewhere, hazing with explosive devices and special hunting seasons have been used with variable success.

Present goose management is directed at 1) maintaining optimum goose numbers and distribution and 2) providing opportunities to view and hunt geese in natural settings without undue regimentation.

Mississippi Flyway History. In 1946, as few as 40,000-50,000 large Canada geese (B. c. interior) remained in the Mississippi Flyway. The hunting season in the flyway that year was closed to protect the remaining birds. A U.S. Fish and Wildlife Service coordinated program of leg banding Canada geese on wintering and breeding areas began. Data from the program allowed the eventual identification of at least 12 populations of large Canada geese nationwide. Initially, these populations were defined primarily on the basis of the wintering areas they used. However, with population growth, the separation of populations has become less distinct.

The spring and fall migrant Canada goose population of primary importance to Minnesota is the Eastern Prairie Population. These birds, most of which are medium-sized and belong to the interior subspecies, breed in highest densities in the lowlands adjacent to the southwest coast of Hudson Bay, with lower densities extending inland. These geese migrate through all of Minnesota, but are most prevalent in the western third of the state. About 90% of the Eastern Prairie population spends winters in the vicinity of the Swan Lake National Wildlife Refuge in Missouri; the remainder winter elsewhere in Missouri and Arkansas and, to a lesser extent, Mississippi and Louisiana.

The Mississippi Valley Population of Canada geese, also primarily the interior subspecies, breeds in the Hudson Bay lowlands east and south of the Eastern Prairie Population breeding area. They migrate principally over the northeast and southeast corners of Minnesota to winter in southern Illinois, southeastern Missouri, and western Kentucky and Tennessee.

The Tallgrass Prairie Population of Canada geese includes the smaller Richardson's (B. c. hutchinsii) and lesser (B. c. parvipes) Canada geese. They breed in the eastern high arctic. The eastern edge of their migration route crosses the northwest corner of Minnesota. The Mississippi Valley and Tallgrass Prairie Populations contribute low numbers to Minnesota's migrant Canada goose flight.

The Rochester-Interlake Population of giant Canada geese breeds in southern Manitoba and winters primarily in Rochester, Minnesota. Because of its limited range, this population is of management concern to Manitoba and Minnesota.

Coinciding with the identification of discrete populations, refuges were developed in Minnesota, Missouri and Illinois and restrictive hunting regulations were imposed throughout the flyway. Increases in Canada goose numbers have been spectacular. In 1938, for example, only 150 Eastern Prairie Population geese wintered at the Swan Lake National Wildlife Refuge in northcentral Missouri. By 1955, 30,000 geese wintered there, and winter populations have approached 200,000 in recent years. Similarly, the Horseshoe Lake Refuge in southern Illinois held 1,000-2,000 geese in the winter of 1928-29. By 1948-49, 90,000 geese wintered in that vicinity and, in recent years, the population has grown to more than 400,000 and spread to other refuges and adjacent parts of Kentucky. The combined influence of restrictive hunting seasons and refuges has allowed the total flyway population to increase to nearly 1 million Canada geese.

Canada goose populations in the Mississippi River Delta, where the Mississippi Valley Population historically wintered, and the gulf coast region of southwestern Louisiana and southeastern Texas, where the Eastern Prairie Population historically wintered, have decreased or failed to increase. Wintering populations of Canada geese have increased dramatically in the refuges in Illinois, Kentucky and Missouri. This has led some biologists to charge that geese were intercepted by mid-latitude refuges. Others believe population segments wintering in the south have been subjected to excessive hunting mortality, and as a consequence, have not responded to management.

Lesser snow geese are divided into Western and Eastern Arctic populations. Mississippi Flyway lesser snow geese breed in the eastern arctic on the west and south shores of Hudson

Bay and Baffin Island. A major migration corridor crosses the far northwest corner of Minnesota. Four other minor migration corridors cover about one-third of the state. These snow geese winter on the Gulf Coast of Louisiana, Texas and Mexico. The wintering population in the Mississippi-Central Flyway has increased by nearly 2 million lesser snow geese.

White-fronted geese utilize the Central and Pacific Flyways. Central Flyway birds nest in the high arctic coastal and delta lowlands. Migration through the United States is through North Dakota to the Texas-Louisiana Gulf Coast and Mexico. White-fronts are uncommon in Minnesota. Populations of white-fronts in the mid-continent have been increasing and now number more than 70,000 in winter.

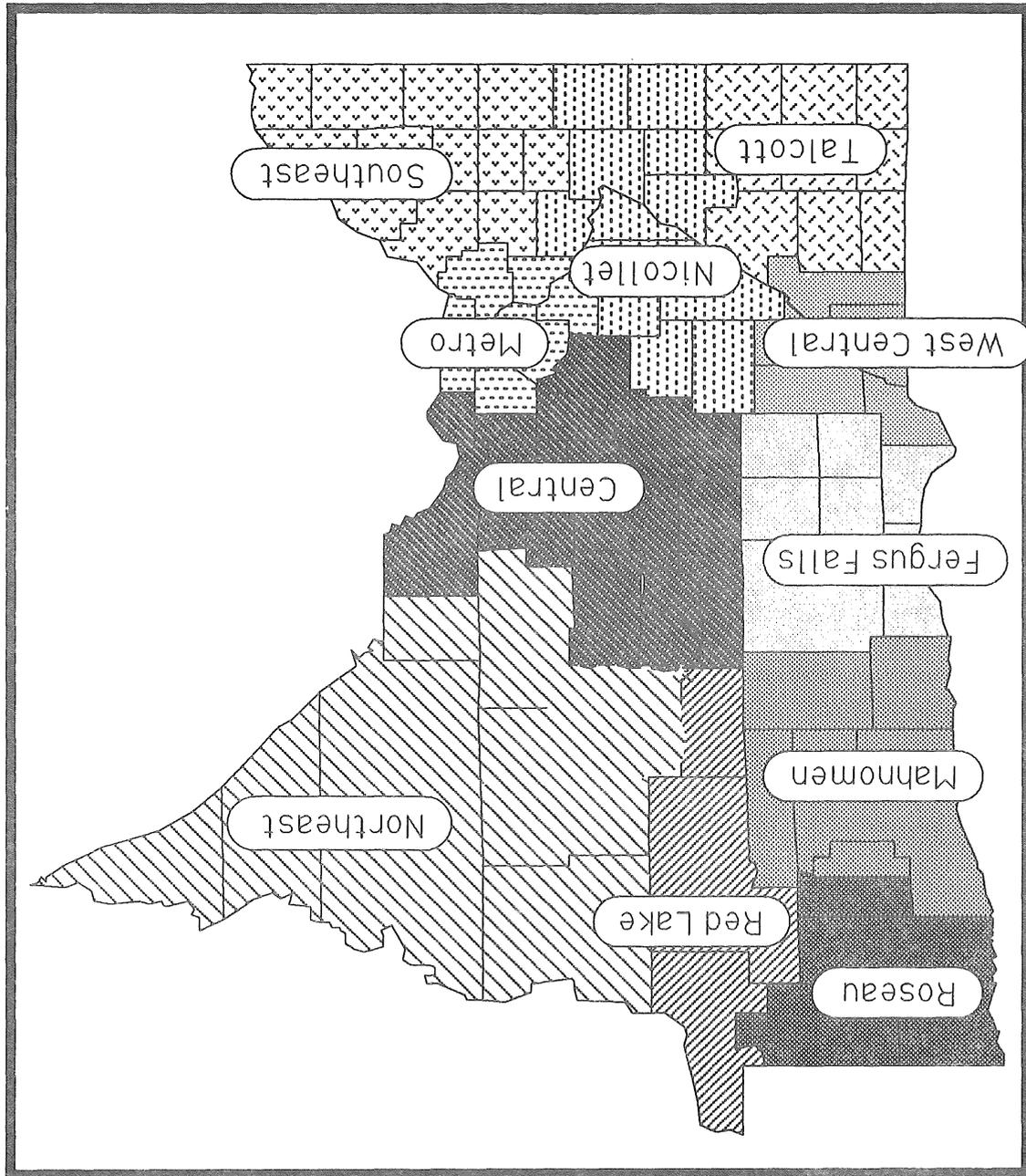
RESOURCE ANALYSIS

Eleven Goose Management Blocks were defined to manage the goose population in Minnesota. (Figure 24-1). Goose Management Blocks provide a biological basis for management.

Canada Geese in Spring and Summer. Giant Canada geese nest statewide, although the quality of the nesting habitat varies by Goose Management Block (Table 24-1). Habitat quality has changed over time and will continue to change as wetlands are restored in some areas and lost in others. Habitat with the greatest potential is found in townships outside the coniferous forest zone having more than 20 wetland basins greater than 10 acres in size. The poorest nesting habitat is found in townships with fewer than 2 wetland basins greater than 10 acres in size and within the coniferous forest zone.

Currently, Canada geese nest most densely and extensively in the Metro and Fergus Falls Goose Management Blocks. Concern about crop depredation and nuisances caused by resident geese is increasing in the Metro, Nicollet, Talcott, West Central and Fergus Falls Goose Management Blocks.

Figure 24-1. Goose management blocks in Minnesota



Statewide increases in nesting Canada geese are expected to continue (Table 24-2). With the exception of a few locations within the Metro Goose Management Block, nesting densities could increase in all occupied habitats if nesting success and goose survival remain high. The actual magnitude of the statewide increase is not measured because no single survey designed to census breeding geese exists.

Canada Geese in Fall. The number of all Canada goose use-days depends on several factors. (A goose use-day is an accepted measure of the use of an area by geese. One goose use-day is the use of an area by one goose for all or part of one day). Fall use-days are influenced by 1) late summer population shifts of resident geese, 2) migration chronology of migrant groups affiliated with refuges, 3) food supplies in agriculture fields, 4) weather and 5) management to encourage or discourage the duration of stay.

The North American Waterfowl Management Plan, Eastern Prairie Population plan and the Rochester-Interlake goose management group propose increases in migrant Canada geese important to Minnesota (Table 24-3). Reaching these objectives will depend on spring migration habitat conditions in the Mississippi Flyway, weather and the resulting recruitment in the arctic and southern Manitoba and overall harvest rates. Should the populations approach objective levels, potential fall Canada goose use-days will increase.

Canada goose use-days increase rapidly in late September and peak earliest in the northern Goose Management Blocks and latest in the Rochester Goose Management Block (Table 24-4). Total fall Canada goose use-days are highest in the West Central and Roseau Goose Management Blocks. Most fall use is associated with areas providing food and security. The Fergus Falls Goose Management Block has the greatest number and acres of refuges used by Canada geese in fall. Crop depredations can occur in the vicinity of some fall concentration areas depending on crop harvest chronology and fall weather.

Fall Canada goose use-days will continue to increase if current population growth and management continues (Table 24-5). Goose Management Blocks with populations of giant Canada geese have shown the greatest relative increases in fall goose use-days and are expected to continue to receive the greatest relative increases.

The Mahnomen Goose Management Block is the only block for which data is available that has lost fall goose use-days and this decline is expected to continue. Although not measured, it is likely that fall use of the Red Lake Goose Management Block has also declined. Goose use-days in the Roseau and West Central Goose Management Blocks have increased relatively little since 1975-79, with little future change expected.

Because Eastern Prairie Population geese are most numerous, changes in their numbers and length of stay in fall would affect statewide goose use-days significantly. Should management changes occur, the greatest effects would be seen in the Roseau and West Central Goose Management Blocks and to a lesser degree in the Talcott and Fergus Falls Goose Management Blocks. Changes in the Tallgrass Prairie Population will have minor effects that will be restricted to the Roseau Goose Management Block. Mississippi Valley Population changes will have little influence on state totals as relatively few of these birds stop in the state. Changes in the Rochester-Interlake Population will influence primarily the Rochester Goose Management Block and to a lesser extent the Metro and Fergus Falls Goose Management Blocks.

Canada Geese in Winter. The number of Canada geese remaining in Minnesota during winter is influenced by 1) migratory traditions, 2) racial identities, 3) open water suitable for roosting and 4) available foods. Food and roosting site availability is determined largely by crop harvest chronology and winter severity. Giant Canada geese are best able to cope with Minnesota's cold winters. Years with

mild winters and little snowfall see a significant number of medium-sized interior Canada geese also spending much of the winter in the state.

The mid-December counts of Canada geese have been used as indices for the number of geese wintering in Minnesota (Table 24-6). Variability is due mainly to fluctuations in the numbers of geese present. Interpretation of the data has been complicated by changes in the coordination of the U.S. Fish and Wildlife Service mid-December Goose Survey. Presently, the West Central and Rochester Goose Management Blocks accommodate the most wintering geese. Actual numbers of wintering geese are lower than the mid-December counts in most years because of migrations out of state after the survey. Nuisances or crop depredation associated with wintering geese can occur to some extent in the Metro, Rochester, Central and Fergus Falls Goose Management Blocks each year.

Generally, the numbers of wintering geese have increased, but their use of various wintering areas has not been consistent. Greatest increases have probably been in unsurveyed areas in the Central Metro Goose Management Blocks.

Lesser Snow Geese in Fall. Factors influencing fall Canada goose use-days are also important to lesser snow geese. However, those conditions are probably less important in Minnesota than are 1) proportion of young in the fall flight, 2) physical condition of migrating geese and 3) late summer and fall weather in Canada. In years when young lesser snow geese are abundant or when early migrations of geese in poor condition occur, they stop more frequently in Minnesota to feed and rest.

Generally, snow geese are most abundant in the Roseau Goose Management Block with peak numbers during the last 6 years occurring the first week of October (Table 24-7). The peaks are much lower and occur somewhat later in other Goose Management Blocks. Unlike Canada geese, many snow geese stop

during the fall migration and are not censused because of their irregular and more widespread occurrence, lower numbers, shorter lengths of stay and lack of association with refuges.

Fall lesser snow goose use-days have declined statewide and are expected to continue to decline (Table 24-8). The decline is largely attributed to a westerly shift in fall migration routes. The reasons for the shift are not understood.

The North American Waterfowl Management Plan proposes a reduction in numbers of breeding lesser snow geese that are important to Minnesota. A lower breeding population is considered desirable because of brood rearing habitat degradation in the arctic. Degradation is caused by over-browsing geese. If the North American population objective is realized, fewer potential snow goose use-days will result.

Goose Hunting and Viewing. The demand for goose hunting and viewing is difficult to determine for a number of reasons.

With regard to hunting demand, all waterfowl hunters are potential goose hunters, but some specialize in geese. Responses to the Minnesota Department of Natural Resources Small Game Hunter survey indicate an average of 50,000 people hunted Canada geese and an additional 14,000 hunted other geese, almost entirely lesser snow geese, annually during the last 6 years. Because the Small Game Hunter Survey does not inquire whether a hunter specifically sought geese, casual goose hunters are probably counted as if they had a chance to kill a goose while they were duck hunting.

In terms of viewing, there is a less identifiable clientele. The activity is not really well defined and it occurs year round. No survey has been devised to capture this information.

Since 1982, Canada goose hunters and days afield have been greatest in the West Central Goose Management Block (Table 24-9). Snow goose hunter numbers have been highest in the Northeast, West Central and Nicollet Goose Management Blocks.

Hunters have spent the most days hunting snow geese in the Nicollet Goose Management Block. People would like to see and hunt more snow geese statewide. Generally, the demand for Canada geese is being met; except in the Northeast, Red Lake, Mahnomen and Roseau Goose Management Blocks where people would like more resident and migrant Canada geese.

Since 1980, the number of active waterfowl hunters has declined nearly 15%. Changes in the number of active waterfowl hunters will influence the number of people hunting geese. Projections from the Small Game Hunter Survey suggest that the average number of Canada goose hunters will decline 5% in the Red Lake and Mahnomen Goose Management Blocks by 1993. Less than half as many hunters will pursue snow geese by 1993 if current trends continue (Table 24-10). Canada goose hunter numbers will likely increase in Goose Management Blocks because of the growing populations of resident Canada geese. Canada goose hunter numbers will likely decrease the most in Goose Management Blocks having few resident geese and no large managed areas. Hunters are opportunists and changes in snow goose hunter numbers is related to regional changes in snow goose numbers.

Estimated Goose Harvest. The number of geese harvested is influenced by 1) numbers of geese available and their distribution in fall, 2) numbers of hunters afield, 3) specific hunting regulations in effect and 4) fall weather. Harvest estimates are available from the U.S. Fish and Wildlife Service Harvest Survey and the Minnesota Department of Natural Resources Small Game Hunter Survey. Federal estimates for Canada geese harvested have averaged 11% less than state estimates over the last 6 years. Federal estimates for lesser snow and white-fronted geese have averaged 52% lower for the 5 years Minnesota has surveyed the harvest of other geese. Both surveys are designed to furnish county and state estimates. Whereas the sampling error at the county level is probably greater than for the state estimate, examination of

groups of counties over time provides an insight for smaller geographic areas. Federal estimates have a longer history than the state survey and therefore have been used in the plan.

In recent years, Minnesota has harvested more Canada geese than any other state in the Mississippi Flyway. Nationwide, it is second only to Maryland. During the last 6 years, an average of 22% of the United States portion of the Mississippi Flyway harvest has occurred in Minnesota. This portion has been increasing and may reach 28% by 1992. Continued growth of Minnesota's share of the flyway harvest may be a concern to the U.S. Fish and Wildlife Service and other states and provinces if it is viewed as a disadvantage to their programs or contrary to existing flyway management plans.

For the period 1979-84, the average Canada goose harvest occurring in any Goose Management Block was directly related to the average number of fall goose use-days occurring in the block. The average harvest of Canada geese has increased in all but 2 Goose Management Blocks (Table 24-11). The greatest proportional increases of harvest occurred in Goose Management Blocks having growing populations of resident geese, the Rochester Goose Refuge and the Lac qui Parle Wildlife Management Area. Most Goose Management Blocks will continue to support an increased harvest. The Fergus Falls and Metro Goose Management Blocks are expected to increase more in the next 6 years than from 1979 to 1984. Under current harvest management, the West Central Goose Management Block harvest is expected to change relatively little.

Currently, the Eastern Prairie Population is of most concern among states in the western part of the Mississippi Flyway. Harvest of Canada geese in part of the West Central Goose Management Block, where Eastern Prairie Population geese predominate, has been managed by annual quotas established by the Mississippi Flyway Council and the U.S. Fish and Wildlife Service. Whereas the harvest distribution of Eastern Prairie Population geese within the state has changed

over time, an index to total Eastern Prairie Population harvest has remained relatively constant (Table 24-12). Similar annual harvest indices are not available for other populations. Significant increases in the numbers of giant Canada geese taken by hunters has probably occurred. The number of geese harvested from the Mississippi Valley Population and Tallgrass Prairie Population has probably changed little.

Racial or subspecific composition of the Canada goose harvest varies throughout the state. The criteria used to separate subspecies are the subject of scientific debate. The available data suggests that medium-sized geese from the Eastern Prairie Population are predominant in the harvest from the Roseau and West Central Goose Management Blocks (Table 24-13). In contrast, large-sized geese are most common in the bag of the Fergus Falls, Talcott and Rochester Goose Management Blocks.

Minnesota hunters kill a small proportion of the Mississippi Flyway harvest of lesser snow geese. Recently, an average of 8% of the United States portion of the flyway harvest came from Minnesota. Since 1979, this proportion has fluctuated from more than 24% to less than 1%. The proportion does appear to be declining. If current trends continue, Minnesota hunters will take approximately 5% of the United States portion of the Mississippi Flyway harvest by 1992.

Statewide, lesser snow goose harvest has declined slightly over past years, although yearly estimates vary (Table 24-10). The distribution of the harvest has changed significantly in recent years, however, with proportionately more geese being harvested in the northern Goose Management Blocks and fewer in the south. The snow goose harvest will most likely decline slightly statewide during the next 6 years, but because of the extreme variability in harvest estimates, this projection might be misleading.

RESOURCE VALUE

In addition to their intrinsic values, geese and the hunting of them have a monetary value to state and local economies. Economic analysis of statewide goose hunting has not been done, but a 1985 survey of goose hunters in the vicinity of the Lac qui Parle Wildlife Management Area indicated per capita expenditures exceeded \$400 per hunter using the area. Hunters using the Wildlife Management Area shooting stations spent more than \$500,000, and total expenditures from goose hunters in the Lac qui Parle area exceeded \$2.2 million. Total goose hunter-days associated with Lac qui Parle Wildlife Management Area are likely underestimated. Thus, estimates of total expenditure are probably low. Half of the expenditures occurred in the local area and over 98% all hunters were Minnesota residents. Three-quarters of the hunters lived more than 100 miles away. Although per capita expenditures by Lac qui Parle goose hunters cannot be compared with those of other goose hunters, or with non-hunting recreationists, the total contribution from these activities to Minnesota and local economies is substantial.

Table 24-1. Square miles of Canada geese breeding habitat by goose management block in Minnesota.

Goose management block	Square miles a breeding habitat					Overall quality index
	Poor	Fair	Good	Excellent	Total	
Roseau	4,922		288		5,210	1.11 <u>a/</u>
Red Lake	5,144				5,144	1.00
Mahnomen	5,003	972	252	1,008	7,235	1.62
Fergus Falls	986	1,080	1,836	1,800	5,702	2.78
Northeast	18,555				18,555	1.00
Central	5,846	2,412	2,232	324	10,814	1.73
West Central	1,224	1,712	324	72	3,332	1.77
Talcott	3,301	2,509			5,180	1.43
Nicollet	2,808	4,513	540	72	7,933	1.73
Rochester	6,231	504			6,735	1.08
Metro	588	972	972	288	2,820	2.34
Totals	54,604	14,674	6,444	3,564	79,290	1.48

a/ Where; 1.00 = Poor, 4.00 = Excellent

Table 24-2. Projected growth of resident Canada goose populations, 1987-92.

Goose management block	<u>Existing</u> Increase from 1973-78 average to 1979-85 average	<u>Projection</u> 1987-92 average over 1979-85 average	Source
Roseau	ND <u>a/</u>		
Red Lake	ND		
Mahnomen	+173%	+250%	Aerial Breeding Pair Survey
Fergus Falls	+315%	+225%	Aerial Breeding Pair Survey
Northeast	ND		
Central	ND		
West Central Breeding Pair Survey	+21%	+10%	Aerial
Talcott Breeding Pair Survey	+21%	+10%	Aerial
Nicollet	+21%	+10%	Aerial Breeding Pair Survey
Rochester	ND		
Metro	+350%	+200%	U of M Studies

a/ ND = No data

Table 24-3. Winter population of Canada geese important to Minnesota.

Population	Number of Geese (x 1000)		1980-84 Trend
	Winter 1984	Year 2000 Objective	
Eastern Prairie	168	200 <u>a/</u>	Stable
Tall Grass Prairie	197	255	Increasing
Mississippi Valley	477	500	Increasing
Rochester-Interlake	35	50	Increasing

a/ The North American Waterfowl Management Plan and the Eastern Prairie Population plan currently differ on this objective. The Eastern Prairie Population plan proposes a winter objective of 300,000 geese by the year 2000 with 100,000 geese wintering south of Missouri.

Table 24-4. Average weekly Canada goose use-days (x1000) by goose management block for all goose concentration areas, 1980-85.

Goose Management Block	Week in						Total	Refuge ^a acreage [*]
	October				November			
	1	2	3	4	1	2		
Roseau	238 ₍₁₂₎ ^{xx}	188 ₍₁₂₎	100 ₍₁₂₎	55 ₍₁₂₎	33 ₍₃₎	20 ₍₃₎	634	77 ₍₆₎
Red Lake	10 ₍₁₎	8 ₍₁₎	6 ₍₁₎	3 ₍₁₎			27	11 ₍₁₎
Mahnomen	17 ₍₄₎	21 ₍₄₎	27 ₍₄₎	24 ₍₄₎	22 ₍₂₎	11 ₍₁₎	122	28 ₍₄₎
Fergus Falls	62 ₍₁₀₎	101 ₍₁₀₎	136 ₍₁₀₎	143 ₍₁₀₎	134 ₍₁₀₎	104 ₍₁₀₎	680	197 ₍₁₆₎
Northeast	16 ₍₄₎	16 ₍₄₎	13 ₍₄₎	9 ₍₂₎	5 ₍₂₎	1 ₍₂₎	60	18 ₍₁₎
Central	12 ₍₄₎	15 ₍₄₎	18 ₍₄₎	18 ₍₄₎	15 ₍₄₎	11 ₍₃₎	89	109 ₍₆₎
West Central	372 ₍₄₎	500 ₍₄₎	511 ₍₄₎	542 ₍₄₎	533 ₍₄₎	522 ₍₃₎	2,980	19 ₍₂₎
Talcott	42 ₍₇₎	52 ₍₇₎	63 ₍₈₎	71 ₍₆₎	64 ₍₆₎	50 ₍₅₎	342	4 ₍₂₎
Nicollet	38 ₍₁₀₎	57 ₍₁₀₎	75 ₍₅₎	90 ₍₅₎	90 ₍₅₎	55 ₍₄₎	405	21 ₍₇₎
Rochester	41 ₍₁₀₎	62 ₍₁₀₎	99 ₍₁₀₎	160 ₍₁₀₎	229 ₍₁₀₎	225 ₍₁₀₎	816	86 ₍₄₎
Metro	52 _(?)	69 _(?)	85 _(?)	102 _(?)	119 _(?)	105 _(?)	532	20 ₍₃₎
Totals	900	1,089	1,133	1,217	1,244	1,104	6,687	590

a/ (x 1000) Includes statutory refuges, wildlife management area sanctuaries and refuges, wildlife production area refuges, national wildlife refuges, state parks

b/ Number of fall use areas (some of which are not routinely censused)

Table 24-5. Fall Canada goose use-days since 1975 projected to 1992 under current patterns of population change for routinely censused areas. a/

Goose management block	1975-79 Avg. (x 1000)	1980-85		1987-92 Projection	
		% Change	Average (x 1000)	% Change	Average (x 1000)
Roseau <u>b/</u>	503	+4	524	+10	577
Red Lake	ND		ND		
Mahnomen <u>c/</u>	19	-53	9	-50	5
Fergus Falls <u>d/</u>	128	+79	229	+20	274
Northeast <u>e/</u>	43	+12	48	+15	55
Central <u>f/</u>	29 <u>j/</u>	+59	46	+95	89
West Central <u>g/</u>	2,309	+9	2,510	+10	2,762
Talcot <u>h/</u>	145	+19	172	+30	223
Nicolllet	ND		ND		
Rochester <u>i/</u>	453	+58	716	+55	1,110
Metro	ND		ND		
Totals	<u>3,629</u>	<u>+17</u>	<u>4,254</u>	<u>+20</u>	<u>5,095</u>

- a/ Fall = 1 October to 15 November
- b/ Includes Roseau WMA, Thief Lake WMA, Agassiz National Wildlife Refuge
- c/ Includes Tamarac National Wildlife Refuge
- d/ Includes Fergus Falls City Geese Flock
- e/ Includes Rice Lake National Wildlife Refuge
- f/ Includes Sherburne National Wildlife Refuge
- g/ Includes Lac qui Parle WMA
- h/ Includes Talcot Lake WMA
- i/ Includes Rochester Refuge
- j/ Census data for 1979 only

Table 24-6. Canada geese reported during U.S. Fish and Wildlife Service mid-December goose survey 1980-85.

Goose management block	Average (x 1000)	Range (x 1000)	Number of areas surveyed
Roseau	NR <u>a/</u>		
Red Lake	NR		
Mahnomen	NR		
Fergus Falls	4.3	1.6- 6.5	1
Northeast	NR		
Central	0.4 <u>b/</u>	0.2- 1.0	1
West Central	28.5	7.0-62.1	4
Talcott	3.2	1.3- 3.5	2-4
Nicollet	1.0 <u>c/</u>	0- 3.5	1
Rochester	24.8	12.5-34.9	1-2
Metro	2.1 <u>d/</u>	0.4- 4.3	10-19
Totals	64.3	23.0-115.8	20-32

a/ NR = None reported

b/ MDNR estimate; not reported in mid-December survey

c/ 1982-85

d/ 1981-85

Source: U.S. Fish and Wildlife Service

Table 24-7. Average weekly lesser snow goose-use days (x1000) by goose management block for all goose concentration areas, 1980-85. a/

Goose management block	Week in						Totals	Refuge acreage b/
	October				November			
	1	2	3	4	1	2		
Roseau	61 (3) d/	27 (3)	15 (3)	8 (3)	2 (2)		113(0.65) c/	77 (6)
Fergus Falls		1 (1)	4 (1)	2 (1)	3 (1)	3	13(0.08)	197 (16)
Northeast	2 (1)	1 (1)	1 (1)				4(0.02)	18 (1)
West Central	1 (2)	5 (2)	5 (2)	7 (2)	5 (2)	3 (2)	26(0.15)	19 (2)
Talcott	1 (1)	2 (1)	4 (1)	3 (1)	4 (1)	3 (1)	17(0.10)	4 (2)
TOTALS	65	36	29	20	14	9	173	315

a/ Unlisted goose management blocks usually have fewer than 1,000 goose-use days in all weeks

b/ (x 1000) Includes statutory refuges, Wildlife Production Area sanctuaries and refuges, Wildlife Production Area refuges, National Wildlife Refuge refuges, state parks (source: 1985 Wetland Wildlife Research and Populations Group Refuge Inventory)

c/ Proportion of state total

d/ Number of fall use areas (some of which are not routinely censused)

Table 24-8. Fall lesser snow goose use-days since 1975 projected to 1992 under current patterns of population change for routinely censused areas. a/

Goose Management Block	Average snow goose use-days 1975-79 (x 1000)	1980-85		1987-92 Projection	
		% Change	Average snow goose use-days (x 1000)	% Change	Average snow goose use-days (x 1000)
Roseau <u>b/</u>	109	-28	78	-29	55
Red Lake	ND <u>g/</u>		ND		
Mahnomen <u>c/</u>	T <u>h/</u>		T		T
Fergus Falls <u>d/</u>	27	-85	4	-75	1
Northeast	6	-33	4	-50	2
Central	T		T		T
West Central <u>e/</u>	50	-64	18	-67	6
Talcott <u>f/</u>	15	-40	9	-33	6
Nicollet	ND		ND		
Rochester	T		T		T
Metro	ND		ND		
TOTALS	207	-45	113	-38	70

a/ Fall = October to 15 November

b/ Includes Roseau WMA, Thief Lake WMA, Agassiz National Wildlife Refuge

c/ Includes Tamarac - National Wildlife Refuge

d/ Includes Orwell WMA

e/ Includes Lac qui Parle WMA, Big Stone National Wildlife Refuge

f/ Includes Talcott Lake WMA

g/ ND = No data

h/ T = Trace, Less than 1000

Table 24-9. Geographic distribution of goose and duck hunters (x100) and hunter-days (x100), 1982-84.

Goose management block	Canada geese				Other geese				Ducks			
	Hunters		Days		Hunters		Days		Hunters		Days	
	N	%	N	%	N	%	N	%	N	%	N	%
Roseau	39	8	171	6	9	9	41	6	34	3	202	2
Red Lake	8	2	40	1	4	4	25	4	60	5	410	4
Mahnomen	12	3	55	2	4	4	30	4	57	5	377	4
Fergus Falls	62	13	344	11	11	11	59	8	166	13	1,212	13
Northeast	24	5	173	6	13	13	80	11	179	14	1,237	13
Central	27	6	142	5	8	8	45	6	229	18	1,498	16
West Central	135	29	745	25	12	12	59	8	58	5	476	5
Talcott	26	6	275	9	10	10	111	16	63	5	584	6
Nicollet	48	10	448	15	12	12	137	19	177	14	1,585	17
Rochester	44	10	371	12	8	8	75	11	100	8	878	9
Metro	37	8	273	9	7	7	47	7	127	10	1,022	11
Totals	462		3,037		98		709		1,250		9,481	

Table 24-11. Federal estimates of Canada goose harvest (x 1000) since 1973 projected to 1992 under current patterns of population change and harvest.

Goose management block	1973-78 [*]			1979-84		1987-92 Projection	
	Average	Range	% Change	Average	Range	% Change	Average
Roseau	8.9	4.6-19.0	+20	10.7	5.3-17.8	+15	12.3
Red Lake	0.7	0- 1.5	-29	0.5	0- 1.6	0	0.5
Mahnomen	2.2	0.5- 4.2	-55	1.0	0.5- 1.5	-15	0.8
Fergus Falls	2.9	1.5- 4.2	+66	4.8	1.2-11.4	+80	8.6
Northeast	0.7	0.1- 1.8	+43	1.0	0.5- 2.8	+20	1.2
Central	0.9	0- 2.0	+100	1.8	0.5- 3.4	+90	3.4
West Central	16.3	3.2-34.1	+71	27.8	21.0-37.0	0	27.8
Talcott	1.4	0.4- 3.4	+257	5.0	3.3- 6.9	+100	10.0
Nicollet	3.0	1.0- 5.5	+33	4.0	1.9- 8.8	+5	4.2
Rochester	3.6	1.4- 4.9	+119	7.9	1.8-14.0	+50	11.8
Metro	0.9	0- 1.5	+189	2.6	0- 6.5	+220	8.3
Totals	41.5	19.1-56.0	+62	67.1	50.1-82.7	+32	88.9

* Excludes 1976 because of hunting ban due to fire danger

Table 24-12. Harvest of Canada geese from the Eastern Prairie Population since 1973 projected to 1992 under current patterns of population change and harvest.

Goose management block	a/ b/ 1973-78		% Change	1979-84		1987-92 Projection	
	Average	Range		Average	Range	% Change	Average
Roseau	6,350	2,176-10,988	-58	2,650	936-3,836	0	2,650
Red Lake	47	0-138	-100	0		0	
Mahnomen	695	0-1,257	-60	280	85-823	0	280
Fergus Falls	691	246-1,399	0	689	437-1,494	0	689
Northeast	570	78-1,964	-86	77	0-152	0	77
Central	266	65-844	-77	61	0-278	0	61
West Central	7,187	2,377-12,492	+52	10,909	6,581-14,376	0	10,909
Talcott	523	260-841	+42	744	524-972	0	744
Nicollet	484	130-1,120	-43	276	85-416	0	276
Rochester	281	78-687	-11	251	87-339	0	251
Metro	106	65-172	+34	142	76-278	0	142
Totals	17,200		-7	16,079		0	16,079

a/ Indices determined by Eastern Prairie Population Subcommittee of the Mississippi Flyway Technical Section and apportioned throughout state on the basis of recovery distribution of Swan Lake Missouri bandings, 1973-84

b/ Excludes 1976 because of hunting ban due to fire danger

Table 24-12. Size class proportions for Canada geese bag-checked in various goose management blocks, 1980-86.

Block	% in Size Class [*]			Number	Years
	Small	Medium	Large		
Roseau	10	60	30	1,442	1982-86
Fergus Falls	15	26	59	129	1982
West Central	5	68	27	3,846	1984, 86
Talcott	2	35	63	311	1980, 81
Rochester	2	41	57	51	1984-86

* Classification by measurement criteria developed by the Eastern Prairie Population subcommittee of the Mississippi Flyway Technical Section in 1982.

Table 24-10. Federal lesser snow goose harvest estimates since 1973 projected to 1992 under current patterns of population change and harvest.

Goose management block	1973-78		% Change	1979-84		1987-92 Projection	
	Average	Range		Average	Range	% Change	Average
Roseau	900	0-2,000	+344	4,000	0-18,600	-5	3,800
Red Lake	100	0- 300	+500	600	0- 2,700	-5	600
Mahnomen	1,000	0-3,700	+20	1,200	0- 3,500	-5	1,100
Fergus Falls	1,700	0-3,700	-71	500	0- 1,900	-5	500
Northeast	800	0-1,600	0	800	0- 3,300	-5	800
Central	1,400	0-2,900	-29	1,000	0- 2,700	-5	900
West Central	2,000	0-7,200	-60	800	0- 2,300	-5	800
Talcott	1,400	0-3,000	-50	700	0- 2,700	-5	600
Nicollet	1,700	400-5,800	+12	1,900	0- 5,400	-5	1,800
Rochester	2,600	700-7,400	-77	600	0- 3,000	-5	600
Metro	300	0-1,000	-67	100	0- 300	-5	100
Totals	12,900	3,400-37,600	-5	12,200	1,300-39,700	-5	11,600

* Excludes 1976 because of hunting ban due to fire danger

Long range planning for geese

SERVICE: Conservation of goose populations for their intrinsic and ecological values.

PRODUCT: Opportunities for appreciation and use of geese

GOAL: Manage resident and migrant goose populations at socially acceptable levels for maximum long-term high quality hunting and viewing within the context of the North American, national and Mississippi Flyway management plans.

OBJECTIVE 1: * Nesting Canada goose objectives by Goose Management Block.

Goose management block	% Increase	
	<u>Existing</u> % Change from 1973-78 to 1980-85 Averages	<u>Objective</u> % Change to 1992 from 1980 - 85
Roseau	ND	ND
Red Lake	ND	ND
Mahnomen	+ 173%	+ 250%
Fergus Falls	+ 315%	+ 50%
Northeast	ND	ND
Central	ND	+ 100%
West Central	+ 21%	+ 10%
Talcott	+ 21%	+ 10%
Nicollet	+ 21%	+ 10%
Rochester	ND	ND
Metro	+ 350%	+ 100%

* Problems and strategies for Objective 1-4 follow Objective 4

ND = no data

OBJECTIVE 2. Attain the following fall use-days by Canada geese.

Goose Management Block	Fall use days* x 1000	
	Existing Average for 1980-85	Objective for 1992
Roseau	524	603
Red Lake	ND	ND
Mahnomen	9	7
Fergus Falls	229	275
Northeast	48	96
Central	46	90
West Central	2,510	2,510
Talcott	172	258
Nicollet	ND	ND
Rochester	716	1,010
Metro	ND	ND

* One fall use-day is the use of an area by one goose for all or part of one day.

ND = No data

OBJECTIVE 3. Attain the following fall use-days by lesser snow geese.

Goose Management Block	Fall use-days x 1000	
	Existing Average for 1980-85	Objective for 1992
Roseau	78	70
Red Lake	ND	ND
Mahnomen	1	1
Fergus Falls	4	4
Northeast	4	4
Central	1	1
West Central	18	16
Talcott	9	8
Nicollet	ND	ND
Rochester	1	1
Metro	ND	ND

ND = No data

OBJECTIVE 4. Attain the following wintering populations of Canada geese.

Goose Management Block	Winter population x 1000	
	Existing Average for 1980-85	Objective for 1992
Roseau	NR	
Red Lake	NR	
Mahnomen	NR	
Fergus Falls	4.3	2.2
Northeast	NR	
Central	0.4	0.2
West Central	28.5	28.5
Talcott	3.2	3.2
Nicollet	1.0	1.0
Rochester	24.8	24.8
Metro	2.1	1.1

NR = No record

PROBLEM 1. Goose populations and/or their lengths of stay are below desired levels in some areas.

STRATEGY A. Develop new goose management areas.

STRATEGY B. Promote agricultural practices that provide late summer and fall food sources.

STRATEGY C. Establish more statutory refuges.

STRATEGY D. Transplant Canada geese and support appropriate transplant efforts by other organizations.

PROBLEM 2. Goose populations are too high and/or their lengths of stay too long in some areas, causing crop damage, nuisance, disease and airport and highway safety concerns.

STRATEGY A. Develop and implement a policy to address depredation and other nuisances.

STRATEGY B. Increase goose hunting opportunities and encourage local governments to relax shooting restrictions in urban areas.

STRATEGY C. Work with the University of Minnesota and federal agencies to assist local governments with the development and implementation of goose management programs.

STRATEGY D. Discourage winter feeding and practices that maintain open water at inappropriate locations.

STRATEGY E. Provide information to the public on problems caused by winter feeding and on techniques to reduce depredation and other nuisances.

STRATEGY F. Provide technical and financial assistance to public and private land managers to reduce depredation and other nuisances.

STRATEGY G. Update the U.S. Fish and Wildlife Service disease contingency plans and cooperate with other public agencies in poultry disease monitoring programs.

STRATEGY H. Evaluate statutory refuges, change boundaries and make other appropriate adjustments.

STRATEGY I. Develop new goose management areas.

PROBLEM 3. Elimination of warm water discharge into Silver Lake will lower the capability of the Rochester Goose Management Block to overwinter Canada Geese.

STRATEGY A. Work with the Rochester Public Utility Board to maintain open water in the winter.

STRATEGY B. Evaluate the need for additional wintering areas in the Rochester area and develop them if needed.

PROBLEM 4. The limitations of some information reduce management effectiveness.

STRATEGY A. Improve nesting and fall use surveys.

STRATEGY B. Cooperate with the U.S. Fish and Wildlife Service to improve the winter population survey process.

STRATEGY C. Evaluate population management and do additional research as needed.

STRATEGY D. Investigate economic and recreational values of the goose population.

OBJECTIVE 5. Annually provide an average of 56,000 goose hunters a minimum of 375,000 recreational days, with average goose harvest distributed as follows:

Goose Management Block	Harvest x 1000			
	Canada goose harvest		Lesser snow goose harvest	
	1979-84 Average	1987-92 Average	1979-84 Average	1987-92 Average
Roseau	10.7	12.3	4.0	3.8
Red Lake	0.5	0.5	6.0	0.6
Mahnomen	1.0	1.0	1.2	1.1
Fergus Falls	4.8	9.6	0.5	0.5
Northeast	1.0	2.0	0.8	0.8
Central	1.8	3.4	1.0	0.9
West Central	27.8	27.8	0.8	0.8
Talcott	5.0	7.5	0.7	0.6
Nicollet	4.0	6.0	1.9	1.8
Rochester	7.9	11.8	0.6	0.6
Metro	2.6	8.3	0.1	0.1
Totals	67.1	90.2	17.6	11.6

PROBLEM 1. Ensuring an equitable harvest within the states and provinces of the Mississippi Flyway makes it difficult to shoot the desired numbers of geese.

STRATEGY A. Develop and implement annual harvest strategies for the Eastern Prairie population of geese by participating in Mississippi Flyway Committees.

STRATEGY B. Work through the Mississippi Flyway Council and U.S. Fish and Wildlife Service to provide more liberal hunting season frameworks and bag limits in areas having large populations of giant Canada geese.

STRATEGY C. Open refuges to goose hunting when desirable.

PROBLEM 2. Concentrations of geese lead to unethical and unsafe hunter behavior.

STRATEGY A. Continue the present system of controlled hunts and expand them where appropriate.

STRATEGY B. Encourage other public and private land managers to provide hunting opportunities.

STRATEGY C. Support the Department of Natural Resources advanced hunter education and firearms safety training programs to address problems of hunter ethics.

STRATEGY D. Inform hunters of ethical behavior using public service announcements on radio, television and billboards.

STRATEGY E. Develop incentive methods to decrease trespass and landowner/hunter problems and open additional private lands to hunting.

PROBLEM 3. The limitations of some information reduce management effectiveness.

STRATEGY A. Systematically collect and report on taxonomic measurements of geese harvested statewide.

STRATEGY B. Develop better methods of distinguishing the several races of Canada

geese in coordination with the Mississippi Flyway Technical Section.

PROBLEM 4. Illegal and unethical hunting behavior reduces the quantity and quality of hunting.

STRATEGY A. Expand specialized enforcement efforts.

STRATEGY B. Continue and improve the Waterfowl Law Enforcement Training Programs.

STRATEGY C. Improve communications between Divisions, Agencies and outside concerned organizations to identify and correct enforcement issues.

STRATEGY D. Develop multi-task units of conservation officers to include waterfowl enforcement specialists and assign them to areas posing major enforcement problems.

STRATEGY E. Appoint a full-time waterfowl enforcement specialist supervisor.

STRATEGY F. Develop additional forensic methods to be used to improve the law enforcement effort.

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25. Tundra Swan

The tundra, or whistling swan (Cygnus columbianus), is one of two swans native to North America. The other species is the trumpeter swan (C. buccinator), currently being reintroduced to Minnesota. A third species in Minnesota is the mute swan (C. olor), an exotic species that is currently rare, but is becoming more common through releases and escapes from private captive flocks.

RESOURCE MANAGEMENT

Tundra, a common migrant through Minnesota, and trumpeter swans are afforded state protection under Minnesota Statute and federal protection under the Migratory Bird Treaty Act of 1918 and later treaties. Swans are listed as game birds by migratory bird treaties, but the treaty with Great Britain closed the season on swans from 1916 through 1926. Swan seasons have remained closed in Minnesota since 1916. Mute swans are not protected by state or federal law.

Tundra swans are managed according to guidelines in cooperative management plans developed for each flyway through flyway councils, the U.S. Fish and Wildlife Service and the Canadian Wildlife Service.

RESOURCE ANALYSIS

Tundra swans are widely distributed and abundant in North America. The population is divided into an eastern

population and western population based on winter distribution. Swans of the eastern population breed mainly along the Arctic coast of Canada and winter primarily in the Chesapeake Bay area and coastal North Carolina. Swans of the western population breed in western Alaska and winter in California, a few other western states and British Columbia. There is limited exchange between the 2 populations. Migrants of the eastern population stop over in most provinces and northern states including Minnesota. At least 75% of the fall and 90% of the spring populations pass through Minnesota each year.

Data concerning populations of migrant tundra swans in Minnesota is meager. Migrating swans are recorded only in the fall on principal concentration areas. Peak populations on the Upper Mississippi National Wildlife Refuge usually occur in early November and have been as high as 28,000 in 1985. During one reporting period in 1985, over 45,000 tundra swans were reported in Minnesota -- 4,500 at Rice Lake National Wildlife Refuge, 13,000 at Sherburne National Wildlife Refuge and 28,000 at Upper Mississippi National Wildlife Refuge.

Winter indices of western population and eastern population tundra swans in the United States averaged 59,000 and 80,000 swans, respectively (Table 25-1). The annual rate of increase in the eastern population has been about 2 to 3% since the late 1940s. The western population has increased since the late 1940s, but information since 1982 indicates a short-term decline in the population.

RESOURCE VALUE

The primary uses of the tundra swan are observation and subsistence harvest. Utah, Nevada, Montana and North Carolina held a limited recreational hunting season during 1985, with a tightly controlled hunt. Nonconsumptive use

Table 25-1. Status and goals for the North American tundra swan population.

Population	Winter population index 1984-1985	Recent trend 1980-1985	Winter index goal year 2000
Eastern population	80,000	Increasing	80,000
Western population	59,000	No change	60,000

Source: Minnesota Department of Natural Resources

of the tundra swan resource in Minnesota is concentrated on the Upper Mississippi National Wildlife Refuge at Weaver during the fall. Tundra swans are visible across the state during their migrations.

The unregulated subsistence harvest of eastern population swans and their eggs occurs when they nest or migrate near Eskimo villages. Diseases, collisions, lead poisoning and poaching contribute to swan mortality.

RESOURCE VALUE

Tundra swans provide scientific values and are indicators of healthy aquatic ecosystems. They provide viewing and photographic enjoyment to many Minnesotans. The resource values of swans are presently unmeasured.

Long range planning for tundra swan

PRODUCT: Tundra swans for their ecological value and opportunities for use and appreciation.

GOAL: Provide recreational uses of tundra swans consistent with the welfare of the eastern population and with international treaties and flyway management plans.

OBJECTIVE 1. Protect migrant tundra swan populations.

PROBLEM 1. The limitations of some information reduces management effectiveness.

STRATEGY A. Continue and improve annual fall migration surveys.

STRATEGY B. Monitor migration habitat use.

STRATEGY C. Monitor populations for signs of disease.

PROBLEM 2. The quality and quantity of habitat are declining.

STRATEGY A. Identify, protect and maintain migration habitat.

STRATEGY B. Encourage public and private land managers to protect and maintain migration habitat.

STRATEGY C. Restore traditional migration sites and minimize unnecessary disturbance.

PROBLEM 3. Tundra swans can cause crop damage.

STRATEGY A. Support cooperative depredation control programs.

OBJECTIVE 2. Increase opportunities for use and appreciation of tundra swans by 1992.

PROBLEM 1. The limitations of some information reduces management effectiveness.

STRATEGY A. Investigate recreational uses and determine levels that maximize use while protecting the resource.

STRATEGY B. Assess the public interest in swan hunting in Minnesota and monitor swan harvest in other states.

PROBLEM 2. Viewing sites are sometimes disturbed by other uses.

STRATEGY A. Minimize disturbance at traditional migration viewing sites.

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26. Webless Migratory Game Birds

Webless migratory game birds in Minnesota are the American woodcock (Scolopax minor), American coot (Fulica americana), common snipe (Gallinago gallinago), sora rail (Porzana carolina), Virginia rail (Rallus elegans) and common moorhen (Gallinula chloropus). Webless refers to the absence of webbing in the birds' feet.

AMERICAN WOODCOCK

American woodcock inhabit early successional forest types of the eastern United States and southern Canada. They were common in much of southeastern Minnesota but in that area are now found primarily in the unglaciated counties and the Mississippi and Minnesota river bottoms where intensive agriculture, logging and development have not destroyed their habitat. They also inhabit the prairie-forest transition zone and the forested area north and east of that zone.

Before European settlement, extensive northern pine forests and mature northern hardwood stands undoubtedly supported fewer woodcock than the post-logging-era aspen forests. At present, Minnesota has no habitat management programs directed specifically toward woodcock, although these birds generally benefit from white-tailed deer and ruffed grouse management programs. The loss of critical wintering habitat in Louisiana has reduced Minnesota's woodcock population.

The U.S. Fish and Wildlife Service coordinates 2 annual woodcock surveys. The spring singing ground survey gives an index of the breeding population. The fall wing collection survey provides an index to recruitment. Both surveys are designed to obtain trend data on multi-state regions rather than for individual states.

COOTS

Coots are most abundant in the prairie pothole region of the United States and Canada. Their preferred breeding areas are deep freshwater marshes with about a 50:50 ratio of open water to emergent vegetation. Their main breeding range in Minnesota is west of the Mississippi River in the prairie and prairie-forest transition zones. Breeding populations of coots are estimated annually by the Minnesota Department of Natural Resources spring aerial waterfowl breeding pair survey.

COMMON MOORHEN

Common moorhens have habitat requirements similar to those of coots. They are distributed throughout the eastern half of the United States and in portions of the west, although they aren't abundant anywhere. In Minnesota, they are an uncommon summer resident in the southern half of the state.

COMMON SNIPE

The common snipe breeds throughout the northern half of the United States and most of Canada. They prefer mudflats and shallow wetland areas dominated by mosses, sedges, grasses and low shrubs. Snipe are found throughout Minnesota, most common in the north central area and least numerous in the south.

SORA AND VIRGINIA RAILS

Sora and Virginia rails breed throughout most of the

United States and southern Canada and are associated with shallow wetland edges of sedge and cattail. Both rails are found throughout the state, but are scarce in the northeast.

RESOURCE MANAGEMENT

The Migratory Bird Treaty Act of 1918 placed webless migratory game birds under federal protection. Annual hunting seasons and bag limits are set by the U.S. Fish and Wildlife Service and Minnesota Department of Natural Resources.

Since 1976, harvest estimates for webless migratory game birds in Minnesota have been obtained from mail surveys of randomly selected hunters. Before 1976, harvest information was obtained from hunter report card returns. The U.S. Fish and Wildlife Service obtains harvest estimates for coots from an annual waterfowl harvest survey.

With the exception of coots, all of these species had occasional closed hunting seasons in Minnesota before 1952. The most extensive closures were from 1930 to 1937 for woodcock and from 1941 to 1952 for snipe. The nationwide snipe closure was needed because of low population levels caused by drought on the breeding range and extended cold periods on the winter ranges. National interest in snipe hunting was high at the turn of the century, but the 13 year closure ended most of the hunting tradition. The mean annual snipe harvest in Minnesota for the 5 years before the closure was 9,800, but dropped to 3,800 for the 5-year period after seasons were reopened. In the 1970s the average snipe harvest reached 20,000--a harvest similar to those reported from the early 1920s.

Nationwide, webless migratory game birds, with the exception of woodcock in the northeastern states, have been viewed as minor species by hunters and natural resource agencies. No population surveys are conducted on snipe, rails or moorhens. Minnesota has no management programs

for these wetland associated species, although the birds often benefit from waterfowl management programs. Although no population information is available for these 4 species, their abundance probably declined with the extensive loss of shallow wetlands from intensive agricultural development.

RESOURCE ANALYSIS

Woodcock population indices in Minnesota from 1969 to 1985 suggest that this species peaked in 1976 and 1977 and has been gradually approaching the long-term mean in recent years. No data is available regarding the actual size of spring or fall populations in Minnesota.

Estimates of Minnesota's breeding coot populations show marked year-to-year fluctuations. Some of the most pronounced fluctuations likely result from sampling errors introduced because the survey is designed primarily to count mallards. However, even the lowest yearly estimates indicate that coots are more numerous than most species of waterfowl in the state. The spring aerial survey covers only the northwest, central and southwest Minnesota Department of Natural Resources regions. Coot densities are typically highest in the southwest region and very low in the central region.

Webless migratory game birds are pursued by a small number of avid, specialized hunters in Minnesota. Based on harvest records for recent years, approximately 19,000 woodcock, 15,000 coots, 7,000 snipe and 1,500 rails and moorhens are taken annually.

Statewide harvest trends indicate a steady increase in the harvest of woodcock from a 5-year average of only 3,000 in 1945-49 to more than 62,000 in 1980-84. A sharp increase in the harvest occurred during the 1970-74 period at a time when ruffed grouse numbers were high and grouse hunters were also taking woodcock. The harvest has continued to increase during the 1975-79 and 1980-84 periods. The Department of

Natural Resources publicized woodcock hunting through news releases and feature articles from 1968 to 1971. When grouse populations declined in recent years, some hunters apparently sought out woodcock.

The coot harvest has varied considerably, but with no apparent trends. The snipe harvest increased slowly after the closed seasons of 1941 to 1952 and has remained stable since 1970. There is insufficient information available to determine harvest trends for rails and moorhens.

Recent data on hunter days and harvests separated by Minnesota Department of Natural Resources regions indicates that most woodcock hunting and harvest occur in the northeast and central regions. Coot hunting and harvest are distributed evenly among all but the southeast and metro regions. A similar pattern is evident for snipe, although the northwest receives slightly less hunting and harvest than the northeast, central and southwest regions. Rails and moorhens are hunted mostly in the central and southwest regions, but the majority of the harvest occurs in the central and northeast regions.

RESOURCE VALUE

Woodcock, snipe and rails provide hunting opportunities in early September at a time when seasons for other species have not yet opened. Woodcock and snipe, in particular, provide high quality hunting. Hunters who pursue these birds often become very dedicated to their sport. Coots are usually taken incidentally by waterfowl hunters, but some hunters actively pursue coots and strongly disagree with the commonly held belief that coots are poor table fare. Because coots are present in large numbers in the fall, there is a great deal of potential for increasing their popularity as a game bird.

The potential for nonhunting enjoyment of webless

migratory game birds is high. The unique courtship displays of woodcock and snipe, the secretive nature of rails and moorhens and the territorial antics of coots have a high aesthetic appeal for bird-watchers and other outdoor enthusiasts.

Long range planning for webless migratory game birds

PRODUCTS: Populations of coots, American woodcock, common snipe, sora rails, Virginia rails and common moorhens for their ecological value and opportunities for use and appreciation.

GOAL: Provide long-term recreational use of webless migratory game bird populations within the federal framework for the harvesting of migratory game birds.

OBJECTIVE 1. Maintain breeding populations, hunter opportunity and annual harvests as follows.

Species	Breeding populations	Hunter days	Annual harvests
American woodcock	Greater than 2.2 singing males per route	87,000	61,000
Coots	200,000 birds	71,000	51,000
Common snipe	To be determined	31,000	17,000
Rails and moorhens	To be determined	5,400	2,000

PROBLEM 1. The quality and quantity of habitats are declining.

STRATEGY A. Protect, acquire, maintain and improve breeding and migration habitats.

STRATEGY B. Encourage other public and private land managers to protect, acquire, maintain, and improve breeding, migration and winter habitats.

STRATEGY C. Develop and implement woodcock habitat management guidelines.

STRATEGY D. Provide information to land management personnel about optimum habitats for coots, snipe, rails and moorhens.

PROBLEM 2. The public is not aware of the recreational potential and food value of webless migratory game birds.

STRATEGY A. Provide information to the public about webless migratory game birds.

PROBLEM 3. The limitations of some information reduce management effectiveness.

STRATEGY A. Develop and implement population and habitat inventories.

STRATEGY B. Research population ecology, habitat requirements and harvest potential.

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27. Gray Partridge

Gray partridge (Perdix perdix), commonly known as the Hungarian partridge, is a game bird indigenous to Europe. It was established in Minnesota during the 1920s through stockings by sportsmen's clubs and the Minnesota Department of Conservation.

RESOURCE MANAGEMENT

Gray partridge achieved game bird status in 1939. Since then, management has included stocking, hunting season regulation, enforcement and monitoring the population and harvest.

Very little habitat management aimed at increasing partridge densities currently exists in Minnesota and other midwestern states. Lack of management results from inadequate information on the habitat needs of partridge, nonexistent management strategies and minimal interest in partridge because past densities and harvests were very low. The last reason persists despite the recent increases in population and annual hunter harvest.

Ideal partridge habitat is cropland interspersed with patches or strips of grassland and low shrub cover. Agricultural areas beneficial to partridge are intensively cultivated areas with idle corners and edges planted to grasses, windbreaks with rows of shrubs less than 9 feet high, small fields and undisturbed cover plantings. Farming practices that benefit partridge are late hay mowing and

providing feeding areas such as small grains and 4 rows of corn left around farm shelterbelts. Agricultural practices that have a negative impact are burning and heavy grazing, early haying, transforming idle areas into areas that are intensively grazed or cultivated, pesticide use, removal of residual vegetation and large crop fields.

Gray partridge can benefit from land management practices directed at pheasants and waterfowl. Wetland acquisition by the Minnesota Department of Natural Resources for waterfowl usually includes adjacent uplands maintained as grasslands and used by partridge. Pheasant habitat management provides grass cover, food plots and shrub rows important to partridge. Long-term agricultural set-aside programs also benefit partridge.

Although modern agriculture's impact on the partridge is not clear, when Minnesota's land use changed during the past 20 years, partridge numbers increased. There remains a need to determine more exactly which agricultural practices are beneficial to partridge. This situation is clouded by land-use practices that may actually be detrimental to partridge by removing habitat, but result in an increase in partridge numbers because of reduced populations of pheasants, which may be a competitive species. The pheasant affects the partridge through nest parasitism and direct competition for habitat.

Increasing pheasant densities are correlated with decreasing partridge densities. In parts of southwestern Minnesota, there are high partridge densities and very few pheasants. Woody cover plantings higher than 9 feet are beneficial to pheasants, but cause increased predation on partridge by providing avian predator roosting sites. Areas planted to tall, dense nesting cover also benefit pheasants, but are of little value to partridge.

The partridge has never had the opportunity to develop to its full potential in Minnesota, unlike in England where it is well-managed and is a very popular game bird. Despite the lack of a comprehensive partridge management program,

areas in southwestern Minnesota have densities of partridge approaching 80 birds per square mile. In England, where management aimed directly at gray partridge includes shrub rows, moderate density nesting cover, predator control and a coordination between agriculture and wildlife needs, partridge densities approaching 300 birds per square mile have been recorded.

RESOURCE ANALYSIS

Supply

Presently, partridge inhabit approximately 45,000 square miles of prairie farmland in the southwestern half of the state. Minnesota's August roadside counts show that partridge are most dense in Minnesota Department of Natural Resources Region 4 in southwestern Minnesota and the western portion of Region 1 along the North Dakota border (Figure 27-1). Minnesota Department of Natural Resources Regions 3, 5 and 6 contain some partridge. Since 1977, Minnesota's fall partridge population has been estimated to vary from 500,000 to 800,000 birds.

Demand

Minnesota ranks among the top 4 states and Canadian provinces in gray partridge harvest. During the late 1970s and early 1980s, more than 100,000 partridge were harvested annually in Minnesota. In the past 6 years, (1979-1984) the gray partridge has ranked third in harvest among the state's game birds.

About 320,000 small game licenses have been sold on average in the last 6 years. About 27,000 of these hunters took an average of 80,000 partridge per year (Table 27-1). As the supply of partridge increased, so has the demand. However, less than 20% of the partridge population is harvested annually and a 2-fold increase would be tolerable.

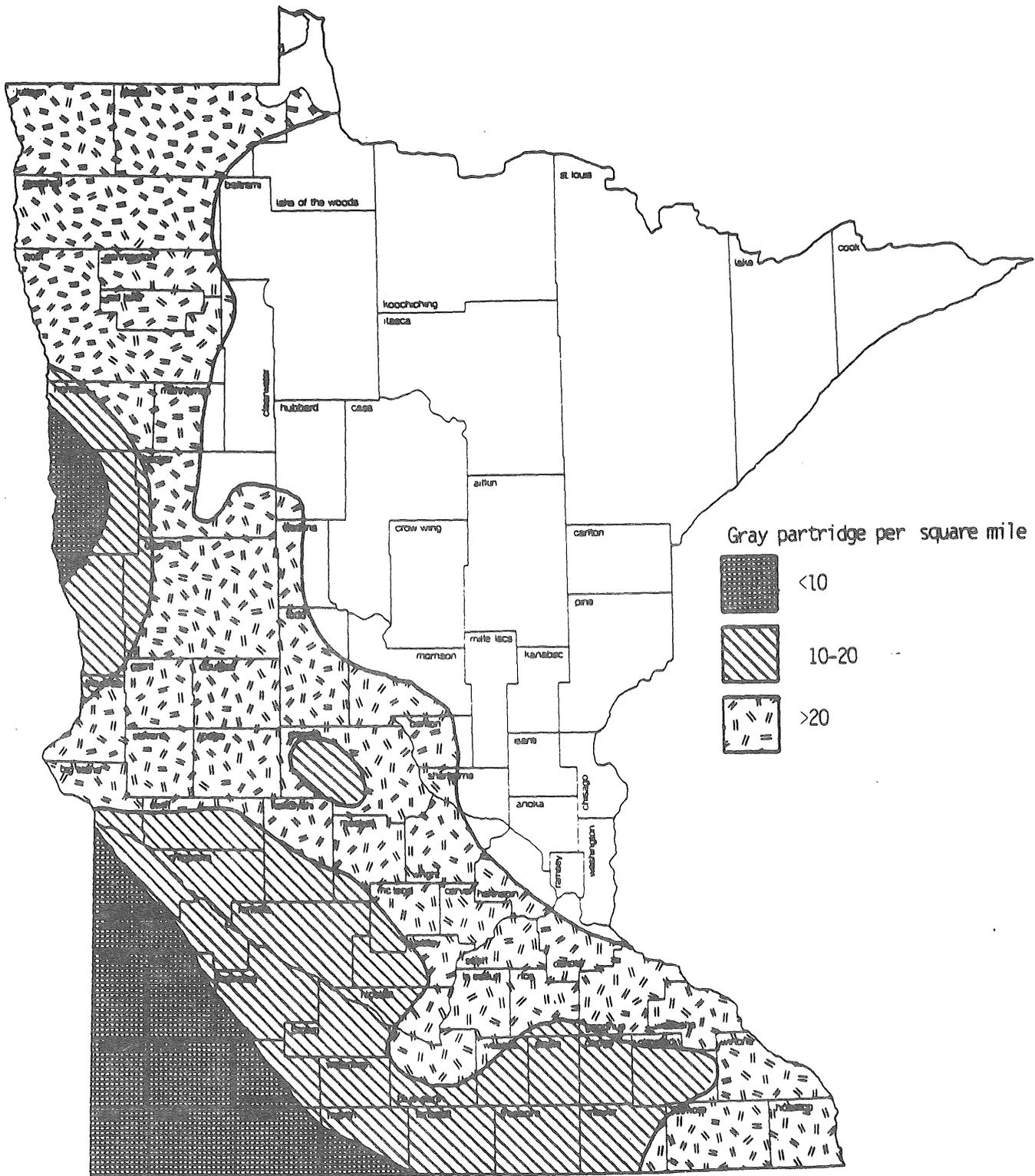


Figure 27-1. Estimated fall gray partridge densities in Minnesota, 1981-1985.

Table 27-1. Number of gray partridge hunters and harvest in Minnesota, 1979-1984.

Year	Small game hunters 1000s	Estimated gray partridge hunters 1000s	Estimated gray partridge harvest 1000s
1979	337	33	108
1980	361	38	101
1981	373	32	110
1982	314	21	52
1983	276	21	74
1984	261	15	31
Average	320	27	80

Gray partridge are not hunted in proportion to their population densities because upland bird hunters have concentrated their efforts in areas with higher pheasant densities. Low partridge harvests were correlated with low pheasant harvests between 1975-1984. Prior to 1975, low harvests were related to low partridge population levels and lack of a partridge hunting knowledge and tradition.

Gray partridge are an important resource to sportsmen and the nonhunting public. Landowners delight in observing and feeding "their" partridge. If current agricultural trends continue and pheasant harvests decline, the demand on partridge by sportsmen will increase. The partridge is the only upland game bird in the Red River Valley.

Partridge have been an important species in Minnesota for use in wildlife exchange programs with other states.

Trends

The partridge population was relatively high by 1941 with gradual declines through the late 1940s, 1950s and early 1960s. Since 1964, the partridge population has been increasing despite the lack of management aimed at this species. The harvest of partridge in Minnesota increased substantially in the 1970s and 1980s, followed by a recent precipitous decline. The average harvest of partridge went from approximately 20,000 birds annually through the 1960s and early 1970s to more than 100,000 per year between 1978 and 1981. If partridge populations stabilize or continue to increase, and if more hunters gain experience with this species, more sportsmen would be expected to concentrate on partridge hunting.

RESOURCE VALUE

Average partridge habitat supports few other game species. The partridge is able to increase in numbers despite severe winters and intensified agricultural land use in Minnesota.

The value of the partridge to the economy of Minnesota is clouded because partridge are hunted incidentally to at least 7 other game species--pheasant, waterfowl, fox, rabbit, deer, squirrel and sharp-tailed grouse. The partridge harvest provides increased hunter satisfaction, so more hunter-days are spent pursuing all of these species.

In a 1984 Minnesota survey of dedicated gray partridge hunters, 90% reported that they hunted partridge along with pheasants during the pheasant season. However, 95% of these hunters reported they would continue hunting partridge if seasons were closed for the other game species. The hunting season for partridge in recent years has averaged nearly 3½ months.

Approximately 27,000 small game license purchasers hunt

gray partridge in Minnesota (Table 27-1). A recent Wyoming study estimates partridge hunters spend approximately \$30 per hunting day. Minnesota hunters who pursued only partridge hunted an average of 19.3 days. The partridge hunter who also hunts other species, spends approximately 10 days per season pursuing partridge. Using these figures, partridge hunters spend an estimated \$7.5 million annually in Minnesota--an important addition to the rural economy. Partridge hunting is slowly increasing despite the lack of dedicated wildlife management dollars or special stamp programs.

The Minnesota Department of Natural Resources initiated a Hungarian Partridge Cooperators Program in 1983 to solicit partridge hunter cooperation. This dedicated group of sportsmen is indicative of growing interest in the partridge as a game bird.

As the game bird that does the best in Minnesota's intensively cultivated areas, partridge represent a good investment for management in Minnesota's farmland.

Long range planning for gray partridge

PRODUCT: Gray partridge for their ecological value and opportunities for use and appreciation.

GOAL: Maintain current gray partridge population for recreational, educational, cultural, economic and ecological values.

OBJECTIVE 1. Maintain gray partridge population at 500,000-800,000 through 1992.

PROBLEM 1. Limitations in some information reduce management effectiveness.

STRATEGY A. Develop and implement a plan of priority research needs.

STRATEGY B. Identify and evaluate habitat management techniques.

STRATEGY C. Develop and implement habitat management guidelines.

STRATEGY D. Research interspecific competition with ring-necked pheasant.

OBJECTIVE 2. Increase the annual average harvest to 110,000 gray partridge by 1992.

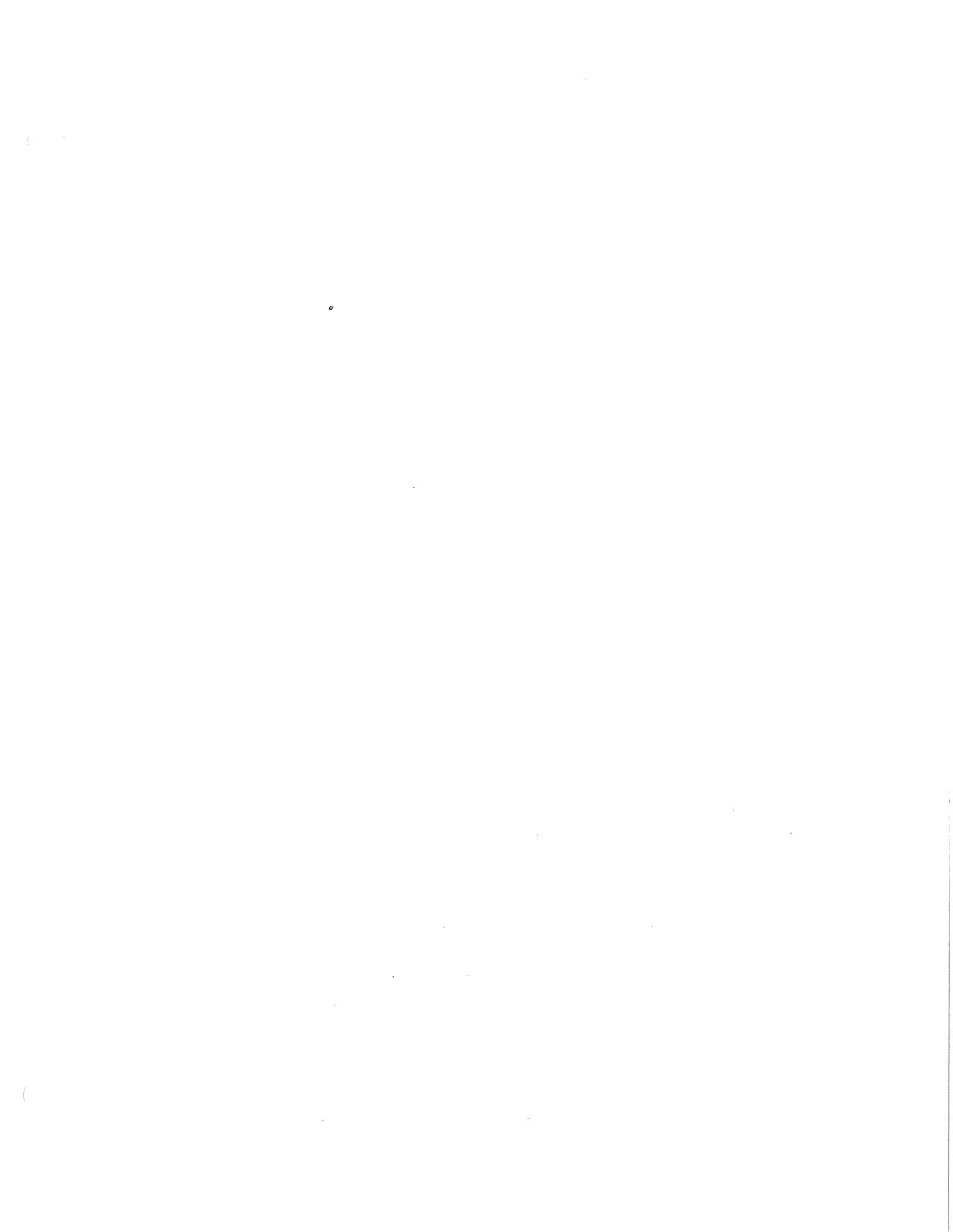
PROBLEM 1. Gray partridge are under-utilized.

STRATEGY A. Investigate successful hunting techniques and factors affecting hunter satisfaction.

STRATEGY B. Provide information to the public and other agencies on gray partridge.

STRATEGY C. Determine how the hunting of other species influences the harvest of gray partridge.

STRATEGY D. Improve hunter access to private land.



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28. Greater Prairie-chicken

The greater prairie-chicken (Tympanuchus cupido pinnatus), indigenous to the vast grassland areas of central North America, once occupied all or portions of 16 states. Peak populations of this species were reached in the late 1800s to early 1900s. Today, however, huntable populations of the greater prairie-chicken are found only in Kansas, Nebraska, Oklahoma and South Dakota.

Most historians agree that the prairie chicken occupied only the southern one-third of Minnesota in presettlement times. During early settlement, however, prairie chickens expanded their range throughout Minnesota. Remnant prairie chicken flocks remained in southeastern Minnesota until the late 1930s and in east-central Minnesota until the mid 1960s.

Prairie chicken peak populations were incidental to early farming operations. The homesteader's relatively small grain fields scattered throughout the vast prairie grasslands produced ideal habitat. This habitat base was expanded northeastward during the era of the great fires. Since the early 1900s, grasslands have been replaced with large grain fields and the northern forest has reclaimed many idle farms and fields, causing a reduction of prairie chicken habitat and populations.

RESOURCE MANAGEMENT

The first protection given to prairie chickens in Minnesota was in 1858 when the hunting season was closed from February 15 to July 15. Generally, subsequent law

changes shortened the season and established later opening dates. In 1868, prairie chicken and other upland gamebird nests were protected and possession or sale of game bird eggs was prohibited. In 1874, devices such as traps, nets and snares were outlawed. The export of prairie chicken and other game was made illegal in 1877. A daily bag limit of 25 birds was imposed in 1891. Regulations from 1919 to 1933 called for 2 week sessions in odd numbered years. The hunting season was closed from 1936-39 and open from 1940-1942. The season has been closed since 1943. Despite this protection, prairie chicken numbers gradually declined and continue to decline.

Prairie chicken currently occur in western central Minnesota (Figure 28-1). Wildlife habitat preservation by the Minnesota Department of Natural Resources began with the "Save the Wetlands" program in 1951. The U.S. Fish and Wildlife Service began a similar acquisition program in 1961.

Since 1971, The Nature Conservancy, a private organization, has acquired native prairie areas throughout Minnesota. Fortunately, many of these areas are located in the present prairie chicken range.

Public, state and federal lands, or land owned and managed by private conservation organizations such as The Nature Conservancy, provide most of the habitat for prairie chickens in northwestern Minnesota. Prairie chickens occur primarily on private land in northcentral Minnesota.

Low land prices and large acreages of private land for sale in northcentral Minnesota provide an excellent opportunity for acquisition of prairie chicken habitat and management units. The present reduced agricultural demands coupled with high landowner interest in local prairie chicken populations should be given high priority for management plans.

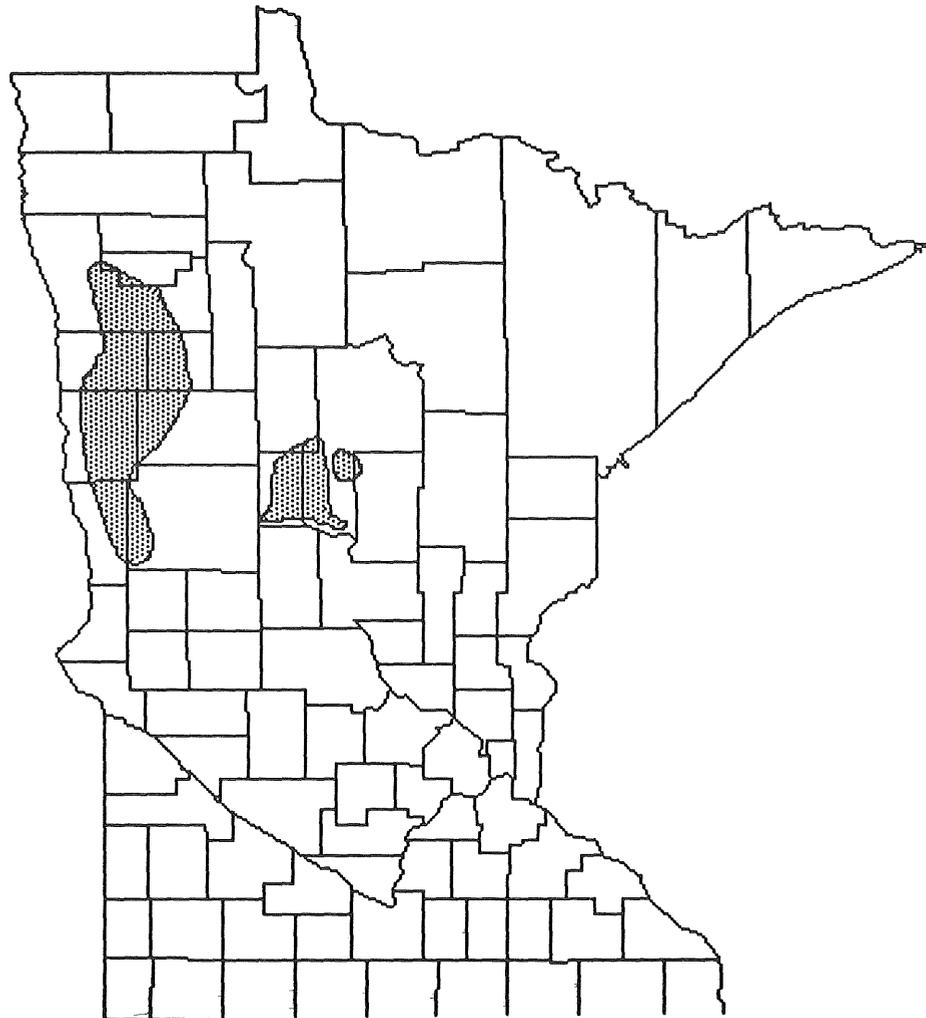


Figure 28-1. Current distribution of greater prairie chicken in Minnesota.

Much of the remaining habitat on private lands is owned by railroads, sand and gravel companies, land speculators, livestock farmers and a few prairie enthusiasts. Over the long run, grasslands in private ownership are declining as these habitats are converted to other uses or as natural succession occurs, although the Conservation Reserve Program has provided some short-term relief.

Since 1980, Minnesota has provided tax relief to persons who own lands with qualifying native prairie. Under the Native Prairie Tax Credit Program, the owner receives a tax credit for, and pays no taxes on, acres maintained in native prairie. Within the northwestern prairie chicken range, this program affected 4,689 acres in 8 counties in 1986.

Habitat Needs

An ideal prairie chicken management unit should be one-third to one-half in native (preferred) or tame grasslands. Native grouse are preferred. Sedge meadows and lowland brush should comprise about 25%. The remainder can be made up of a combination of cropland, pasture and hayland, with no more than 10% of the unit containing tree groves that exceed 20 feet in height.

Although unburned grasslands provide nesting and brooding habitats, periodic burning is a practical management tool needed to maintain the vigor of the prairie community. Alfalfa fields cut for hay, lightly grazed pasture, and first-year legumes following small grains also provide quality brood cover. If left undisturbed, grass-legume seeded areas can also provide desirable nesting habitat. Brood habitat should be adjacent to nesting habitat wherever possible.

Preferred roosting areas are somewhat wet and consist of lowland brush and sedge meadows with less than 10% in willow or other shrubs. These areas are also used to some

extent for nesting and brood rearing during years immediately following burning. Prescribed burning of lowland brush and sedge meadows is necessary to maintain the shrubs in early stages of development.

Natural foods for the prairie chicken consist of wild rose hips and buds of birch, aspen, willow, dogwood, hazel, cottonwood and oak. If surrounding crop fields are not fall plowed, waste grains usually provide an additional source of winter food. Where fall plowing is extensive, strategically located food plots may be beneficial. No-till, ridge-till or other types of farming that reduce fall plowing should be encouraged whenever possible.

RESOURCE ANALYSIS

Because of habitat destruction, prairie chicken populations in Minnesota plummeted. Today a breeding population of 2,000 to 3,000 birds occur in portions of 9 northwestern and 3 northcentral counties. The largest populations are located on the beach ridges of glacial Lake Agassiz between Crookston and Fergus Falls. The remainder is a disjunct population in Cass, Wadena and Hubbard counties.

Prairie chicken population trends are obtained from counts of displaying adult males on traditional booming grounds or leks. Volunteers have censused leks annually since 1974. As recently as 1982, 1,648 males were counted on 146 leks. In 1986, 677 males were observed on 98 leks. Although survey efforts are somewhat standardized, reliance on volunteers hampers direct year-to-year comparisons.

Major limiting factors to prairie chicken populations are; 1) the lack of large managed grassland expanses and wet habitats, 2) natural succession of prairie to forest, 3) habitat conversion, and, 4) high chick mortality from predation and weather. Unless these factors are controlled, viable prairie chicken populations in Minnesota will be eliminated.

Beginning in 1986, two programs--The federal Conservation Reserve Program and Minnesota's Reinvest in Minnesota--pay landowners to seed erodible cropland to cover and to leave the land undisturbed for 10 years. Many of these Conservation Reserve Program and Reinvest in Minnesota fields will provide large grassland acreages in the prairie chicken range and a favorable impact on their population is anticipated. If extended indefinitely, these programs would help to provide permanent protection for these areas.

RESOURCE VALUE

The spring nesting display of the prairie chicken on leks is one of the most spectacular of all North American gamebirds. This annual spectacle not only attracts female prairie chickens but is an aesthetic attraction for birdwatchers, photographers and prairie chicken enthusiasts who quietly observe the males' activities from blinds. To witness this courtship display, many people spend undetermined amounts of money for lodging, fuel and food for a unique nonhunting experience.

In the 4 states that have huntable populations of greater prairie-chicken, significant numbers of resident and nonresident hunters benefit local economies while pursuing this native game bird of the prairies. A huntable population in Minnesota would add to the economic value of the prairie chicken resource, while not distracting from its aesthetic appeal.

A prairie chicken population of at least 6,000 breeding birds would ensure the survival of this species in Minnesota, as well as provide substantially increased user opportunities.

Long range planning for greater prairie-chicken

PRODUCT: Greater prairie chickens for their ecological value and opportunities for use and appreciation.

GOAL: Maintain self-sustaining populations of greater prairie-chicken in Minnesota.

OBJECTIVE 1. Achieve and sustain a breeding population of 6,000 greater prairie-chickens by 1992, distributed by Minnesota Department of Natural Resources regions as follows:

Region	% of Population	Minimum population
1	70	4,200
3	25	1,500
4	5	300

PROBLEM 1. Habitat is being lost through conflicting agricultural practices, vegetational succession and in some places, conversion to conifers.

STRATEGY A. Acquire 2,000 acres of grasslands annually, at least through 1992.

STRATEGY B. Provide preferred habitat on public and private lands primarily through increased prescribed burning, as well as mechanical and chemical treatment.

STRATEGY C. Retain public lands and regulate public land leases to ensure habitat protection.

STRATEGY D. Provide technical and financial assistance for private land management, through Minnesota Department of Natural Resources Wildlife and Private Forestry Management Programs.

STRATEGY E. Promote agricultural programs that provide habitat, such as the Conservation Reserve Program, Prairie Tax Credit and Reinvest in Minnesota.

STRATEGY F. Educate land management personnel regarding habitat needs and encourage compliance with the Habitat Management Guidelines.

STRATEGY G. Establish greater prairie-chicken management units through the Minnesota Department of Natural Resources Forest Area Unit Planning process.

STRATEGY H. Stengthen the environmental review and mitigation process.

STRATEGY I. Support and seek legislation that will define Minnesota Department of Natural Resources liability when assisting private landowners with prescribed burns.

PROBLEM 2. The limitations of some information reduce management effectiveness.

STRATEGY A. Locate and document existing habitat.

STRATEGY B. Develop and implement techniques to identify potential habitat.

STRATEGY C. Develop and implement a range-wide population survey.

STRATEGY D. Determine areas where interspecific competition with the ring-necked pheasant limits greater prairie-chicken population increases.

STRATEGY E. Investigate economic and recreational values.

PROBLEM 3. Several areas may contain suitable habitat but are devoid of greater prairie-chicken.

STRATEGY A. Conduct feasibility studies for reintroductions.

STRATEGY B. Conduct reintroductions and assist in inter-agency reintroduction efforts.

OBJECTIVE 2. Expand opportunities for appreciation of greater prairie-chicken by 1992.

PROBLEM 1. Greater prairie-chicken ecology is not well understood by the public.

STRATEGY A. Provide information to the public about greater prairie chicken ecology.

PROBLEM 2. There is insufficient information about current and potential opportunities for use and appreciation.

STRATEGY A. Investigate uses and develop opportunities that maximize recreation while protecting the prairie chicken resource.

STRATEGY B. Implement hunting seasons when populations are adequate.

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29. Northern Bobwhite

The Minneapolis Daily Tribune in 1869 credited General H. H. Sibley and Franklin Steele with transplanting northern bobwhite quail from Iowa into Minnesota. It is not clear whether this action resulted in the original establishment of the northern bobwhite quail (Colinus virginianus) in Minnesota, or if this species is indigenous.

Early land-clearing and associated farming created conditions that enabled the wild bobwhite population to expand as far north as Pine County. In the 1920s, estimated harvests ranged from 6,000 to 10,000 birds annually. Unfortunately, the population decline beginning in the 1930s reduced the present bobwhite population to isolated pockets in the southern portion of its former range (Figure 29-1). Intensified cropping and grazing are cited as causes for the decline.

RESOURCE MANAGEMENT

The first step to begin a new management program for Minnesota would be to design and implement a survey to determine the potential bobwhite range. This would include the amount and types of habitats used by existing coveys. Determining the genetic makeup of existing coveys would be valuable for selecting the best transplant stock for unoccupied, managed habitats.

Until an active habitat management program for northern bobwhite can be implemented, efforts should be made to

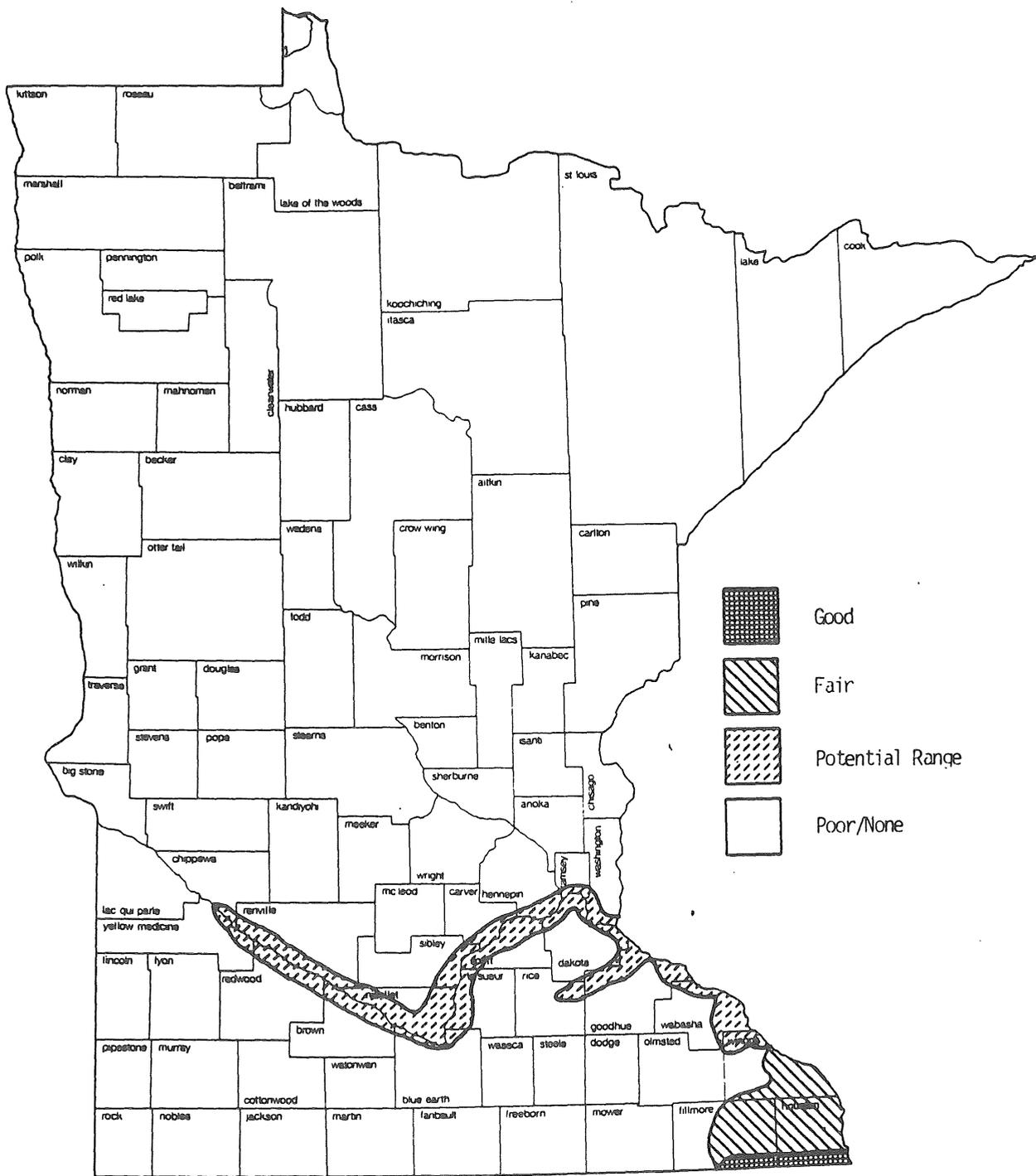


Figure 29-1. Range of northern bobwhite, and range potential, in Minnesota. (Source: Minnesota Department of Natural Resources)

consider the bobwhite's needs when developing food plots for deer and turkeys in Fillmore, Houston and Winona counties. The development of northern bobwhite habitat in these counties should be given high priority on lands retired under the Conservation Reserve and Reinvest in Minnesota programs.

Bobwhite survival is greatly reduced when more than 6 inches of snow covers their range in November and continues to accumulate through March, making it difficult for them to find food. Therefore, the primary goal of bobwhite management in Minnesota must be the development of strategically located winter food and cover areas throughout their range. This would include planting woody cover areas such as red cedar and other shrubs and fencing them, where necessary, to exclude cattle. Dependable winter food sources, such as food plots or feeders, must be provided near these cover areas. Also, undisturbed grassland cover for nesting should be available within a one-half mile radius of the managed wintering areas to provide optimum reproductive opportunities.

Before 1958, bobwhite management was limited to regulating hunting seasons, enforcing regulations, and stocking adult birds. Although the bobwhite is still considered a game species, essentially all management was terminated in 1958 with the closure of the hunting season.

RESOURCE ANALYSIS

Few wild bobwhite exist in Minnesota today, although exact numbers are unknown. The potential for a huntable population will depend on management efforts and funds.

Predicting the interest for a hunting season on bobwhites is difficult. However, a 1980 federal survey of hunters and fishermen found that 27,500 days were spent by 3,900 potential Minnesotans pursuing bobwhites in other states. To provide this number of hunters with the

opportunity to harvest an average of 5 bobwhite per season would require a fall population of more than 50,000 birds. With a minimum density of 3 coveys per square mile and 15 birds per covey, the demand for an allowable harvest of 20,000 bobwhites would require management of about 1,200 square miles of prime range. This population could provide over 20,000 hunter-days of recreation on which hunters could be expected to spend more than \$600,000.

To achieve and sustain a fall population of 10,000 bobwhites, which could provide an annual mean harvest of 4,000 birds, would require about 10 townships (360 square miles) of range. This population level would provide approximately 5,000 hunter-days of recreation for about 800 hunters.

RESOURCE VALUE

At least 10 million bobwhites are harvested annually in the United States, making them second only to the mourning dove as America's most harvested upland gamebird. Although Minnesota does not presently support huntable populations, many of our hunters travel to Iowa, Nebraska and other states to the south to pursue this exciting game bird.

Interest in the bobwhite by various Minnesota residents led to formation of the Bobwhite Quail Society of Minnesota. This group currently locates and monitors coveys, coordinates an annual survey run primarily by school bus drivers, finances, builds, and stocks winter feeders, and works with landowners to kindle an interest in and appreciation for this neglected resource.

Long range planning for northern bobwhite

PRODUCT: Northern bobwhite for their ecological value and opportunities for use and appreciation.

GOAL: Manage a self-sustaining wild northern bobwhite population in its primary range.

OBJECTIVE 1. Achieve and maintain a wild northern bobwhite population of 10,000 birds by 1992.

PROBLEM 1. Land use practices have drastically reduced the quantity and quality of habitat.

STRATEGY A. Protect, acquire, maintain and improve habitat, specifically:

- a. give high priority to the development of habitat for the bobwhite on land retired in southeastern Minnesota under the federal Conservation Reserve Program and the state Reinvest in Minnesota Program;
- b. integrate management into existing deer, turkey and pheasant habitat programs.

STRATEGY B. Provide information on habitat needs to land management personnel.

STRATEGY C. Influence Congress and the U. S. Department of Agriculture to change their annual set-aside programs so that critical habitat is not destroyed.

STRATEGY D. Provide technical and financial assistance for private land management, through the Minnesota Department of Natural Resources Division of Fish and Wildlife Private Lands Program and Division of Forestry Private Forest Management Program.

STRATEGY E. Establish demonstration areas for the management of bobwhite.

PROBLEM 2. Several areas may contain suitable habitat but are devoid of northern bobwhite.

STRATEGY A. Conduct feasibility studies and consider initiating reintroductions and assisting in inter-agency reintroduction efforts.

PROBLEM 3. The limitation in some information reduces management effectiveness.

STRATEGY A. Design and implement spring breeding and summer brood surveys.

OBJECTIVE 2. Expand opportunities for use and appreciation of northern bobwhite by 1992.

PROBLEM 1. Northern bobwhite ecology is not well understood by the public.

STRATEGY A. Provide information to the public on northern bobwhite ecology.

PROBLEM 2. Information is needed about current and potential opportunities for use and appreciation of bobwhites.

STRATEGY A. Survey and monitor current types and levels of nonhunting use.

STRATEGY B. Determine potential nonhunting, and hunting use levels that maximize recreation while protecting populations.

STRATEGY C. Implement hunting seasons when populations are adequate.



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30. Ring-necked Pheasant

Minnesota ranks in the top 8 of 33 states that have huntable ring-necked pheasant (Phasianus colchicus) populations. A well-established pheasant population exists in the southern two-thirds of Minnesota (40,930 square miles) and occupies all or parts of 68 counties (Figure 30-1). Less than 2% of the pheasant range is in public ownership.

Current fall populations vary from 0.5 to 2 million birds (Table 30-1). This is considerably less than the 2 to 6 million birds (100 pheasants per square mile) that sustained pheasant harvests in the vicinity of 1 million birds in previous decades (Figure 30-2).

Present population levels are the result of a dramatic decline that began in 1964 (Figure 30-3). The primary causes of this drastic reduction were the rapid elimination of prime nesting and brood rearing habitats when the federal Soilbank Program was discontinued. This was followed by intensified farming and the annual federal feed grain programs resulting in large blocks of unsafe nesting and brood cover. Farming practices that increase field size, reduce plant diversity, eliminate winter food, and increase use of pesticides, both herbicides and insecticides, continue to complicate the pheasant's struggle for survival.

Pheasant populations do best in rich farmland areas with a mixture of row crops, small grains, pastures,

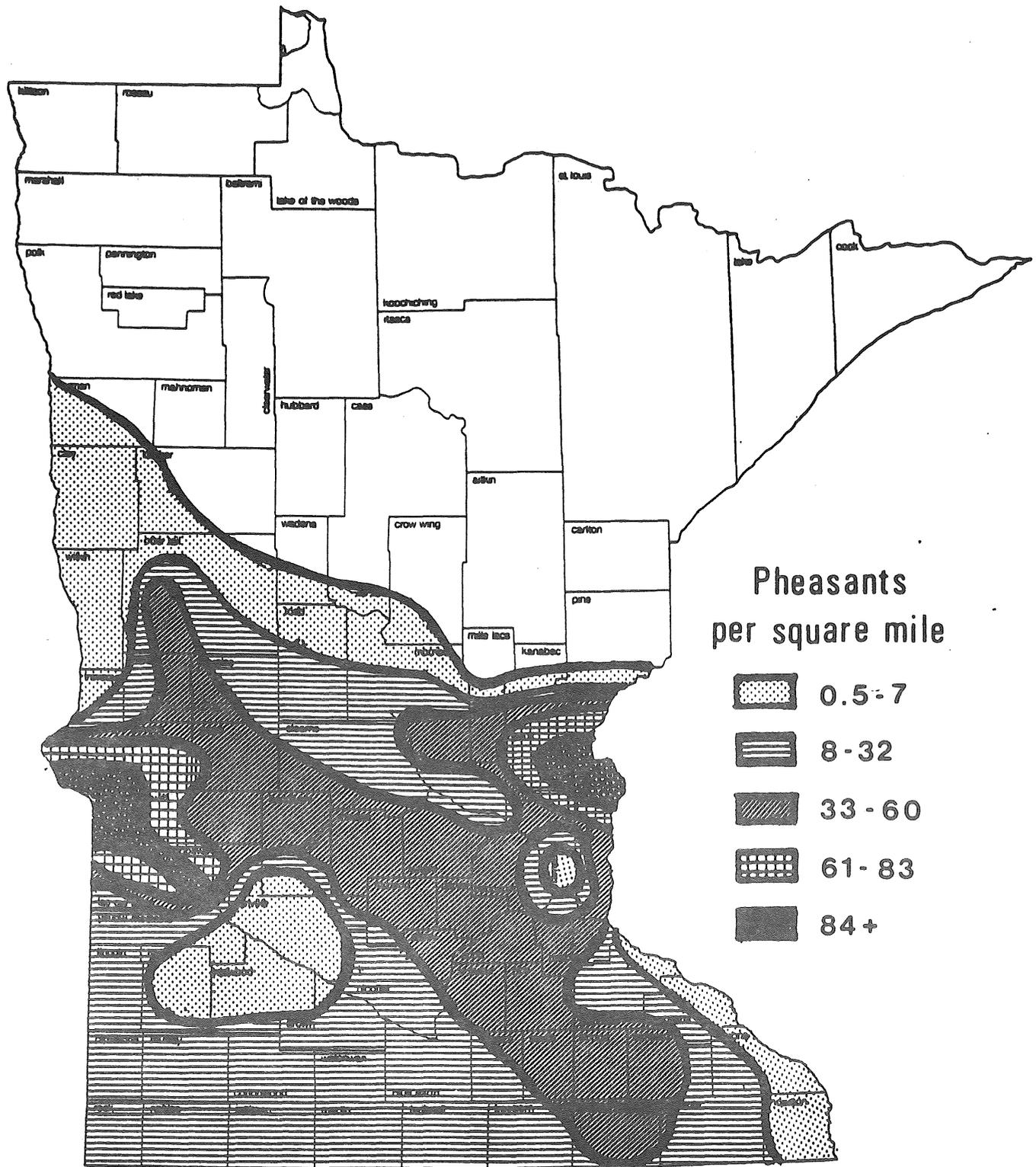


Figure 30-1. Current pheasant distribution and fall population densities in Minnesota. Numbers represent the mean for the years 1980 through 1985. (Source: Minnesota Department of Natural Resources)

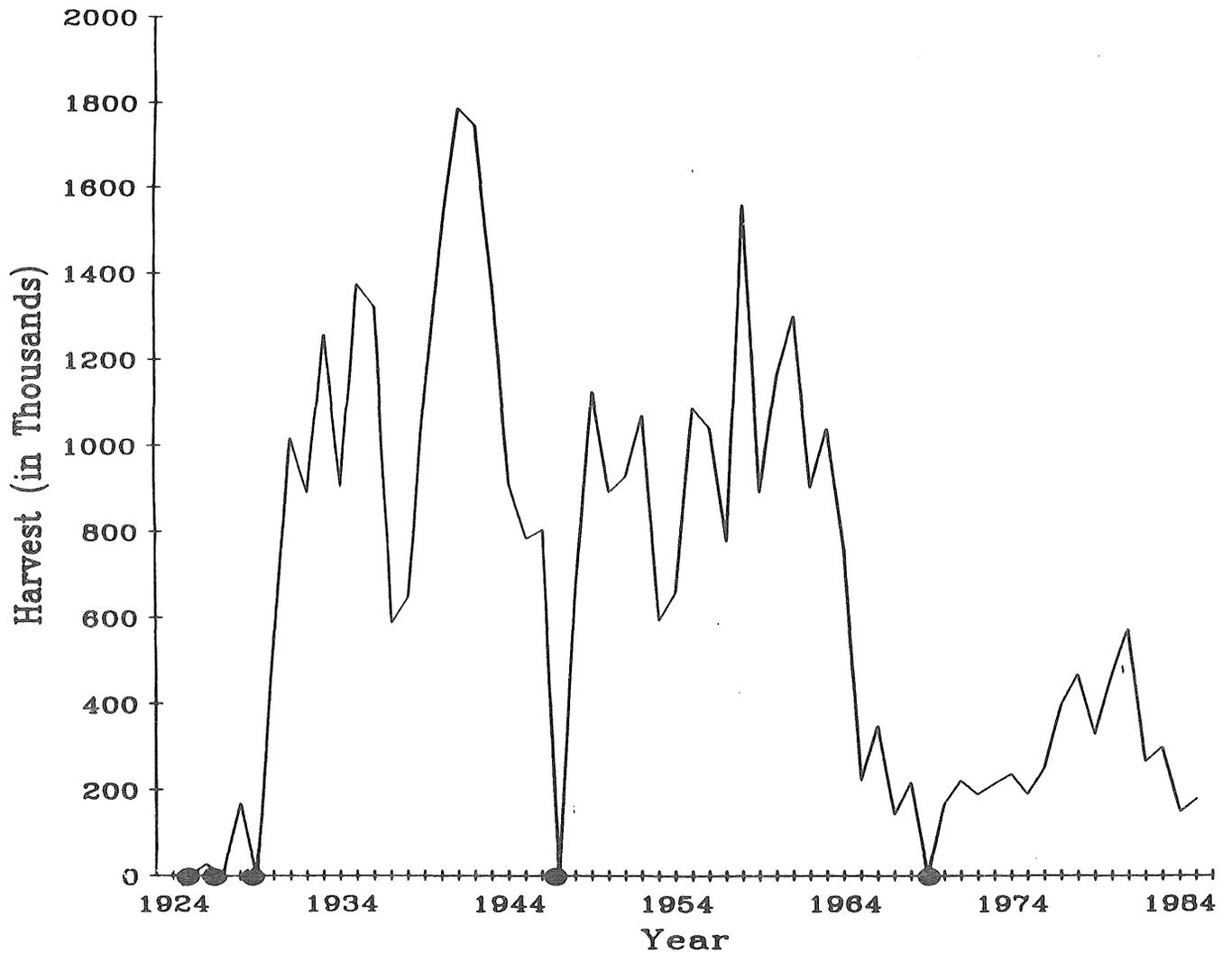


Figure 30-2. Estimated pheasant harvest in Minnesota for 1924 through 1985. (Source: Minnesota Department of Natural Resources)

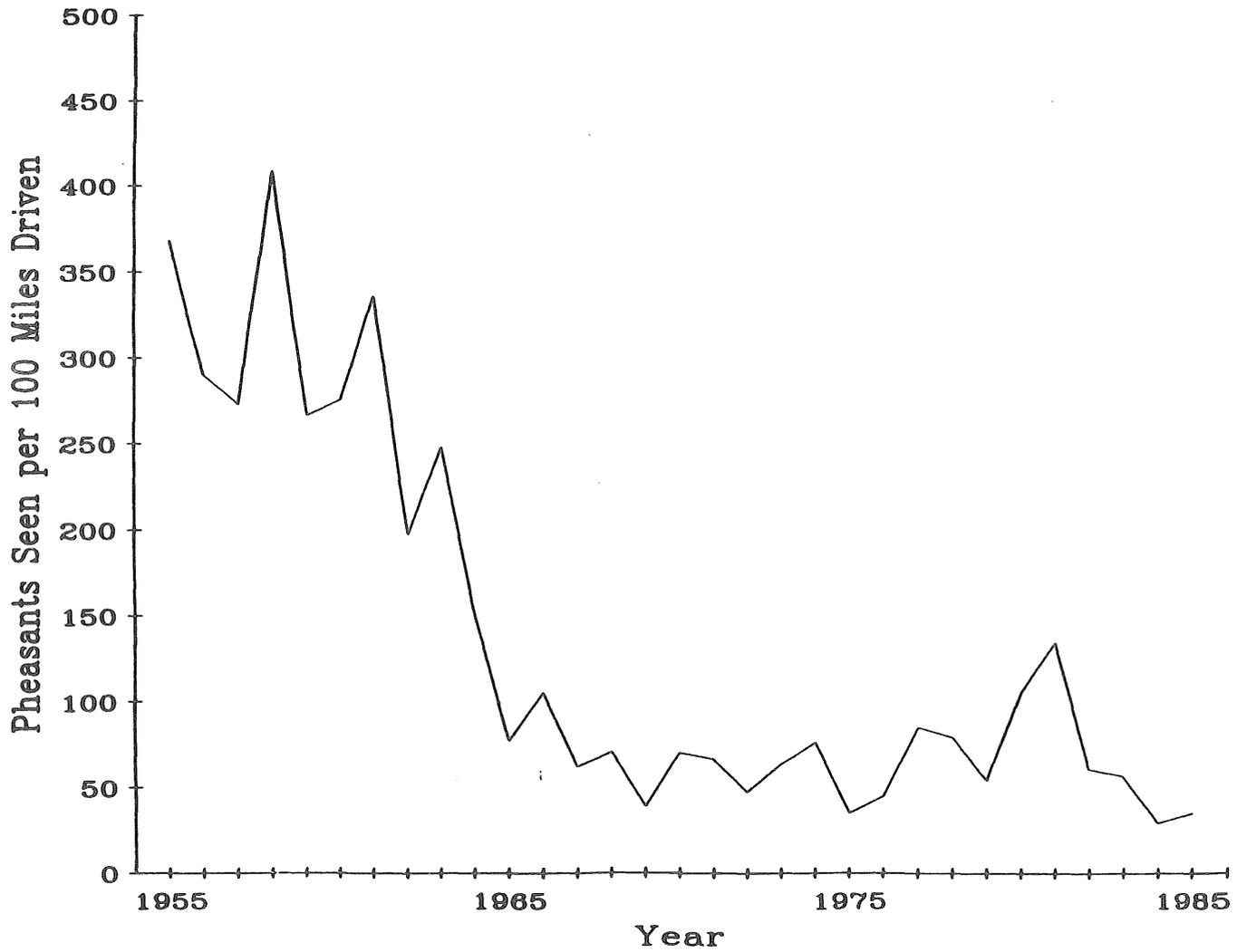


Figure 30-3. Number of pheasants counted per 100 miles driven in August, 1955 to 1985. (Source: Minnesota Department of Natural Resources)

Table 30-1. Pheasant population and harvest data summarized by 5-year intervals from 1950 to 1984.

Period	Pheasants x 1000			
	Population		Harvest	
	Mean	Range	Mean	Range
1960-64	4,097	3,000- 5,000	1,033	758- 1,340
1965-69	1,158	758 1,764	186*	0- 340
1970-74	1,047	890- 1,364	203	166- 235
1975-79	1,238	755- 1,680	326	188- 468
1980-84	1,369	526- 2,144	350	148- 573

* The mean includes a zero for the closed season in 1969.

Source: Minnesota Department of Natural Resources

undisturbed grasslands and winter cover areas such as marshes and farmstead shelterbelts. The best areas comprise 5% to 10% undisturbed grasslands, approximately 10% small grains and/or pasture and 3% to 5% wetland and shelterbelts. Between 50% and 80% of the better habitat areas are usually being farmed intensively for various feed grain crops; such as corn, soybeans and wheat.

At present, less than 2% of the pheasant range is in undisturbed grassland, which is critical for nesting and brood rearing. Much of the grassland, pasture and small grains fields have been converted to the production of row crops. The remaining grassland areas are usually mowed during the peak nesting period or grazed so heavily that they provide little or no cover for nesting and brood rearing. The remaining small grain fields are often

heavily sprayed with herbicides, greatly reducing their value as broodrearing areas.

Agricultural drainage has eliminated many marshes throughout the pheasant range. The quality and abundance of other winter cover areas such as farmstead shelterbelts have declined. Those shelterbelts not eliminated by farm expansion are deteriorating as winter cover because of age, composition and grazing practices. Extensive fall plowing eliminates food and cover needed by pheasants and other wildlife to survive Minnesota's long and severe winters.

RESOURCE MANAGEMENT

From 1916--the year of the successful pheasant introduction--to 1968, pheasant management in Minnesota consisted of regulating hunting seasons, enforcing regulations, stocking adult pheasants, paying predator bounties, monitoring population trends, estimating harvest, providing interested people with day-old chicks and providing technical assistance in developing and preserving habitat. In the late 1940s and early 1950s, free trees were made available to interested landowners to establish woody cover plantings.

In 1951, the state began acquiring wetlands primarily for waterfowl. This program, however, preserved some critical pheasant habitat and for the first time provided this state's wildlife agency with public lands that could be managed for pheasants. Trees and shrubs were planted on these lands to develop additional winter cover and food plots were established to provide winter food.

Since 1968, in addition to its wetland acquisition program, the Division of Fish and Wildlife has provided cost-sharing for habitat establishment on private lands, technical assistance and population and harvest monitoring. The cost-share program has provided more than \$100,000 annually in partial payment to landowners for developing

10-row woody cover plantings, nesting cover areas and food plots. Whenever possible, payments have been meshed with similar cost-sharing practices under various federal agricultural conservation programs.

Beginning in 1983, sales of the newly legislated Pheasant Stamp expanded the cost-sharing program by an additional \$300,000 annually. This new funding also allowed the Division of Fish and Wildlife to initiate a major roadside habitat management effort and to support the National Agricultural Program Representative. The National Agricultural Program Representative, stationed in Washington, D.C., watchdogs the various federal programs and legislation affecting wildlife habitat in farmland areas.

REGIONAL PLANS

Region 1

Approximately 18%, or 7,243 square miles, of Minnesota's pheasant range is located in Region 1. The southwest half of this region's pheasant range is flat to gently rolling and contains rich soils used for intensive feed production of corn, soybeans and small grains. Despite low pheasant populations at present, this area produced some of the highest populations in the past.

With the addition of undisturbed grasslands and winter food/cover plots through the land retirement programs and roadside program, this area could once again support fall pheasant densities in the range of 80 to 150 birds per square mile. Portions of this area have significant numbers of wetlands already in public ownership, federal waterfowl production areas and state wildlife management areas. These pockets of habitat provide a viable pheasant population base for expansion onto private land with habitat improvement. They also provide public access to a significant portion of the pheasant resource.

The northeastern half of this region's pheasant range is rolling and contains less fertile soils. Despite a mixture of woodlands, marshes, swamps and farming, this area does not support the density of pheasants expected. The potential for a high pheasant population in this area is reduced by land use practices associated with intensive dairy farming, headed by grazing and intensive hay mowing, and by its location at the northern fringe of the pheasant range.

From 1981 to 1985, pheasant densities averaged 27 birds per square mile in Region 1. With the addition of undisturbed grasslands and winter food/cover plots, however, this area could be expected to support fall pheasant densities in the neighborhood of 60 to 100 per square mile.

Region 2

Very little suitable pheasant habitat occurs in Region 2.

Region 3

Approximately 18%, or 7,252 square miles, of Minnesota's pheasant range is located in Region 3. The western half of this area is similar in topography, soils and habitat quality to the northeastern half of Region 1 pheasant range. Therefore, average fall pheasant densities can be expected to exceed 40 per square mile with additional habitat.

The land in the eastern half of Region 3 is flat to gently rolling. Like the western half, the land is used primarily for dairy and mixed livestock farming. Because of its proximity to the Twin Cities, there is a high proportion of hobby farmers, many of whom work to attract wildlife to their lands. Despite being on the northern edge of the pheasant range, portions of this area have periodically experienced high pheasant densities. These

eruptions have been preceded by 2 or 3 mild winters and early springs. Recent research has also shown that winter food/cover plots are very important in maintaining viable, productive pheasant populations in this area and in similar areas in the remainder of Region 3 and Region 1. Population densities should average higher than those in the western half of the region at about 70 pheasants per square mile.

The average annual pheasant density from 1981 to 1985 was 36 pheasants per square mile. With periodic population eruptions and provision of adequate winter food/cover plots, pheasant densities could be expected to average at least 60 per square mile.

Region 4

Nearly 42%, or 17,016 square miles, of the pheasant range is located in Region 4. The entire region is characterized by flat to gently rolling land with rich soil. This area is under intensive cultivation for feed grain crops, particularly corn and soybeans. Few of the many wetlands that once dotted its landscape remain and most of these are in public ownership; many of those that are not publicly owned are in jeopardy of being drained. This area once produced some of the highest pheasant population densities observed in Minnesota (Figure 30-1).

Unfortunately, the rich soils and long growing season that encourage lush, tall grassy cover preferred by pheasants, also encourages intensive farming for feed grains. Therefore, few grasslands remain. At present, roadsides provide the largest single source of grassland in this region. During the last five years, 1981-1985, fall pheasant densities have averaged 27 birds per square mile in this region. However, with the potential retirement of more than 50 acres of cropland per square mile under the federal Conservation Reserve Program, federal Acreage Production Program and state Reinvest in Minnesota Program, plus the reduction of mowing in roadsides, fall population densities

could be expected to range from 70 to 150 pheasants per square mile throughout most of this region.

Region 5

Approximately 16%, or 6,745 square miles, of the pheasant range is located in Region 5. The western two-thirds of this range has similar problems and potentials as does Region 4. The eastern one-third, however, is unique in Minnesota. This unglaciated area, called the driftless area, is characterized by hills and heavily dissected bluffs. The flatter tops and the valleys are farmed for feed grains and hays, while the hillsides are pastures and woods. Dairy farming, the predominant land use, reduces this area's potential for high pheasant populations because pastures are overgrazed by livestock and hay mowing is intensive.

In this region, fall densities averaged 24 pheasants per square mile for 1981 to 1985. With the potential addition of undisturbed nesting cover under Conservation Reserve Program and Reinvest in Minnesota, however, pheasant densities of 40 to 80 birds per square mile are possible.

Region 6

Approximately 6%, or 2,674 square miles, of the pheasant range is located in Region 6. The gently rolling land is highly urbanized, but high pheasant densities are still present in undeveloped lands and surrounding rural areas. During the period of 1982 to 1984, almost 17% of the pheasant hunters spent 16% of the total hunter-days in this region and accounted for 12% of the pheasant harvest (Table 30-2). Its proximity to the Twin Cities and an adequate pheasant population during those years probably accounted for this heavy use by hunters.

Table 30-2. Percent of pheasant range, population, hunters and hunter-days in 5 Department of Natural Resources regions, 1982-1984.

Region	Pheasant		Hunters	
	Range	Population	Hunter	Hunter-days
1	18	14	10	9
3	18	22	24	21
4	42	37	33	36
5	16	15	15	17
6	6	12	17	18

Source: Minnesota Department of Natural Resources

Continued urbanization and pressure on landowners to allow hunting, however, could cause increasing access problems for hunters. During the 1960s the number of pheasant hunters was the primary driving force in small game license sales. Since 1970, pheasant populations, even though low, still have a significant impact on license sales.

The fall population density for this region averaged 29 birds per square mile annually from 1981-1985. With the addition of stable nesting and winter food/cover conditions, densities in the vicinity of 80 birds per square mile could be attained.

RESOURCE VALUE

During the last 25 years, the estimated number of licensed pheasant hunters in Minnesota has ranged from a high of 270,000 in 1961 to a low of 47,000 in 1975 (Table 30-1). Their numbers have varied in direct proportion to the size of the pheasant population--more pheasants mean more hunters.

From 1974 through 1983, the number of pheasant hunters averaged 121,400 and produced about \$1 million in annual license revenues. More than 99% of Minnesota's pheasant hunters are residents of the state. Minnesota has never attracted large numbers of nonresident hunters because

hunting is usually better further south in states such as Iowa or South Dakota.

The value of the pheasant and pheasant hunting to Minnesota's economy has yet to be determined. Data from Pennsylvania, South Dakota and 5 midwestern states, however, indicates that pheasant hunting can have a significant economic impact, particularly in rural areas. Studies conducted in these 7 states in the early 1970s estimated that resident pheasant hunters spent an average of \$15 per rooster bagged while nonresident hunters spent more than \$25 per bird. These expenditures included not only licenses, guns, and ammunition, but also travel, meals, lodging and dog care.

After adjusting the 1970 estimates with an inflation factor of 2.5, the mean annual expenditures by pheasant hunters in Minnesota exceeded \$13 million for the years 1980 through 1984, \$37.50/bird for the resident hunter and \$62.50/bird for the nonresident hunter.

A fall population of 3.2 million pheasants would provide a harvest of about 900,000 rooster pheasants and a minimum of 1 million days of recreation for more than 250,000 hunters. A quarter-million hunters would be expected to spend about \$39 per bird bagged for a total of more than \$35 million to hunt pheasants in Minnesota's farmlands. In addition, an undetermined amount would be spent to observe pheasants. Economists estimate that for every dollar spent on an activity an additional \$3 to \$4 is generated into the economy. Therefore, the total impact on the economy would be at least \$125 million.

The increase in the number of pheasant hunters from the present level of 120,000 to at least 250,000 would generate a minimum of \$2 million in additional small game license and pheasant stamp revenues annually. The additional funds would provide almost one-half of the funding needed for this pheasant restoration plan.

This plan meshes well with other programs. The acquisition of wetlands and the development of upland grasslands will have measurable benefits on many waterfowl and songbird populations as well as jack rabbits and deer. Food and cover plantings established as winter cover for pheasants will likewise benefit an array of resident wildlife species such as deer, rabbits, songbirds and gray partridge.

Long range planning for ring-necked pheasant

PRODUCT: Ring-necked pheasant for their ecological value and opportunities for use and appreciation.

GOAL: Manage wild ring-necked pheasants to provide opportunities for hunting and non-hunting recreation.

OBJECTIVE 1: By 1992, achieve and sustain a statewide population of 3 million wild ring-necked pheasants as distributed by Minnesota Department of Natural Resources regions as follows:

Region	Pheasant range*	Average Fall Density**	
		1981-85 average	1992 objective
1	7.2	27	80
2	0	0	0
3	7.2	36	60
4	17.0	27	100
5	6.7	24	60
6	2.7	29	80

* Square miles in thousands

** Pheasants per square mile

PROBLEM 1. The annual Federal Acreage Reduction Program causes critical habitat destruction.

STRATEGY A. Influence Congress and the U.S. Department of Agriculture to change annual federal acreage reduction programs so that critical habitat is not destroyed.

STRATEGY B. Influence Congress to change the composition of the Agricultural Stabilization and

Conservation Service committees to include equal representation by professional natural resource managers.

STRATEGY C. Provide information to the public about negative effects of current annual federal acreage reduction programs.

STRATEGY D. Encourage the U.S. Department of Agriculture and the Congress to stop changing farm program names.

STRATEGY E. Develop and distribute to the public and professional land management personnel clear and concise explanations of farm programs and their environmental effects.

PROBLEM 2. Land use practices continue to reduce the quantity and quality of habitat.

STRATEGY A. Protect, acquire, maintain, and improve habitat, specifically:

- Provide an additional 1 million acres of undisturbed, perennial grassland for nesting and brood rearing;
- Establish 100,000 acres of winter food/cover plots, and 250 10-row shelterbelts, annually;
- Improve management of 1/2 million acres of roadside.

STRATEGY B. Encourage other public and private land managers to protect, acquire, maintain and improve habitat.

STRATEGY C. Support enforcement of regulations that protect critical habitats, such as Swampbuster, Sodbuster and protected waters.

STRATEGY D. Provide technical and financial assistance for private land management through state programs, such as wildlife habitat on private lands, waterbank and the Reinvest in Minnesota Reserve.

STRATEGY E. Encourage tax credits and exemptions for developing or maintaining critical habitat.

STRATEGY F. Support legislation that would eliminate tax incentives and technical assistance that encourage destruction of habitats.

STRATEGY G. Support changes in drainage laws to protect habitat.

STRATEGY H. Encourage research and development of beneficial agricultural practices.

STRATEGY I. Encourage development of state and county regulations that require landowners to reduce soil erosion to the Tolerable Soil Loss (T level).

STRATEGY J. Provide farmers with information on how to reduce nest losses during mowing operations.

PROBLEM 3. Severe winter storms and excessive predation can be important limiting factors.

STRATEGY A. Provide secure winter food and cover complexes in conjunction with safe nesting cover.

STRATEGY B. Develop and implement effective methods of predator management in areas where losses to predators are significant.

PROBLEM 4. The limitations of some information reduces management effectiveness and public understanding.

STRATEGY A. Evaluate effects of specific management techniques and determine cost effectiveness.

STRATEGY B. Provide information to the public on pheasant management.

OBJECTIVE 2. Provide opportunity for at least 250,000 hunters to annually harvest 60% to 90% of the fall rooster pheasant population.

PROBLEM 1. Demand for places to hunt exceeds supply.

STRATEGY A. Develop and implement programs to improve landowner/hunter relationships, hunter ethics and compliance with trespass regulations.

STRATEGY B. Protect, acquire, maintain and improve public hunting areas.

STRATEGY C. Encourage other public and private land managers to protect, acquire, maintain and improve hunting areas.

STRATEGY D. Develop and implement hunter management techniques to reduce conflicts and improve quality.

STRATEGY E. Provide information to the public about hunting areas and opportunities.

PROBLEM 2. Harvest opportunities are limited by current hunting regulations.

STRATEGY A. Gain public support for regulations that more fully use the season framework.

STRATEGY B. Change hunting regulations to provide additional harvest opportunity.

PROBLEM 3. The limitations of some information reduces management effectiveness.

STRATEGY A. Design and implement a hunter pressure and satisfaction survey.

STRATEGY B. Investigate the economic and recreational value of pheasants.

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31. Ruffed Grouse

The ruffed grouse (Bonasa umbellus) is one of the primary gamebirds of Minnesota. It provides excellent sport hunting, is very good to eat and is currently the state's most abundant native gamebird. This species, which typifies our northern forestlands, is claimed by many as the premier upland gamebird of the state.

RESOURCE MANAGEMENT

The future for ruffed grouse management looks good. Ruffed grouse occur throughout the forested portions of Minnesota, but are most abundant in forests dominated by aspen or oak. Minnesota has over 6.8 million acres of commercial aspen and oak forestland. Also, forestry agencies are giving more emphasis to maintaining Minnesota's aspen resource to meet the growing demands of the wood-fiber industry. It appears that the habitat base for ruffed grouse is relatively secure, but there is room for improvement. With more focused management, many forest stands could produce much higher populations.

Population History

Most grouse habitat that exists today is the result of past logging activities. Prior to settlement, Minnesota's best ruffed grouse habitat was probably in the hardwood forests of central Minnesota. This mixed forest of oak, maple and aspen occupied the transition zone between the

western prairies and the northern coniferous forest. Much of it was cleared for agriculture, which destroyed a large amount of the original grouse habitat.

In the mature conifer forests of the north, spruce grouse were once more common than ruffed grouse. However, the spruce grouse nearly disappeared following the logging and fires that occurred between the 1880s and 1920s. A new forest of sun-loving (shade intolerant species) hardwoods replaced the original forest of pine and spruce. This hardwoods-dominated forest was much better suited for ruffed grouse and the species quickly increased.

The forest types most valuable to ruffed grouse are aspen, oak, birch, alder and upland brush, with aspen being the most important. Ruffed grouse occur primarily in forest stands that contain at least 20% aspen. The buds of male aspen are a key winter food source, although hazel, birch, ironwood and cherries are also important. Most drumming logs and nests are located near clumps of mature male aspen.

Ruffed grouse require dense, woody cover to protect them from predators, especially hawks and owls. They utilize brushy growths with 3,000 to 6,000 stems per acre of slender shrubs or saplings for cover. Young aspen stands between 5 and 25 years old, alder swales and upland brush are preferred cover types. Prime ruffed grouse habitat occurs where there is an interspersion of young aspen stands for cover and older aspen stands for food.

The period of peak abundance for ruffed grouse in Minnesota probably occurred during the 1920s and 1930s. Since the 1940s, the aspen-birch forests have been maturing. The aspen-birch forests grew old faster than they were being harvested, especially in areas distant from wood and paper mills and on private lands. Much of the young cover needed by ruffed grouse disappeared and natural succession converted some aspen forest to conifers or maple. Additional habitat was lost to the man-made conversion of

intolerant hardwood stands to conifer plantations by forestry agencies. The gradual aging and loss of second-growth hardwood forests continued until the early 1980s.

There has been an upsurge in logging activity in the northern forests during the 1980s as a result of recent expansions in the paper and fiber board industries. Aspen harvests increased from 0.9 million cords cut from 51,000 acres in 1978 to 1.8 million cords from 87,000 acres in 1987. Aspen harvests are projected to increase to 2.9 million cords, taken from 160,000 acres by 1996. Also, the Reinvest in Minnesota program has provided 1.9 million dollars to be used for regenerating currently non-saleable stands of aspen. The increase in aspen harvest and regeneration efforts should eventually reverse the long-term trend toward too much mature aspen forest.

The total forest area in Minnesota has been declining since the 1940s causing reductions in the habitat base for all forest wildlife, including ruffed grouse. Between 1952 and 1977, forestland decreased from 19.3 to 16.6 million acres. The greatest loss has been in the transition zone due to urban and agricultural development. Large-scale losses are not expected in the northern forest unless mining dramatically expands. Total forest area is projected to decline to 13.6 million acres by 2030, with most of the loss on private lands.

The deterioration and loss of ruffed grouse habitat since the 1940s has apparently caused grouse populations to gradually decline. Statewide harvest figures from 1948 to 1985 suggest a long-term reduction in the harvest by about 5,000 birds per year (Figure 31-1).

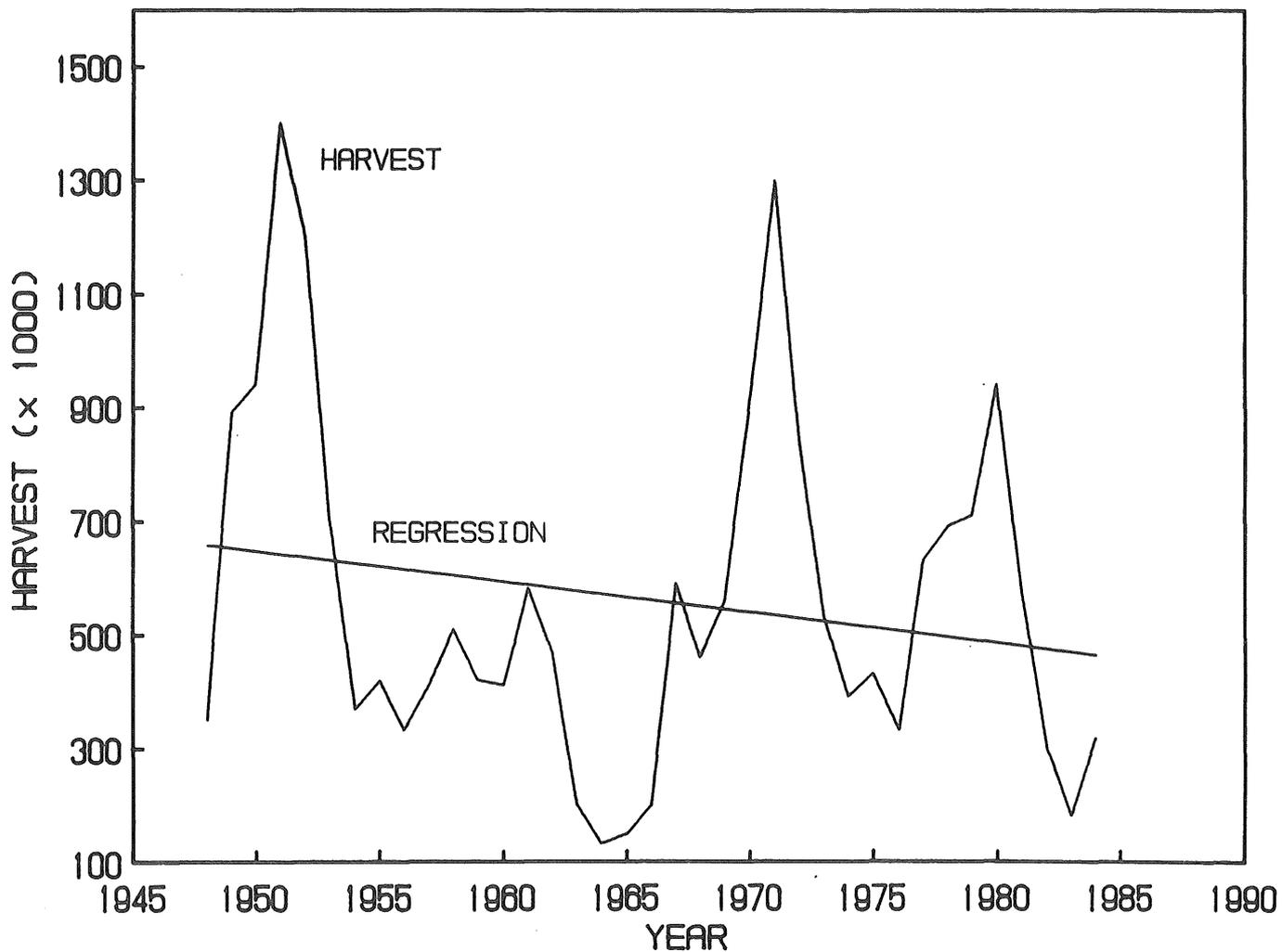


Figure 31-1. Ruffed grouse harvest and trends, 1948-1984.
 (Source: Minnesota Department of Natural Resources)

Management History

Management of ruffed grouse has focused on hunting regulations, population trend surveys, harvest surveys and research. Habitat management has involved coordination with forestry agencies and the development of demonstration projects.

Minnesota's first regulated hunting season for ruffed grouse was in 1858. That season was 7 months long with no restrictions on shooting hours or limits. Bag limits were first imposed in 1903, when the daily and possession limits were set at 25 and 50 birds respectively and the season length was reduced to 61 days. By 1920, the bag limit had been reduced to 5 birds daily and 10 in possession. Shooting times from sunrise to sunset were established in 1932.

Due to concern over periodic population lows, many adjustments were made in season lengths and bag limits from the 1920s thru the 1960s. The season was even closed 20 times between 1917 and 1947. Research eventually proved that hunting closures did not help grouse populations and they were discontinued. Grouse populations are controlled by habitat conditions and environmental factors, not hunting harvests. A standard season framework running from mid-September through December with limits of 5 daily and 10 in possession has been in effect since 1977 and is working well.

Ruffed grouse populations are monitored with spring drumming counts, which were initiated in 1949. This census involves recording the number of drumming grouse heard at 10 stops made along a specified vehicle route. The statewide average drums per stop has ranged from a high of 2.8 in 1952 to a low of 0.6 in 1964 (Figure 31-2).

Harvests are estimated using a mail survey of small game license buyers. The questionnaire provides information on success, effort and location of hunting.

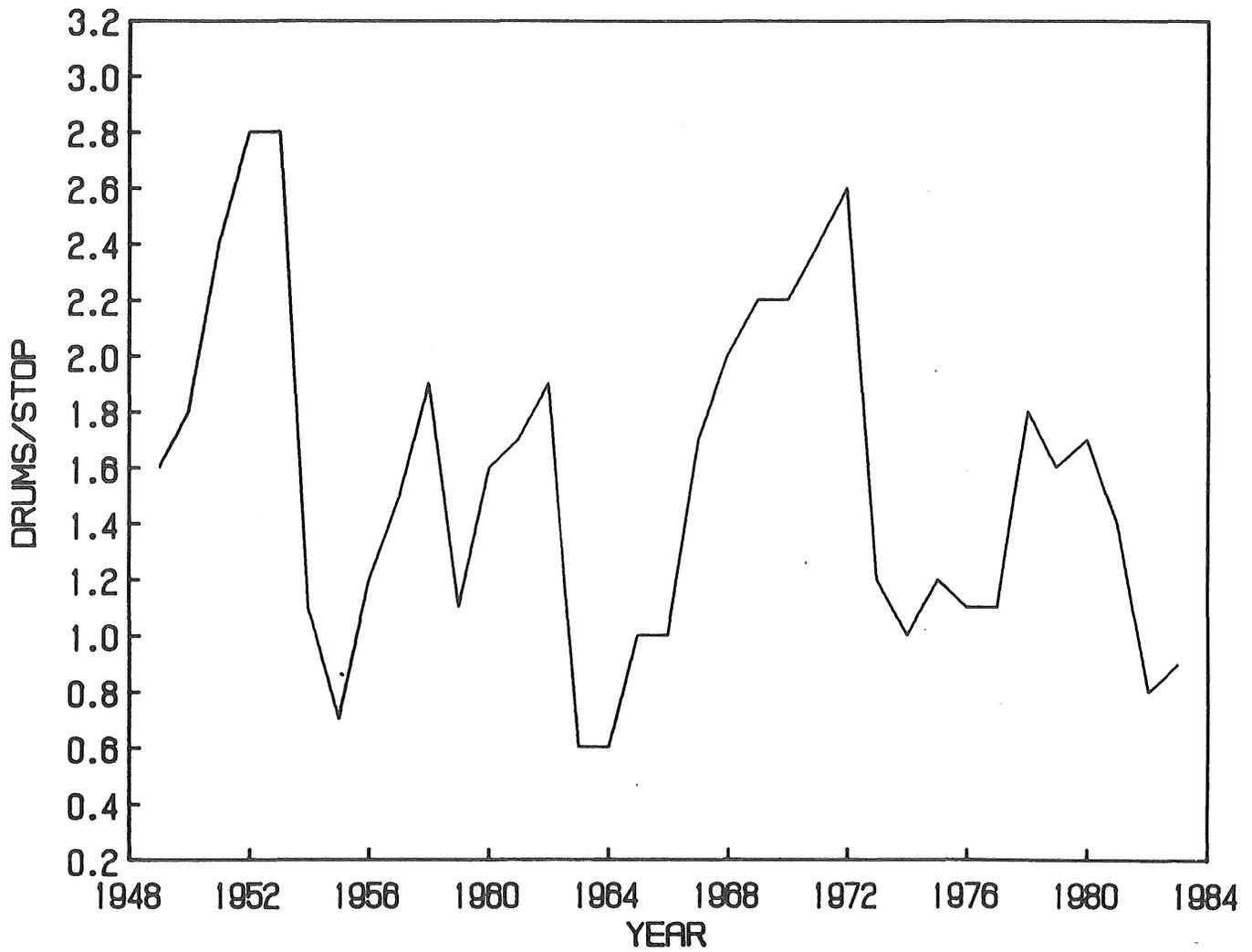


Figure 31-2. Annual ruffed grouse population index (Drums/Stop). (Source: Minnesota Department of Natural Resources)

Survey data has confirmed the cyclic nature of ruffed grouse populations with highs and lows occurring about 10 years apart. Harvest records indicate population lows in 1908, 1919, 1927-1928, 1937-1938, 1945-1946, 1954, 1964, 1974 and 1984. Highs were recorded in 1912, 1923, 1933, 1942, 1950-1951, 1960-1961, 1971-1972 and 1980. The next high is expected around 1990. Cyclic fluctuations have been most pronounced in northwestern Minnesota and least pronounced in southeastern Minnesota.

Research on ruffed grouse has been done primarily as a cooperative project between the Minnesota Department of Natural Resources and the University of Minnesota at the Cloquet Forest Research Center and the Mille Lacs Wildlife Management Area. This work began in 1931 with early studies conducted by Ralph T. King, Gustav Swanson and William H. Marshall. In 1958, an intensive research project on ruffed grouse was undertaken by Gordon W. Gullion of the University of Minnesota. This research continues today and has contributed greatly to our present understanding of population ecology, habitat requirements, management techniques and hunting pressure.

The main approach to managing ruffed grouse habitat has been coordination with state, county and federal forestry agencies. On Minnesota Department of Natural Resources administered lands, this process is facilitated by the Department's Wildlife Forestry Coordination Policy of 1982. This policy provides for the review of forestry projects by wildlife specialists to integrate forest and wildlife management. The Minnesota Department of Natural Resources has also developed the Forestry Wildlife Habitat Management Guidelines, which provide recommendations on the design and location of timber sales to benefit wildlife.

In general, recommendations for ruffed grouse are to maintain intolerant hardwoods on about two-thirds of a management area and to keep one-third of the hardwoods in the 0- to 25- year-age class. Cuts should be 5 to 20 acres

in size and well distributed to create a good interspersion of food and cover.

Grouse habitat improvements are resulting from forestry-wildlife management coordination. However, the economics and administration of commercial timber harvesting currently favor larger sales. Also, Minnesota Department of Natural Resources wildlife staffing is not adequate to maintain close coordination with the many foresters and forestry agencies engaged in commercial timber harvesting.

Direct habitat management for ruffed grouse has not been emphasized. No funds have been dedicated for the management of ruffed grouse habitat, primarily because grouse populations are maintaining themselves at huntable levels. Also, it is currently impractical to manage vast forestlands on a large scale.

Ruffed grouse habitat is indirectly benefited by the deer habitat improvement program. This program provides funding for the wildlife personnel (habitat specialists) who do most of the forestry coordination work, as well as funding for deer habitat projects like browse regenerations, wildlife openings and hunter walking trails that benefit grouse and grouse hunters.

Some direct habitat management has been done as demonstration or research projects. These usually involve a network of small cutovers connected by hunter walking trails seeded to clover. The most notable of these is at the Mille Lacs Lake Wildlife Management Area.

RESOURCE ANALYSIS

With 16.7 million acres of commercial forestland--53% of it publicly owned--Minnesota provides great opportunity for ruffed grouse hunting. Nationwide, Minnesota ranks among the top 4 states--with Wisconsin, Michigan and Pennsylvania--for ruffed grouse hunter numbers and harvest. Minnesota hunters harvest an average of 534,000 grouse annually. Peak harvests have exceeded 1.4 million birds.

Demand

The demand for ruffed grouse hunting fluctuates with the grouse population cycle. Annual small game license sales have been recorded since 1919 and have ranged from 71,382 in 1920 to 379,667 in 1958. These figures include all types of small game hunters. The number of ruffed grouse hunters has been estimated since 1976 using a mail survey of small game license holders. These figures have ranged from 76,000 hunters when the grouse population was low to 151,000 when it was high, with an annual average of 116,000 hunters from 1976 thru 1986.

Demand for ruffed grouse appreciation and use will probably increase as human population and leisure time grow. The state's population is projected to increase 9.5% between 1985 and 2000. However, the growth in population may be offset by concurrent shifts in age structure to more people in older age brackets, and an increase in the number of single parent families, which both result in a decline in hunter numbers. The most growth will occur in the urbanizing strip from Rochester to St. Cloud and in the northcentral lakes region. Increased demand for ruffed grouse hunting will be most noticeable in the transition zone forest and along the southern edges of the northern forest.

Grouse are underutilized in many areas of the state. Many hunters will not walk far from roads or trails and thus remote forest areas receive limited hunting pressure. It may be possible to better utilize the ruffed grouse resource by providing hunters with information about underhunted areas.

Estimates of non-consumptive use of ruffed grouse are not available; however, bird watching and nature study remain popular recreational activities. Visitors to Minnesota forests can enjoy viewing ruffed grouse throughout the year and listen to their unique drumming rituals each spring.

Some forest areas with good access are becoming overcrowded. This problem has greatly increased with the growing popularity of all-terrain vehicles. The new all-terrain vehicles provide quick and easy access to any forest lands that have roads or trails. This is resulting in overcrowding, conflicts between walking and riding hunters, more illegal shooting from motorized vehicles and a degradation of the ruffed grouse hunting and viewing experience. More restrictions on the use of all-terrain vehicles may be necessary to maintain quality ruffed grouse hunting and viewing in popular areas.

Supply

To produce an adequate supply of ruffed grouse, management efforts need to focus upon preventing the conversion of forestland to non-forest uses, promoting the establishment of intolerant hardwoods on suitable non-forested lands and on reforestation sites, maintaining aspen and other forest types important to grouse, and increasing the age class diversity within stands of intolerant hardwoods.

More intensive management of remaining forestlands can maintain or increase the long-term supply of ruffed grouse. Large tracts of mature aspen support only 1 or 2 pairs of breeding grouse and may have no grouse if they lack alder swales or lowland edges, which provide cover in mature stands. Aspen stands cut in 20 to 40 acre blocks, which are typical of public forests being managed for timber production, should support 4 to 6 pairs per 100 acres. In contrast, aspen stands cut in a well-dispersed pattern of 10 acre or smaller cuts can support 8 to 12 pairs per 100 acres. Thus, with intensive ruffed grouse management, it is quite possible to more than double grouse numbers on some areas. However, other management considerations might make such intensive grouse management impractical on a wide scale.

RESOURCE VALUE

In 1971, Pennsylvania hunters harvested an estimated 355,400 ruffed grouse. The total value of this harvest was estimated at \$2,768,566, or \$7.79 per bird. Based on this last figure, the value of Minnesota's 1971 ruffed grouse harvest of 1,297,000 birds would have been \$10,103,630. More recent 1979 Minnesota data suggests a fair replacement value for a ruffed grouse is \$20. Based on this figure, the value of Minnesota's 1979 ruffed grouse harvest of 736,000 birds was \$14,720,000.

Long range planning for ruffed grouse

SERVICE: Conservation of ruffed grouse populations for their intrinsic and ecological values.

PRODUCT: Opportunities for appreciation and use of ruffed grouse.

GOAL: Manage ruffed grouse populations to provide maximum recreational opportunities.

OBJECTIVE 1. Maintain ruffed grouse hunting recreation that provides an average annual harvest of 550,000* through 1992 distributed (Figure 31-13) as follows:

<u>Grouse zone</u>	<u>Harvest objective</u>
Northeast	192,000
Northern	246,000
Northwest	34,000
Central hardwoods	56,000
Southeast	22,000
Totals	550,000

*Based on 20-year average of harvests for 1962-1981. This objective will be evaluated on 20-year average of harvests for 1972-1991.

PROBLEM 1. Long-term population levels necessary to sustain hunting recreation may be adversely affected by loss of forest land and changes in habitat quality and quantity.

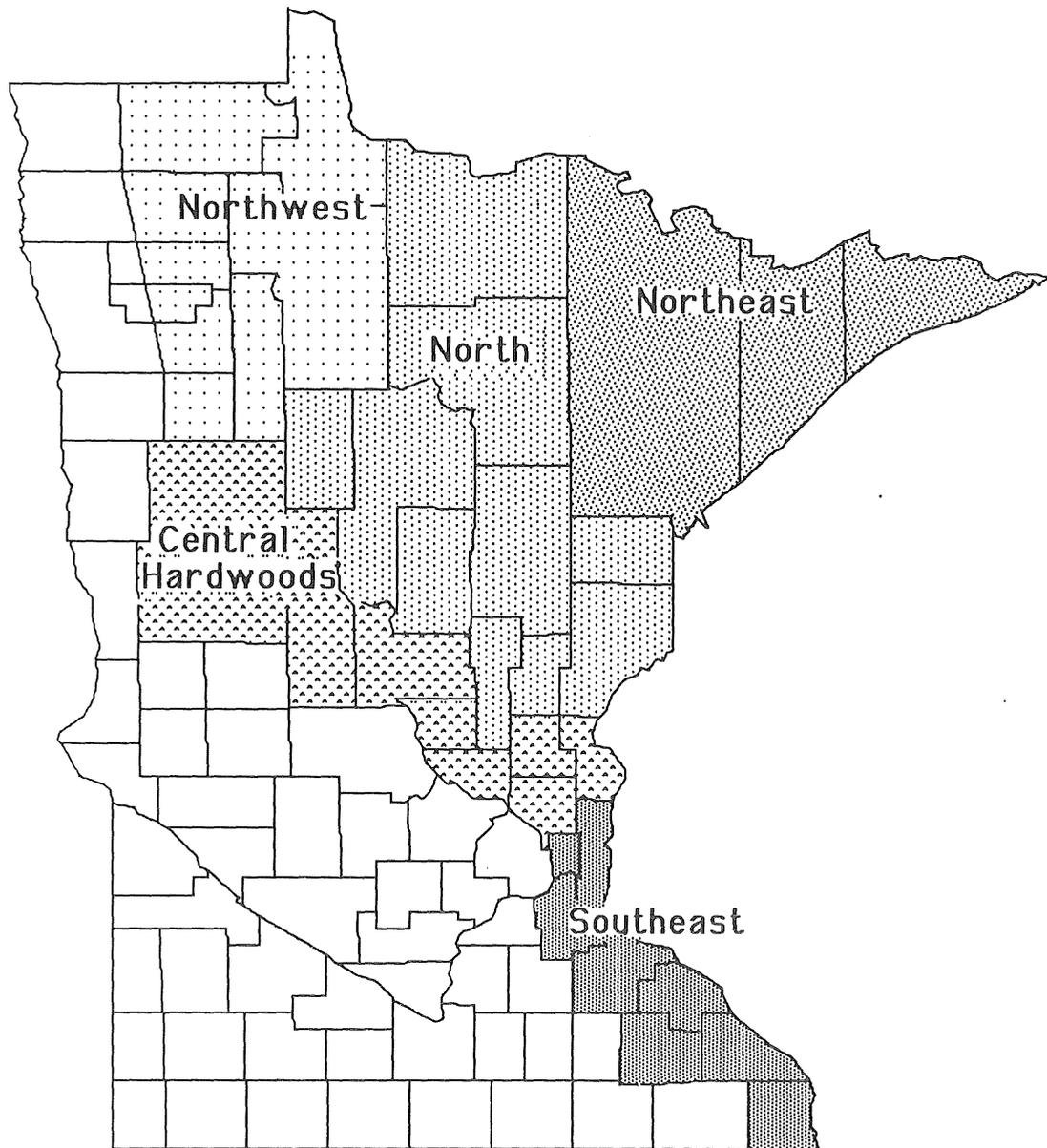


Figure 31-3. Ruffed grouse zones in Minnesota.

STRATEGY A. Improve coordination between public and private forest land managers.

STRATEGY B. Enhance habitat management on private forest lands through expanded Minnesota Department of Natural Resources private land management programs.

STRATEGY C. Develop additional intensive ruffed grouse management and demonstration areas.

STRATEGY D. Provide management and economic information to the public.

STRATEGY E. Strengthen the environmental review and mitigation processes.

PROBLEM 2. Lack of information reduces management effectiveness.

STRATEGY A. Expand research on ruffed grouse ecology, including the effects of harvest, harvest techniques, season length and season timing on populations.

STRATEGY B. Determine economic and recreational values of ruffed grouse populations.

STRATEGY C. Evaluate whether suitable ruffed grouse habitat--devoid of birds--exists outside the primary range and investigate the feasibility of reintroduction.

PROBLEM 3. Hunting pressure is unevenly distributed and may reduce the quality of recreation.

STRATEGY A. Develop and implement a statewide hunter pressure survey.

STRATEGY B. Provide ruffed grouse distribution and hunting pressure information to the public.

STRATEGY C. Redistribute hunters by adjusting harvest regulations.

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Thank you for taking the time to review the plan and providing your comments.

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32. Sharp-tailed Grouse

The sharp-tailed grouse (Pedioetes phasianellus) is indigenous to Minnesota. All Minnesota sharptails likely belong to the prairie subspecies campestris, which also inhabits northern Wisconsin, northern Michigan, northwestern Ontario and southern Manitoba. The subspecies campestris prefers brushland, savanna and boreal peatland habitats dominated by large expanses of grasslands and having a paucity of non-deciduous conifer stands.

Male sharp-tailed grouse perform courtship displays on leks, also known as dancing grounds, consisting of open, often slightly elevated sites. Each spring as many as 35 males establish individual territories on the leks. By foot stomping, tail feather rattling, and sounds of gurgling, hooting and cackling, males compete for the attention of females that gather near the periphery of the ground. Displays are most intense on clear spring mornings, but they occur to a lesser degree in the fall. Leks are the nucleus around which sharptails live and lek locations are traditional unless the habitat becomes unsuitable.

Hens may choose nest sites in grassy or brushy habitats. Chicks hatch in May and June and initially feed almost exclusively on insects. As they mature, their diets include the leaves, fruits and buds of a wide range of deciduous trees, shrubs and forbs. Agricultural grains, when available, are important to fall and winter diets; however, sharptail populations thrive in the absence of agriculture.

Before European settlers arrived, sharptails probably were distributed over the entire state, but occupied only portions of Minnesota at any one time. They were, however, permanent residents of the open bogs associated with the major glacial lake beds and the fire-maintained grasslands and savannas of central and southern Minnesota.

Within the last 100 years, sharp-tailed grouse have occupied most of the state. With the north and westward settlement and gradually intensifying agriculture, some of the destroyed sharptail habitat was temporarily occupied by greater prairie chickens. However, extensive agriculture also destroyed the prairie chicken habitat and distribution of prairie chickens became restricted to remnant areas of unbroken grassland in westcentral Minnesota.

When European settlement reached the northern forest, large areas had been opened by logging. Sharptails, along with other species preferring open habitats, responded to the creation of vast new habitat.

The end of the homestead era in the late 1930s, together with fire prevention and suppression, enabled the plant communities found in natural grass-brushlands, homestead fields, clearings and cutover areas to advance successionaly. Intensifying agriculture, stagnating brushlands and aging forests have caused the present day habitat dilemma of the once abundant sharptail.

RESOURCE MANAGEMENT

Sharptails currently occupy less than one-third of their former statewide range. Within this area, most birds occur in 2 disjunct ranges in northwestern and east-central Minnesota with viable populations (Figure 32-1). The primary habitats are large open grass-brushlands dominated by willows and other shrubs, often interspersed with agriculture. Populations also occur in the large open peatlands of the northern forest, which have a comparatively

slower rate of vegetational succession and on taconite tailings basins on the Mesabi iron range.

As recently as the mid-1970s, the sharptail was Minnesota's third-ranked non-migratory upland game bird in the harvest, next to ruffed grouse and the ring-necked pheasant. Today, sharptail harvests are surpassed by gray partridge and spruce grouse. Without specific and accelerated management, the lowland and upland transition grass-brushland habitat will decline in quality and quantity. Sharptails inhabiting the large open peatlands are slightly more secure; however, their habitat is threatened in some areas by conversion to lowland conifer plantations and commercial wild rice developments. If large-scale peat extraction becomes economically feasible, it would also pose a threat to sharptail habitat.

Population Survey Techniques

Sharptail population surveys have been limited and varied in Minnesota. In 1941, experimental roadside census routes were established in 17 northern counties; these continued in the east-central range in 1944 and in the northwest until 1960. Mail carrier surveys were used from 1959 to 1962 to identify sharptail range, but plans in 1962 for a comprehensive rangewide grouse inventory were never implemented. From 1964 to 1975, population trends were based solely on surveys conducted in two study townships in the northwest.

The present survey evolved from methods pioneered in the northwestern Minnesota studies and efforts in North Dakota and Saskatchewan. Since 1976, displaying males have been counted in the spring by Minnesota Department of Natural Resources personnel and other cooperators along 17 routes in 13 northern counties across the sharptail's primary range.

Regulations Management

In the early 1950s and 1960s, season length, opening dates and bag limits were often adjusted according to sharptail abundance. Before 1971, seasons opened in late September or early October and lasted 2 to 5 weeks. Since 1972, seasons have opened in mid-September and lasted through November. Limits of 3 daily and 6 in possession have been allowed since 1974. Since 1972, sharptail hunting has been open statewide except for the westcentral prairie chicken range.

Habitat Management

Very little habitat was managed specifically for sharp-tailed grouse before the mid-1960s. In the northwest, management consisted of providing food plots and increasing habitat diversity through rotational livestock grazing. No management occurred in the eastcentral range. In both ranges, considerable accidental habitat management occurred through wildfires, which maintained the grassland and brushland components of the sharptails range.

Because the grass-brushland habitat is diminishing from land use conflicts and vegetational succession, current management is geared toward reversing successional trends and preserving habitat. Prescribed burning of noncommercial and nonforested grass-brushlands is conducted, but inadequate funds, equipment and trained personnel limit its full application. Operational Order No. 47, as revised in 1985, may increase prescribed burning by encouraging more training and use of specialized burn teams. The Reinvest in Minnesota Resources Act has provided prescribed burning funds.

Mechanical shearing and, to a lesser extent, hand cutting and herbicide treatment, are used to rejuvenate grass-brushlands where burning is not feasible. Rotational grazing, if livestock densities are limited, can also

control succession. To enhance existing habitat and improve sharptail survival in winter, food plots, usually small grains and legumes, may either be farmed by the Minnesota Department of Natural Resources or sharecropped with Wildlife Habitat Improvement Program monies.

Resolution of conflicting resource management issues is vital. Because of the sharptail's intolerance of conifers, plantings of pine and spruce should be discouraged in habitat complexes containing sharptails or having a recent history--within 20 years--of their presence. Minnesota Department of Natural Resources Private Forest Management and Agricultural Conservation Program practices should discourage tree or shrub planting on private land where sharptails occur. Where vegetation cover is required, such as under the 1985 Conservation Reserve Program administered by the U.S. Department of Agriculture, grasses and legumes, and shrub species favorable to sharptails, such as willow, wild rose and mountain ash, may be planted through cost-share programs while still maintaining an open habitat component. Retention of existing public lands in the sharptail range is crucial for maintaining the potential for managing the existing lands.

RESOURCE ANALYSIS

The roadside surveys in the 1940s failed to document population trends. Surveys in the northwest from 1964 to 1980 depicted fluctuating populations, but no discernible population trend was evident despite a 70% reduction in the number of dancing grounds. During the late 1970s, good populations persisted despite land clearing, probably due to the dry springs, high chick survival and habitat rejuvenated by the 1975-76 wildfire season.

The rangewide population declined 12% from 1981 to 1982, 22% from 1982 to 1983, 23% from 1983 to 1984, 20% from 1984 to 1985 and 10% from 1985 to 1986. Forty-two % of the dancing grounds active in 1984 were inactive in 1985.

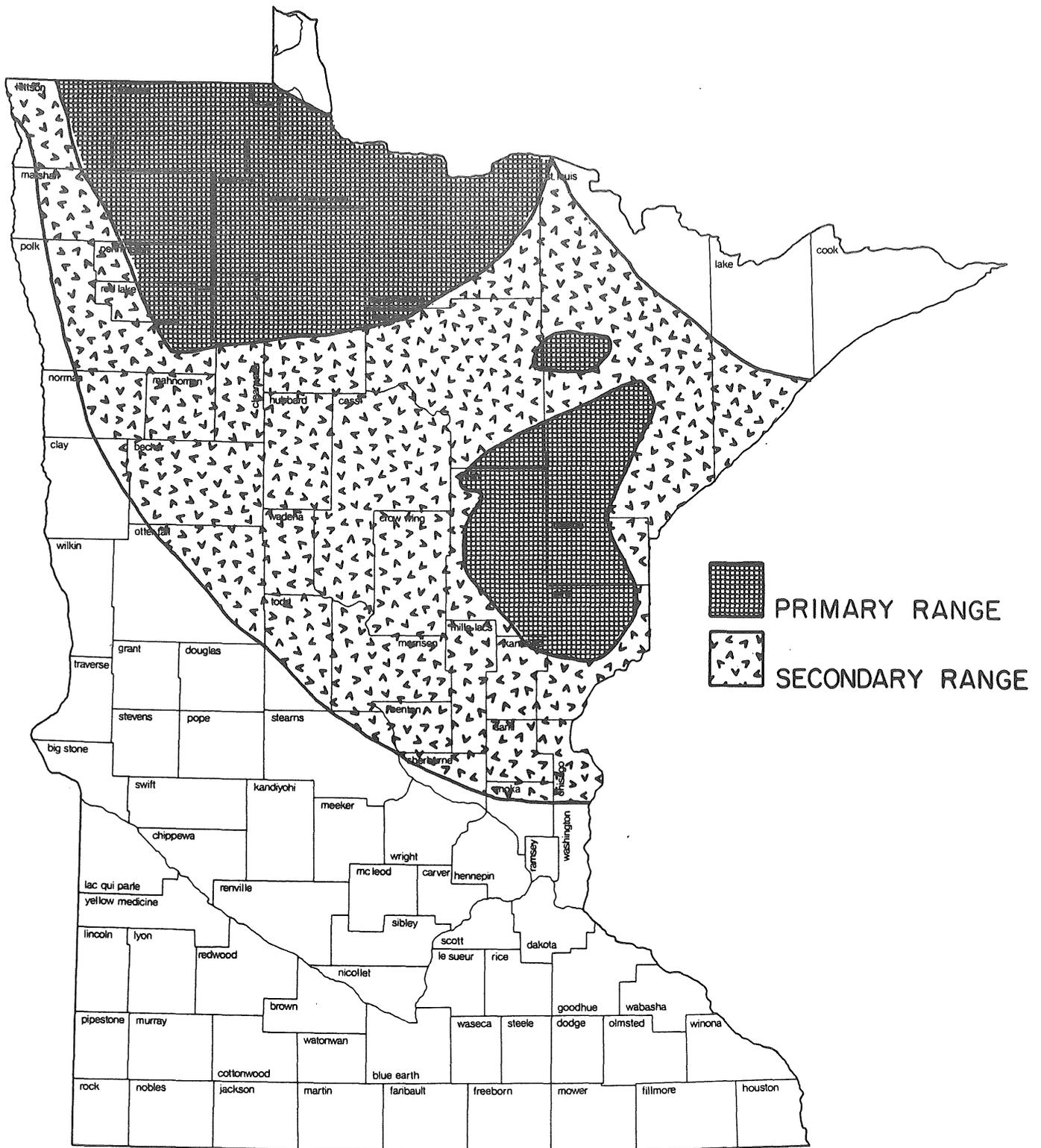


Figure 32-1. Sharp-tailed grouse range in Minnesota. Sharptails occur in scattered populations throughout much of the primary range and in very widely scattered areas of the secondary range. (Source: Minnesota Department of Natural Resources)

The decline in the quantity and quality of sharptail habitat is documented in reports dating back to the early 1950s. These reports referred to the habitat problems as conversion to agriculture, advancing vegetational succession and conversion to conifer plantations. A land-use study from 1963 to 1981 in 2 townships predicted that with existing land use trends, all wildlife habitat, mostly sharptail habitat, in one township, and 60% in another, would be lost by 1992.

Supply

No effort has been made to estimate the total sharptail population, but harvest data are representative of long-term population trends. Sharptail hunter harvest data before 1943 is clouded by combined prairie chicken and sharptail totals. However, the trend in birds harvested since 1949, when 150,000 sharptails were taken, is unmistakably downward (Figure 32-2). Average annual harvests for 10-year periods ending in 1954 and 1964, respectively, were 86,000 and 42,000. In the 2 most recent 10-year periods, harvests were 21,000 and 27,000, respectively. Sharptail harvests declined 76% from 1981 to 1986, and approximately 5,000-7,000 were taken annually from 1983 to 1987. The declining sharptail population, as documented by harvest and survey data, is indicative of the declining open grass-brushlands habitat base.

Approximately two-thirds of the total harvest occurs in the northwest, and the remainder in the eastcentral range (Figure 32-1). Sharptail hunters comprise 2 to 3% of small game hunters when birds are few, and more than 7% when abundant. An average of 5 hunter hours is expended per bird killed, and 0.9 sharptails are taken per hunter day. Fifty % of sharptail hunters use dogs, these hunters flush and retrieve about 50% more sharptails than hunters without dogs.

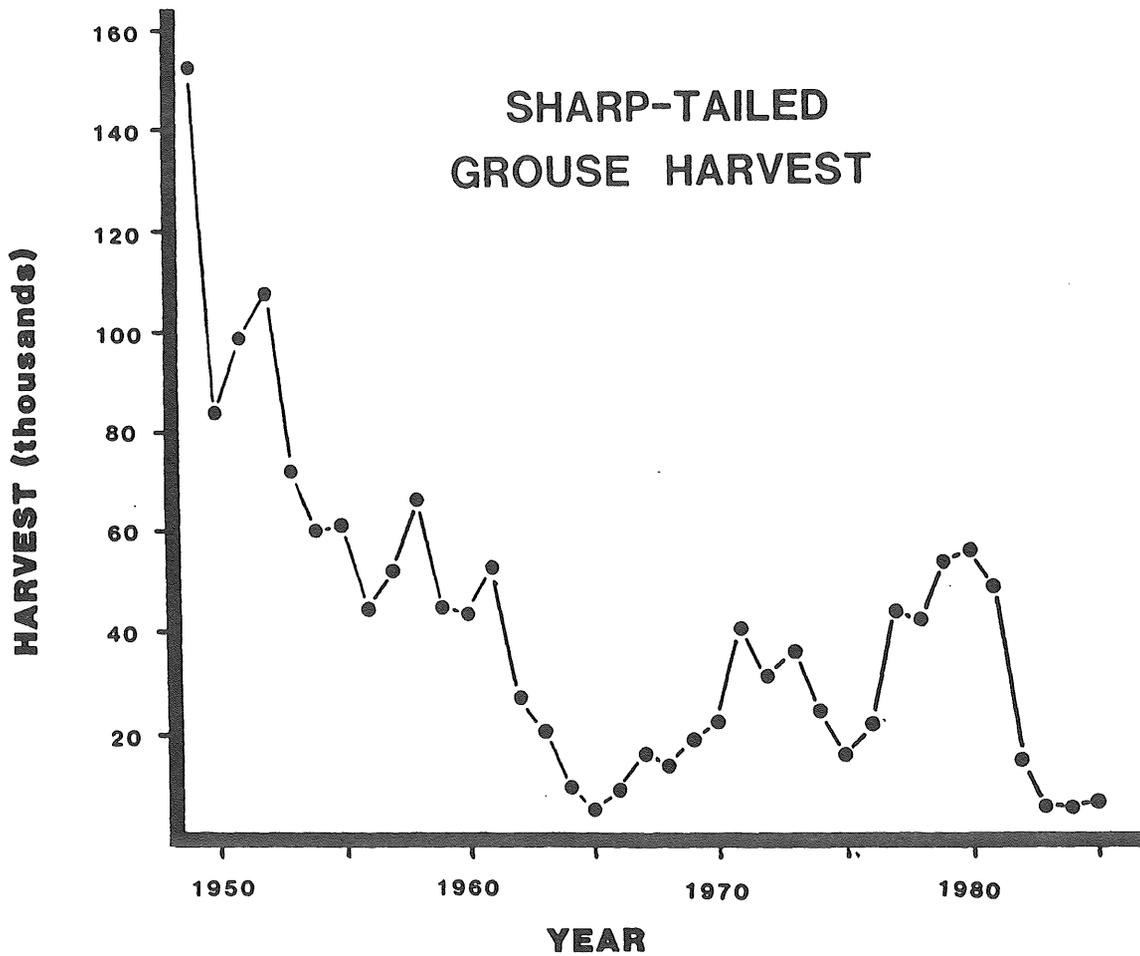


Figure 31-2. Sharp-tailed grouse harvests in Minnesota, 1949-1984. (Source: Minnesota Department of Natural Resources)

Demand

As sharptail habitat and populations have declined, so has the number of sharp-tailed grouse hunters. However, it seems reasonable to assume there is a strong latent demand for sharptail hunting, because the actual demand for upland game bird hunting remains strong. Since 1940, total small game license sales have remained relatively stable, with an average of 302,000 and range of 184,000 to 377,000. The proportion of sharp-tailed grouse hunters has decreased from 10 to 12% in 1940 to about 2 to 7% in the 1980s.

The vivid sharptail courtship displays throughout the spring provide enjoyment for nature viewers, photographers, artists and others, as evidenced by the popular tourist attraction of displaying prairie chickens in Wisconsin and westcentral Minnesota. No estimate is available on the extent of nonconsumptive sharptail use in Minnesota; however, bird enthusiasts regularly view and photograph sharptails from blinds on dancing grounds.

Trends

Without extensive management efforts, Minnesota's sharptail population will continue its long-term downward trend. As a result, the sharp-tailed grouse and its associated grass-brushland ecosystem, will exist as scattered remnant populations, as has already occurred in Michigan and Wisconsin. Presently, both states harvest less than 1,000 sharptails annually, and maintain only remnant populations. There is no imminent threat that the Lake States-Central Province sharptail will become extinct; however, it may occur only as localized, disjunct populations. The sharptail is not an artifact species of one point in time in Minnesota; it is an indigenous species that plays an important part in Minnesota's wildlife heritage.

Sharptail populations do not exhibit clean 10-year cycles like ruffed grouse. However, somewhat bisynchronous population trends suggest that sharptail populations may rise very slightly over the next 6 years. However, without extensive management, these populations will decrease over the long term and may cease to provide an annual harvestable surplus.

The downward trend in the agricultural economy in the 1980s provides opportunity to convert marginal farmland to wildlife habitat. As a result of the Conservation Reserve Program and provisions of the 1985 Food Security Act, many thousands of acres of marginal and highly erodible cropland have been restored to grasslands. This is particularly evident in the northwestern sharptail range. Because the Conservation Reserve Program contracts retire croplands for a period of 10 years, this trend will provide only a short-term boost to sharptail grouse populations.

The potential for conifer plantings on the Conservation Reserve Program acres may limit the habitat gains of this program. In addition to the Conservation Reserve Program creating new habitat, the sodbuster provisions in the Food Security Act are slowly preventing the conversion of grassland and brushlands on highly erodible lands to cropland. Although the commercial wild rice industry is also presently subdued, the trend is toward expanded sale and lease of state lands for rice paddy development.

The trend toward advanced succession is unending, but may be measurably slowed through habitat management by burning, shearing, or chemically treating decadent brushland vegetation. The key to this management and resolving conflicts such as conifer planting in sharptail habitat, is Minnesota Department of Natural Resources Forestry and Wildlife cooperation through policies and agreements.

The Minnesota Sharp-tailed Grouse Society, dedicated to

the preservation and management of sharptails and their habitat, was formed in 1986. It plans to use political and educational processes to publicize the bird's demise, secure funds for management, advertise the economic benefits of sharptails to the rural economy, create renewed interest in sharptails and promote nonconsumptive uses of sharptails.

RESOURCE VALUE

The decline of sharptails and associated habitats in recent years has caused a corresponding decrease in hunters. Presently, the prospects of a satisfying and successful sharptail hunting trip are relatively slim, causing hunters who hunt sharptails to change to other recreational pursuits. As recently as 1980, most motels in the northwestern sharptail range were filled with opening weekend sharptail hunters, but this no longer occurs.

There is little data on the economic value of sharptail hunting and viewing sharptail or the value of related habitats. Each sharptail in the hunter's bag is valued at \$40. With mid-1980s harvest levels of 5,000 to 7,000 sharptails annually, the direct value of sharptail hunting approximates \$2 to 3 million annually. A harvest of 50,000 sharptails would stimulate a \$2 million expenditure, mostly spent in northern Minnesota.

Expenditures to view and photograph sharptails have not been estimated; however, in certain areas nonhunting sharptail use is substantial. For example, the Grantsburg, Wisconsin and Rothsay, Minnesota areas are visited by numerous sharptail and prairie chicken viewers each spring.

No data exists regarding the economic value of lowland and upland sharp-tailed grouse habitat. This type of habitat, besides being a primary habitat for sharptails, deer, moose and other game and nongame species, is valuable for decreasing run-off, providing flood control, reducing soil erosion and recharging ground water supplies. The

overall economic importance of sharptail must include direct expenditures by hunters and wildlife viewers, indirect benefits to local economies from these expenditures and economic and ecological values of the grass-brushland habitats.

Uniqueness

The sharp-tailed grouse is the primary upland game bird of the northern open grass-brushland ecosystem, which includes a variety of open habitats at the lower end of the successional spectrum. The sharptail is to the northern open habitats what the pheasant is to the southern Minnesota agricultural habitats. Because sharptail population fluctuations can be monitored with relative ease, the sharptail serves as a prime indicator species of grass-brushland distribution, abundance and quality.

Long range planning for sharp-tailed grouse

SERVICE: Conservation of sharp-tailed grouse populations for their intrinsic and ecological values.

PRODUCT: Opportunities for appreciation and use of sharp-tailed grouse.

GOAL: Reverse the decline in sharp-tailed grouse numbers and increase the population to a level capable of meeting recreational objectives.

OBJECTIVE 1. By 1992, provide 20,000 hunters with the opportunity to harvest 40,000 sharp-tailed grouse annually, distributed as follows:

Region	Percent of harvest	Harvest
1 Northwest	60%	24,000
2 Northeast	30%	12,000
3 Central	10%	4,000
Totals	100%	40,000

PROBLEM 1. The habitat necessary to produce and maintain a sharptail population capable of sustaining the harvest objective is being lost through plant succession, conflicting agricultural practices and conversion to conifers.

STRATEGY A. Provide preferred habitat on public and private lands primarily through increased prescribed burning, as well as mechanical and chemical treatment.

STRATEGY B. Designate suitable undedicated Minnesota Department of Natural Resources administered, state-owned lands as Wildlife Management Areas.

STRATEGY C. Retain public lands and regulate public land leasing to ensure habitat protection.

STRATEGY D. Acquire open grass-brushland habitats.

STRATEGY E. Provide technical and financial assistance for private land management, through Minnesota Department of Natural Resources Wildlife and Private Forestry Management Lands Programs.

STRATEGY F. Promote agriculture programs that provide habitat, such as the Conservation Reserve Program and the Reinvest in Minnesota Program.

STRATEGY G. Educate land management professionals on sharptail habitat needs and encourage compliance with the Forestry Wildlife Habitat Management Guidelines.

STRATEGY H. Establish sharp-tailed grouse management units through the Minnesota Department of Natural Resources Forest Area Unit Planning process.

STRATEGY I. Support and seek legislation that will enable the Minnesota Department of Natural Resources to assist private landowners with prescribed burns.

STRATEGY J. Strengthen the environmental review and mitigation process.

PROBLEM 2. Limitations in some information reduce management effectiveness and public awareness.

STRATEGY A. Locate and document existing habitat.

STRATEGY B. Develop and implement techniques to identify potential habitat.

STRATEGY C. Develop and implement a range-wide population survey system.

STRATEGY D. Investigate economic and recreational values, and provide information to the public on the need for sharptail management.

STRATEGY E. Investigate the effectiveness and feasibility of reintroducing sharptails in areas with suitable habitat but no current population.

PROBLEM 3. There is a decline in the number of sharptail hunters.

STRATEGY A. Promote sharptail hunting and provide the public with information on population trends and distribution.

STRATEGY B. Provide local business communities with information on the economic and recreational values of sharptails.

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MINNESOTA DEPARTMENT OF NATURAL RESOURCES
Division of Fish and Wildlife
500 Lafayette Road
St. Paul MN 55155-4025

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Comments: _____

Your name: _____

Address: _____

Are these the official comments of an organization? Yes No

Organization: _____

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33. Spruce Grouse

The spruce grouse (Dendragapus canadensis) is indigenous to the coniferous forests of northern Minnesota and ranges as far south as Wadena and Mille Lacs counties. It is one of the forest grouse species that inhabit the transcontinental band of boreal forests. Spruce grouse occur in bog forests of Minnesota characterized by black spruce and tamarac, as well as in jack pine stands and in jack pine-balsam fir or white spruce stands.

RESOURCE MANAGEMENT

Early reports indicate spruce grouse were common throughout Minnesota's northern forests until the late 1800s. However, widespread habitat changes from logging, fires and land clearing caused a rapid decline in their numbers. The young forests of aspen and birch that quickly replaced the conifers were better suited for ruffed and sharp-tailed grouse than for spruce grouse. Along with habitat changes, hunting pressure increased significantly as immigrants and homesteaders moved into the northern part of the state. The birds' lack of wariness and general indifference to people made them easy targets for subsistence hunters.

The combination of habitat destruction and hunting pressure nearly caused the species to become extirpated in the 1920s. Public concern over the declining population caused the Department of Conservation to close the

season in 1923. The season was not reopened until 1969, 45 years later.

During those years, subtle but profound changes were taking place in Minnesota's northern forests. Many aspen-birch forests matured and were replaced by spruce and fir. Jack pine, a species whose reproduction is favored by fires, became the dominant tree species on many upland sites. Burned-over lowland conifer sites regenerated naturally. This habitat changing process was aided by increasingly aggressive and effective forest fire control. At the same time, many small farms and homesteads were abandoned and reverted to forest. These widespread habitat changes favored the increase in spruce grouse populations.

During the 1950s and 1960s it became increasingly evident, judging from spruce grouse sightings and the number of birds mistakenly harvested by ruffed grouse hunters, that complete protection was no longer necessary or desirable. In 1969 the hunting season for spruce grouse was reopened. The spruce grouse season is now concurrent with the ruffed grouse season and the bag and possession limits of the 2 species are in aggregate.

RESOURCE ANALYSIS

Most spruce grouse are harvested incidentally by ruffed grouse hunters. Consequently, the spruce grouse harvest fluctuates directly with the ruffed grouse harvest and probably bears little, if any, relationship to spruce grouse abundance. The spruce grouse harvest from 1976 to 1984 ranged from 10,000 to 34,000, 3 to 6% of the annual combined ruffed and spruce grouse harvest (Table 33-1).

Adequate techniques to survey spruce grouse populations have not been developed but are needed for proper management of the species in Minnesota. Several studies indicate good habitat typically supports spring population densities of 12

Table 33-1. Estimated spruce grouse and ruffed grouse harvests 1976-1984.*

	Year								
	1976	1977	1978	1979	1980	1981	1982	1983	1984
Spruce grouse harvest (1,000s)	14	27	20	27	34	24	14	10	21
Ruffed grouse harvest (1,000s)	332	630	692	709	941	576	302	183	320
Total (1,000s)	346	657	712	736	975	600	316	193	341
% spruce grouse harvest is of the combined ruffed grouse-spruce grouse harvest	4%	4%	3%	4%	4%	4%	4%	5%	6%

* Estimates based on hunter questionnaire responses.

Source: Minnesota Department of Natural Resources

to 24 birds per square mile. However, nowhere in their range do spruce grouse attain spring densities of 80 or more birds per square mile, as reported for ruffed grouse.

A standardized method for assessing spruce grouse habitat suitability does not exist. The statewide habitat base may be increasing from continuing forest maturation, aided by wildfire suppression, conifer reforestation and depressed lowland conifer and jack pine markets.

Presently, the spruce grouse supply probably exceeds demand for consumptive and nonconsumptive users. Improving the public knowledge of habitat preference and behavior would help people better utilize the spruce grouse resource.

RESOURCE VALUE

Spruce grouse are noted for their tame and trusting nature, which makes them excellent subjects for photographers, birdwatchers and other nonconsumptive users. With proper promotion and public education, these nonconsumptive values could surpass the value of the species as a game bird.

From a hunting perspective, this same behavior renders the bird rather unsporting quarry. A largely undeserved reputation for poor palatability, their occurrence in difficult-to-hunt habitat and a general lack of knowledge of the species further discourage hunters. There is a growing trophy demand for the exquisitely plumed males, which should be encouraged and promoted.

Long range planning for spruce grouse

PRODUCT: Spruce grouse for their ecological value and opportunities for use and appreciation.

GOAL: Manage spruce grouse for their recreational, economic, cultural and ecological value.

OBJECTIVE 1. Maintain spruce grouse populations capable of sustaining an average annual harvest of 25,000 birds through 1992.

PROBLEM 1. The limitations of some information reduce management effectiveness.

STRATEGY A. Develop and implement effective population census techniques.

STRATEGY B. Develop and implement a hunter pressure survey and improve the harvest survey.

STRATEGY C. Develop and implement habitat evaluation techniques and habitat management guidelines.

OBJECTIVE 2. Expand opportunities for other recreational uses of spruce grouse by 1992.

PROBLEM 1. People may be unaware of recreational opportunities.

STRATEGY A. Provide information to the public on recreational opportunities.

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34. Wild Turkey

The eastern wild turkey (Meleagris gallopavo silvestris) is the largest American game bird. Its size, senses; especially sight and hearing and displays of gobbling and strutting make it a challenging game bird. Adult toms average 22 pounds and juvenile males about 15. Hens are somewhat lighter.

RESOURCE MANAGEMENT

Wild turkeys occurred in limited numbers in southern Minnesota, but were gone by 1900. The Minnesota Conservation Department first attempted to reestablish wild turkey populations by releasing 250 pen-reared birds in 1926, but this and subsequent releases of pen-reared turkeys failed.

Other states became successful in establishing turkey populations by trapping wild birds and transplanting them into suitable habitat. Their success prompted Minnesota to release 39 wild-trapped turkeys from Nebraska, South Dakota and Arkansas from 1964 to 1968 in Winona County and 29 wild turkeys from Missouri from 1971 to 1973 in Houston County. Expansion of these nucleus populations and other trap and transplant efforts by the Minnesota Department of Natural Resources, spread the turkeys throughout much of southeastern Minnesota.

Population increases enabled spring gobbler hunting to begin in 1978. The Minnesota wild turkey population was

later estimated at 4,000 birds in the spring of 1986, a result of the original 68 wild-trapped birds. Hunttable turkey populations currently exist in about 1,400 square miles of southeastern Minnesota (Figure 34-1). An additional 900 square miles had substantial hunttable populations into the early 1980s, but the populations decreased dramatically. The decrease probably resulted from a combination of factors relating to the genetic makeup of the birds. That area is being restocked with birds from Houston County.

Wild turkeys do quite well in agricultural areas that are less than 25% forested. In Minnesota, there are perhaps 5,000 square miles of potential turkey range (Figure 34-1). Existing and potential range could eventually have a population of 10,000 birds. To achieve the 10,000 bird objective by 1992, an accelerated program of trapping and transplanting would need to be implemented, which would mandate substantial funding increases. In Minnesota, it usually takes 5 to 6 years after transplanting before areas can be opened to hunting.

Wild turkey management and research involves about \$45,000 a year of wildlife funds and \$20,000 a year from the Minnesota Chapter of the National Wild Turkey Federation. Activities include setting hunting regulations; limited trapping and transplanting of birds to new areas; securing food plots; monitoring mortality, productivity and range expansion; and limited research.

The wild turkey program in the 1980s has focused on transplanting birds trapped in southeastern Minnesota or received in trade from other states. Minnesota's Wild Turkey Management Plan developed in 1983 identifies more than a third of the state as a potential release area. Because of limited funding, however, progress has been slow.

The existing program provides 2 to 4 transplants in an average year by 1 trapping crew, which would require perhaps 20 years to have transplants in all suitable areas.

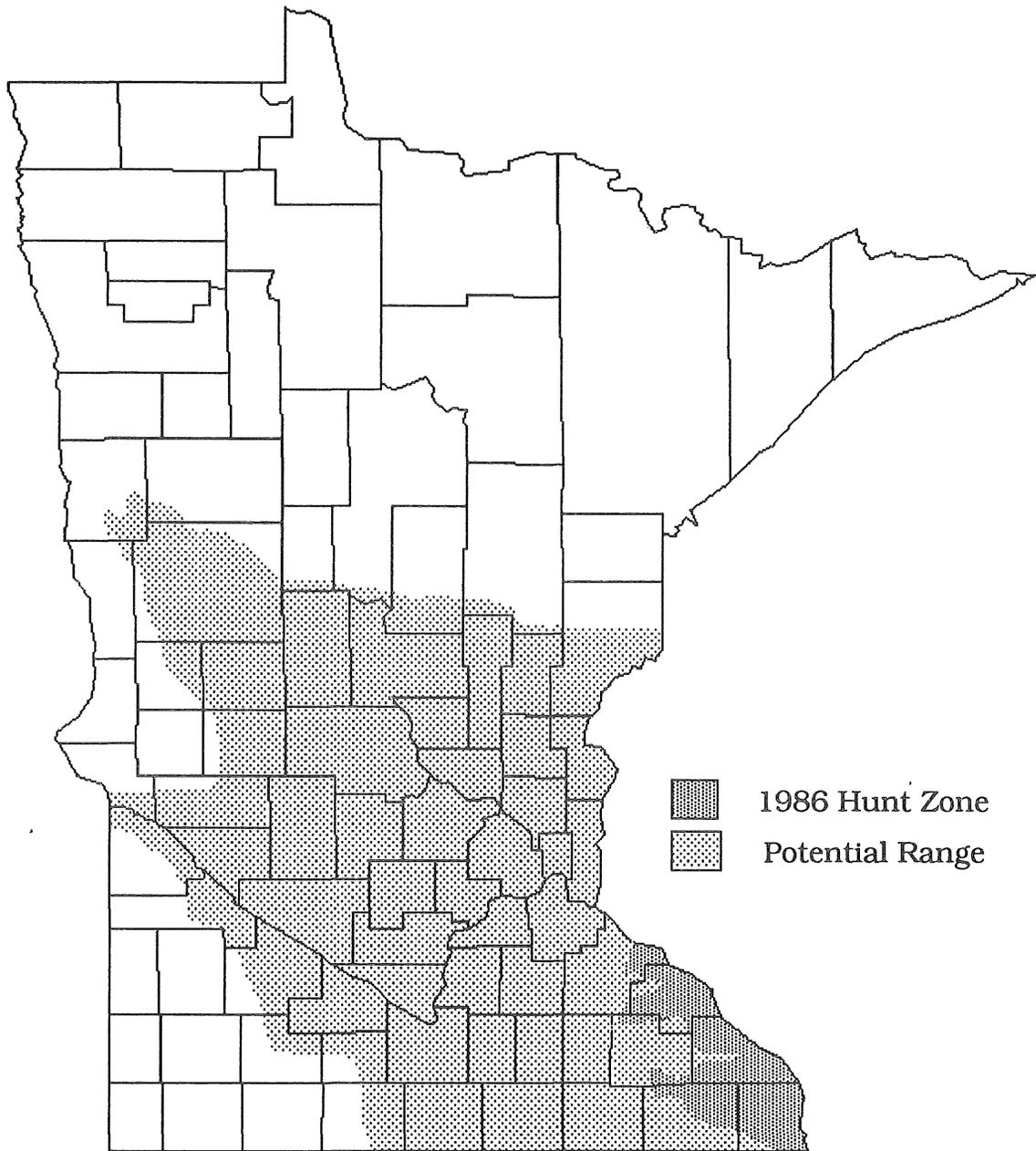


Figure 34-1. 1986 wild turkey hunt zones and potential transplant regions. (Source: Minnesota Department of Natural Resources)

Habitat Management

Habitat is ultimately the most important part of the turkey program, as it is for most wildlife species. Essential wild turkey habitat management, such as securing reliable winter food sources, should be done as soon as possible. Long-term strategies include working with foresters to manage oak forests and providing tax credits to landowners to preserve vulnerable woodlands.

Land use greatly affects wildlife habitat. Residences, weekend retreats, hobby farms and some agricultural development reduce the habitat base and make more areas off-limits to hunting. Such land use can make traditional wintering areas unsuitable. Authority to regulate private land use rests with local government units and private landowners. Working with these local interests to preserve critical habitat or to protect them by easement or fee title purchase, where necessary, would benefit wild turkey populations.

Free-Roaming, Pen-Raised Turkeys

Some individuals raise turkeys under game farm permits for domestic consumption or use on shooting preserves. These turkeys are usually a mix of wild and domestic stock. These pen-raised turkeys sometimes escape or are released and become free roaming in the wild. The DNR program for free-roaming, pen-raised turkeys attempts to prevent problems and remove game farm birds where they cause conflicts. These birds cause wild turkey management problems by;

- Diverting time and money from the management of wild birds
- Causing crop depredation and other damage to human possessions
- Introducing undesirable genes into wild flocks

- Reducing the desirability of release sites through their presence.

RESOURCE ANALYSIS

During spring 1986, approximately 1,800 persons hunted turkeys and 333 registered birds. The season was open only to resident hunters who applied for a permit 4 months before the hunting season and were selected in a random drawing. Landowners or tenants residing on at least 40 acres of agricultural or grazing land received preference in the drawing in accordance with law.

Increasing Minnesota's wild turkey population to 10,000 birds or more could provide hunting opportunities for 8,600 or more hunters. Based on figures from other states, Minnesota could anticipate an annual harvest averaging 2,400 wild turkeys, well beyond the objective of at least 20% of active hunters taking a turkey.

Demand for turkey hunting in Minnesota has been appreciable. In recent years, the number of permit applications has been at least twice the number of permits available (Table 34-1). In the early years of the hunt, there were more applicants than available permits given, but chances of being drawn have increased as more permits became available. Also, the number of applicants has dropped since the early years. Such a decrease is typical of states establishing turkey hunting. As the turkey program builds, permit applications typically climb again, and 8,600 seems a reasonable estimate for hunter demand by 1992.

Many Minnesotans go to other states, especially South Dakota and Missouri, to hunt turkeys. If their demands could be met here, they would probably hunt here. There probably are some non-residents who wish to hunt in turkeys Minnesota, but the number is unknown.

Table 34-1. Minnesota wild turkey hunting summary, 1978-87.

Year	Area of open hunt zone sq. mi.	Number of permit applicants	Number of permits available	Odds of drawing a permit ^a	Number of permits given	Number of persons hunting ^b	Registered turkey harvest	% success ^c
1978	389	10,740	420	25.6:1	411	398	94	23.6
1979	673	11,116	840	12.2:1	827	794	116	14.6
1980	858	9,613	1,200	8.0:1	1,191	1,072	98	9.1
1981	1,242	8,398	1,500	5.6:1	1,556	1,292	113	8.7
1982	1,490	7,223	2,000	3.6:1	1,992	1,625	106	6.5
1983	1,807	8,153	2,100	3.9:1	2,079	1,663	116	7.0
1984	2,061	7,123	3,000	2.4:1	2,837	2,270	178	7.8
1985	2,118	5,662	2,750	2.1:1	2,449	1,959	323	16.5
1986	1,897	5,715	2,500	2.3:1	2,251	1,801	333	18.5
1987	1,747	6,361	2,700	2.4:1	2,520	2,016	520	25.8

^a Calculated with total permits available to be given, and not adjusting for undersubscribed zones and time periods.

^b For 1978-82, based on a post-hunt mail survey. Number actually hunting in 1983-87 was estimated at 80% (from last year the survey was run).

^c Registered turkey harvest divided by number actually hunting, expressed as %.

Source: Minnesota Department of Natural Resources, 1987. Status of Wildlife Populations, Fall 1987 and 1979-1986 Hunting and Trapping Harvest Statistics.

RESOURCE VALUE

Turkeys are elusive and expensive to trap, but their populations can increase rapidly under the right conditions. Hunters will avidly pursue them, even though only 20% may bag a bird.

Revenue from application fees and licenses for turkey hunting, not including small game licenses, totaled \$39,655 in 1986. Using Iowa's 1986 estimate that resident turkey hunters spent an average of \$48.84 per hunting day, 2,000 Minnesota turkey hunters in the field an average of 3.5 days would spend about \$340,000. Expenditures would be about \$1.5 million for 8,600 hunters.

Hunter interest and the bird's qualities have built a mystique around turkey hunting. There is the great size and wariness of turkeys. Once in the field, hunters can enjoy sights, sounds and smells of spring, which are quite different from those of autumn hunts. During a calm spring morning, there is always something active to observe.

Enjoyment of the hunt can be deepened by camping. Because turkey hunting in Minnesota is allowed only in the morning, afternoons may be spent relaxing in camp or pursuing trout in a nearby stream.

Gobblers are usually called by the hunter, who makes sounds like those of a hen turkey. The gobbler may gobble and strut for some time before coming into shotgun or bow range, if he ever does. Hearing the bird heightens anticipation and thus the thrill of bagging it.

A few words cannot adequately describe a turkey hunting experience. Like many things in life, it must be tried to be appreciated. Many who have done it believe it to be unique and a handsome return on the management investment. Many hunters and nonhunters also gain nonconsumptive enjoyment from calling in turkeys.

In addition, wild turkeys offer unique viewing opportunities. Wild turkeys will often respond to calls from experienced individuals, offering wildlife enthusiasts the opportunity to enjoy calling and observing wild turkeys at close range. The number of individuals participating in such wild turkey viewing opportunities is unknown.

Long range planning for wild turkey

SERVICE: Conservation of wild turkey populations.

PRODUCTS: Wild turkeys for their ecological value and opportunities for their use and appreciation.

GOAL: Establish and maintain wild turkey populations in suitable habitats to maximize recreational opportunities.

OBJECTIVE 1. Establish a spring population of 10,000 wild turkeys by 1992.

PROBLEM 1. Natural range expansion is slow and is impeded by fragmented habitat.

STRATEGY A. Continue transplants into suitable habitats and ensure their genetic diversity.

PROBLEM 2. The quantity and quality of habitat are limited and declining.

STRATEGY A. Protect, acquire, maintain and improve habitat.

STRATEGY B. Encourage and support other public and private land managers to protect, acquire, maintain and improve habitat.

STRATEGY C. Establish and maintain reliable winter food sources.

PROBLEM 3. Free-roaming, pen-raised turkeys cause problems.

STRATEGY A. Educate the public regarding the undesirable aspects of releasing pen-raised turkeys.

STRATEGY B. Eliminate free-roaming, pen-raised turkeys in priority habitats.

STRATEGY C. Prevent the release of pen-raised turkeys in priority habitats.

PROBLEM 4. The limitation of some information reduces management effectiveness.

STRATEGY A. Improve population monitoring.

STRATEGY B. Develop and implement research projects to improve management.

STRATEGY C. Evaluate disease problems and cooperate with poultry and livestock disease specialists.

STRATEGY D. Evaluate genetic diversity of transplants.

PROBLEM 5. Poaching and human disturbance can reduce populations.

STRATEGY A. Provide information to the public about wild turkey management and ecology.

STRATEGY B. Increase law enforcement and public awareness in transplant areas.

OBJECTIVE 2. Provide annual hunting seasons for 8,600 people with at least a 20% success rate by 1992.

PROBLEM 1. Demand for hunting opportunities exceeds supply.

STRATEGY A. Limit and distribute hunting pressure through permit allocations.

STRATEGY B. Provide information to the public on hunting opportunities.



FISH AND WILDLIFE PLANNING TEAM
MINNESOTA DEPARTMENT OF NATURAL RESOURCES
Division of Fish and Wildlife
500 Lafayette Road
St. Paul MN 55155-4025

FISH, WILDLIFE & NATIVE PLANT RESOURCES
LONG RANGE PLAN COMMENTS

The Division of Fish and Wildlife is inviting comments from individuals and organizations on the long range plans for the management of fish, wildlife and native plant resources. Use this form, or write us a letter, telling us how we can improve the plan or plans you have reviewed.

Plan Name: _____

Comments: _____

Your name: _____

Address: _____

Are these the official comments of an organization? Yes No

Organization: _____

To mail: fold & seal with tape or place in envelope.

Thank you for taking the time to review the plan and providing your comments.

35. Endangered Flora and Fauna

Countless species have become extinct since the world was formed, each in response to natural environmental changes to which it could no longer adapt. Until recently, biologists have viewed the extinction of species as a natural evolutionary process. Today, however, people have accelerated this natural process and now most extinctions are the result of humans altering world habitat.

Shortly after humans became the primary factor responsible for species extinction, the concept evolved of a species being "endangered" of extinction. The term was applied to species with severely declining populations that were in danger of becoming extinct if corrective actions were not taken. Among the first attempts to restore an endangered species was an effort by President Theodore Roosevelt and the New York Zoological Society to stock bison in the Wichita Mountains Wildlife Refuge in Oklahoma in 1905.

In recent years the term "endangered" has been used generically with a variety of implications. For the purpose of this plan, "endangered" will include all vertebrate and invertebrate animal species and vascular and nonvascular plant species that are officially listed as threatened or endangered by the federal Endangered Species Act of 1973 and all species officially listed as threatened, endangered or special concern by the Minnesota Endangered Species Act. There are several species on the state list, however, that

the Department of Natural Resources has decided are not priorities for the first operational planning phase. These include the wolverine, cougar, woodland caribou and mule deer.

MANAGEMENT HISTORY

An understanding of the Minnesota Endangered Species Act and policy is integral to a discussion of management history. Because policy and law for endangered species differ at the state and federal level, both are reviewed below.

Federal Legislation and Policy

Interest in endangered species protection at the federal level began with the 1942 Convention on Nature Protection and Wildlife Preservation in the Western Hemisphere. The convention advised that contracting governments should adopt measures to prevent the extinction of any given species. The Endangered Species Preservation Act of 1966 provided for research on endangered species and allowed for their legal protection on all federal lands. Shortly thereafter, the Endangered Species Act of 1969 prevented the importation of endangered species of fish and wildlife into the United States and led to creation of the Convention on International Trade in Endangered Species of Wild Fauna and Flora in March 1973. International trade in endangered species was to be regulated and restricted through the enactment of this convention. The Endangered Species Act of 1973 provided virtually complete federal protection to all endangered species of animals and partial protection to plants.

All federally listed species of animals in Minnesota are under the jurisdiction of the U.S. Fish and Wildlife Service. The process to list a species as endangered starts with a petition to the Service. Any interested person,

agency or group may petition to add or delete species to the list. Whether or not evidence is sufficient to warrant action is left to the judgement of U.S. Fish and Wildlife Service biologists. The law provides that all listings are to be finalized within 2 years after they are proposed and the Department of the Interior must review the list every 5 years.

Five Minnesota animals have passed through this process and are now federally listed. The peregrine falcon and Higgin's eye pearly mussel are endangered; the gray wolf and bald eagle are threatened; and the piping plover is threatened in Lake of the Woods and endangered in Duluth. Two plant species have been listed. The dwarf trout lily is endangered and the prairie bush-clover is threatened.

Under provisions of the Endangered Species Act, the Secretary of the Interior is authorized to develop and implement recovery plans for these species. Recovery plans have been prepared for the bald eagle, peregrine falcon, Higgin's eye pearly mussel and gray wolf. Work on recovery plans for the piping plover, dwarf trout lily and prairie bush clover began in the spring of 1986.

The Secretary of Interior is authorized to enter into cooperative agreements with states in which federally threatened and endangered species occur. An agreement entitles a cooperating state to be eligible for 75% cost sharing with the federal government on projects designed to protect or manage listed species.

Since 1979, Minnesota has received anywhere from \$10,000 to \$150,000 of federal endangered species monies each year. Most of these funds supported a major research study on wolf-deer interactions in northcentral Minnesota and an investigation of lead-shot toxicity in bald eagles. Money for plant protection was not requested before 1986 because plants were not previously covered by a cooperative agreement between the Minnesota Department of Natural

Resources and the U.S. Fish and Wildlife Service.

The preservation of endangered species is a low priority under the current federal administration and only \$4 to \$5 million are available each year to all states for recovery projects.

State Legislation and Policy

In 1974 the Minnesota Legislature passed its state endangered species act, which stated that any species considered endangered under the Federal Endangered Species Act of 1973, at the time of enactment, was to be considered endangered by the state. The provisions of the act gave authority to the Commissioner of Minnesota Department of Natural Resources to designate additional Minnesota wildlife species that are not federally listed. This authority, however, was never acted upon, so the state list was identical to the federal list of 1973.

In 1981 the Minnesota State Legislature amended the endangered species act and specified that an official state list of endangered, threatened and special concern species be prepared by January 1, 1984. Three other significant changes were also incorporated into the act. First, plants were added to the scope of the covered species. Second, the law provided that a volunteer technical advisory committee of 30 people would assist the Minnesota Department of Natural Resources in establishing the list. Third, the amendments provided for the list to be updated once every 3 years.

The technical advisory committee was appointed after the 1981 legislative session. Individuals were chosen to represent expertise in 6 major areas: plants, both vascular and nonvascular; invertebrates; reptiles and amphibians; birds; mammals; and fish. Culminating nearly 18 months of work, the Minnesota Department of Natural Resources and the Technical Advisory Committee compiled the state's first

list of endangered and threatened species. After a 60-day period of public review, the list became official in March of 1984. A detailed description of the species listed is presented in the Resource Analysis Section.

Approximately one year later, in June 1985, the Commissioner of Natural Resources issued Commissioner's Order Number 2204, which contained new regulations regarding restrictions and permit requirements for the taking, possession, importation, transport, purchase, sale and disposal of threatened and endangered species. The intent of the order was to extend the same protection for threatened as is provided for endangered species under current Minnesota statutes. State species of special concern receive no official protection.

RESOURCE MANAGEMENT

Federal Programs

In the past 10 to 15 years, federal and state management of federally listed species in Minnesota has focused almost entirely on 2 species--the gray wolf and the northern bald eagle. Federal dollars for the wolf have supported intensive research efforts by federal personnel in northeastern Minnesota and state personnel in northcentral Minnesota. Federal monies have also supported federal field personnel who are responsible for handling wolf depredation complaints.

The Chippewa National Forest leads in management and research efforts on the bald eagle on national forest lands. Federal dollars have also supported management and inventory work on the Superior National Forest, annual inventory work on all nonfederal lands and a state study investigating the effects of lead poisoning.

Federal dollars were combined with monies from the state and private sources to support an aggressive breeding

restoration program for the peregrine falcon. Federal money was made available in 1986 for research and management of the dwarf trout lily and the piping plover. Federal dollars, however, have not yet been spent on the federally endangered Higgins's eye pearly mussel.

State Programs

Because a list of state endangered, threatened and special concern species did not become official until 1984, management of these species is a new responsibility for the Division of Fish and Wildlife. Most of the responsibility for animal species has been delegated to the Nongame Wildlife Program and plant species to the Natural Heritage Program. Both programs have recognized endangered species as an integral part of their comprehensive long-range plans. The Nongame Wildlife Supervisor also serves as the official endangered species coordinator for the Department of Natural Resources.

It is the basic strategy of the Nongame Wildlife Program and the Natural Heritage Program to prevent animals and plants from becoming endangered through preventive conservation efforts. Such efforts include a combination of inventory, planning, research, education, habitat management, data management, promotion, coordination and species restoration work. There are currently more than 90 Nongame Program and Natural Heritage projects underway in Minnesota.

Funding for the nongame projects comes from the Nongame Wildlife checkoff on state income tax returns. The checkoff also helps to support portions of the Natural Heritage Program; for example, rare plant monitoring and data management. General funds from the legislature also support the Natural Heritage Program's endangered plant work.

Nearly one-third of the annual nongame program's budget is expended on endangered species projects. Based on the

nongame planning process, the program is currently engaged in cooperative efforts to restore peregrine falcons, burrowing owls and trumpeter swans to Minnesota.

Research and inventory efforts are also focused on a host of state-listed species including the wood turtle, sandhill crane, chestnut-collared longspur, Forster's tern and five-lined skink. Habitat management projects are underway to help the piping plover, common tern and many prairie species. Nest management plans are being prepared for each bald eagle nesting territory on state, county and private lands. Rare plant monitoring by the Natural Heritage Program includes work on prairie bush clover, American ginseng, prairie white-fringed orchid, ram's head lady's slipper and kitten-tails. Many education efforts by the Nongame and Heritage programs focus on endangered species.

Environmental review of all project proposals submitted to the Minnesota Department of Natural Resources must consider impact on state and federally listed species. When potential conflicts are identified, mitigating measures are developed and implemented. Records for the occurrences of all listed species, both plants and animals, are maintained in the database of the Natural Heritage Program.

Although the Nongame Program and the Natural Heritage Program have assumed major responsibility for endangered species management in Minnesota, many other programs, agencies and organizations have an equally important role. For example, habitat acquisition and management efforts by other programs within the Division of Fish and Wildlife have significantly benefitted the endangered species resource. An aggressive acquisition program within the Minnesota Department of Natural Resources Section of Wildlife has protected thousands of acres of critical wetland and grassland habitats, particularly in western Minnesota.

A new program within the Division of Fish and Wildlife,

the Scientific and Natural Areas Program, is charged exclusively with designating and managing natural areas of statewide significance. Sites that provide critical habitat for endangered species are among the program's top priorities. Close coordination between the Scientific and Natural Areas Program, the Nongame Wildlife Program, and Natural Heritage Program helps insure that, when these sites are identified, they become acquisition priorities for the Scientific and Natural Areas Program. Among the sites recently acquired is Pine and Curry Islands in Lake of the Woods, one of the primary breeding sites for the piping plover in North America. A portion of Kilen Woods State Park in Jackson County was designated as a Scientific and Natural Areas in 1984. This site contains the largest known population of prairie bush clover, a federally threatened species.

Several other programs within the Section of Wildlife are involved with endangered species management. Perhaps most significant is the involvement of the Section's Research Unit. With principal financial support from the federal endangered species office, the Research Unit, for nearly 6 years, has conducted an intensive field study of gray wolves in northcentral Minnesota. The Division's furbearer program has also focused some of its efforts on 2 state-listed mammals, the spotted skunk and pine marten.

Other divisions and programs within the Minnesota Department of Natural Resources are also involved with protection and management of endangered resources. The Division of Minerals, for example, has worked closely with staff in the Division of Fish and Wildlife to identify peatlands containing critical habitat for endangered plants and animals. Likewise, the Division of Forestry has developed habitat management guidelines for certain endangered species and the Division of Parks and Recreation has found management activities in endangered species.

Cooperative efforts continue to identify and protect critical habitats on state forest and state park lands. The Minnesota Department of Natural Resources Natural Heritage Register has become an important tool in these efforts. The registry is designed to provide official recognition to tracts of public land that contain natural features of special interest and to honor public agencies that manage these lands to protect and perpetuate the features of interest.

Other Programs

Private, non-profit organizations, such as the Minnesota Chapter of The Nature Conservancy, have made major contributions to the protection and management of endangered resources. Acquisition of critical habitat throughout the state has protected habitat for such species as the greater prairie-chicken and piping plover. Grant monies are also made available each year to encourage research on state-listed species. Projects on species such as peregrine falcons, wood turtles, loggerhead shrikes and prairie bush clover have been cooperatively funded by The Nature Conservancy, the Nongame Wildlife Program or the Natural Heritage Program. The Nature Conservancy is also a major cooperator in the statewide peregrine falcon restoration effort.

Causes of Endangerment

Loss of habitat is the primary reason that many species have become endangered, threatened or of special concern. Four of the 6 endangered birds are dependent on small remnants of the once widespread prairie ecosystem. Deterioration of habitat through plant succession is also a factor, especially when remaining habitat becomes limited. Tree encroachment onto prairies and granite outcrops, for example, have threatened the habitat of prairie birds and the five-lined skink.

For other species, their habitat requirements are so narrow that they probably never were abundant. Many of the tiger beetles, for example, are only found in association with specialized habitats like sand dunes. Many endangered plant species, too, are restricted to habitats such as algal talus slopes and moderate cliffs. The greatest danger of extinction for many of these small, less mobile species is the loss of these unique and often unusually small habitats.

Environmental contamination is also a major cause of endangerment. Low populations of the bald eagle and peregrine falcon have been caused largely by pesticide residues in the food chain. The degradation of our waterways through chemical and sediment pollution is one of the causes of mollusk population declines in the Mississippi River. Herbicide accumulation in wetland basins is a serious threat to many endangered wetland plant species.

Although endangered and threatened species are legally protected, some of the special concern species are still harvested, even commercially. Many snakes are collected and sold as pets or to biological supply houses and snapping turtles are commonly sold for meat. Nearly 35% of all the amphibians and reptiles that occur in Minnesota are listed as species of special concern because of their commercial value in the pet trade. Species protected by the endangered species act are taken illegally and legally. Bald eagles are shot by vandals even though they are our national bird. Ginseng and golden seal are legally harvested commercially.

Some species like elk, pelican, rattlesnake and gray wolf can create real or perceived problems for the general public. Commercial fishermen in Lake of the Woods and sport fishermen elsewhere have complained that pelicans compete with them for certain fish species, even though these fish make up a very small portion of the pelican's

diet. For many people, one snake is too many, much less several hundred that may come out of a hibernaculum in their backyard.

Some endangered species are recovering. Peregrine falcons and trumpeter swans are being reintroduced in Minnesota and elsewhere. Although reintroductions for some species have been successful, they are generally very expensive and labor intensive. Some bird species that are at the top of the food chain also seem to be responding to bans on the use of DDT and other organochlorine pesticides. Thus, the bald eagle and osprey are recovering with a minimum of money spent.

RESOURCE ANALYSIS

Supply

Minnesota's endangered, threatened and special concern animals include mammals, birds, fish, reptiles, amphibians, mollusks and butterflies. Fourteen percent of the 693 animals in the faunal groups considered for the official state list were subsequently listed. Of approximately 3,000 plant species, including vascular plants, bryophytes and lichens, 6.4% are listed (Table 35-1).

Eight animal species among the 693 considered for listing are extirpated from Minnesota, although this is not recognized as an official status category by Minnesota statutes. Fifteen of the state's 20 species of tiger beetles and 9 of the state's 60 species of jumping spiders are proposed for state listing, but the Department of Natural Resources does not have authority to list these particular invertebrates. There are also 21 plant species currently proposed by the state as endangered, 14 plant species proposed as threatened and 21 proposed as special concern.

A summary of all state and federally listed species is included in Appendix 35-A (animals) and Appendix 35-B (plants). Appendices 35-C and 35-D contain a complete list

Table 35-1. Plants and animals listed under Minnesota and federal endangered species laws.

Animals		State	Federal	% Listed
693 species	Endangered	12	5	2.4
	Threatened	8	3	1.6
	Special Concern	76	-	11.0
TOTALS		96	8	15.0

Plants		State	Federal	% Listed
Approximately 3,000 species	Endangered	45	1 (proposed)	1.5
	Threatened	42	1 (proposed)	1.4
	Special Concern	105	-	3.5
TOTALS		192	2 (proposed)	6.5

Source: Minnesota Department of Natural Resources

federally listed endangered, threatened and special concern animals and plants, including regional occurrences of each. Animals that are extirpated or under consideration for state or federal listing are in Appendix 35-E; plant species under consideration are listed in Appendix 35-F.

The majority of listed species in the endangered animal category occur in Region 1 (Table 35-2), reflecting the large-scale loss of native prairie habitat in northwestern Minnesota. However, when all 3 status categories, endangered, threatened and special concern are considered, Regions 5 and 6 support the largest number of listed species. This is because of the large number of listed fish, mollusks, reptiles and amphibians that occur in or along the Mississippi River below Minneapolis-St. Paul. Fish and mollusks have been reduced in number because of siltation, pollution and the locks and dams that hinder their migration. The listed amphibians and reptiles are generally limited to the southeastern part of the state because this is the northern limit of their range in the United States.

Table 35-2. Occurrence in Department of Natural Resources Regions of animals listed as endangered, threatened and special concern under state and federal endangered species laws.

Designation	Department of Natural Resources Regions				
	1	2	3	4	5&6
Endangered	7	2	1	3	4
Threatened	4	4	6	4	6
Special concern	36	23	28	26	46
Totals	47	29	35	33	56

The northeast region of the state, Region 2, has the lowest number of listed animals, reflecting the fact that this portion of the state has had the least amount of habitat alteration.

Regions 5 and 6 harbor most of the listed plant species (Table 35-3), because of the varied nature of the landscape and great habitat diversity. The next largest concentration is in Region 2, because of unique and limited habitats associated with Lake Superior and the border lakes. The third largest concentrations is in Region 1 and most of the listed plants here occur in the large peatlands of glacial Lake Agassiz.

Table 35-3. Occurrence in Minnesota Department of Natural Resources regions of plants listed as endangered, threatened and special concern plants under state and federal endangered species laws.

Designation	Department of Natual Resources Regions				
	1	2	3	4	5&6
Endangered	6	11	4	5	22
Threatened	12	16	0	11	20
Special Concern	33	29	15	26	50
Totals	51	56	19	42	92

(Source: Minnesota Department of Natural Resources)

Demands

Public interest and concern for the plight of endangered species have grown steadily over the past several decades. Contributions to and participation in many conservation organizations--many which specifically target preservation of endangered resources--serve as one barometer of citizen support. For example, in 1958, the Minnesota Chapter of The Nature Conservancy had 60 members statewide; by 1985 membership had increased to 5,548. The Nature

Conservancy fund-raising campaign in 1986 that focused on preserving critical areas in Minnesota generated approximately \$612,000 in private and corporate funds. Several years later, a similar campaign successfully generated more than 2.5 times that amount. Membership and participation in other state conservation organizations, such as the Minnesota Chapter of the Audubon Society, Minnesota Native Plant Society and the Isaac Walton League have shown similar trends.

The passage and support of Minnesota's Nongame Checkoff also demonstrate both public and legislative support for endangered resources. A funding system that allows citizens to donate a dollar or more on their state income tax form to the state nongame program, Minnesota's nongame checkoff is among the most successful in the country. Nearly 30% of the annual income is targeted toward restoration, research, inventory, management and educational projects for state and federally listed plant and animal species. The remainder of nongame checkoff monies support management of non-listed species.

During the 1984 tax year, more than 11% of Minnesota citizens filing state income tax forms contributed to the Nongame Fund via the checkoff. This is the highest level of citizen support in the United States and points to the strong conservation ethic and support for endangered and nongame resources among Minnesota's public. Attempts by a few legislators to divert these monies for other purposes have resulted in public outcries and subsequent demands that the monies be left untouched or subsequently reinstated.

Several other recent events in Minnesota demonstrate public concern and demand for endangered species preservation. During the 1981 state legislative session, environmental organizations, with support from the Minnesota Department of Natural Resources, were successful in generating legislative support to strengthen Minnesota's endangered species law.

Public response to several events in the Twin Cities also demonstrates support for endangered species. In 1984, after many years in preparation, the Science Museum of Minnesota in St. Paul opened a large and comprehensive exhibit on the gray wolf. Despite public controversy that had enshrouded the wolf for years, the exhibit became the most popular temporary exhibit ever to show at the museum. Since then it has traveled to other major sites throughout North America.

The peregrine falcon project in Minneapolis demonstrated considerable public support. Six peregrine falcon chicks were successfully hatched in 1984 from the top of the Multifoods Building, a downtown Minneapolis skyscraper. The abundant supply of pigeons in the metropolitan area provided a readily available food supply for the birds. Unfortunately, the Minneapolis Health Department decided to continue the use of strychnine for pigeon control in late 1985. When the decision was reported in the Minneapolis Star and Tribune, it prompted a deluge of outraged phone calls to the mayor's office. The department soon promised to switch to a rocket-netting pigeon control program, which is considerably more selective, cost-efficient and ecologically sound.

Although these examples provide a persuasive argument for public support, it does not mean that the public has a sound understanding and knowledge of endangered species or that public support is prevalent statewide. A landmark study by Stephen Kellert 1979 of Harvard University entitled "Public Attitudes toward Critical Wildlife and Natural Habitat Issues," revealed that the general public has a poor perception of species endangerment. In the study, more than 30% of the people interviewed nationwide cited industrial and chemical pollution as the principal causes of endangerment, although in reality these factors have not been as important as habitat loss through land use

development.

Equal support does not exist for all endangered species. In various socio-economic conflict situations, for example, weighing the trade-offs between building a hydroelectric power plant vs. preserving critical habitat for an endangered fish, most Americans are willing to forego diverse social benefits to protect certain endangered species, but not all endangered species. Species for which they are willing to make such sacrifices are generally those that are large or aesthetically appealing, such as eagles, grizzly bears, butterflies and orchids. Smaller vertebrates and invertebrates that are often perceived negatively, such as spiders, snakes and bats, are generally excluded.

Significant progress toward protecting, managing and restoring endangered species has been made in Minnesota in recent years. Yet, to accomplish the enormous tasks that still lie ahead, it will be increasingly important to strengthen the public's concern for all endangered plants and animals. Focused public education efforts could result in the development of an even stronger conservation ethic among Minnesota citizens.

Trends

Some species are experiencing a comeback because of past conservation efforts. Prohibition of DDT has permitted Minnesota's bald eagle population to recover. Intensive restoration efforts are underway for the peregrine falcon, which was extirpated from the eastern United States because of its sensitivity to DDT and will likely restore a breeding population to the eastern border of Minnesota in the next 10 to 20 years.

Habitat loss is a threat that faces the majority of listed species. There is little hope that the pressure for continued development will lessen.

Southern and Western Minnesota Trends

Intensification of farming practices is projected to continue in Minnesota's agricultural area, though perhaps at a slower rate than in the past 10 to 15 years. Forty-two of the state's 96 officially listed animal species and 54 of the 192 listed plant species have all or a portion of their range in this zone.

Four bird species that were members of Minnesota's original prairie avifauna no longer occur in the state; four additional species have declined to the point that they are officially classified as state endangered. The future of at least 2 of these species -- the Baird's sparrow and Sprague's pipit -- is dismal. These species will likely never recover to the point of sustaining viable populations.

The new federal farm policy and new legislation passed by the Minnesota state legislature will encourage farmers not to cultivate erodible farmland, and to plant, instead, good wildlife cover. Aggressive acquisition and preservation actions by private conservation organizations and public agencies have been the most important tools available to help endangered species on agricultural lands. Whether the new federal farm policy will also benefit endangered species remains to be seen.

Northern Minnesota Trends

Thirty-two of Minnesota's 96 officially listed animal species and 65 of the 192 listed plant species occur exclusively or partially within the northern forest zone. The primary land use trends projected for this area include expanded agricultural conversion on the western border, an increase in forest management and some increase in urban land use.

Agricultural conversion could negatively affect many wetland species such as the sandhill crane, American bittern and yellow rail. Forest management intensification

could negatively affect species dependent on mature and old-growth forest stands, such as the red-shouldered hawk, bald eagle, osprey and ram's-head lady's-slipper. Increased urbanization, particularly for recreational or retirement homes, could place additional pressure on these same species.

Again, federal farm legislation, such as Swampbuster, will begin to address the problems of wetland conversion. The U.S. Fish and Wildlife Service, U.S. Forest Service and the Minnesota Department of Natural Resources have implemented a variety of planning efforts that identify protection of endangered species and communities as a priority. For example, the Minnesota Department of Natural Resources Division of Forestry and Division of Fish and Wildlife have developed forest management guidelines that combine timber harvest strategies with endangered species management. Additionally, a number of private organizations have focused efforts on endangered species protection in northern Minnesota.

Central Minnesota Trends

The most dramatic land use changes will likely occur in central Minnesota's transition zone. Most of these changes will involve conversion of forest and agricultural lands to urban lands. Approximately 80% of the state's urban land needs will be met in this zone. Clearly this could negatively affect many species. Sixty-three of the state's 96 listed animal species and 80 of the 192 listed plant species have all or a portion of their range extending into this region. Much of the damage that has already occurred in the agricultural zone may be irreversible. The biggest challenge for federal and state agencies, private organizations, and individuals in the next 10 to 15 years may be to insure that the same does not occur in the transition zone.

RESOURCE VALUE

Each plant and animal species has an intrinsic value as a functional part of the ecosystem. Each represents an untapped reservoir of unique genetic information that might eventually cure a disease or solve a complex technological problem. Some species may also have a symbolic, recreational, religious or historical value.

Although it is often difficult to assign an economic value to each species, the consequences of allowing them to perish would be the irreplaceable loss of any potential benefits these species may provide. Regardless of their ultimate value to humans, all species have an inherent right to their continued existence. Protecting this right for all species, as well as preserving society's future options, is the goal of the Division of Fish and Wildlife endangered species program.

Although better documentation of economic benefits would lend further support to the need for endangered species preservation, it is not the program's goal to generate financial profits. Instead, the goal is to preserve the genetic diversity and integrity of natural ecosystems and native species. Nevertheless, economic benefits do accrue.

For example, individuals will travel great distances to Minnesota and pay guides for the opportunity to observe rare species like the bald eagle and gray wolf. This travel helps the economy. Nationwide it has been documented that over \$4 billion are spent annually on the non-hunting enjoyment of wildlife, including endangered species.

Long range planning for endangered flora and fauna

PRODUCT: Endangered, threatened, and special concern species for their ecological value and opportunities for use and appreciation.

GOAL: Improve status of endangered, threatened, and special concern species, hereafter referred to as listed species and promote re-establishment of select extirpated species.

OBJECTIVE 1: Prevent listed species from becoming extirpated or extinct, enhance self-sustaining populations of listed species and improve the status of bald eagle, piping plover, wood turtle, common tern, prairie bush clover, white-fringed orchid and American ginseng by 1992.

PROBLEM 1: Management priority and responsibility for most species have not been established.

STRATEGY A. Develop and implement Department of Natural Resources management guidelines on management of listed species.

STRATEGY B. Participate in the federal and state listing processes and establish priority rankings for listed species.

STRATEGY C. Prepare and implement recovery plans for select endangered and threatened species and management plans for other listed species.

PROBLEM 2. Critical habitats of listed species are being destroyed.

STRATEGY A. Identify critical habitats and document loss and degradation.

STRATEGY B. Protect, acquire, maintain and improve critical habitat.

STRATEGY C. Encourage other public and private land managers to protect, acquire, maintain and improve critical habitat.

STRATEGY D. Develop and implement a Department of Natural Resources policy that protects critical habitat on public land.

STRATEGY E. Provide in-house training on critical habitat management and protection.

STRATEGY F. Exchange critical habitat information with land management personnel.

PROBLEM 3. Interspecific competition and predation can hinder recovery efforts.

STRATEGY A. Reduce mortality in recovering populations.

STRATEGY B. Provide safe habitat.

STRATEGY C. Reduce interspecific competition.

PROBLEM 4. Exploitation and illegal taking may place listed species in jeopardy.

STRATEGY A. Document legal and illegal taking of listed plants and animals.

STRATEGY B. Establish and improve regulations that protect listed species.

STRATEGY C. Develop, implement, and support public education programs to reduce exploitation and illegal taking.

Strategy D. Provide in-house training on listed species identification.

PROBLEM 5. Limitations in some information reduce management effectiveness.

STRATEGY A. Research population dynamics, behavior and ecology of priority species and determine their distribution and abundance.

STRATEGY B. Develop and implement a data management system for listed species.

STRATEGY C. Conduct and support research on economics, social values and public attitudes.

STRATEGY D. Encourage other agencies, institutions and organizations to acquire and share data on priority listed species.

PROBLEM 6. Public support for management of some listed species is inadequate.

STRATEGY A. Develop and implement information and education programs.

STRATEGY B. Monitor public support for management.

PROBLEM 7. Funding is insufficient to manage listed species.

STRATEGY A. Document funding needs and priorities (see Funding Chapter Plan for the Management of Nongame Wildlife in Minnesota).

STRATEGY B. Stabilize and increase existing sources of revenue, especially the Nongame Wildlife Management Account.

STRATEGY C. Actively seek new sources of funding, especially for listed plant species management.

OBJECTIVE 2. Establish self-sustaining populations of trumpeter swan and peregrine falcon by 1992.

PROBLEM 1. Supply of young and eggs is limited.

STRATEGY A. Acquire young and eggs from identified sources.

PROBLEM 2. Mortality of newly released young is high.

STRATEGY A. Identify and selectively eliminate

predators from the immediate vicinity of the release site.

STRATEGY B. When feasible, eliminate the predators habitat from the immediate vicinity of the release site.

STRATEGY C. Monitor newly released birds.

OBJECTIVE 3. Reestablish self-sustaining populations of other extirpated species within their former ranges, as feasible.

PROBLEM 1. Clear priorities for future restorations have not been established.

STRATEGY A. Establish restoration criteria and develop priority list.

STRATEGY B. Develop future restoration plans.

Appendix 35-A

Summary of animals listed as endangered, threatened and special concern under Minnesota and federal endangered species laws.

	Total Species in Minnesota		State	Federal	% State Listed
Mammals	80	Endangered	-	-	25
		Threatened	1	1	
		Special Concern	16		
		Extirpated			
Birds (Breeding species only)	233	Endangered	5	3	14
		Threatened	2	2	--- Piping Plover
		Special Concern	19		--- is both endangered
		Extirpated	5		and threatened in
					Minnesota.
Amphibians & reptiles	48	Endangered	1	-	35
		Threatened			
		Special Concern	14		
Fish	149	Endangered	-	-	11
		Threatened	-	-	
		Special Concern	16		
Mollusks	58	Endangered	2	2	7
		Threatened	-	-	
		Special Concern			
Butterflies	125	Endangered	3	-	12
		Threatened	3	-	
		Special Concern	9		

Appendix 35-A (Continued)

	Total Species in Minnesota		State	Federal	% State Listed	
Totals	593	Endangered	12	5	--- Piping Plover is --- both endangered and threatened in Minnesota.	14
		Threatened	8	3		
		Special Concern	76			
		Extirpated	(8)			
Total Listed Species			96	8	(Piping Plover was only counted once)	

* Extirpated is not an official status category recognized by the State Endangered Species Law; the number of extirpated species was not included in the calculation of the total number of listed species.

Appendix 35-B

Summary of plants listed as endangered, threatened and special concern under Minnesota and federal endangered species laws.

	Total Species in Minnesota		State	Federal	% State Listed
Vascular Plants	1,800	Endangered Threatened Special Concern	38 40	1 1	10
Bryophytes	500	Endangered Threatened Special Concern	1 -	- -	1
Lichens	550	Endangered Threatened Special Concern	6 1	- -	2
Totals	2,850	Endangered Threatened Special Concern	7 1	1 1	1
Total Listed Species			17	2	

Appendix 35-C

Occurrence in Department of Natural Resources administrative regions of endangered, threatened and special concern animals listed under Minnesota and federal endangered species laws.

	Department of Natural Resources Region				
	1	2	3	4	5&6
Endangered					
Peregrine falcon		X			X
Piping plover	X	X			
Burrowing owl	X			X	
Sprague's pipit	X				
Baird's sparrow	X				
Chestnut-collared longspur	X			X	
Five-lined skink				X	X
Higgins eye mussel					X
Fat pocketbook					X
Uncas skipper			X		
Assiniboia skipper	X				
Uhler's arctic	X				
Birds	5	2	0	2	1
Reptiles & amphibians	0	0	0	1	1
Mollusks	0	0	0	0	2
Butterflies	2	0	1	0	0
Threatened					
Gray wolf	X	X	X		
Bald eagle	X	X	X		X
Loggerhead shrike	X	X	X	X	X
Wood turtle		X	X		X
Blanding's turtle			X	X	X

Appendix 35-C (continued)

		Department of Natural Resources Region				
		1	2	3	4	5&6
Dakota skipper		X		X	X	
Ottoe skipper					X	X
Karner blue						X
	Mammals	1	1	1	0	0
	Birds	2	2	2	1	2
	Reptiles	0	1	2	1	2
	Butterflies	1	0	1	2	2
Special concern						
American elk		X				
Least shrew						X
Mountain lion						
Wolverine						
Marten		X	X			
Rock vole			X			

Appendix 35-C (continued)

	Department of Natural Resources Region				
	1	2	3	4	5&6
Special Concern (continued)					
Prairie vole	X		X	X	X
Woodland vole					X
Keen's myotis		X	X	X	X
Mule deer	X	X	X	X	X
Heather vole		X			
Eastern pipistrelle	X			X	X
Caribou	X	X			
Spotted skunk	X	X	X	X	X
Northern bog lemming	X	X			
Northern pocket gopher	X				
Horned grebe	X				
White pelican	X			X	
American bittern	X	X	X	X	X
Red-shouldered hawk	X	X	X		X
Osprey	X	X	X		
Prairie chicken	X		X		
Sandhill crane	X		X		
King rail	X		X	X	X
Yellow rail	X	X	X		
Common moorhen	X		X	X	X
Upland sandpiper	X	X	X	X	X
Marbled godwit	X			X	
Wilson's phalarope	X		X	X	
Forster's tern	X		X	X	X
Common tern	X	X	X		
Short-eared owl	X			X	
Louisiana waterthrush			X		X
Henslow's sparrow	X				X

Appendix 35-C (continued)

	Department of Natural Resources Region				
	1	2	3	4	5&6
Sharp-tailed sparrow	X		X		
Snapping turtle	X	X	X	X	X
Racer				X	X
Timber rattlesnake					X
Rat snake					X
Fox snake			X	X	X
Western hognose snake	X		X	X	X
Eastern hognose snake				X	X
Gopher snake	X		X	X	X
Massasauga				X	
Northern cricket frog				X	X
Bullfrog					X
Pickereel frog					X
Lake sturgeon	X	X	X		X
Crystal darter					X
Blue sucker			X		X

Appendix 35-C (continued)

	Department of Natural Resources Region				
	1	2	3	4	5&6
Special Concern (continued)					
Bluntnose darter					X
Plains topminnow				X	
Gravel chub					
Blue catfish					X
American brook lamprey				X	
Yellow bass					X
Black redhorse					X
Pallid shiner					X
Pugnose minnow					X
Slender madtom					X
Topeka shiner				X	
Paddlefish					X
Shovelnose sturgeon				X	X
Elephant ear					X
Ebony shell					X
Freija fritillary		X			
Frigga fritillary	X	X			
Dorcas copper	X	X	X		
Bog copper	X	X	X		X
Disa alpine		X			
Red-disked alpine	X	X			
Poweshiek skipper	X			X	X
Jutta arctic		X	X		
Bog fritillary		X			
Mammals	9	7	4	5	7
Birds	18	6	14	9	8
Reptiles & amphibians	3	1	5	8	13

Appendix 35-C (continued)

		Department of Natural Resources Region				
		1	2	3	4	5&6
	Fish	1	1	2	3	14
	Mollusks	0	0	0	0	2
	Butterflies	5	8	3	1	2
Listed Animal Summary						
	Endangered	7	2	1	3	4
	Threatened	4	4	6	4	6
	Special Concern	36	23	28	26	46
Total		47	29	35	33	56

Appendix 35-D

Occurrence in DNR administration regions of endangered, threatened and special concern plants listed under Minnesota and federal endangered species laws.

	Department of Natural Resources Region				
	1	2	3	4	5&6
Endangered Species					
<u>Asclepias stenophylla</u> Gray					X
<u>Besseye bullii</u> (Eaton) Rydb.					X
<u>Decalia suayeolens</u> L.					X
<u>Chrysosplenium iowense</u> Rydb.					X
<u>Christatella jamesii</u> T. & G.					X
<u>Cypripedium arietinum</u> R. Br.	X	X	X		
<u>Dreba norvegica</u> Gunn.				X	
<u>Eleocharis wolfii</u> Gray		X			
<u>Empetrum atropurpureum</u> Fern. & Wieg.	X			X	
<u>Erythronium propullans</u> Gray					X
<u>Gerardia auriculata</u> Michx.				X	X
<u>Hydrastis canadensis</u> L.					X
<u>Isoetes melanopoda</u> Gay & Dur.				X	
<u>Lespedeza leptostachya</u> Engelm.				X	X
<u>Lesquerella ludoviciana</u> (Nutt.) S. Wats.					X
<u>Littorella americana</u> Fern.		X			
<u>Malaxis paludosa</u> (L.) Sw.	X				
<u>Montia chamissoi</u> (Ledeb.) Durand & Jackson					X
<u>Napaea dioica</u> L.					X
<u>Oryzopsis hymenoides</u> (R. & S.) Ricker	X				
<u>Osmorhiza chilensis</u> H. & A.		X			

Appendix 35-D (continued)

Occurrence in DNR administration regions of endangered, threatened and special concern plants listed under Minnesota and federal endangered species laws.

	Department of Natural Resources Region				
	1	2	3	4	5&6
<u>Parthenium integrifolium</u> L.					X
<u>Platanthera flava</u> (L.) Lindl. var. <u>herbiola</u> (R. Br.) Ames & Corrall			X		X
<u>Platanthera leucophaea</u> (Mutt.) Lindl.	X			X	
<u>Poa paludigena</u> Fern. & Wieg.			X		
<u>Polygala cruciata</u> L.					X
<u>Polystichum braunii</u> (Spenner) Fee var. <u>purshii</u> Fern.		X			
<u>Potamogeton lateralis</u> Morong	X				
<u>Ruellia humilis</u> Nutt.					X
<u>Sagina nodosa</u> (L.) fenzl ssp. <u>borealis</u> Crow		X			
<u>Saxifraga cernua</u> L. var. <u>latibracteata</u> Fern.		X			
<u>Scieria triglomerata</u> Michx.					X
<u>Sedum rosea</u> (L.) Scop. var. <u>leedyi</u> Rosend. & Moore					X
<u>Subularia aquatica</u> L.			X		
<u>Sparganium glomeratum</u> Laest.		X			
<u>Sullivantia renifolia</u> Rosend.					X
<u>Talinum rugospermum</u> Holzinger			X		X
<u>Tofieldia pusilla</u> (Mich.) Pers.		X			
Total		6	11	4	5 22

Appendix 35-D (continued)

	Department of Natural Resources Region				
	1	2	3	4	5&6
Threatened Species					
<u>Allium cernum</u> Roth					X
<u>Ammophila breviligulata</u> Fern.		X			
<u>Androsace septentrionalis</u> L. var. <u>pulverulenta</u> (Rydb.) Knuth	X				
<u>Arabis holboellii</u> Hornem. var. <u>retrofracta</u> (Graham) Rydb.	X	X			
<u>Arenaria macrophylla</u> Hook.		X			
<u>Arnica chionopappa</u> Fern.		X			
<u>Asclepias hirtella</u> (Pennell) Moodson					X
<u>Asclepias sullivantii</u> Englem.				X	X
<u>Asplenium trichomanes</u> L.		X			X
<u>Cacalia tuberosa</u> Nutt.				X	
<u>Carex conjuncta</u> Boott					X
<u>Carex dayisii</u> Schwein. & Torr.					X
<u>Carex hallii</u> Olney	X			X	
<u>Carex praticola</u> Rydb.					X
<u>Carex sterilis</u> Willd.	X			X	X
<u>Desmodium illinoense</u> Gray					X
<u>Drosera anglica</u> Huds.	X	X			
<u>Drosera linearis</u> Goldie	X	X			
<u>Dryopteris marginalis</u> (L.) Gray					X
<u>Eleocharis olivaceae</u> Torr.		X			
<u>Eleocharis rostellata</u> Torr.	X	X			
<u>Gerardia gattingeri</u> Sm.				X	X
<u>Jeffersonia diphylla</u> (L.) Pers.					X
<u>Lycopodium porophyllum</u> Lloyd & Underwood				X	X

Appendix 35-D (continued)

	Department of Natural Resources Region				
	1	2	3	4	5&6
<u>Mamillaria vivipara</u> (Nutt.) Haw.				X	
<u>Melica nitens</u> Nutt.					X
<u>Nymphaea tetragona</u> Georgi	X	X			
<u>Pellaea atropurpurea</u> (L.) Link					X
<u>Plantago elongata</u> Pursh				X	
<u>Rhynchospora capillacea</u> Torr.	X	X		X	X
<u>Rubus chamaemorus</u> L.	X				
<u>Salicornia rubra</u> Nelson	X			X	
<u>Saxifraga alzoon</u> Jacq. var. <u>neogaea</u> Butters		X			
<u>Scleria verticillata</u> Muhl.	X			X	X
<u>Vaccinium uliginosum</u> L. var. <u>alpinum</u> Bigel		X			
<u>Valeriana edulis</u> Nutt. ssp. <u>ciliata</u> (T.&G.) Meyer					X
<u>Woodsia glabella</u> R. Br.		X			
<u>Woodsia scopulina</u> D.C. Eat.		X			
<u>Xyris torta</u> Sm.					X
Total		12	16	0	11 20

Appendix 35-D (continued)

	Department of Natural Resources Region				
	1	2	3	4	5&6
Special Concern Species					
<u>Adoxa moschatellina</u> L.		X			X
<u>Agrostis geminata</u> Trin.		X			
<u>Allium schoenoprasum</u> L. var. <u>sibiricum</u> (L.) Hartm.		X			
<u>Antennaria aprica</u> Greene	X			X	
<u>Arenaria dawsonensis</u> Britt.					X
<u>Arethusa bulbosa</u> L.	X	X	X		X
<u>Aristida longiseta</u> Steud.				X	
<u>Aristida tuberculosa</u> Nutt.			X		
<u>Asclepias amplexicaulis</u> Sm.					X
<u>Astragalus flexuosus</u> Dougl.				X	
<u>Astragalus missouriensis</u> Nutt.				X	
<u>Astragalus neglectus</u> (T.&G.) Sheld.	X				
<u>Athyrium pycnocarpon</u> (Spreng.) Tides					X
<u>Bacopa rotundifolia</u> (Michx.) Wettst.	X			X	
<u>Baptisia leucophaea</u> Nutt.					X
<u>Botrychium lunaria</u> (L.) Sw.		X			
<u>Botrychium mormo</u> Wagner	X				
<u>Buchloe dactyloides</u> (Nutt.) Engelm.				X	
<u>Carex annectens</u> Bickn.					X
<u>Carex exilis</u> Dew.	X	X			
<u>Carex laxiculmis</u> Schwein.					X
<u>Carex obtusata</u> Lilj.	X				
<u>Carex scirpiformis</u> Mack. X					
<u>Carex woodii</u> Dew.					X
<u>Cephalanthus occidentalis</u> L.					X
<u>Chamaerhodos nuttallii</u> Pick.	X				

Appendix 35-D (continued)

	Department of Natural Resources Region				
	1	2	3	4	5&6
<u>Cirsium hillii</u> (Canby) Fern.	X		X		X
<u>Cladium mariscoides</u> (Muhl.) Torr.	X	X	X		X
<u>Claytonia caroliniana</u> Michx.		X			
<u>Cyperus acuminatus</u> Torr. & Hook.				X	
<u>Cypripedium candidum</u> Muhl.	X		X	X	X
<u>Decodon verticillatus</u> (L.) Ell.			X		X
<u>Deschampsia flexuosa</u> (L.) Trin.		X			
<u>Desmanthus illinoense</u> (Michx.) MacM				X	
<u>Dicentra canadensis</u> (Goldie) Walp.					X
<u>Dodecatheon meadia</u> L.					X
<u>Draba arabisans</u> Michx.			X		X
<u>Dryopteris goldiana</u> (Hook.) Gray				X	X
<u>Echinochloa walteri</u> (Pursh.) Nash					X
<u>Eleocharis pauciflora</u> (Lightf.) Link var.	X	X			
<u>fernaldii</u> Svenson					
<u>Eryngium vuccifolium</u> Michx.				X	X
<u>Euphrasia hudsoniana</u> Fern. & Wieg.		X			
<u>Floerkea proserpinacoides</u> Willd.			X		X

Appendix 35-D (continued)

	Department of Natural Resources Region				
	1	2	3	4	5&6
Special Concern Species (continued)					
<u>Gentiana affinis</u> Griseb.	X				
<u>Gentianella amarella</u> (L.) Borner ssp. <u>acuta</u> Michx.) Gillett	X				
<u>Geocaulon lividum</u> (Richards.) Fern.	X	X			
<u>Glaux maritima</u> L.	X				
<u>Hamamelis virginiana</u> L.					X
<u>Haplopappus spinulosus</u> (Pursh) DC.				X	
<u>Helianthus nuttallii</u> T.&G. ssp. <u>rydbergii</u> (Br.) Long	X		X	X	
<u>Hydrocotyle americana</u> L.				X	
<u>Juncus stygius</u> L. var. <u>americanus</u> Buchenau	X	X			
<u>Leersia lenticularis</u> Michx.					X
<u>Limosella aquatica</u> L.	X			X	
<u>Myosurus minimus</u> L.				X	
<u>Oenothera rhombipetala</u> Nutt.					X
<u>Opuntia humifusa</u> Raf.				X	
<u>Orobanche fasciculata</u> Nutt.	X			X	X
<u>Orobanche ludoviciana</u> Nutt.	X				X
<u>Orobanche uniflora</u> L.					X
<u>Panax quinquefolium</u> L.	X		X	X	X
<u>Paronychia fastigiata</u> Fern.					X
<u>Pinguicula vulgaris</u> L.		X			X
<u>Platanthera clavellata</u> (Michx.) Luer		X	X		X
<u>Poa wolfii</u> Scribn.		X			X
<u>Polygonum arifolium</u> L.			X		X
<u>Polygonum viviparum</u> L.		X			

Appendix 35-D (continued)

	Department of Natural Resources Region				
	1	2	3	4	5&6
<u>Polystichum acrostichoides</u> (Michx.) Schott.					X
<u>Potamogeton vaseyi</u> Robbins	X	X	X		
<u>Ranunculus lapponicus</u> L.	X	X			
<u>Rhynchospora fusca</u> (L.) Ait. f.	X	X			
<u>Rudbeckia triloba</u> L.				X	X
<u>Sanicula canadensis</u> L.				X	X
<u>Schedonnardus paniculatus</u> (Nutt.) Trel.				X	
<u>Scutellaria ovata</u> Hill var. <u>versicolor</u> (Nutt.) Fern.					X
<u>Solidago mollis</u> Bartl.				X	
<u>Solidago sciaphila</u> Steele					X
<u>Spartina gracilis</u> Trin.	X				
<u>Stellaria longipes</u> Goldie	X				
<u>Symphoricarpos orbiculatus</u> Moench					X
<u>Tephrosia virginiana</u> (L.) Pers.					X
<u>Thelypteris hexagonoptera</u> (Michx.) Weatherby					X
<u>Tofieldia glutinosa</u> (Michx.) Pers.	X	X			X
<u>Tradescantia ohiensis</u> Raf.					X

Appendix 35-D (continued)

	Department of Natural Resources Region				
	1	2	3	4	5&6
Special Concern Species (continued)					
<u>Triglochin palustris</u> L.	X	X		X	X
<u>Trillium nivale</u> Riddell				X	X
<u>Triplais purpurea</u> (Walt.) Champm.					X
<u>Tsuga canadensis</u> (L.) Carr.		X	X		
<u>Utricularia gibba</u> L.	X	X			
<u>Verbena simplex</u> Lehm.				X	X
<u>Viola lanceolata</u> L.		X			X
<u>Viola novae-angliae</u> House	X	X	X		
<u>Viola nuttallii</u> Pursh				X	
<u>Waldesteinia fragarioides</u> (Michx.) Tratt.		X			
<u>Xyris montana</u> Ries.	X	X			
Totals		33	29	15	26 50

Appendix 35-E

Animal species extirpated and under consideration for listing as endangered, threatened or special concern under Minnesota and federal endangered species laws.

Extirpated Animals

Bison
American elk
Brown bear
Trumpeter swan*
Swallow-tailed kite
Whooping crane**
Long-billed curlew
McCown's longspur

*

Extirpated as a breeding species but reintroduction efforts are underway.

**

Extirpated as a breeding species but occasionally seen in migration.

Species Under Consideration for Federal Listing

Loggerhead shirke
Ferruginous hawk
Swainson's hawk
Karner blue

Species Proposed for State Listing

Tiger beetles

Cicindela denikei W. J. Brown; Proposed Endangered
Cicindela fulgida fulgida Say; Proposed Endangered
Cicindela fulgida westbournei Calder; Proposed Endangered

Appendix 35-E (continued)

Species Proposed for State Listing (continued)

Cicindela limbata nympha Casey; Proposed Endangered

Cicindela lepida Dejean; Proposed Threatened

Cicindela macra macra Leconte; Proposed Threatened

Cicindela patruela patruela Dejean; Proposed Threatened

Cicindela formosa manitoba Leng; Proposed Special Concern

Cicindela hirticollis hirticollis Say; Proposed Special Concern

Cicindela pusilla pusilla Say; Proposed Special Concern

Cicindela scutellaris criddlei Casey; Proposed Special Concern

Cicindela terricola Say; Proposed Special Concern

Cicindela splendida cyanocephalata Eckhoff; Proposed Special Concern

Cicindela limbata transversa Leng; Proposed Special Concern

Extirpated Species and Species under Consideration for State or Federal Listing

Spiders

Tutelina fromicaria (Emerton); Proposed Endangered

Pellenes rutherfordi (Gertson and Mulaik); Proposed Threatened

Sassacus papenhoei (Peckham and Peckham); Proposed Threatened

Marpissa grata (Gertsch); Proposed Special Concern

Metaphidippus arizonensis (Peckham and Peckham); Proposed Special
Concern

Paradamoetas fontana (Levi); Proposed Special Concern

Phidippus apacheanus (Chamberlin and Gertsch); Proposed Special
Concern

Phidippus pius (Scheffer); Proposed Special Concern

Appendix 35-F

Plant species under consideration for listing as endangered, threatened or special concern under Minnesota and federal endangered species laws.

Species under consideration for federal listing:

Botrychium mormo
Cirsium hillii
Gerardia auriculata
Napaea dioica
Sedum integrifolium ssp ledeyii
Talinum rugospermum
Besseyia bullii
Chrysosplenium iowense
Listera auriculata
Platanthera praeclara
Poa paludigena
Polemonium occidentale var lacustre
Sullivantia renifolia
Viola novae-angliae
Woodsia oregana var. cathcartiana

Species proposed for state listing:

Endangered

Bartonia virginica
Calamagrostis lacustris
Calamagrostis purpurascens
Caltha natans
Carex crus-corvi
Carex formosa
Carex garberi

Threatened

Achillea siberica
Carex michauxiana
Carex pallescens
Carex plantaginea
Eleocharis parvula
Eupatorium sessilifolia
Euphorbia missurica

Special Concern

Aster shortii
Bidens discoidea
Carex laevivaginata
Cymopterus acaulis
Desmodium cuspidatum
Desmodium nudiflorum
Erigeron acris

Species proposed for state listing:

Endangered

Carex katahdinensis
Carex rossii
Carex supina
Carex xerantica
Crataegus douglasii
Eleocharis nitida
Empetrum nigrum
Listera auriculata
Najas gracillima
Oxytropis viscida
Polygonum careyi
Anemone multifida
Botrychium campestre
Polytaenia nuttallii
Tillaea aquatica

Threatened

Heteranthera limosa
Luzula parviflora
Muhlenbergia uniflora
Osmorhiza obtusa
Phacelia franklinii
Rotala ramosior
Selaginella selaginoides
Silene nivea
Juncus marginatus

Special Concern

Gaura biennis
Iodanthus pinnatifidus
Juncus brachycarpus
Marsilea mucronata
Paronychia canadensis
Potamogeton bicupulatus
Potentilla hippiana
Potentilla nicolletii
Psoralea tenuifolia
Pyrola minor
Rorippa sessiliflora
Sagittaria graminea
Senecio indecorus
Woodsia alpina

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36. Nongame Wildlife

The term nongame wildlife, while not a taxonomic category, is used in this planning document to refer to wildlife species not covered by other long range plans. The majority of these species are native nonhunted vertebrates.

An effective planning process for Minnesota Department of Natural Resources nongame wildlife management has been active since the early 1980s. That process has produced a series of excellent planning documents including Volumes 1-5 of the Plan for the Management of Nongame Wildlife in Minnesota and volume 3 is included with this plan as Appendix 36-A.

RESOURCE MANAGEMENT

Historically, management for nongame wildlife has been a secondary benefit of direct management for game or endangered species. For example, marshland purchased for ducks is also beneficial to black terns and pied-billed grebes, as well as many other species. Other management practices, such as prescribed burning, have benefited both game and nongame species. Yet, certain groups of animals such as raptors, reptiles, bats and colonial waterbirds have not had their specific needs met by these indirect management practices.

In 1981, the passage of Minnesota Statute 97.488 allowed protection of Minnesota's endangered plant and

animal species. The bill directed the appointment of a technical committee to formulate the endangered species list. The Commissioner of the Department of Natural Resources formalized this list and established protective measures in Commissioner's Order 2204 in May 1985. During this process the status of all nongame species was reviewed and official protection was extended to listed species. This 1981 act, however, did not provide any additional protection for species not listed as endangered, threatened or of special concern.

Nongame Wildlife Program

In 1977, nongame wildlife received direct attention from the Minnesota Department of Natural Resources through the creation of the Nongame Wildlife Program. A nongame supervisor was hired and nongame management projects were initiated. Funding was derived from the Game and Fish Fund and totalled less than \$30,000 annually from 1977 to 1980.

In 1980, the Nongame Wildlife Checkoff was established by the Minnesota Legislature and taxpayers were given the opportunity to check off for nongame species on their state income and property tax forms. The contribution rate in Minnesota has been the highest in the nation with 9 to 12% of Minnesota taxpayers donating to the Nongame Fund each year. The average individual donation has been \$5 and the fund now generates \$800,000 annually (Table 36-1).

Since 1980, the Nongame Wildlife Program has grown to a staff of 6 regional specialists, 5 technicians, a zoologist and a program supervisor.

Table 36-1. Nongame Wildlife Program donations for 1980-1987.

Tax Year	Number of Donations	Total Amount Donated
1980	154,376	\$523,743
1981	194,092	\$619,253
1982	200,154	\$616,665
1983	194,429	\$649,816
1984	194,876	\$702,168
1985	162,501	\$787,780
1986	133,729	\$765,962
1987	122,985	\$818,650

Source: Minnesota Department of Revenue report to the Nongame Wildlife Program

Research and management activities are conducted by the nongame staff and other Section of Wildlife staff, as well as biologists supported in part by grants from the Nongame Program. The Nongame Program staff has directed its field activities toward many projects, such as purple martin, colonial waterbirds, common loon surveys and raptor rehabilitation.

From 1980 to 1985, nearly \$32,000 was awarded to researchers to support 21 projects dealing with nongame wildlife ecology. Several of these projects dealt with

species distribution and abundance. Other topics included mercury contamination in juvenile common loons, forest fragmentation and the development of a study guide to reptiles and amphibians.

Education is a major priority for the Nongame Program. As in research and management efforts, financial support is provided to outside individuals or agencies for the development of educational materials including films, slide/tape shows and books on wildlife distribution and abundance. Emphasis is placed on presentations to individuals who can carry the message to interested groups.

RESOURCE ANALYSIS

The nongame wildlife long-range plan covers a large number of mammals, birds, reptiles, amphibians, mollusks and crustaceans native to Minnesota. Nongame fish and species classified as endangered, threatened or of special concern are covered in other long-range plans. Exotic species such as the mute swan, house sparrow, European starling and rock dove (common pigeon) are covered, but the house mouse and Norway rat, two exotic pest species, are not. In total, the plan covers 316 birds, 35 mammals, 15 reptiles, 16 amphibians, 36 mussels and an undetermined number of crustaceans (Appendix 36-B). Of the 673 wild vertebrates, excluding fish found in Minnesota, this plan covers 382 or 57%.

Mammals

Among Minnesota's 80 mammal species, only the gray wolf is listed as threatened, 16 are listed as special concern and 35 are considered nongame wildlife. These nongame wildlife species include 5 shrews, 2 moles, 5 bats, 9 squirrels, 1 pocket gopher, 1 pocket mouse, 8 new world mice, 2 jumping mice, 1 porcupine and 1 weasel. The house mouse and the Norway rat are the only exotic species of wild

mammals that have become established in Minnesota and they are not included in this chapter. Within the last 150 years, the following species have been extirpated in Minnesota; woodland caribou, elk, plains grizzly bear, mule deer, pronghorn, cougar and wolverine. Occasional sightings of caribou, mule deer, cougar and pronghorn have been made in recent years. Elk were reintroduced in 1935 with marginal success.

The northwest, northeast and metropolitan regions of the state have been well surveyed by mammalogists. In other regions, however, more information is needed to verify the presence or absence of certain species.

The presence of some species is not always desirable. Some small mammal species have potential for creating problems of local economic significance. Eastern moles and plains pocket gophers damage lawns, gardens, pastures and sod farms. Thirteen-lined ground squirrels and woodchucks can create problems in pastures by excessive digging. Woodchucks can also create extensive burrows under foundations and can damage gardens. Deer mice, white-footed mice, flying squirrels and red squirrels may enter houses and outbuildings and make nests in them. Porcupines damage trees and woodland voles can girdle fruit and shade trees.

Some people perceive that they have a problem whenever bats are present. Bats can create smelly, noisy and undesirable situations in attics and they can carry histoplasmosis or rabies. But in general, bats are beneficial because they prey heavily on nocturnal insects. In many cases, the problem lies not with the bats but with the human prejudice that is involved. Summer ranges and winter hibernacula are not well-known for all of Minnesota's bat species. More research needs to be done to understand our bat populations.

Some counties, townships or utility companies pay small

bounties for pocket gophers and thirteen-lined ground squirrels. These bounties have essentially no impact on the pest populations involved and are not endorsed by the Minnesota Department of Natural Resources.

Birds

Among Minnesota's 396 bird species, 27 are listed as endangered, threatened or of special concern and 316 are considered nongame wildlife. There are 6 extirpated nongame species; American swallow-tailed kite, peregrine falcon, whooping crane, eskimo curlew, long-billed curlew and McCown's longspur. The only species that has become extinct in recent times is the passenger pigeon. Minnesota has 4 exotic nongame avian species--the mute swan, house sparrow, European starling and rock dove or common pigeon.

Of the 316 avian species that are considered nongame wildlife, 246 occur regularly, 23 are casual, and 47 are accidental. Minnesota has no endemic avian species. (See the Glossary at the end of this plan for definition of regular, casual, accidental occurrence and endemic species).

While most nongame birds are rather innocuous, some can cause problems. Some fish-eating birds cause localized depredation problems at fish hatcheries, holding ponds for minnow dealers, commercial fish ponds and trout farms. Species that can cause this type of problem include the great blue heron, double-crested cormorant and belted kingfisher. The double-crested cormorant and white pelican are occasionally blamed for eating too many walleyes. Actually, these birds feed largely on rough fish and are not a limiting factor for gamefish populations.

Some birds of prey cause localized depredation problems for poultry raisers who do not keep their birds confined to a pen. Species in this category include the great horned owl, northern goshawk, Cooper's hawk and bald eagle. Perceived problems also exist for other birds of prey,

especially falcons and accipiters. The dislike or hatred that some people have for birds of prey, so-called chicken hawks, is a difficult bias to overcome and malicious killing of these species persists.

Various blackbird species probably cause the greatest economic damage by nongame birds in the state. Blackbirds sometimes feed heavily on sunflower fields, especially in western Minnesota. Concerted efforts by farmers may be necessary to reduce crop depredations. The major species involved are red-winged blackbirds, common grackles, brown-headed cowbirds and, occasionally, yellow-headed blackbirds.

Economic damage can also be caused by woodpeckers when they search for insects and insect larvae that hide under cedar siding. Certain types of rough cedar siding are especially prone to damage, because the manufacturing process creates small grooves under the cedar veneer where small larvae can exist.

Colonies of cliff swallows can create a nuisance by building their mud nests under the eaves of buildings. Barn swallows can make a mess if they nest in an undesirable--from the owner's perspective--location of the barn or if they nest over a porch light and then "dive" at people entering the house.

A serious global problem is developing with neotropical migrant species that are losing their winter range as tropical rain forests are cut down. A similar problem that may affect interior forest migrants is the continuing fragmentation of our larger contiguous forest tracts. Both of these trends may cause declines in Minnesota populations of certain avian species.

Reptiles and Amphibians

Minnesota's reptile and amphibian fauna include 49 species of which 17 are listed as endangered, threatened or

of special concern. Only the snapping turtle, also a species of special concern and the leopard frog are considered game species. The leopard frog is harvested commercially and sold for fish bait. The remaining 31 species are considered nongame wildlife; 6 turtles, 2 lizards, 7 snakes, 5 salamanders, and 11 toads and frogs.

No reptiles or amphibians have become extinct or extirpated in recent times. There are no exotic populations of reptiles or amphibians in Minnesota.

Many southern reptiles and amphibians reach the northern or northwestern limit of their range in the driftless (unglaciated) hardwood forest region of southeastern Minnesota. A few western prairie species reach the eastern limit of their range in Minnesota.

Nongame reptiles and amphibians create some actual and perceived problems in Minnesota. Many people do not like snakes. For this reason, many beneficial snakes, primarily garter and hognose snakes, are killed every year. This old prejudice is passed on from generation to generation. The only solution to this problem is a long-term educational program.

Until 1989, some counties and townships in southeastern Minnesota still paid bounties on rattlesnakes. It was a long-standing tradition that did little to control rattlesnake populations and, if anything, only perpetuated the myth that snakes are evil creatures that should be killed. In May 1989, state legislation was passed eliminating bounties on rattlesnakes.

Several nongame reptiles and amphibians, especially some species of turtles and snakes, have high appeal and value as pets. This can be an educational experience and a rewarding hobby, but it needs to be done within a framework of regulations that prevent depleting wild populations. Unrestricted collecting for commercial purposes could also cause the decline of local populations. Current Department

of Natural Resources reptile and amphibian regulations are out-of-date, confusing and do not provide adequate protection.

Invertebrates

The extent of the Department of Natural Resources's interest and responsibility for wild animals is not limited to vertebrates, but extends to invertebrates as well. This is a considerable extension of responsibility because, on a biomass or diversity basis, invertebrates are by far the largest animal group.

Except for certain groups of arthropods and mollusks, most of Minnesota's invertebrate fauna have not been identified or studied. The problem is further compounded by a shortage of qualified specialists. As a result, little is known about much of the state's invertebrate fauna.

Only 2 groups of invertebrates will be discussed in this plan, the mollusks--with emphasis on the mussels--and the crustaceans.

Mollusks

The current abundance and condition of populations of freshwater mollusks in Minnesota are poorly known. Inadequate funding for field research at state and federal levels and the vast number of state waterways requiring examination, contribute significantly to the lack of information.

Minnesota's snail fauna is relatively rich, and although some species are in serious trouble in specific areas, existing data indicates no serious problem statewide. Of the 40 species of mussels in Minnesota, 2 are listed as endangered and 2 are considered of special concern (Appendix 36-C). There are another 6 species probably restricted to the upper Mississippi River, below St. Anthony Falls, and perhaps the St. Croix River, below Taylor's Falls, that are

jeopardized because of habitat destruction and water pollution. These are:

<u>Quadrula metanerva</u> (Raf.)	Monkeyface
<u>Megalonaias gigantea</u> (Barnes)	Washboard
<u>Plethobasus cyphus</u> (Raf.)	Bullhead
<u>Ellipsaris (Phagiola) lineolata</u> (Raf.)	Butterfly
<u>Arcidens confragosus</u> (Sag)	Rockshell
<u>Alismodonta viridis</u> (Raf.)	Sippershell

Major problems facing management of mollusks are limited information, habitat destruction, water pollution and unclear management responsibilities. Basic field work is needed to determine species population.

In addition, the Minnesota Department of Natural Resources must delegate specific responsibility for mollusk management so that issues concerning mussels can be dealt with effectively.

Crustaceans

The number of species, distribution and range of crustaceans in Minnesota are very poorly known. Currently, there is not even a list of species known to occur in the state.

There are 2 major problems facing management of crustacean species in Minnesota. The first is adequate information about species and populations. The second is that management responsibility within the Minnesota Department of Natural Resources has not been officially delegated.

RESOURCE ANALYSIS

Quantitative data on the demand for nongame wildlife is scarce. The following qualitative statements summarize the demand for nongame uses of wildlife in Minnesota:

1. The demand for all types of benefits from nongame wildlife populations will continue to increase because of the public's growing environmental awareness and increasing appreciation for all living things.
2. The information needs of the public regarding distribution and status of many nongame species already exceeds what is available.

GLOSSARY

- Species for which there are records in 10 or 9 of the past 10 years are considered Regular.
- Species for which there are acceptable records in 8 of the past 10 years are discussed by the committee on an individual basis and by consensus are defined as either Regular or Casual.
- Species for which there are acceptable records in 7, 6, 5 or 4 of the past 10 years are considered Casual.
- Species for which there are acceptable records in 3 of the past 10 years are discussed by the committee on an individual basis and by consensus are defined as either Casual or Accidental.
- Species for which there are acceptable records in 2, 1 or none of the past 10 years are considered Accidental.
- Extirpated species formerly occurred regularly in the state, but disappeared and are not expected to recur.
- Extinct species formerly occurred in the state, but no longer occur anywhere in the world.
- Endemic species belong exclusively to, or are confined to, a particular place.
- Neotropical pertains to a geographical area comprising that part of the new world extending from the Tropic of Cancer southward.

Long range planning for nongame wildlife

SERVICE: Conservation of nongame wildlife populations for their intrinsic and ecological values.

PRODUCT: Opportunities for appreciation and use of nongame wildlife.

GOAL: To protect and manage nongame wildlife and increase opportunities for use and appreciation.

OBJECTIVE 1. Maintain viable populations of nongame wildlife species in order to prevent their decline to threatened, endangered or special concern status.

PROBLEM 1. Some populations of nongame wildlife are declining.

STRATEGY A. Protect, acquire, maintain and improve habitat and implement the habitat chapter of the "Plan for the Management of Nongame Wildlife in Minnesota-Vol. III."

STRATEGY B. Encourage other public and private land managers to protect, acquire, maintain and improve habitat.

STRATEGY C. Strengthen the environmental review and mitigation processes.

STRATEGY D. Assess the effects of collecting for the pet trade, scientific supply houses and the bait industry.

STRATEGY E. Develop and implement a policy on possession and management of exotic species.

STRATEGY F. Promote public education programs to reduce illegal or unnecessary taking and unregulated collecting.

STRATEGY G. Develop and implement methods to control excessive interspecific competition.

STRATEGY H. Improve, promote and enforce regulations that protect nongame wildlife.

PROBLEM 2. A shortage of biological and socioeconomic information on nongame species complicates management.

STRATEGY A. Research population dynamics, behavior and ecology of priority species and determine their distribution and abundance.

STRATEGY B. Develop and implement a data management system and implement the data acquisition and information management chapters of the "Plan for the Management of Nongame Wildlife in Minnesota-Vol. III."

STRATEGY C. Conduct and support research on economics, social values and public attitudes.

STRATEGY D. Effectively communicate and apply existing research findings.

PROBLEM 3. The Nongame Wildlife Management Account is vulnerable to elimination or decline, as has occurred in other states with checkoff programs.

STRATEGY A. Implement the funding chapter of the "Plan for the Management of Nongame Wildlife in Minnesota-Vol. III."

PROBLEM 4. Conflicting policies result from unclear or conflicting resource management responsibilities, goals, objectives and strategies.

STRATEGY A. Clarify management responsibilities of all Minnesota Department of Natural Resources programs impacting nongame wildlife populations and reconcile goals, objectives and strategies.

STRATEGY B. Implement the coordination chapter of the "Plan for the Management of Nongame Wildlife in Minnesota-Vol. III."

STRATEGY C. Develop and promote training programs and educational information for agency personnel.

PROBLEM 5. Some nongame wildlife species become a nuisance or cause damage.

STRATEGY A. Provide information and technical assistance to reduce problems.

OBJECTIVE 2. Encourage an additional 275,000 days of use and appreciation annually by 1992.

PROBLEM 1. Information on types and levels of use is insufficient.

STRATEGY A. Survey and monitor use.

STRATEGY B. Investigate recreational uses and develop opportunities that maximize recreation while protecting the resource.

PROBLEM 2. People may be unaware of recreational opportunities.

STRATEGY A. Provide information to the public on recreational opportunities, promote tourism.

STRATEGY B. Implement the public awareness and appreciation chapter of the "Plan for the Management of Nongame Wildlife in Minnesota-Vol. III."

1/8/90

Public Review Draft

36-17

Appendix 36-A

FISH AND WILDLIFE PLANNING TEAM
MINNESOTA DEPARTMENT OF NATURAL RESOURCES
Division of Fish and Wildlife
500 Lafayette Road
St. Paul MN 55155-4025

FISH, WILDLIFE & NATIVE PLANT RESOURCES
LONG RANGE PLAN COMMENTS

The Division of Fish and Wildlife is inviting comments from individuals and organizations on the long range plans for the management of fish, wildlife and native plant resources. Use this form, or write us a letter, telling us how we can improve the plan or plans you have reviewed.

Plan Name: _____

Comments: _____

Your name: _____

Address: _____

Are these the official comments of an organization? Yes No

Organization: _____

To mail: fold & seal with tape or place in envelope.

Thank you for taking the time to review the plan and providing your comments.

-----fold here-----

From

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FISH & WILDLIFE PLANNING TEAM
Section of Ecological Services
Minnesota Department of Natural Resources
500 Lafayette Road
St. Paul MN 55155-4025

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37. Native Prairie

In presettlement times prairies covered much of the midwest, closely corresponding to what is now the nation's corn belt (Figure 37-1). Since then the tallgrass prairie has been largely destroyed by settlement and cultivation. Of the 400,000 square miles that once existed in North America, less than 2% survives today. Today, Minnesota contains less than 1% of the 28,000 square miles of tallgrass prairie that once existed within the state.

Native prairie is composed of diverse assemblages of plant and animal species; however, the most striking feature of the prairie is its relative uniformity across its large geographic range. Prairie vegetation is dominated by a few major prairie grasses. These grasses have predictable distribution patterns that coincide with different moisture levels. In general, prairie cordgrass and bluejoint dominate the wet lowlands; big bluestem and Indian grass occupy the deep, moist upland soils of high fertility; and little bluestem and sideoats gramma occur on the thin soils of dry uplands.

In Minnesota the tallgrass prairie once covered approximately 18 million acres west of a diagonal line running roughly between the northwest and the southeast corners of the state. It occupied a wide variety of landforms including beach ridges and swales, flat glacial

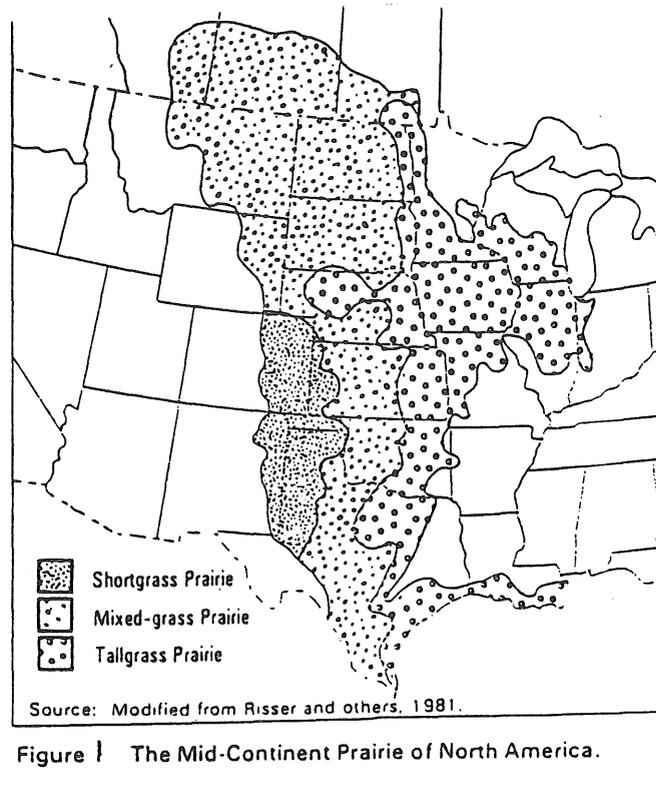
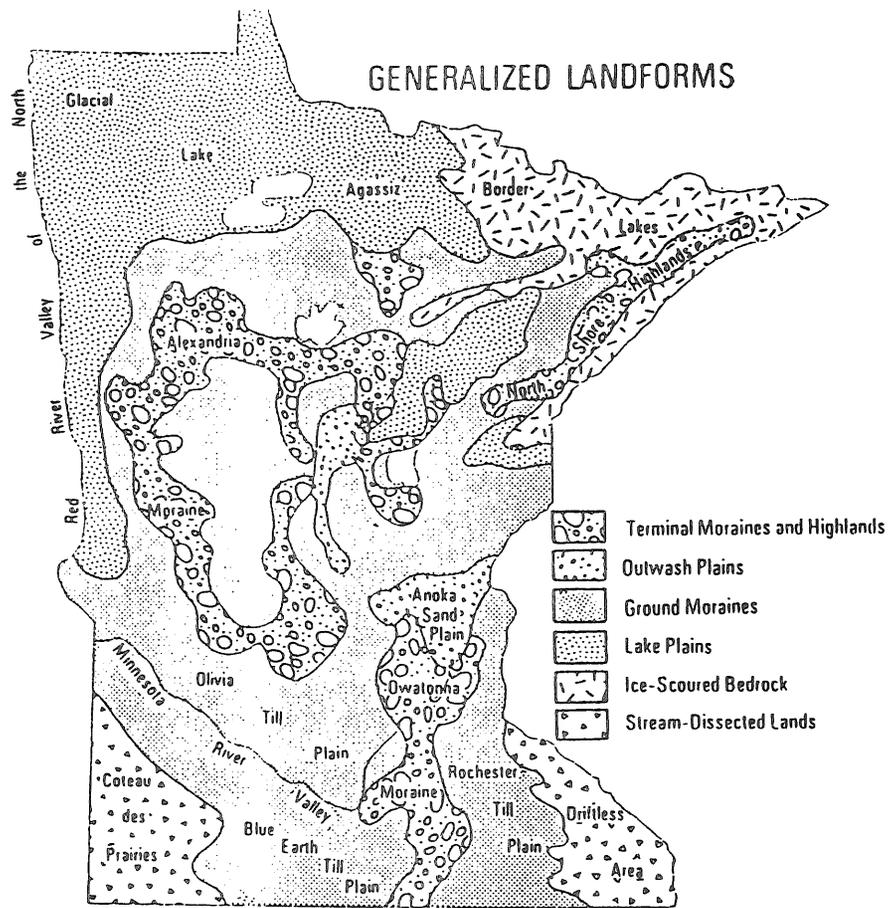
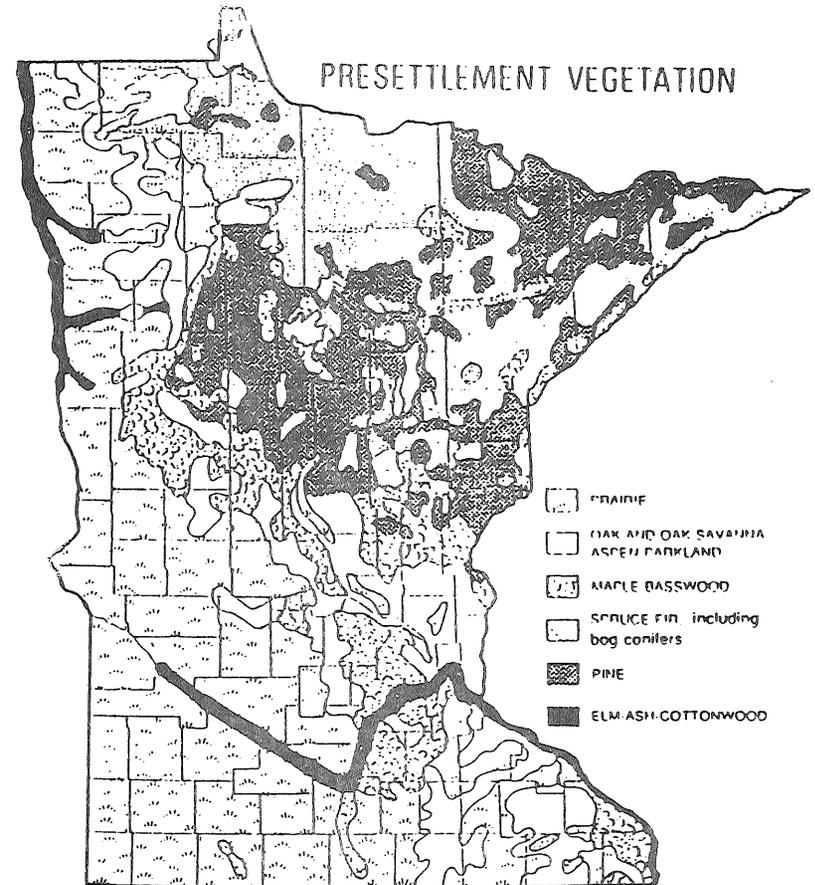


Figure 1 The Mid-Continent Prairie of North America.



Source: Modified from Wright in Sims and Morey, 1972.



Presettlement vegetation types in Minnesota. (Adapted by Patricia Burwell from an unpublished map drawn by F. J. Marschner in 1930 for the United States Department of Agriculture, Washington, D.C.)

lake beds, morainic hills, steep bluffs and rolling till plains (Figure 37-2).

Significant differences in the composition of prairie plants and animals occur on these different landform types and across the state's southeast to northwest climatic gradient. Distinctive groupings of species can be associated with certain environmental conditions; however, these species assemblages or communities do not form discrete boundaries. Rather, they continuously intergrade forming an ecological continuum.

RESOURCE MANAGEMENT

A classification of Minnesota's native prairie types is outlined in Table 37-1. This classification scheme was developed by the Natural Heritage Program. It separates the continuum of native prairie into 4 major classes and further defines several natural community types within each class (Appendix 37-1). Known occurrences of each of the defined prairie community types are ranked according to their quality and condition. Quality refers to their degree of naturalness; that is, how closely their structure and composition resemble presettlement conditions.

Four ranks are given: Grade A = excellent, Grade B = good, Grade C = marginal, Grade D = poor (Appendix 37-2). Quality ranking is a system for comparatively evaluating a particular occurrence of native prairie and thus helps determine its protection and management priority. Quality ranking is also used to monitor the success of management prescriptions applied to a parcel of native prairie. The management goal typically is to maintain or to improve the quality rank.

Post Settlement Changes

Before European settlement tallgrass prairie covered approximately one-third of the state. Beginning in 1850,

agriculture became the backbone of the state's economy and the most productive prairie lands quickly disappeared under the plow. The remaining prairie was often grazed or mowed for hay. More recently, in the 1970s, Minnesota experienced a sharp expansion in agricultural production that resulted in an accelerated loss of prairie habitat. In many counties within the prairie region, from one-fourth to one-half of the previously uncultivated land became cropland. With more than 99% of the tallgrass prairie being lost to cultivation in the past 130 years.

The loss of large expansion of tallgrass prairie caused substantial reductions in population size and distribution of many native prairie species. By the mid-1800s the herds of bison and elk had vanished. The long-billed curlew and McCowens longspur were extirpated. The greater prairie-chicken was extirpated from the southern part of the state. One hundred and five species of vascular plants and animals associated with prairie have been designated as endangered, threatened, or of special concern in the state, largely the result of habitat loss. These species represent 42% of all designated rare species in Minnesota.

Most of the remaining prairie that remains in Minnesota occurs as isolated remnants. The largest areas of native prairie are in northwestern Minnesota, in the Red River Valley. It is generally associated with dry, gravelly soils or wet areas not suitable for farming. Since European settlement, these prairies have been used as hayfields or pastures. The central part of the Red River Valley is nearly continuous cropland. However, toward the eastern margin of the valley, cultivation was inhibited by an undulating landscape of dry ridges and wet swales marking former glacial Lake Agassiz shorelines. Within this interbeach area, thousands of acres of prairie still exist as privately owned pastures, hayfields or as public land.

Table 37-1. Minnesota prairie community classification.

Major Class	Natural Communities
Mesic blacksoil prairie	Southeast Mesic Blacksoil Prairie Southwest Mesic Blacksoil Prairie Northwest Mesic Blacksoil Prairie Eastcentral Mesic Blacksoil Prairie
Dry lime prairie	Gravel Prairie Dolomite Prairie Glacial Till Hill Prairie Bluff or Goat Prairie
Dry sand prairie	Dry Sand Prairie
Wet blacksoil prairie	Southeast Wet Blacksoil Prairie Southwest Wet Blacksoil Prairie Northwest Wet Blacksoil Prairie Eastcentral Wet Blacksoil Prairie

In other parts of the state, considerably less native prairie remains. It is estimated that less than 450 acres of mesic blacksoil prairie is left in southeastern Minnesota. Almost all of the mesic blacksoil prairie in southwest Minnesota is gone. There are numerous bluff prairies in the southeast, but these were only a small component of the original prairie. Some large tracts of glacial till hill prairie also exist, associated with the Minnesota River Valley, Alexandria moraine and Prairie Couteau. In total, however, it is estimated that only 150,000 acres of native prairie remains in the state, less than 1% of the original total.

Habitat Protection

Compared to other midwestern states, Minnesota has a relatively good record of protecting remaining prairie. In fact, no other state in the upper midwest surpasses Minnesota in the number of acres of tallgrass prairie protected. More than 48,000 acres receive some degree of protection under several programs that protect prairie from

conversion to other vegetation types or land uses.

The organizations that protect and manage the largest acreages of native prairie are the Minnesota Department of Natural Resources, the U.S. Fish and Wildlife Service and The Nature Conservancy. Within these organizations is a range of programs that varies widely in the type of protection they provide. A description of these programs, their objectives and the number of prairie acres they protect is provided in Table 37-2 and Appendix 37-D.

For the purposes of this plan, The Nature Conservancy land will be considered as public land because this organization allows the public access to its properties for many uses and management is similar to other public lands.

The majority of these protected prairie lands are but small fragments of the original prairie landscape. There are only a few areas left in the state which support the complex interspersion of prairie, wetland and topography, that are large enough to maintain their original ecosystem features and functions. A number of rare grassland species require these large habitat expanses and mosaics of different habitat types.

Because of their size and complexity, several of these large prairie landscapes have not received any systematic protection or management. Loss of prairie lands within these areas still continues. For example, 4,000 acres of the 8,000-acre Felton Prairie landscape has been converted into cropland and gravel pits between 1974-1985, and 5,000 acres of the 12,000-acre Pembina Trail Prairie landscape was plowed up in 1984.

One example of a successful large protection effort is the Lac qui Parle Project, recently established by the Department of Natural Resources and The Nature Conservancy. The objectives of this project are to acquire and manage carefully selected upland prairie tracts adjacent to an existing 29,000 acre lake and wetland area. This will create a landscape reserve that represents the entire range

of habitat variability--from lake through marsh to upland prairie--that characterizes the upper Minnesota River valley. This type of large-scale protection effort requires extensive coordination and is typically beyond the scope of any one program.

Two-thirds of the state's prairie lands are not under any type of protection program. These are especially vulnerable to conversion to cropland or to deterioration from various land use activities e.g., herbicide application, heavy grazing, interseeding with non-native species such as clover. In addition, a number of the protected prairies are only minimally protected. In a program such as the Prairie Tax Credit Program, a landowner is only obligated to protect the prairie for one year. The 1987 legislature removed the credit for enrolled acres so that, in the future, the only remaining incentive in this program will be the exemption of enrolled lands from property taxes. Some publicly owned prairie land is at risk because prairie preservation is not recognized as the highest management objective.

The 1987 Minnesota legislature, with the enactment of the Reinvest in Minnesota Native Prairie Bank (M.S. 84.96 Sec. 19) and the Prairie Landscape Reserve Program (M.S. 84.91 Sec. 98.1), explicitly recognize the value of native prairie and mandated its restoration, management and protection (Appendix 37-E). The Prairie Landscape Reserve bill requires the Department of Natural Resources to plan for the restoration and management of native prairie on a landscape scale. The Native Prairie Bank Program authorizes the Department of Natural Resources to protect native prairie by entering into conservation easements with landowners.

Table 37-2. Types of prairie protection in Minnesota.

Organization *Program	Prairie acres	Type of protection	Management objectives
MINNESOTA DEPARTMENT OF NATURAL RESOURCES			
* Wildlife Management Area	10,000	Fee title ownership	Wildlife management
* Scientific and Natural Areas	7,000	Fee title ownership and 5,000 acres leased from The Nature Conservancy	Scientific, ecological
* Division of Parks and Recreation	4,916	Fee title ownership	Recreation, ecological
* Minnesota Native Prairie Tax Credit Program	12,000	Voluntary, financial incentive	Prairie preservation
* Prairie Bank	new program	Conservation easement	Prairie preservation
THE NATURE CONSERVANCY			
* Preserve System	12,000	Fee title ownership and 5,000 acres leased to the Department of Natural Resources	Scientific, ecological
* Private Landowner Registry Program	Unknown	Voluntary compliance	Preservation, ecological value
U.S. FISH AND WILDLIFE SERVICE			
* Waterfowl Production Areas and Refuges	13,000	Fee title ownership	Waterfowl production

Management Activities

Historical evidence indicates that fires were prevalent in grasslands. In the past, fires probably occurred every 3 to 10 years. Fire controls tree and shrub growth, reduces litter build-up, provides habitat diversity and variability, and stimulates growth and flowering of many prairie plant species. Grazing by large herds of native ungulates was also a significant ecological factor in tallgrass prairie ecosystems. Grazing creates structural diversity in the grazed and ungrazed areas and compositional diversity through differential grazing of certain species. Management activities on protected prairies are directed primarily at replicating the effects of these historical fires and grazing patterns. In addition, considerable attention is focused on control of exotic non-prairie species.

Management of the state's prairie lands lags significantly behind protection efforts and is attributed to inadequate ecological information about prairies and inadequate recognition of prairies as a valued resource. The primary management constraints are personnel, training and equipment to conduct the necessary burning.

In recent years, prescribed burning and other prairie management activities have been increasing. Ideally, one-third of all prairie acreage should be burned each year, essentially creating a 3-year rotation for burning. The Department of Natural Resources is presently burning approximately 15% of its prairie annually. The U.S. Fish and Wildlife Service burns roughly 12%, and The Nature Conservancy presently burns 28% of its prairie lands each year. Very little private prairie is burned.

Management on private prairie lands is primarily grazing or cutting hay. Grazing is typically season-long, although some operations do employ more sophisticated range management systems designed to maintain the prairie in a productive condition. The quality of native prairie

pastures is variable. Herbicides are occasionally used for weed control and some fields are fertilized and improved by interseeding with tame pasture species such as red clover and timothy grass.

Reestablishment of prairie is another major management activity. The first such prairie restorations were conducted at the University of Wisconsin Arboretum in the mid-1930s. Today public agencies have become involved in prairie reestablishment projects in every midwestern state. In Minnesota, prairie is planted for wildlife habitat; as a conservation practice on private lands through various government farm programs, such as Conservation Reserve Lands of the Reinvest in Minnesota Program; by road authorities such as the Department of Transportation and the Department of Natural Resources Roadsides for Wildlife Program; and to restore natural vegetation on disturbed lands and for landscape purposes.

RESOURCE ANALYSIS

The major issues facing Minnesota's prairies today are;

- protection of the remaining native prairie remnants,
- improving the management and restoration of prairies,
- protecting and enhancing large prairie reserves.

Protecting prairie as a unique part of Minnesota's biological and historical heritage attracts widespread interest. A concerted effort is underway among public and private agencies and organizations to protect and restore native prairie. These programs have been able to protect a third of the remaining prairie lands in the state. Protection of the remaining two-thirds is the most fundamental conservation priority for the prairie resource.

To focus efforts effectively, there is a need for accurate information on the location, extent and quality of

existing native prairie. The Minnesota County Biological Survey (Appendix 37-E) was suggested by the department and funded by the Legislative Commission on Minnesota Resources and The Nature Conservancy in 1987 as a pilot project to systematically inventory and evaluate, county-by-county, the state's rare natural features. During the survey's pilot phase from July 1987 to June 1989, survey staff conducted an inventory of 6 western prairie counties.

The comprehensive biological data collected within the survey area has proven to be the best foundation for developing the native prairie conservation program. Continuation of the Minnesota County Biological Survey program will enable the Department of Natural Resources to effectively plan for statewide prairie protection and management.

Prairies are dynamic ecosystems requiring active management, most notably burning, to maintain their structure and composition. The level of management activity on public and private prairies is far less than needed. To get public prairie lands burned once every 3 to 4 years will require a 3-fold increase in prescribed burning efforts as well as increased control of non-native weed species.

Many acres of prairie on private land are becoming degraded due to a lack of adequate management. The Department of Natural Resources and others seek to identify prairie on private land and offer incentives to protect this resource through Prairie Bank and Prairie Tax Credit programs. Once identified and protected, however, there is no assistance available from state or private organizations to landowners for the management or development of their prairie.

The next decade may be the last opportunity to protect and develop large tracts of native prairie in Minnesota. This potential is limited to a few areas in the state, the interbeach area in the northwest, the Alexandria Moraine,

the upper Minnesota River Valley in westcentral Minnesota, the Prairie Coteau in the southwest and the Mississippi River Valley in the southeast.

It is possible to create prairie landscape reserves in these regions, comprised of an integrated network of protected prairie lands, prairie restoration sites and private prairie lands, all managed cooperatively on a landscape scale. Creative partnerships between public agencies, conservation organizations and private landowners are the key to protecting large, viable preserves.

RESOURCE VALUE

Prairie is critical as habitat for many native species of plants and animals. Almost half of the state's rare species occur on prairies. Prairies are also important for several other purposes; scientific, recreational, historical, educational and agricultural, including grazing and cutting of hay.

Research on the native prairie ecosystem can yield many benefits. Most current agricultural crops are grown on soils that developed on grasslands and many crops were derived from wild plants with a grassland origin. Agricultural research scientists depend on the broad genetic base of wild grasses and forbs to help them develop new disease and drought resistant strains of hybrid seed. There is research interest in the ability of native prairie grasses to renew damaged soil structure and improve soil fertility. Medical researchers have only recently begun analyzing the extracts of many common plants.

Recreational interest in prairies ranges from nature photography, to birdwatching and hunting. The 1985 U.S. Fish and Wildlife Service National Survey of Hunting, Fishing and Wildlife Related Recreation reported that over 90% of Minnesotans participate in wildlife associated recreational activities.

More utilitarian uses of prairie land includes grazing and cutting hay. Native prairie hay is often sold to stockyards which use it to feed range cattle. It is also used locally to feed heifers and dry cows. Prairie hay can be relatively economical to produce because of its low production costs and drought resistance.

The demand for prairie is difficult to assess because of the lack of measurements and the difficulty in measuring variables. Socioeconomic information on the values of native prairies to various segments of the public might help clarify levels of demand.

Long range planning for native prairie

SERVICE: Conservation of native prairie communities.

PRODUCTS: Opportunities for appreciation and use of native prairie communities.

GOAL: Protect, restore and enhance native prairie communities, the species they contain, and the critical ecological processes that give rise to these communities.

OBJECTIVE 1. Protect and maintain 150,000 acres of native prairie statewide by preventing the further loss of native prairie through conversion to other land uses.

PROBLEM 1. The absence of comprehensive information on the location, extent and quality of existing native prairie sites reduces effective native prairie protection and management.

STRATEGY A. Continue the operation of the Minnesota County Biological Survey to inventory all of the existing native prairie sites in the state. Store inventory information in the Natural Heritage and Nongame Wildlife programs.

STRATEGY B. Improve dissemination of Minnesota County Biological Survey information to land management and land regulation agencies such as the following for use in their programs: Fish and Wildlife Service, Agricultural Stabilization Conservation Service/Soil Conservation Service County, zoning officials and Department of Natural Resources divisions and field managers.

STRATEGY C. Summarize Minnesota County Biological Survey information into practical formats for public use.

PROBLEM 2. There are numerous high quality native prairie sites threatened by immediate destruction. Most of these sites are not under any formal protection program; but the few that are need more protection.

STRATEGY A. Through a coordinated approach with the U.S. Fish and Wildlife Service, The Nature Conservancy and other land management agencies and organizations, acquire in fee title approximately 15,000 acres of native prairie by 1992.

STRATEGY B. Increase the number of landowners and acres enrolled in the Native Prairie Tax Credit Program from 270 to 375 landowners and 10,000 to 15,000 acres, respectively, by 1992.

STRATEGY C. Implement the Native Prairie Bank Program allowing landowners to sell conservation easements to the Department of Natural Resources to protect their prairie land.

STRATEGY D. Upgrade current administrative protection afforded native prairie sites.

OBJECTIVE 2. Maintain or improve the quality ranking (Appendix 37-B) on 80,000 acres of existing native prairie lands by 1992.

PROBLEM 1. A large amount of native prairie is

deteriorating in quality because is not burned on a regular basis.

STRATEGY A. Expand the coordinated interdisciplinary Department of Natural Resources prescribed burning effort to a level capable of burning all its native prairie on a once per 3 to 4-year cycle.

STRATEGY B. Develop improved techniques and equipment for grassland fires.

STRATEGY C. Expand prescribed burning training opportunities.

STRATEGY D. Resolve any liability, statutory or jurisdictional problems constraining the prescribed burning effort.

STRATEGY E. Improve the public understanding and acceptance of prescribed burning for management purposes.

PROBLEM 2. Land management plans and programs affecting prairie lands do not consistently incorporate objectives and strategies for managing the prairie resources.

STRATEGY A. Insure that management plans for public lands that contain native prairie include appropriate objectives and strategies for managing them.

STRATEGY B. Insure that state, federal and local program rules, regulations and plans adequately address prairie management and protection needs.

PROBLEM 3. There is inadequate ecological information about the biological and associated management needs for native prairie community types and species.

STRATEGY A. Collect, publish and distribute basic data on rare species prairie community relationships to resource managers, landowners and other interested parties.

STRATEGY B. Research and monitor the responses of existing prairie communities and species to prairie, forest and agricultural management activities.

STRATEGY C. Research and monitor the effects of environmental conditions and human activities that impact prairies, such as exotic species, pesticides and other chemicals, grazing, cutting of hay and cropping.

PROBLEM 4. There is little assistance available to private landowners for the management or restoration of prairie on their land.

STRATEGY A. Establish a prairie management assistance program for private landowners, including cost-sharing and technical assistance.

STRATEGY B. Work with existing agricultural education and assistance programs to develop and promote the best management practices for cutting hay and grazing on prairies.

STRATEGY C. Survey private prairie owners to identify some of their perceptions, attitudes, characteristics and motivations for protecting their prairie.

STRATEGY D. Carry out a public awareness campaign to improve public awareness and understanding of native prairie.

OBJECTIVE 3. Create, protect and enhance 3-large prairie landscape reserves comprised of an integrated network of public prairie lands, restoration sites and private prairie lands in compliance with the 1987 Prairie Landscape Reserve Program legislation (Appendix 37-D).

PROBLEM 1. The variable quality of available biological data on native prairie inhibits the effective design and implementation of a system of prairie landscape reserves.

STRATEGY A. Support continuation of the Minnesota County Biological Survey so that comprehensive information on native prairie distribution, abundance and condition is available by 1992 and use such information in designing and implementing prairie landscape reserves.

STRATEGY B. Conduct basic research on the minimum size requirements for a prairie landscape reserve.

STRATEGY C. Establish specific goals and objectives for each prairie landscape reserve with an ongoing performance review mechanism to evaluate the success of meeting objectives defined

for each area.

PROBLEM 2. The current level of coordination of diverse landowners and land management programs is insufficient to establish and maintain prairie landscape reserves.

STRATEGY A. Coordinate protection efforts between the U. S. Fish and Wildlife Service, The Nature Conservancy, Divisions within the Department of Natural Resources and other protection agencies and organizations to consolidate and enlarge the few remaining large prairie tracts.

STRATEGY B. Develop coordinated management strategies among the various landowners to maximize efficiencies and take advantage of unique equipment and technical capabilities.

STRATEGY C. Establish financial and technical incentives for long-term private landowner participation in a prairie landscape reserve.

STRATEGY D. Build a good working relationship among all the interested parties in a project area by establishing strong communication networks.

APPENDIX 37-A

MINNESOTA PRAIRIE COMMUNITY CLASSIFICATION

Prairies are defined as natural communities dominated by native prairie grasses and forbs with tree cover less than 10%. Four broad subclasses are defined: Mesic Blacksoil Prairie, Dry Lime Prairie, Dry Sand Prairie and Wet (Low) Blacksoil Prairie. This natural community classification was developed by the Department of Natural Resources-Natural Heritage Program to efficiently inventory and catalogue information on Minnesota prairies for the purposes of determining their relative endangerment and conservation priority.

Mesic Blacksoil Prairie

Mesic blacksoil prairies, often referred to as tallgrass prairie, are found throughout the prairie region of Minnesota on deep, nutrient rich, loam soils with a dark A soil horizon. Soil moisture ranges from dry-mesic to wet-mesic; the dominant clover types being the tall grasses, big bluestem (Andropogon gerardi) and Indian grass (Sorghastrum nutans). The blacksoil prairie shows considerable variation--in species composition and site occupation--across its range. It is subdivided into 4 natural communities defined by geographic region; southeast, southwest, northwest and eastcentral.

Southeast Blacksoil Prairie. This natural community, found east of the Prairie Coteau region and south of the Minnesota and Cottonwood Rivers, is the most species-diverse prairie community type in Minnesota. The flora shows a strong eastern and southern influence with only minor influence from the Great Plains to the west. Prairie species restricted to or modal to the southeast blacksoil prairie include Baptisia leucantha, B. leucophaea, Eryngium

yuccifolium, Parthenium integrifolium and Cacalia tuberosa. Less than 500 acres of intact southeast blacksoil prairie are known to exist, the remnants are largely confined to railroad rights-of-way.

Southwest Blacksoil Prairie. A prairie community of southwest Minnesota that is found on the deep soils of till plains. The flora here shows a southern and western influence and lacks many of the species with eastern affinities that are found in the southeast Blacksoil Prairie. Prairie species restricted to southern Minnesota and found in the southwest blacksoil prairie include Ratibida pinnata, Silphium laciniatum, and Prenanthes aspera.

Northwest Blacksoil Prairie. This prairie community is found on the deep soils of the lake plain and beaches of Glacial Lake Agassiz and the surrounding morainic and till plain uplands. The flora has a northern and western influence and is less species-rich and less productive than the blacksoil prairies to the south. Large acreages of blacksoil prairie have been protected on the lower slopes of the numerous beach ridges; however, the flat bed of glacial Lake Agassiz itself is almost entirely under cultivation.

Eastcentral Blacksoil Prairie. This prairie community is found on the deep soils of nearly level outwash plains and terraces of the Minnesota and Mississippi rivers. The prairie here shows an overlapping flora where species typical of the northwest and southwest mesic prairies occur together. Species of southern and eastern affinities include: Helianthus occidentalis, Penstemon digitalis, Artemesia serrata and Oxypolis rigidior.

Dry Lime Prairies

The dry lime prairies are communities found on shallow or droughty soils over dolomite bedrock, calcareous gravel or calcareous glacial till. Lime prairies occur on a variety of physiographic sites including calcareous beach

deposits, gravelly glacial kames, limestone capped bluffs of the driftless area, and rocky glaciated hills. Soil moisture typically ranges from dry to dry-mesic. The dominant cover types are the mid-grasses, little bluestem (Andropogon scoparius) and sideoat grama (Bouteloua curtipendula). Dry lime prairies have the strongest species affinity to the Great Plains prairies and have a lower species richness than the blacksoil prairies. Four natural communities are recognized.

Gravel Prairie. A prairie community that occurs on well-drained to excessively drained gravelly soils. The dominant plants are the prairie grasses, little bluestem (Andropogon scoparius) and sideoats grama (Bouteloua curtipendula). The gravel prairie is found on the crests of beach ridges associated with glacial Lake Agassiz, on outwash areas along major rivers and on the gravelly crests of morainic hills and ridges in southwest Minnesota. Soil moisture ranges from dry to dry-mesic. Characteristic forbs include many western prairie species as Petalostemum occidentale, Solidago mollis, Haplopappus spinulosa and Astragalus missouriensis.

Dolomite Prairie. This prairie community occurs on well-drained shallow soils overlying limestone bedrock at a few inches to 2 feet below the surface. Soils are often rocky with glacial boulders at the surface. The dominant prairie grasses are little bluestem (Andropogon scoparius), big bluestem (Andropogon gerardi) and sideoats grama (Bouteloua curtipendula). Dolomite prairie is found on the high terraces of the Minnesota River from Mankato to Fort Snelling. Characteristic species include Aster sericeus, Liatris cylindracea, Arenaria stricta, Aster ericoides, Artemisia caudata and Kuhnia eupatoroides.

Glacial Till Hill Prairie. A prairie community that is found on somewhat deep droughty soils formed in calcareous glacial till. This community occurs on steep side slopes along rivers and deep drainage ways. Soils

typically have rocks and limestone fragments at the surface. They are common on irregular moraine areas in south-central and western Minnesota. They have many characteristic dry to dry-mesic species in common with the bluff prairies of southeast Minnesota; however, they have a higher floristic affinity to the Great Plains. Glacial till hill prairies contain many western xerophytes at the eastern periphery of their range including Solidago mollis, Astragalus missouriensis, Astragalus lotiflorus, Agropyron smithii, Stipa viridula and Petalostemum occidentale. The dominant grasses are Andropogon scoparius, Bouteloua curtipendula and Stipa spartea.

Bluff or Goat Prairie. A natural community restricted to southeast Minnesota on steep south to west-facing limestone capped bluffs adjoining the Mississippi River and its minor tributaries. Bluff prairies occur as openings on otherwise forested slopes and are usually less than 10 acres. Soils are shallow and well drained. The vegetation is dominated by little bluestem (Andropogon scoparius), sideoats grama (Bouteloua curtipendula) and big bluestem (Andropogon gerardi). Characteristic plants include Silphium laciniatum, Amorpha canescens, Koeleria cristata, Aster sericeus, Euphorbia corollata and Liatris cylindracea.

Dry Sand Prairie

Dry sand prairies are found on coarse textured soils ranging from sands to sandy loams. Soil pH ranges from acid to neutral; soil fertility is characteristically low. Sand prairies are found on a variety of landforms throughout the northwest, southwest, southeast and eastcentral sections of the state. They are associated with sandy river terraces, inland dunes, glacial lake beach lines and coarse sandy outwash. Two types are defined. Sand prairie occurs on droughty sandy soils of low fertility.

Dry Sand Prairies. Dry sand prairies are found on the sandy beach ridges of glacial Lake Agassiz and the sand outwash plains associated with the Mississippi River. The dominant plants are sand reed (Calamovilfa longifolia), little bluestem (Andropogon scoparius) and june grass (Koeleria cristata). Characteristic plants include Hudsonia tomentosa, Cyperus schweinitzii, Sporobolus cryptandrus, Selaginella rupestris, Monarda punctata, Ambrosia psilostachya and Polygala polygama.

Dry sand prairies show considerable variation in species composition across their geographic range. The sand prairies in southeastern Minnesota contain a number of species that are at their northern and western limits and occur nowhere else in Minnesota. These include Talinum rugospermum, Asclepias amplexicaulis and Tephrosia virginiana.

Sand Dune Prairie. The sand dune prairie occurs on sand dune complexes that are found in southeast Minnesota, along the Mississippi River below Lake Pepin; in eastcentral Minnesota, on the Anoka sandplain and in northwest Minnesota along the eastern side of the glacial Lake Agassiz basin. Sand dunes, often containing active blowouts, are characterized by their infertile soils and droughtiness, that perpetuates pioneer conditions. The flora is similar to the dry sand prairie and contains a mix of barrens and dry to dry-mesic prairie species including Calamovilfa longifolia, Andropogon scoparius, Koeleria cristata, Hudsonia tomentosa, Bouteloua hirsuta and Selaginella rupestris. Tephrosia virginiana occurs on sand dune prairies only in southeastern Minnesota.

Wet Blacksoil Prairie

The wet blacksoil prairie occurs on deep organic mineral soils found in low areas subjected to seasonal inundation. A characteristic gley layer forms beneath the soil surface. Low prairies are typically dominated by the wet prairie grasses, cordgrass (Spartina pectinata) and

bluejoint grass (Calamagrostis canadensis). Sedges (Carex spp.) may also be present. Prevalent forbs include Gentiana andrewsii, Hypoxis hirsuta, Aster novae-angliae and Liatris pycnostachya. Wet prairies occur throughout the prairie region of the state, frequently along water courses and in swales between the beach ridges of glacial Lake Agassiz. Low prairies show considerable variation across their geographic range and will eventually be separated into 4 natural communities.

Appendix 37-B

QUALITY RANDING FOR NATIVE PRAIRIE COMMUNITIES

Occurrences of native prairie are ranked according to how closely they resemble presettlement conditions. Four ranks are given: Grade A = excellent, Grade B = good, Grade C = marginal, Grade D = poor. Criteria for the above ranks are different for each prairie community and are defined in their respective status sheet (Appendix 37-C). The general criteria for each quality rank are:

- A. outstanding natural prairie community. Tracts virtually undisturbed by man or recovered to an extent where community composition is intact and reflects the native presettlement conditions. These are the best examples of Minnesota's original natural community types.
- B. natural community occurrences that, due to slight man-induced disturbances or their small size, are less than outstanding. These occurrences retain most of their pre-settlement structure and composition and with protection and appropriate management, these areas often will return to more natural conditions.
- C. prairies moderately disturbed by man, but still maintain sufficient natural features that merit protection. Although community composition has been altered, and tracts are not of natural area quality, such areas often act as important environmental corridors and wildlife habitat. Tracts illustrating the process of succession and restoration after disturbance are often valuable for education and research.

D. degraded prairie tracts where severe disturbance has significantly altered community composition. The natural features that merited protection have often been destroyed.

Quality ranking is designed to comparatively evaluate occurrences of native prairie and thus help determine protection and management priority. Quality ranking is also used to monitor the success of prairie management prescriptions, the management goal typically being to maintain or improve the quality rank of a native prairie parcel.

APPENDIX 37-C
GLACIAL TILL HILL PRAIRIE
ELEMENT ABSTRACT

Basis for Concern

Although glacial till hill prairies are still relatively common on the landscape, most have been severely degraded by heavy grazing. Examples of glacial till hill prairies that reflect native presettlement conditions are rare.

Description and Distribution

This prairie natural community is found on somewhat deep, droughty soils formed in calcareous glacial till. They commonly occur on steep sided slopes along rivers, creeks and deep drainageways. Soils typically have rocks and limestone fragments at the surface. Glacial till hill prairies are commonly found from southcentral to western Minnesota, similar prairies are found on irregular moraine areas in northwest Iowa and eastern South Dakota. These hill prairies may be 5 acres, being separated by forested ravines or they may occupy larger areas as part of continuous prairie. Large continuous till hill prairies are common south of the Minnesota River along drainage channels of the Couteau des Prairie and the Blue Earth Till Plain. Less common are the small hill prairies occurring as openings in otherwise forested slopes on the Alexandria Moraine and Olivia Till Plain.

Because of the extreme topographic variation of these sites, the vegetation assemblages are complex. In general, the vegetation is characterized by dry and dry-mesic prairie. Vegetation is dependent on degree of slope,

position along slope, orientation of slope and soil type. Dry prairie, dominated by mid and short grasses, is commonly associated with inclusions of small gravelly pockets on steep hills and ridges. Characteristic dry prairie plants include blue gramma (Bouteloua gracilis), hairy grama (B. hirsuta), lotus milkvetch (Astragalus lotiflorus), Indian paintbrush (Castilleja sessilifolia), gerardia (Gerardia aspera), stiffstem flax (Linum rigidum) and white beard tongue (Penstemon albidus). Many of these are western prairie species having their origins on the Great Plains.

Dry-mesic prairie, dominated by mid and tall grasses, is commonly found on the deeper, loamy soils of shallow slopes and drainage-ways. These sites, at least under undisturbed conditions, harbor a large number of mesic species. These include coreopis (Coreopsis palmata), golden alexanders (Zizia aptera), downy phlox (Phlox pilosa), compass plant (Silphium laciniatum), wood betony (Pedicularis canadensis), culvers root (Veronicastrum virginianum) and white lettuce (Prenanthes racemosa).

Current Status

Most of the large, continuous glacial till hill prairies in Minnesota have been degraded or destroyed by intensive grazing of the slopes and plowing of the hill crests. Where the soils are unsuitable for cropping-along steep slopes-grazing is a common practice. Moderate to heavy grazing alters the natural species composition, typically a shift from mesic to xeric native plant species, reduces native species diversity and increases the presence of exotic species. Very few examples of glacial till hill prairie that reflect undisturbed, presettlement conditions are known.

Representative sites:

Hole-in-the-Mountain Prairie, Lincoln County
Moulton Township Hill Prairie, Murray County

Glacial Till Hill Prairie-Element Occurrence Ranking

Occurrences of glacial till hill prairie are ranked according to how closely they resemble presettlement conditions. Exemplary sites ranked B or higher are considered natural areas of statewide significance.

RANK A--Prairie sites are virtually undisturbed by man or recovered to an extent where community structure and composition are intact and reflect presettlement conditions. Such areas occur where the soil has not been disturbed, they display a high native species diversity and lack of exotic or weedy species. Species of the glacial till hill prairies tend to be mesic prairie species. Disturbance, notably by intensive grazing, often results in the elimination of such mesic species as downy phlox (Phlox pilosa), coreopsis (Coreopsis palmata), blazing star (Liatris aspera), golden alexanders (Zizia aptera), compass plant (Silphium laciniatum) and wood betoney (Pedicularis canadensis). Rank A prairies are conspicuous because they contain these species and others that are the first to disappear with grazing. In general, rank A prairies have a well-established mesic prairie component on the clay loams associated with lower and shallower slopes and in the draws extending upslope.

RANK B--These prairies are similar in species composition to rank A sites, except some of the conservative species may be absent or the complement of characteristic species may not

be fully represented. These tracts typically have a history of light to moderate grazing. As a result, the original proportions of prairie species may have shifted, typically to an increase in dry prairie species over mesic species. However, the site still maintains a relatively natural character, containing species that maintain themselves under light grazing but are reduced or eliminated with heavy grazing such as lead plant (Amorpha canescens), prairie lily (Lilium philadelphicum), alum root (Heuchera richardsonii), white prairie clover (Petalostemum candidum) and showy milkweed (Asclepias speciosa). With removal of grazing, these sites will revert to a more natural condition.

RANK C--These sites are characterized by species composition and structure that have been substantially altered from their presettlement character. A long history of moderate to heavy grazing activity is usually the major disturbance. The habitat has a low native species diversity reflecting the loss of conservative native species, an increase in weedy native species and invasion by exotic weeds. In general, the mesic tallgrass prairie species are reduced relative to the mid and shortgrass species. Side oats grama (Bouteloua curtipendula) and little bluestem (Andropogon scoparius) typically dominate the habitat. The following native species, all favored by moderate grazing, often dramatically increase in population: rigid goldenrod (Solidago rigida), prairie smoke (Geum triflorum), wolfberry (Symphoricarpos occidentale), and purple locoweed (Oxytropis lamberti). Purple prairie clover (Petalostemum purpureum), purple cone flower (Echinacea pallida) and dotted blazing star (Liatris punctata) also persist in moderately grazed habitat.

RANK D--These are heavily disturbed sites where the natural prairie vegetation has been significantly altered. The vegetation is dominated by weedy species that are not part

of the native prairie community. These sites have suffered from a long history of heavy grazing and often have been sprayed with herbicides. Characteristic weedy plants include bluegrass (Poa spp.), brome grass (Bromus inermis), quack grass (Agropyron repens), bindweed (Convovulus sp.), sweet clover (Melilotus spp.), green needle grass (Stipa viridula) and western wheatgrass (Agropyron smithii).

APPENDIX 37-D

PRAIRIE PROTECTION PROGRAMS
OF THE
MINNESOTA DEPARTMENT OF NATURAL RESOURCES

SECTION OF WILDLIFE

Acres of prairie: 10,000

Purpose: The Section of Wildlife acquires land for wildlife management purposes.

Protection: Most wildlife management areas are purchased to provide habitat and hunting opportunity for game animals and the occurrence of prairie is secondary. Protection of the prairie is an important objective where it occurs on these units.

Quality: The quality of the native prairie on wildlife management area ranges from near pristine to highly degraded.

Management: Each area wildlife manager determines the quantity of prairie management to be done in the manager's work area. Presently, about one-half of the managers within the prairie counties conduct prescribed burns within their work units. The number of acres burned in recent years has been increasing. In the Detroit Lakes work area of Norman, Clay, Becker and Mahnomen counties, for example, an active prescribed burn program was initiated in 1982. This work area contains approximately 4,100 acres of native prairie. The number of acres burned has increased from 525 acres in 1982 to 1,240 acres in 1985.

Acres of prairie: 2,000 in fee title under the Scientific and Natural Areas Program and 5,000 acres leased from The Nature Conservancy.

Purpose: Scientific and Natural Areas are managed solely for the protection of the state's rarest and most endangered natural features.

Protection: The Scientific and Natural Areas Program offers the highest amount of legal protection that natural land can receive in Minnesota. Scientific and Natural Areas are either owned in fee title or leased to the state to be dedicated as Scientific and Natural Areas. Under the leasing arrangement, qualifying private preserves, such as 11 The Nature Conservancy sites, are assured long-term protection. Scientific and Natural Areas are also designated on land administered by other divisions within the Department of Natural Resources.

Quality: The Scientific and Natural Areas system of preserves contains outstanding examples of prairie. Prior to designation, these sites are reviewed for their natural quality and recommended for protection by the Commissioner's Advisory Committee on Scientific and Natural Areas.

Management: These sites are managed to preserve and enhance their native prairie communities and species. Detailed management plans are prepared for each site. Management activities are carried out by Scientific and Natural Areas/Wildlife staff or other managers as agreed to by the administering discipline.

The Native Prairie Bank Program

Acres of prairie: This program was established in 1987. \$300,000 was appropriated for fiscal year 1988/1989.

Purpose: To protect prairie from conversion to cropland or other uses.

Protection: Land enrolled under this program is protected by permanent or limited duration easements acquired by the Department of Natural Resources from private landowners. Priority is given to permanent easements. The Commissioner may enter into easements that allow selected agricultural practices such as cutting hay or grazing.

Quality: Prairie enrolled under this program will range from good to excellent.

Management: Any grazing or haying done on these lands will be done under guidelines agreed to by both the Department of Natural Resources and the landowner.

Division of Parks and Recreation

Acres of prairie: 4,916

Purpose: State parks must provide both for the protection of natural resources and their recreational use by the public.

Protection: Prairie in state parks is relatively well protected. The park's natural features are often the major attraction. Providing for recreational opportunities, however, is typically the highest priority objective.

Quality: Prairie remnants occur in 15 state parks. The quality is variable. A number of these remnants have been designated as state Scientific and Natural Areas because of their significance.

Management: Management of prairie is typically overseen by the regional resource manager or the park manager. Management includes burning, brush control and restoration.

Minnesota Prairie Tax Credit Program

Acres of Prairie: 12,000

Purpose: To provide private landowners with a financial incentive to protect their prairie.

Protection: Qualifying lands are exempt from property tax as long as the natural state of the approved tract is maintained. Grazing is not permitted, but cutting of hay is allowed. Up until 1987 these landowners also received a tax credit for enrolled acres. The credit was repealed in 1987.

Quality: The quality of prairie enrolled under this program ranges from fair to excellent.

Management: A large percentage of the land enrolled in the program is owned by farmers using the land as native hayfields. The rest receives little or no direct management.

The Nature Conservancy (TNC)

Acres of prairie: 12,000, 5,000 acres are leased to Department of Natural Resources.

Purpose: The principal objective of The Nature Conservancy is the preservation of undisturbed natural habitats supporting rare and endangered plant and animal species.

Protection: These lands are owned in fee title. eleven of the preserves have been given added protection by designation as state Scientific and Natural Areas.

Quality: The Nature Conservancy preserves protect some of the highest quality prairie left in the state.

Management: The Nature Conservancy initiated a prescribed burn program in 1962. Burn plans are designed for each preserve; and records kept on all prescribed burns. The Nature Conservancy conducts burning in the spring and fall, burning over 3,500 acres a year.

U.S. Fish and Wildlife Service

Acres of Prairie: 13,000

Purpose: The primary objective of the U.S. Fish and Wildlife Service is the production of waterfowl.

Protection: Prairie is recognized by the U.S. Fish and Wildlife Service as providing desirable and safe cover for ducks and other wildlife when it is maintained in a vigorous, managed state.

Quality: Prairie on U.S. Fish and Wildlife Service lands, waterfowl production areas and wildlife refuges ranges from good to poor. They have an active restoration program, reseeding former cropland to native grasses.

Management: Approximately 12%, or 1,500 acres, of native prairie on wildlife production areas is burned annually, mostly in April and May. Grazing is used by the Morris Wetland District on 225 acres of prairie.

APPENDIX 37-E

LEGISLATIVE MANDATES REGARDING RESTORATION AND PROTECTION OF MINNESOTA PRAIRIE

The 1987 Minnesota legislature, with the enactment of the Native Prairie Bank (M.S. 84.96 Sec. 19) and the Prairie Landscape Reserve program (M.S. 84.91 Sec. 98.1), explicitly recognizes the value of native prairie and mandates its restoration, management and protection. The Prairie Landscape Reserve law requires the Department of Natural Resources to plan for the restoration and management of native prairie on a landscape scale. Landscape reserves will be comprised of integrated networks of protected prairie lands, prairie restoration sites and private prairie lands where compatible agricultural practices are encouraged. The new law establishes a prairie biologist position within the Scientific and Natural Areas Program to carry out landscape reserve planning and management. The Act also requires a study to determine the feasibility of establishing prairie seed production areas for the purpose of providing prairie plant seed of Minnesota origin for restoration projects across the state.

Also enacted by the 1987 Legislature was a Native Prairie Bank Program that authorized the Department of Natural Resources to protect native prairie by entering into conservation easements with landowners. The easements may be permanent or of limited duration, a minimum of 20 years. Easements may allow selected agricultural practices such as mowing of wild hay. A total of \$300,000 was allocated to initiate the Native Prairie Bank.

These model programs provide a strategy for restoring and maintaining the biological diversity of the prairie ecosystem of Minnesota. Establishing large continuous prairie reserves will have national significance and will be

) critical for maintaining water quality, inhibiting soil erosion, providing recreational opportunities, enhancing scenery and land values, and conserving numerous endangered grassland plants and animals.



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51. Sandhill Crane

Six subspecies of sandhill cranes (Grus canadensis) inhabit North America. Three of these are resident in Mississippi, Florida and Cuba, whereas the other 3 are migratory. Sandhill cranes breeding in Minnesota have been assigned to the eastern population of subspecies (G. c. tabida) which nests in parts of Minnesota, Wisconsin, Michigan, Ontario and Manitoba.

Presently, there are 2 breeding populations of sandhill cranes in Minnesota. The northwest population is located in Kittson, Roseau, Marshall, Lake of the Woods, Beltrami, Pennington and Red Lake counties. The eastcentral population is found in Anoka, Isanti, Sherburne, Morrison, Kanabec, Aitkin, Pine and Mille Lacs counties.

Sandhill cranes nest in shallow marshes or bogs and defend territories ranging from one-half to over 1,000 acres in size. Breeding habitat requires shallow water for nesting and nocturnal roosting; a feeding area such as a meadow, agricultural field or open woodland; and a certain degree of isolation from human activity.

Sandhill cranes are longlived and begin breeding when 3 to 5 years of age. Nests normally contain only 2 eggs and frequently only one colt survives, so there is little potential for rapid population growth. Cranes may mate for life and normally migrate in family groups. Family groups break up in the spring as adults become aggressive toward their young of the previous year and drive them off

the nesting territory. These young non-breeding cranes typically form small flocks, which may disperse from the breeding area during the summer.

Eastern greater sandhill cranes migrate to a major staging area on the Jasper-Pulaski Fish and Wildlife Area in Indiana, before proceeding on to wintering sites in southern Georgia and Florida. Minnesota's eastcentral population of cranes follow this route after first staging at the Crex Meadows Wildlife Management Area in northwestern Wisconsin. Recent evidence indicates that some, if not most, of the northwest population migrates southwest to the Texas gulf coast. Consequently, the population affiliation and subspecific status of the northwest cranes are open to question.

In addition to Minnesota's breeding cranes, thousands of non-resident cranes migrate through northwest and westcentral Minnesota in spring and fall. The migrant cranes are not readily distinguishable from local birds. Presumably the migrants are birds that breed in Canada and, at least some, belong to the Canadian subspecies (G. c. rowani). The origin and distinction of these cranes are undetermined. No information exists on age-ratios or recruitment of this migrant population. In some years when crop harvests in Minnesota are delayed by weather, concentrations of local and migrant cranes can cause crop depredations.

MANAGEMENT HISTORY

Prior to 1870, breeding sandhill cranes were reported to be common in Minnesota south and west of the heavily forested areas. However, rapid settlement of the prairie areas in the late 1800s, combined with wetland drainage and unregulated market and subsistence hunting, resulted in a rapid decrease in sandhill crane numbers. By 1900 the bird was considered rare in Minnesota. In 1916 crane hunting in

the United States and Canada was prohibited by the Migratory Bird Treaty Act.

Drought in the 1930s probably led to further reductions in crane numbers as additional large marshes were drained and cultivated. By 1944 the breeding population in the state was estimated to be only 10 to 25 pairs. A few pairs persisted in the remote wetlands of Roseau, Kittson, Marshall and Beltrami counties into the 1950s.

A few summering cranes were reported in eastcentral Minnesota in the 1950s. It is uncertain whether cranes had persisted undetected in remote areas or whether they moved in from western Wisconsin. During the late 1950s and early 1960s, a few breeding cranes were reported in Morrison, Aitkin and Anoka counties.

Both the northwest and eastcentral populations have been gradually increasing since the early 1960s. This is probably due to protection and management of wetlands, continued harvest restrictions and increased public awareness of wildlife conservation.

Because of increasing sandhill crane populations, hunting seasons were reopened in the United States and Canada in 1960 and 1964, respectively. Presently, sandhill cranes are hunted in 9 western states and 2 Canadian provinces. Sandhill cranes residing in eastcentral Minnesota migrate through the eastern United States and remain protected. On the other hand, most cranes belonging to Minnesota's northwest population probably migrate southwest to the Texas gulf coast and may be subjected to hunting in the Dakotas, Oklahoma and Texas.

In 1977, the sandhill crane came under the jurisdiction of Minnesota's newly formed Nongame Program. Observation card surveys to determine presence of cranes were carried out in 1977, 1978 and 1979. Sandhill cranes have also been the subject of several masters thesis projects at St. Cloud State University. In March of 1984, the sandhill crane was designated a species of special concern in Minnesota.

RESOURCE MANAGEMENT

Minnesota Department of Natural Resources funding for sandhill crane projects comes from the Section of Wildlife and the Nongame Wildlife Fund. Projects to date have emphasized obtaining information on the bird's status and distribution. In addition to the observation card surveys of 1977-79, another survey of breeding and migrant cranes was completed in 1985. This survey estimated sandhill crane populations since 1980 based on interviews with Minnesota Department Natural Resources wildlife managers, U.S. Fish and Wildlife Service personnel and other people with a professional or personal interest in sandhill cranes.

Currently, the Minnesota Department of Natural Resources and St. Cloud State University participate in the Eastern Greater Sandhill Crane Census, a 1-day count in late October coordinated by the U.S. Fish and Wildlife Service. There are no large-scale annual breeding crane surveys or management programs directed specifically at sandhill cranes.

A limited amount of prescribed burning designed to benefit sandhill cranes is being conducted in eastcentral Minnesota. In addition, cranes sometimes benefit from management programs directed at waterfowl, sharp-tailed grouse or moose. On the other hand, continued expansion of urban and rural development poses a threat to crane habitat in eastcentral Minnesota and little legal protection exists to prevent the destruction or degradation of crane habitat.

RESOURCE ANALYSIS

Supply

Breeding cranes are not found in the heavily forested areas of northeastern Minnesota, nor are they normally seen south of the Twin Cities. Numbers of breeding sandhill cranes are gradually increasing in Minnesota. Their low population was 10 to 25 pairs in 1944. A 1976 St. Cloud

State University survey estimated 70 to 85 pairs in the northwest population and 20 to 25 pairs in the eastcentral population. The 1977-1979 Minnesota Department of Natural Resources surveys estimated at least 225 pairs in the northwest and 75 pairs in the eastcentral area. The 1985 Minnesota Department of Natural Resources survey estimated 760-1160 pairs in the northwest and 87-109 pairs in the eastcentral population. With few exceptions, these surveys were all based on incidental observations and may be subject to large error. Some area wildlife managers feel that the 1985 figures are conservative. The 2 breeding populations are expanding their ranges toward each other. If this continues the 2 populations will overlap at some point in the future.

The summer distribution and abundance of non-breeding cranes in Minnesota are virtually unknown. However, information from other states suggests that the number of non-breeders may approximately equal the number of breeding pairs.

Although some migrant cranes probably pass through the eastcentral region, there is no noticeable influx during either spring or fall. Minnesota's eastcentral cranes leave the state in early October.

In contrast, several thousand fall migrants pass through the northwest and stop at a number of staging areas in northwestern and westcentral Minnesota. Many migrating cranes are present in these areas through mid-October and some remain until freeze-up. A 1983 aerial survey in eastern Kittson and northwestern Roseau counties tallied 4,350 cranes, the observer estimated the total population in the area at the time to be 6,000 cranes.

Other important sandhill crane staging areas include the Thief Lake Wildlife Management Area and the Agassiz National Wildlife Refuge. Over 4,000 cranes were observed on the 2 areas during the fall of 1987. The highest concentrations of fall staging cranes usually occur in the

Borup-Felton area of southern Norman and northern Clay counties, where a peak of 8,000-10,000 was seen in mid-October 1982. These various fall counts were not coordinated, making it difficult to determine total numbers of migrant cranes passing through the state in any given year.

Demand

Although there is no quantitative information on the public demand for sandhill cranes specifically, they have a high aesthetic appeal for bird-watchers and other outdoor enthusiasts. Recreational uses of sandhill cranes for photography, viewing of courtship displays, tape recording of crane vocalizations, and so on, likely exist that are not being met, simply because people are not aware of when and where cranes may be observed.

There is also a demand, of unknown magnitude, to resume sport hunting of sandhill cranes in the northwestern portion of the state. A hunting season might be structured to help reduce crop depredations caused primarily by migrant cranes. However, we presently have insufficient biological information on breeding and migrant cranes to evaluate whether the crane population can sustain limited hunting pressure. A model developed for central flyway sandhill crane populations suggested that a hunted crane population would be about three-fourths the size it would be if unhunted.

RESOURCE VALUE

The sandhill crane is an ancient species and has existed in essentially its present form for some 4 to 9 million years. It is 1 of only 2 crane species in North America. The sandhill crane has intrinsic value as an integral part of the ecosystem.

As a source of recreation, the sandhill crane's large size, trumpeting call and elaborate dancing displays make

it a spectacular bird of high aesthetic value to birdwatchers, nature photographers and other outdoor enthusiasts. The sandhill crane also can be an exciting bird to hunt.

Because of the sandhill crane's aesthetic appeal and its association with wetlands, it has value as a symbol for public agencies such as the Minnesota Department of Natural Resources and the U.S. Fish and Wildlife Service, to help educate the public about the value of wetlands and habitat preservation.

Long range planning for sandhill crane

SERVICE: Conservation of sandhill crane populations for their intrinsic and ecological values.

PRODUCT: Opportunities for appreciation and use of sandhill cranes.

GOAL: Increase size and range of summering sandhill crane populations; cooperatively manage migrant populations and expand opportunities for recreational use and appreciation of local and migrant cranes.

OBJECTIVE 1: Allow natural expansion of northwest and eastcentral sandhill crane breeding populations and ranges through 1992, currently estimated at 760 to 1,160 pairs and 87 to 109 pairs, respectively.

PROBLEM 1. Insufficient information reduces management effectiveness.

STRATEGY A. Determine size, distribution, age structure and recruitment rates of sandhill crane populations.

STRATEGY B. Determine subspecies status and migration routes of the northwest breeding population.

STRATEGY C. Inventory existing habitat and conduct detailed habitat analyses.

STRATEGY D. Research additional habitat management techniques.

STRATEGY E. Evaluate sandhill crane response to land retirement programs.

PROBLEM 2. In some areas, quantity of breeding habitat is declining due to land use changes and natural succession.

STRATEGY A. Protect, acquire, maintain and improve habitat on public and private land.

STRATEGY B. Identify priority areas and apply beneficial habitat management techniques such as prescribed burning, wetland enhancement and food plots.

STRATEGY C. Strengthen the environmental review and mitigation process to protect habitat.

STRATEGY D. Identify specific parcels of land with management potential for sandhill cranes through forest unit planning and other land management planning processes.

PROBLEM 3. Management of sandhill cranes requires extensive coordination with external agencies.

STRATEGY A. Coordinate Minnesota Department of Natural Resources management strategies with the U.S. Fish and Wildlife Service, Canadian Wildlife Service, state and provincial conservation agencies and the North American Crane Working Group.

OBJECTIVE 2. Support natural expansion of sandhill crane populations migrating through Minnesota by maintaining sufficient spring and fall migration habitat.

PROBLEM 1. Insufficient information on migrant cranes, particularly in northwest Minnesota, reduces management effectiveness.

STRATEGY A. Determine numbers, distribution, subspecies, migration routes and migration chronology for sandhill cranes migrating through northwest Minnesota.

STRATEGY B. Identify important migration feeding and staging areas, and evaluate their use.

PROBLEM 2. Sandhill cranes can cause crop depredation.

STRATEGY A. Assess the extent of crop depredation caused by sandhill cranes.

STRATEGY B. Evaluate and implement crop depredation control methods such as lure crops, alternative crop harvesting techniques and foraging flock dispersal.

PROBLEM 3. Migration habitat may need active management due to land use changes, natural succession or overcrowding.

STRATEGY A. Protect, acquire, maintain and manage migration habitat.

STRATEGY B. Implement effective migratory management techniques.

OBJECTIVE 3. Provide 10,000 recreation days of sandhill crane viewing by 1992.

PROBLEM 1. Public awareness and appreciation of sandhill cranes are limited.

STRATEGY A. Develop and distribute information on sandhill cranes and recreational opportunities.

PROBLEM 2. Information on current recreational use of sandhill crane are limited.

STRATEGY A. Determine current levels of recreational use.

STRATEGY B. Evaluate recreational preferences of sandhill crane users, identify recreational management techniques and apply that information in management planning.

STRATEGY C. Evaluate economic impacts of sandhill crane recreational use.

OBJECTIVE 4. By 1992, consider establishing a future hunting season for sandhill cranes in northwest Minnesota.

PROBLEM 1. Information on the feasibility and impacts of establishing a season is insufficient.

STRATEGY A. Estimate possible effects of hunting in northwestern Minnesota on breeding and migrant sandhill cranes.

STRATEGY B. Evaluate public interest in sandhill crane hunting.

STRATEGY C. Evaluate potential costs and benefits of initiating sandhill crane hunting.

STRATEGY D. Estimate likely effects of hunting on current recreational use of sandhill cranes.

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Plan for the Management of Nongame Wildlife
Nongame Wildlife
in Minnesota

Volume 3 - Issues

Date: October 30, 1984

Minnesota Department of Natural Resources
Division of Fish and Wildlife
Nongame Wildlife Program
St. Paul, Minnesota

Funded by: Minnesota citizens through their
donations to the Nongame Wildlife Fund.



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INTRODUCTION

This document, Volume 3 - Issues, is the mid-point in the Plan for the Management of Nongame Wildlife in Minnesota. It is based on the two preceding volumes which described the scope and content of the planning process (Volume 1 - The Planning Concept) and provided background information (Volume 2 - Resource Assessment) necessary for the development of this document.

The eight resource issues addressed in the volume have been identified by Nongame Wildlife Program personnel, assisted by a Technical Advisory Committee of representatives from other Department of Natural Resources disciplines and by the general public (Minn. Dep. Nat. Resouc. 1981). Although the issues are interrelated, they are presented individually in separate chapters. The order of their presentation is not intended to indicate priority of concern. The issues are equally important.

Each issue is concisely described in an Issue Statement and introductory paragraph which provide a focus for the Discussion section. The discussion elaborates on the cause of the issue; past actions to define, monitor and/or resolve the issue; and consequences of not resolving the issue.

The last section of each chapter is an outline of Opportunities to Resolve the Issue. These opportunities are not policy recommendations; they are suggested approaches for addressing a specific issue. One or more of the opportunities may evolve into strategies for Issue resolution to be delineated in Volume 4 (Goals and Strategies). They even may become future policy recommendations.

Volume 3 serves two important functions. It provides a description of the issues identified as important for the management of Minnesota's nongame resource and is the basis for formulating the Nongame Wildlife Program's strategic plan (Volume 4 - Goals and Strategies) and Operational Plan (Volume 5). In these subsequent volumes, goals and strategies will be developed to correspond with each Issue.

The issues that follow are dynamic and complex. Their relative importance may be perceived differently by various people and will change as future environmental, economic, social and political conditions evolve. As a result, this volume will need periodic revision. Your continued comments on its contents are encouraged and welcome.

COMPREHENSIVE PLANNING

Issue Statement: LONG RANGE COMPREHENSIVE PLANNING IS NECESSARY FOR OPERATION OF THE NONGAME WILDLIFE PROGRAM IN A MANNER CONSISTENT WITH RESOURCE NEEDS AND CITIZEN INTERESTS.

The Nongame Wildlife Program will operate more effectively and efficiently if guided by a comprehensive plan which considers legal mandates, resource needs and priorities, citizen desires, and the long-term consequences of Program actions. The Nongame Wildlife Program management plan must: 1) define the scope and limits of the Nongame Wildlife Program's responsibilities; 2) identify the Program's goals and priorities; and 3) effectively guide Program activities toward the attainment of quantified objectives for the conservation of the nongame resource.

Discussion: Primary authority for the management of wildlife resides with the Commissioner of the Department of Natural Resources (DNR) who is empowered to preserve, protect, and propagate all desirable species of wild animals (Minn. Stat. Sec. 97.48 subd. 8). The Commissioner delegates responsibility for wildlife conservation programs to the Division of Fish and Wildlife.

In 1977, the Division's Section of Wildlife initiated the Nongame Wildlife Program in recognition of nongame needs and in response to growing public interest in the well-being of the State's entire wildlife resource. The Program was staffed by one full-time biologist financed from the Game and Fish Fund. In 1980, the Nongame Wildlife Program's potential to fulfill its responsibilities was enhanced by the passage of the Minnesota Nongame Wildlife Checkoff law (Minn. Stat. Sec. 290.431 (1981 Sup.)). The law

established the Nongame Wildlife Fund with revenues derived from voluntary citizens' donations. Within two years, a staff of seven full-time personnel, with an annual operating budget exceeding \$500,000, was conducting more than 50 nongame resource management projects (Minn. Dep. Nat. Resour. 1984a).

The rapid expansion of Minnesota's nongame program typifies the growth of nongame programs in other states. Currently, 32 states operate resource management programs funded by citizen donations. These programs exemplify nationwide interest and concern for all wildlife and other natural resources.

Guiding the long-term direction of such rapidly growing programs is difficult. A number of considerations may affect program development and operation. A comprehensive plan has been identified by Nongame Wildlife Program personnel, Department administrators, and interested citizens as the only realistic way to simultaneously address all constraints affecting the Nongame Wildlife Program's operation.

The primary purpose of planning is to become more effective at realizing results (Crowe 1983). The consequences of a failure to address Nongame Wildlife Program constraints through a comprehensive plan include the possibility that low priority projects could be chosen, major resource needs may be overlooked, and the mandate to insure the well-being of all the state's wildlife may not be adequately met.

The first steps have already been taken in response to the planning need. In Minnesota, a planning position was created within the Nongame Wildlife Program in 1982. Subsequently, a nongame plan (Minn. Dep. Nat. Resour. 1983a) was initiated. At the federal level, the U.S. Fish and Wildlife Service and the U.S. Forest Service have implemented planning

efforts intended, in part, to identify priority resource needs and federal management actions for selected nongame species (U.S. Dep. Inter. 1983; U.S. Off. Fed. Register 1983a; Salwasser and Mealey 1982; Suring and Mathisen 1983).

One of the major considerations to be addressed by the state plan is a need for consistent funding for nongame resource management activities (Howard et. al. 1980). Tax checkoff legislation has not completely resolved the matter. A consistent level of funding is not guaranteed from checkoff funding as donations may vary from one year to the next. Obtaining funds via public donation requires considerable promotional effort. To some extent, this compels selection of highly visible management projects featuring popular, well-known species. The challenge is to encourage citizen participation while balancing resource needs, promotional considerations, and public preferences for fund allocation (Boggis 1984). Additionally, current financing is not adequate to simultaneously undertake all the actions which have been identified as important for the conservation of Minnesota's nongame resource (Minn. Dep. Nat. Resour. 1981). Consequently, priorities must be defined (see Issue on Endangered Species) by the planning effort.

Another consideration is the absence of an official definition of the term "nongame." While the Department's obligation for endangered and threatened species is a legislative mandate, Bobwhite Quail, Prairie Chicken, Sandhill Crane, American Elk, Pine Marten, and Woodland Caribou are examples of species for which Nongame Wildlife Program jurisdiction and management responsibilities are uncertain. As a consequence, the Nongame Wildlife Program is still working to clarify its responsibilities relative to Minnesota's 600+ vertebrate species and their habitats. A determination

of the Nongame Wildlife Program's responsibility for invertebrate species must also be made.

Nationwide, there is no standard or generally accepted definition of the term "nongame." The various states with nongame programs have different operational definitions. None of the state definitions conform exactly with the federal definition in the Fish and Wildlife Conservation Act of 1980 which reads:

"(6) The term "nongame fish and wildlife" means wild vertebrate animals that are in an unconfined state and that --

(A) are not ordinarily taken for sport, fur, or food, except that if under applicable State law, any of such animals may be taken for sport, fur, or food in some, but not all, areas of the State, any of such animals within any area of the State in which such taking is not permitted may be deemed to be nongame fish and wildlife;

(B) are not listed as endangered species or threatened species under the Endangered Species Act of 1973 (16 U.S.C. 1531-1543); and

(C) are not marine mammals within the meaning of section 3(5) of the Marine Mammal Protection Act of 1972 (16 U.S.C. 1362(5)).

Such term does not include any domesticated species that has reverted to a feral existence. (PL 96-366 Sept. 29, 1980)."

In Minnesota, an unofficial definition has been proposed as follows:

"The term "nongame" includes all wildlife not directly managed with license revenue. Additionally, the term "nongame resource" shall mean the nongame species in combination with their habitats." (Tech. Advisory Committee meeting, Nov. 1983, unpublished minutes).

A final consideration in plan development relates to the fact that nongame resource management is a recent field which is still evolving from the traditions of game management and an understanding of ecological principles. Animals under the jurisdiction of nongame programs usually have not been managed, and few precedents exist on how to proceed. In many cases the information on life history and distribution of nongame species is scant. Species and habitat management techniques are often undefined or nonexistent (see Issues on Data Management and Data Acquisition).

Nevertheless, innovative techniques are being developed and implemented

(Temple 1983, Nongame Wild. Assoc. N. Am. 1983). The need to be aware of these recent advances in the nongame management field, coupled with the rapid expansion of management programs and the considerable effort required to promote public participation in program financing can only be balanced by thoughtful planning.

To date, the Nongame Wildlife Program planning effort has: 1) produced a resource assessment, 2) proposed an operational definition of the term "nongame" in order to clarify the Program's scope of responsibility, and 3) identified eight major resource issues. With such a comprehensive planning process underway, the Nongame Wildlife Program will, in the next year, begin to address the needs and priorities identified in the planning effort. Projects may continue as in the past, priorities may be reordered, or new projects may be initiated. This initiative, coupled with existing state and federal planning efforts, should enhance the effectiveness of all programs intended for the benefit of the citizens and the nongame resource.

Opportunities to Resolve the Issue:

1. Adopt an official definition for the term "nongame." Consider the term "nongame fish and wildlife" as defined in PL 96-366-Sept. 29, 1980 as an alternative to reduce the proliferation and complications of inconsistent legal definitions.
2. Prepare a general statement on behalf of the Division that: 1) officially defines the term "nongame," 2) delineates the Nongame Wildlife Program's responsibilities within the scope of the Division's obligations to wildlife, invertebrates, and native plants, 3) sets forth the Program's philosophy and establishes policies on the management of invertebrates and other resource

one staff botanist. Together, these programs represent the Department's ongoing and expanded commitment to the management of plants, animals and natural habitats not traditionally a focus of Department activities.

The benefits of a broad ecosystem approach are many, and such a philosophy has implications Department-wide. Consequently, it may be more appropriate to secure Departmental funding for the Natural Heritage Program botanist position. Clarification of each program's responsibilities, functions and goals relative to the nongame resource is necessary to avoid duplication of effort and maximize effectiveness.

The Nongame Wildlife Program must also clarify the mechanisms for incorporating its concerns and information into the Division's overall policy and decision making network. Because of the Division's past emphasis on programs for game species, and some differences in the habitat needs of various wildlife species, some revisions in current programs may be necessary to assure that all Division actions reflect a comprehensive approach to wildlife conservation.

The actions and policies of all other Divisions within the DNR also have the potential to affect nongame wildlife. Peatland development is an example. Regulation of peat mining is under the control of the Division of Minerals. The constraints which necessitate the Division of Mineral's consideration of the needs of wildlife associated with peatlands requires coordination with the Division of Fish and Wildlife. Two projects have been jointly undertaken to provide information on the consequences of peat mining for wildlife and on the mitigation alternatives possible to minimize potential adverse effects.

Similarly, the Division of Forestry controls extensive land areas throughout the state and also influences many industrial, county, and

private forest landowners. Timber management on these public and private forest lands has a substantial influence on nongame wildlife and vice versa. The consequences of this timber/wildlife interrelationship on forest management are acknowledged by the Division of Forestry in the statement: "The increasing public interest in nongame species has placed greater demands on natural resource agencies to assess the ecological impacts of timber and forest game projects and to manage for ecological diversity rather than concentrating management on a few species" (Minn. Dept. Nat. Resour. 1982a).

Opportunities for integrating timber and wildlife management already exist in Minnesota through the Forestry/Wildlife Coordination Policy and the Forestry/Wildlife Coordination Guidelines to Habitat Management (Minn. Dep. Nat. Resour. 1982b). A number of nongame concerns are currently addressed in these guidelines. A necessary step to promote further consideration of nongame resource needs by forest land managers is development of additional guidelines specific to nongame species. Actions to accomplish this have already been initiated.

Coordination with the Division of Parks and Recreation is also important. The Division of Parks and Recreation has management authority for state park lands. These parks are important to the nongame resource. They offer an opportunity to manage for special conditions such as old growth forest types or endangered species habitats. In the agricultural areas, these park lands provide an appreciable amount of undisturbed habitat, particularly woodlands. Additionally, park employees provide natural resource interpretive services to nearly 500,000 visitors annually. Much of this programming focuses on wildlife.

In addition, the Nongame Wildlife Program needs to communicate with the

Department's Office of Planning, Land Bureau, Division of Enforcement, Environmental Education Board, Trails and Waterways Unit, Bureau of Information and Education, and the Division of Waters. The formal mechanism for interaction is through the Department's Planning and Environmental Review Team which coordinates policy development and other major Division actions. Coordination and communication among the disciplines on less substantial matters is informal and depends on direct contacts among DNR's personnel.

Except for the Division of Fish and Wildlife, consideration of wildlife needs is a secondary responsibility of all Department disciplines. Consequently, there will be differences in goals and policies that will require compromise. Perfect coordination and communication is not always possible. When necessary, these differences can be minimized through memoranda of understanding, joint goal setting sessions, joint policy statements, periodic information meetings, work agreements and other appropriate means.

Inter-Agency Coordination - Numerous other government agencies affect Minnesota's nongame resource, either directly or indirectly. In addition to the DNR, the U.S. Fish and Wildlife Service and the National Park Service have direct responsibilities for nongame resource conservation. As part of its legal mandate to practice multiple use management, the U.S. Forest Service has responsibility for wildlife habitat conservation on the 2.8 million acres of land under its jurisdiction in Minnesota. The Forest Service has made a very substantial effort to address nongame wildlife needs in its land management and research programs. The Nongame Wildlife Program's working relationship with these agencies involves exchanges of information and coordination of programs to avoid duplication of effort.

Most other agencies do not have wildlife conservation as a significant part of their mission. They impact the nongame resource through the activities that they conduct or regulate (e.g., Pollution Control Agency, Environmental Quality Board, MN Department of Agriculture, Department of Transportation). It is vital that the Nongame Wildlife Program remain informed of these regulatory actions so that information, assistance, or management actions can be provided when needed or requested by these agencies. While communication with these agencies has been active in the past, improved communication is desirable.

The Nongame Wildlife Program's ability to address the needs of some nongame species is complicated in part because the species' ranges extend beyond the state's boundaries. Therefore, interagency coordination at the state and regional level will be needed for successful implementation of some management actions. The U.S. Fish and Wildlife Service has shown considerable initiative in this regard through the annual Endangered Species Coordinators' Meeting for Region 3 representatives from 8 midwest states and Ontario.

It is the Division of Fish and Wildlife's responsibility to incorporate information on wildlife resources into the decision making process of other agencies whenever their activities impact the resource. For this to occur, it is important that the data base from which such information comes is accurate, complete, and readily available. The Nongame Wildlife Program's role in regard to information exchange is discussed as part of the Data Acquisition and Information Management Issues.

Coordination with Private Organizations - A diverse group of private organizations interested in the management and utilization of natural resources, including nongame wildlife, exists in Minnesota. Collectively

these groups motivate legislators and government agencies to make decisions which may substantially impact the nongame resource. These organizations must be identified and their interest and support for nongame species encouraged. Such private organizations include:

- a) The Nature Conservancy, Minnesota Ornithologists' Union; National Audubon Society, Sierra Club, Izaak Walton League, Minnesota Conservation Federation, and other citizen conservation organizations;
- b) The Farm Bureau, Farmers Union, National Farmers Organization, and other agricultural organizations;
- c) Industrial organizations such as those of the timber and mining industries;
- d) Private landowner and lakeshore associations; and
- e) Professional groups such as The Wildlife Society and the Society of American Foresters.

A good working relationship has developed between the Nongame Wildlife Program and many of these organizations. Some contact should be established with all groups as knowledge and communication is preferable to after-the-fact "crisis management."

The potential complexity of involvement in nongame management on the part of these various agencies and groups is exemplified by the endangered Five-lined Skink (Eumeces fasciatus). The total habitat of this species in Minnesota is approximately 2,000 acres. This habitat is owned or managed by numerous private individuals, a private corporation, Minnesota Department of Transportation, a county park, a county historical society, a county highway department, a municipal park, county administered tax-forfeited land, and The Nature Conservancy. It is vital that there be close coordination among

the various groups to assure that resource issues important for Five-lined Skink management are addressed by the proper parties with a minimum duplication of effort. In this particular case, the Nongame Wildlife Program is serving as the coordinating agency. In other situations it may be necessary for the Nongame Wildlife Program to serve only as a source of information to the coordinator.

Future Considerations - Coordination is a matter of communication and cooperation. It is difficult to accomplish unless the responsibility for coordination is clearly defined, all important participants are identified and are willing to cooperate, and information is exchanged in a timely manner. Leadership responsibilities must be clearly designated and actively assumed in order to successfully implement coordinated efforts.

There is an expectation on the part of some private and public groups that the Nongame Wildlife Program should assume all responsibility for coordination, leadership and funding activities that impact nongame resource management in Minnesota. However, the Nongame Wildlife Program is small and alone cannot accomplish all that is needed. In some instances, the Nongame Wildlife Program may serve the needs of the resource by assuming such coordination or leadership responsibilities. In other circumstances, it may be more appropriate for other agencies with the necessary experience and administrative skills to assume leadership or coordination jobs for specific projects. The task at hand is to develop a strategy that delineates the Nongame Wildlife Program's approach to matters of coordination.

Opportunities to Resolve the Issue:

1. Focus initial attention on coordination with the Division of Fish and Wildlife's other programs, particularly the Natural Heritage Program and the Scientific and Natural Areas Program.

2. Initiate joint planning sessions with other agencies/organizations to delineate areas of responsibility and interest, establish goals, cost share operational costs where appropriate, and cooperatively initiate actions to preserve and manage the nongame resource in a coordinated manner .
3. Encourage and assist, to the extent possible, the National Park Service, the U.S. Fish and Wildlife Service, and the U.S. Forest Service in conserving native wildlife and habitat as provided by legislation or cooperative agreements .
4. Develop or revise Forestry/Wildlife Coordination Policy and Habitat Guidelines and other similar policies and cooperative agreements with DNR divisions, other state agencies, and public or private organizations to encourage integration of efforts .
5. Conduct special orientation programs and joint training sessions to familiarize other agency personnel with the Nongame Wildlife Program goals and activities such as the endangered species law and listing process; and conversely, to familiarize Program personnel with other agencies' responsibilities and activities .
6. Jointly initiate and fund studies with other agencies or individuals on resource management considerations of mutual interest .

7. Identify areas where duplication of effort is occurring (e.g. handling and nongame wildlife control problems and preparation of extension education material) and develop strategies to cooperatively proceed in a more efficient manner.
8. Work directly with agricultural organizations, the timber and mining industries, and private landowner associations to increase their awareness of nongame wildlife resources, the Nongame Wildlife Program, and opportunities for joint initiatives of mutual benefit.
9. Promote an understanding within the private groups mentioned in opportunity 8 of the extensive citizen interest and support which exists in Minnesota for nongame resource conservation.
10. Encourage a Division of Fish and Wildlife planning effort to more clearly delineate the relationships between the Nongame Wildlife Program and other Division programs within the context of the Division's overall responsibility for statewide wildlife resource management.
11. Seek out specific opportunities to work with county and municipal government agencies on cooperative projects of research, inventory, or management and to provide technical assistance to their personnel for nongame management on county lands.
12. Implement a mechanism through the existing interagency network to assess any nongame concerns which may be identified in the environmental review processes of other government agencies (EQB, PCA, etc.).
13. Improve the Division's knowledge of the economic value of the states' wildlife resources. Agencies, legislators, and individuals

are generally familiar with dollar value. When the Division can present wildlife in economic terms, others may develop a greater appreciation for the resource.

14. Meet regularly and work jointly with selected District Foresters, Park Managers, private landowners, and others on innovative, cooperative nongame management projects to demonstrate coordinated management. Publicize these efforts at appropriate public meetings.
15. Identify opportunities for other agencies, organizations, or individuals to implement actions to benefit the nongame resource.
16. Initiate a public relations effort to create a general public awareness. A receptive public can make it easier to gain cooperation of groups and agencies.
17. Maintain a directory of agencies, organizations, and individuals conducting nongame resource-related activities.

PUBLIC AWARENESS AND PUBLIC PARTICIPATION

Issue Statement: PUBLIC AWARENESS, UNDERSTANDING AND APPRECIATION OF WILDLIFE NEEDS AND VALUES MUST BE ENCOURAGED IN ORDER TO ENHANCE PUBLIC PARTICIPATION AND INSURE FUTURE WILDLIFE RESOURCES.

A well-informed citizenry is the most important advocate of wildlife conservation. Minnesotans' concerns about the state's wildlife resources and their interest and understanding of wildlife resource needs should be nurtured in order to insure a future for all wildlife in Minnesota.

Discussion: People who are knowledgeable and concerned about natural resources and who are involved with resource conservation are the Department's strongest allies in successfully protecting and enhancing wildlife resources. It is difficult, however, to generate support or enthusiasm for wildlife species that the public dislikes, fears, or has never heard about. There is a need, therefore, to: 1) increase the general public's awareness of nongame species that occur in Minnesota, 2) raise their level of appreciation of these species and their habitats, 3) change negative attitudes toward certain species, 4) determine the nature and extent of public interest in wildlife, and 5) identify ways to enhance opportunities for public participation with wildlife resources.

Public Awareness - A large number of Minnesotans are interested in and concerned about the state's wildlife resources. However, even the concerned citizens are not necessarily well-informed. Many wildlife enthusiasts are unaware of the principles of population biology, ecosystems dynamics, or wildlife management. As a consequence, their actions on behalf of the wildlife resource may be inadvertently detrimental or counter to agency

actions. These citizens are interested in more knowledge. They should be encouraged to learn more and to express their concern. The enthusiasm, energy, and money of these well-meaning citizens need to be channeled in directions that work in concert with agency programs for the benefit of wildlife.

At the other end of the spectrum is an indifference to wildlife and habitat coupled with an absence of public understanding that is detrimental to many wildlife populations. Landowners, for example, may unknowingly destroy wildlife habitats, especially for those species that are inconspicuous or not well known. There is also a prejudice against certain species such as reptiles, bats, and predators. In some cases, an unnecessary fear results from ignorance of the animals' habits and of their value as part of the ecosystem. Such attitudes often result in wildlife harassment, capture and killing to the extent that local populations may be destroyed and important or unique habitat lost. Improved public awareness is needed to counteract such attitudes.

Creating public awareness is the process of informing and educating the public to the values and benefits of wildlife. The DNR's Bureau of Information and Education is responsible, in part, for informing and educating Minnesota's residents about the state's fish and wildlife resources. This is being attempted primarily through the distribution of the Volunteer magazine, loan of films, and news releases. Much of this information reaches people who are already interested in wildlife and probably have some prior knowledge of natural resource management.

The six regional naturalists and seasonal interpreters in the Division of Parks and Recreation, as well as the Division of Fish and Wildlife's area managers and biologists also provide information and present programs on

wildlife. The Minnesota Environmental Education Board (MEEB), also within the DNR, works to increase citizens' awareness about environmental and natural resource issues. MEEB focuses primarily on land use, energy, and water quality issues. Cooperatively MEEB, the Nongame Wildlife Program, and the State Department of Education have recently brought Project WILD to Minnesota's schools. Project WILD is an interdisciplinary, supplementary environmental and conservation education program for elementary and secondary educators. Emphasizing wildlife as a way to understand our responsibilities to all living things, Project WILD's goal is "to develop awareness, knowledge, skills and commitment which will result in informed decisions, responsible behavior and constructive actions... for wildlife, and the environment upon which all life depends."

These approaches and techniques have generally been inefficiently financed to reach the broad cross-section of general public audiences with constructive, informational, and inspirational messages regarding wildlife conservation needs and opportunities. This inadequacy could be overcome, in part, by increasing the use of modern electronic media and sound public relations principles.

In recent times, the demand for wildlife information has increased to a level where available Department personnel and facilities alone cannot provide for all public demands. In addition to the DNR, there are other government agencies and private organizations that provide information and promote awareness and concern for nongame wildlife. These include the U.S. Fish and Wildlife Service, the U.S. Forest Service, the U.S.D.A., the National Park Service, the Minnesota Agriculture Experiment Station, and Extension Service, the local National Audubon Society chapters, county conservation reserves, nature centers, the James Ford Bell Museum of Natural

History, the Science Museum of Minnesota, the Minnesota Ornithologists' Union, the Minnesota Herpetological Society, the Minnesota Humane Society and others. Recently, 60 facilities were identified in Minnesota, including 25 in the seven county metropolitan area, which provide wildlife and environmental education information (Minn. Nat. Assoc. 1984). The Nongame Wildlife Program's contribution to these statewide educational efforts needs to be delineated.

Despite present efforts, apparently the message is not reaching that segment of the citizenry that is unconcerned or poorly informed about wildlife. Unless a broad scale public awareness and understanding of wildlife is encouraged and increased, the wildlife resource will continue to suffer loss or degradation of habitat and, for some species such as snakes, unnecessary persecution.

Public Participation - Public awareness often leads to public participation. Public participation is a more complex process of citizen involvement in: 1) wildlife-related activities such as fishing, hunting, trapping, birdwatching or nature study, 2) legislative initiatives on behalf of the wildlife resource, 3) private activities to benefit wildlife, and/or 4) Nongame Wildlife Program development or operation.

Public participation in the development of the nongame management plan is encouraged under federal planning guidelines. The Nongame Wildlife Program sincerely desires such input, and a mechanism to encourage plan review has been established (Mn. Dep. Nat. Resour. 1983a). Public participation in the planning process is essential, not simply because Minnesota's citizens "pay the bills" through donations to the Nongame Wildlife Fund. Ultimately, the actions which will most directly insure wildlife's survival will be the natural resource laws adopted by all level

of government at the demand of an informed citizenry concerned for the preservation of wildlife habitat.

Increasingly, people want to participate directly in activities to benefit wildlife. A number of private citizens, for example, have shown considerable initiative in establishing a network of privately operated rehabilitation centers in Minnesota - the Wildlife Assistance Cooperative. For many people, the care of orphaned or injured individual wild animals is an easily understood and appealing idea. The Section of Wildlife allows private individuals to conduct wildlife rehabilitation activities at their own expense under the appropriate state and federal licenses. Except for funding to the Raptor Research and Rehabilitation at the University of Minnesota for the care of individual endangered or threatened raptors, the Division does not subsidize such wildlife rehabilitation efforts. The reason for this distinction in funding relates to the expectation that the fate of an individual member of a threatened or endangered species may be of consequence to the population. However, the impact on a population of rehabilitating a few individuals of a common species is insignificant. While rehabilitation is a popular activity, Department personnel are concerned that it not draw public commitment and DNR funding away from more critical habitat-related conservation activities.

A number of opportunities currently exist for public participation in the Nongame Wildlife Program's operation through volunteer cooperation in census and survey or education and promotion activities. A need exists, however, to improve the effectiveness of present participation and provide new opportunities.

Historically, the greatest public participation has been hunting, trapping or fishing for game species which were considered "valuable."

Knowing the habits of game animals was often a necessity for survival in a wilderness frontier. As agriculture expanded and settlements grew to towns, wildlife species that were valuable needed protection from over-harvesting. Legislation protecting birds was adopted, and wildlife agencies were created which established hunting seasons and limits on the number of game animals that could be legally taken. Although there was some interest in nongame species on the part of a few naturalists, scientists, birdwatchers, and legislators, most people gave little thought or time to nongame wildlife.

After World War II, Minnesota's major cities drew people from the country and small towns and away from direct contact with wildlife. As generations were raised in urban and suburban settings, their experience with wildlife declined. Inner city residents became far removed from most wildlife, knowing only the urban adapted sparrows, pigeons, and squirrels. Citizens who stayed on the farm often considered some forms of wildlife a nuisance, competitor, or target. Those that still enjoyed the outdoors participated in weekend fishing, hunting, or birdwatching trips.

During this time, wildlife agencies continued to focus on deer, grouse, pheasants, and ducks in rural and undeveloped areas of the state. Actions on behalf of wildlife in the urban environments generally consisted of providing technical assistance in response to citizen complaints resulting from unpleasant human-wildlife interactions.

The environmental movement that developed in the 1960's has helped to refocus citizen interest in natural resource conservation. Concern for pollution, toxic wastes, pesticides, habitat degradation, and endangered species, along with a realization of the limit to the availability of natural resources, profoundly influenced urban-raised and university-educated residents as well as those on farms and in small towns.

Participation with wildlife has grown beyond the traditional activities of recreational hunting and fishing. Birdwatching has become the fastest growing wildlife-related activity in North America (Butler 1983), with many participants enjoying the activity in their own backyard. Membership has increased in the National Audubon Society, the Sierra Club, and other organizations as citizens organized to lobby for environmental issues.

The concentration of this new constituency of wildlife enthusiasts and environmentalists in urban areas, combined with increasing citizen demand for agency personnel to do something about bats in attics and snakes in basements, prompted a new concept - urban wildlife management, intended to promote citizens' understanding and enjoyment of wildlife in their everyday experiences.

The role of federal, state and private organizations in urban wildlife management has been discussed elsewhere (Noyes 1974). A number of states have recently established urban wildlife management programs with nongame checkoff revenues. Because the majority of Minnesotans now live in urban areas, establishment of such a program in Minnesota has been suggested as one alternative for improving public awareness and opportunities for participation with wildlife. The Hennepin County Park Reserve District, the U.S. Fish and Wildlife Service's Minnesota Valley National Wildlife Refuge, and the nature centers already provide considerable wildlife management services and recreational opportunities in the state's major metropolitan area of the Twin Cities. The appropriateness of Nongame Wildlife Program involvement in an urban wildlife program must be carefully assessed.

Future Considerations - Identification of the types of wildlife experiences preferred by the public and an assessment of the need for increased opportunities to enhance such participation should be made before

the Nongame Wildlife Program initiates any new participation or recreation efforts.

Opportunities to Resolve the Issue:

1. Delineate publics, public groups and their information needs. Survey public attitudes toward and knowledge of various wildlife species and their needs. Identify the type of wildlife experience preferred by these public groups (Kellert 1980) and design Nongame Wildlife Program actions to focus on providing for those perceived needs and interests by expanding existing facilities and programs.
2. Identify areas of misinformation, lack of information and negative attitudes, and acquire and utilize educational products to correct such problems.
3. Conduct public education programs to increase awareness and appreciation of nongame species and their habitats. These programs should stress the importance of habitat and focus on basic ecological principles such as food webs and predator-prey relationships. They also should inform the public of DNR projects that involve nongame species.
4. Develop or acquire educational materials and programs which make it easy for educators to provide information about habitat and ecological principles. The most effective methods for reaching and influencing the most people should be employed. The general public and the school systems should be targeted. Youth groups like Future Farmers of America, 4-H, and Scouts should be considered.
5. Promote awareness and understanding of the economic benefits and values of wildlife and the ecological advantages of retaining

habitat for wildlife.

6. Develop an urban wildlife component for the Nongame Wildlife Program that would concentrate on increasing public awareness and appreciation of wildlife in Minneapolis/St. Paul and other metropolitan areas.
7. Simplify and promote usable and understandable wildlife regulations. Repeal bounties on venomous reptiles and upgrade wildlife possession regulations as needed for native and exotic species.
8. Encourage development of new methods/information systems to deal with nuisance wildlife complaints in a cost-effective manner.
9. Promote community environmental programs and distribute nongame information through MEEB and the existing environmental network, or through purchase of materials such as movies and slide-tapes for local use and distribution. Work closely with local conservation and sportsmen's groups.
10. Develop opportunities for public participation through a well-planned volunteer program. Possible activities include loon and heron colony observations, bird house and feeder observations, or backyard wildlife habitat programs.
11. Promote citizens' support for legislative actions on environmental issues.
12. Consider the creation of a citizen advisory body for the Nongame Wildlife Program.
13. Encourage private landowner interest and concern for nongame resources by providing technical services relative to:
 - a) understanding and controlling nuisance wildlife situations

- b) avoidance of actions which degrade wildlife habitat
 - c) mitigation of habitat loss
 - d) improvement of habitat including urban and backyard habitats and woodlots.
14. Clarify responsibility for promotional activities and delineate opportunities for cooperative efforts between the Bureau of Information and Education and the Nongame Wildlife Program.
 15. Seek the cooperation of such agencies of the University of Minnesota Agriculture Experiment Station and the Agricultural Extension Service in the use of their communication network to distribute educational and technical materials.
 16. Consider semi-annual working sessions of DNR personnel with private individuals and representatives of agencies and organizations to inform them of DNR projects and plans.

DATA ACQUISITION

Issue Statement: INFORMATION ON THE ECOLOGICAL AND ECONOMIC VALUES OF NONGAME SPECIES IS ESSENTIAL TO ADEQUATELY PRESERVE AND PROTECT THE NONGAME RESOURCE.

Biological information on nongame species is incomplete. This shortage of knowledge results in inadequate understanding of the ecological value of these species, the needs of the resource, and the problems that may threaten the future availability of wildlife. Additional information on the economic and aesthetic value of many nongame species is also essential to adequately preserve and protect the nongame resource.

Discussion: The principal charge of the Nongame Wildlife Program is to conserve Minnesota's nongame wildlife resource. Successful conservation depends on adequately understanding resource needs and the issues that confront the resources' continued existence. Such knowledge makes it possible to design and implement actions necessary to insure the perpetuation of nongame species and their habitats.

Data Acquisition Needs - The problems are that: 1) data are either lacking or inadequate for most species and 2) the types of information needed are diverse. For example, bird enthusiasts across the state are carefully delineating the distribution and abundance of nearly 400 bird species found in Minnesota. In contrast, the present county occurrence of even the common, but less appealing small mammal, reptile, or amphibian species are poorly documented. Data on the historical distribution and abundance of species and extensive information on species' life histories and habitat requirements are needed, as is data on the current quantity and

condition of various habitats. At the same time, a system is needed to monitor changes in habitat quality and quantity. Wildlife professionals also need information on the economic values of wildlife in Minnesota, as well as documentation of wildlife-associated recreation demand.

Historical data and current distribution records establish a baseline against which future population trends can be evaluated. Life history and distribution data are essential to understanding animals' needs, habitat relationships, and capabilities for continued existence.

If efforts to acquire essential ecological and economic data are not taken, program staff, as well as others, will be limited in their ability to address major resource issues. There are continuing demands to evaluate how proposed land use projects may impact sensitive or critical species. Because of inadequate information, comments are frequently limited to very general observations based on the assumption of large-scale alterations to the habitat. The ability to suggest alternatives that might mitigate negative impacts to species of concern is usually minimal.

Decisions regarding acquisition and habitat management for nongame species are equally hampered by the absence of essential data. Habitat acquisition is considered an important tool in wildlife conservation, but it can be expensive. Given the limited financial resources of state and federal natural resource agencies, it is critical that data be available to make informed acquisition decisions. Once a tract that provides critical habitat for species is acquired, agencies may need additional information for proper management.

The major reason for the absence of information is that funding has not been available to support nongame research or inventory projects. Monies recently available through Section 6 of the Endangered Species Act of 1973

have been inadequate, often difficult to obtain, and principally directed at federally listed endangered or threatened species.

Actions to Date - The Nongame Wildlife Program - One of the principal objectives of the Minnesota Nongame Wildlife Program must be the development of an efficient and effective strategy to acquire essential resource data. Since its inception in 1977, the Nongame Wildlife Program has emphasized the need for expanded inventory and field research projects. Prior to 1981, field efforts depended on volunteers to collect distribution and abundance information. Such efforts helped delineate the statewide distribution of summering loons (Henderson 1979b, Hirsch and Henderson 1980), document the presence of two separate concentrations of breeding Sandhill Cranes (Henderson 1978), and recorded 455 nesting locations for Minnesota's colonial waterbirds - herons, egrets, cormorants, grebes, gulls, and terns (MN Dep. Nat. Resour. 1984b). These inventories have made important contributions to our knowledge. A future staff priority should include an evaluation of these projects to improve the consistency in volunteer efforts and the statistical design of the surveys.

With the availability of nongame checkoff funds in 1981, a major effort was initiated to design an expanded and comprehensive research and inventory program that began with the 1982 field season. One important aspect was the development of a small grants program to encourage and fund inventory and research on Minnesota's nongame fauna. Among the 35 projects so far funded (Daniels 1981, Nehl 1982, Loch 1982) are an investigation of the response of nongame birds to aspen management for Ruffed Grouse (Fouchi in prep.), the development of a guide to the study of amphibians and reptiles in Minnesota (Karns in prep.), and an investigation of the effects of prairie management on nesting birds (Johnson in prep.).

The Nongame Wildlife Program, with advice from Minnesota's Endangered Species Technical Advisory Committee, has initiated major inventory and research projects focusing on species needing immediate attention.

In collaboration with the University of Minnesota-Duluth and the Arrowhead Regional Development Commission, an aggressive program of research, inventory, and habitat management was initiated to protect and enhance Minnesota's population of the endangered Piping Plover (Cuthbert and Wiens 1982, 1984, Met. Int. Comm. 1983). An intensive one-year study was conducted (Lang 1982, 1983) to delineate the distribution and abundance of Minnesota's rarest lizard, the Five-lined Skink (Eumeces fasciatus).

Because little was known about bat species native to Minnesota, a third major project to delineate the distribution and abundance of bats in southeastern Minnesota, particularly at winter hibernacula, was initiated (Birney in prep.). A second phase of the study will focus on bats which are concentrated primarily in northern Minnesota.

The Nongame Wildlife Program has also contracted for a compilation of all the statewide occurrence records of reptiles and amphibians since 1944. This is the preliminary step in the eventual publication of the first new accounting of herptofauna since Reptiles and Amphibians in Minnesota was published (Breckenridge 1944).

A stream survey begun in 1971 to document the native fish fauna in Minnesota's riverine habitats has been re-initiated in collaboration with the Section of Fisheries. Publication of an atlas of Minnesota fishes is anticipated following the 1984 field season. Other major projects in 1984 include a field investigation of wood turtles (in cooperation with the Minnesota Chapter of The Nature Conservancy), design of a statewide frog survey, and an investigation of the habitat requirements of sensitive bird

species in Minnesota's peatlands in cooperation with the Department's Division of Minerals.

Actions to Date - Other Agencies - The nongame wildlife resource is broad in scope, and the Nongame Wildlife Program is not the only agency responsible for data acquisition or resource management. Numerous federal, state, and county agencies and private organizations also are directed by mandates pertaining to nongame wildlife. The Endangered Species Office of the U.S. Fish and Wildlife Service has direct responsibility for coordinating data compilation activities pertaining to all federally listed endangered species as well as candidates for federal listing. The U.S. Fish and Wildlife Service has sponsored studies on the economic values and citizen demand for wildlife (Kellert 1980, U. S. Dep. Inter. 1982b) and is conducting a National Wetlands Inventory. Major efforts to monitor, inventory, and conduct applied research on numerous nongame species by the North Central Forest Experiment Station and the Chippewa and Superior National Forests (U.S. Dep. of Agriculture, U.S. Forest Service) are also contributing to our knowledge of the Minnesota resource.

At the state level, the DNR's Division of Minerals has been very active in initiating major research and inventory projects on nongame wildlife associated with peatlands (Minn. St. Plan. Agen. 1979). Some monies continue to be available to fund applied research pertaining to peatland reclamation and its implications for wildlife. The Division of Forestry also collects information pertinent to the nongame resource such as the Phase I and Phase II inventories of the distribution, quantity and quality of forest cover types. When completed, Phase II may serve as a system for monitoring trends in forest habitat availability on public lands. The Natural Heritage Program catalogs rare native plant communities and other

habitat data pertinent for nongame management. The Natural Heritage Program also maintains the computerized distribution records on the state's endangered, threatened, and special concern plants and animals including selected invertebrate species.

Numerous other groups within the Department of Natural Resources as well as other state agencies also are involved in projects that provide information on the nongame resource (Mn. Dep. Nat. Resourc. 1983b). For example, the DNR's Division of Waters maintains the statewide Protected Waters and Wetlands Inventory. The Minnesota Land Management Information Center within the State Planning Agency maintains a data base of general land use and natural resource data - the Minnesota Land Management Information System (MLMIS).

Notable among county efforts is that by the Hennepin County Park Reserve District. Inventory and species restoration projects at each of their large preserves in the seven county metropolitan area have added significantly to understanding the resource in this area.

Private and/or non-profit conservation groups as well as public institutions are helping to resolve the need for more data. The Minnesota Audubon Council, the Minnesota Ornithologists' Union and, most recently, the Minnesota Herpetological Society, are active in promoting interest in and knowledge of the nongame resource. Among public institutions, the numerous state universities and colleges, as well as the Bell Museum of Natural History and the Science Museum of Minnesota, are all important groups addressing this issue.

Future Considerations - Certainly the progress made in resolving this issue, particularly since checkoff funds became available, has been substantial. Nevertheless, the tasks that remain are numerous. Four points

become immediately clear. First, the Nongame Wildlife Program cannot possibly collect pertinent data on all of the hundreds of nongame species. Limited staff and revenue must be directed towards the most critical wildlife resources first, and criteria are needed to establish priorities for research in balance with other Program functions. Second, absence of data impedes the progress of numerous agencies and organizations charged with managing natural resources. Because financial and personnel constraints limit each group's actions, it is essential that the agencies cooperate in efforts to generate the necessary information. Third, research efforts should, in part, be designed to identify and/or test management techniques. Fourth, research results must be published so that information is available for use by all people interested in its application.

An effort to establish species priorities for the Nongame Wildlife Program has begun. The first priority is the Department's legal responsibility to protect those nongame species on Minnesota's official list of endangered, threatened, and special concern species (MN Dep. Nat. Resour. 1983c). Beyond a consideration of endangered and threatened species, all agencies and organizations are confronted with a problem of selecting priority species. Recently several attempts have been made to design an objective system to assist in the decision-making process (Neimi 1982). These methods are based on assessments of species' current abundance, historical abundance, general distribution, degree of threat, and critical needs. Some methods also evaluate components of the species' public appeal and economic value (Landry 1979, N.D. Game and Fish 1982, Nye 1981). Such methods should be evaluated by the Nongame Wildlife Program as it establishes a priorities ranking system for Minnesota.

It is also important that some measures are taken to monitor species.

Without baseline data that reflect general population trends, selection of priorities will be difficult. Some established monitoring procedures involving periodic surveys are already available for birds (e.g., Christmas Bird Counts, the U.S. Fish and Wildlife Service's Breeding Bird Survey Routes (see Henderson 1984), and the Section of Wildlife's Roadside Survey). For other vertebrates, monitoring methodology is currently not available.

Establishment of periodic surveys may not be the only means of monitoring these species. Monitoring the "health" and/or availability of the habitats the species depend on, or selecting indicator species, also are possible techniques. The challenge ahead is to decide what to monitor and how to efficiently accomplish the task.

In addition to selecting species priorities and monitoring techniques, the Nongame Wildlife Program needs to review the major habitat management actions that are currently employed in Minnesota and assess their implications to the nongame resource. Finally, the Nongame Wildlife Program also needs to be aware of priorities of other agencies in order to effectively cooperate with their research activities and to exchange information and research findings.

Opportunities to Resolve the Issue:

1. Encourage and coordinate with other agencies, organizations or individuals conducting research or compiling data on nongame species or on matters of concern to the nongame resource.
2. Identify the most effective and efficient combination of manpower and dollars available to conduct nongame studies and implement the findings.
3. Seek guidance from other state agencies, the U.S. Fish and

Wildlife Service, and other organizations on the most effective survey, census, and monitoring procedures and, where practical, coordinate programs to avoid duplication of effort.

4. Remain informed regarding all field nongame studies being conducted in Minnesota.
5. Develop guidelines and procedures which define priority species and management activities.
6. Design and implement inventory and monitoring programs to provide baseline data for determinations of status or management needs of species of concern in Minnesota.
7. Encourage modification of Phase I and Phase II forest inventories to provide more useful wildlife habitat data.
8. Participate in the State Planning Agency's update of the MLMIS land use data base to assure that information on statewide habitat will be available.
9. Formulate programs of applied research to examine effects of various land management practices or natural resource utilization programs on nongame species and their habitats.
10. In cooperation with other agencies, initiate and fund more forestry and wildlife research projects on the long-term effects of timber and game management on forest ecosystems.
11. Every effort should be made to publish findings in professional journals and popular periodicals.
12. Where practical, incorporate nongame species into game inventory programs.
13. Encourage university personnel to conduct more wildlife research projects within Minnesota.

14. Encourage and participate in agencies' efforts to determine and publicize the economic values of the state's wildlife resources.

INFORMATION MANAGEMENT

Issue Statement: INFORMATION MANAGEMENT AND NONGAME WILDLIFE PROGRAM ADMINISTRATION REQUIRE AN UP-TO-DATE AND ACCESSIBLE DATA SYSTEM COMPATIBLE WITH OTHER NATURAL RESOURCE DATA BASES.

Coincident with the Nongame Wildlife Program's mandate to conserve the nongame resource is the need to efficiently manage information about that resource. Biological and economic data describing the resource must be well-organized and readily accessible to the public and resource managers so that wise decisions can be made. Equally important is the need to manage administrative information so that program goals are attained in the most efficient and effective manner.

Discussion: There are three major aspects to the issue of information management. First is the short-term need to organize and manage data that has already been acquired. Second is a long-term need to manage additional data acquired through new inventory and research projects. The third aspect of this issue is the need for the Nongame Wildlife Program to develop a data management system compatible with other computerized data bases and sources of resource information compiled by other investigators.

Information Management Needs - The Nongame Wildlife Program has initiated several projects to gather distribution and abundance data. Until recently, these data have been organized and maintained in manual files. Consequently, the Nongame Wildlife Program's efforts to analyze, interpret, summarize and disseminate this resource information have not kept pace with the influx of data contributed by expanded staff and volunteer efforts. Hundreds of records have been accumulated and keeping them organized and

accessible has become difficult.

In addition to handling existing biological information, Nongame Wildlife Program personnel must be able to efficiently manage existing administrative information (e.g., revenues, expenditures, staff time). Much of this information is available but needs to be compiled and computerized for quick access so that staff can evaluate the costs and benefits of program actions. Such analyses will facilitate wise decisions regarding allocation of Program revenue and staff time.

Also, prior to initiating any new data collection efforts, the Nongame Wildlife Program must consider how such new data will be managed and utilized. Such determinations should be made during the initial phase of project design to enhance the overall utility and quality of research or inventory efforts. When these considerations are not taken into account, unnecessary constraints may be imposed on the Program's ability to properly manage the information at a later date. The Nongame Wildlife Program's colonial waterbird survey exemplifies this problem.

The more than five years of data available for many of the waterbird nest sites includes counts or estimates of active nests and breeding pairs for each species nesting in a colony. Currently, these data are maintained in extensive manual files that continue to grow. The data are plagued with numerous reporting inconsistencies, caused in part by inadequate instructions for conducting the surveys and incomplete project design. Such problems have made it extremely difficult to analyze, summarize or computerize the information.

Finally, the Nongame Wildlife Program should develop a data system compatible with other computerized data bases (MLMIS, Phase I and Phase II inventories, etc.) and secondary sources of resource information collected

by other investigators. Considerable information already is available on many nongame species, often in published reports and journals. Although numerous computerized library search services are now available it is a major task to compile sources that are pertinent. The Nongame Wildlife Program must first determine what information is needed and, subsequently, how it will be stored and utilized. A decision must be made as to whether the Nongame Wildlife Program should serve as a repository that will centralize all statewide nongame resource information. Or, instead, should the Nongame Wildlife Program maintain only its own data and refer inquiries regarding other nongame resource information to other sources? Another important consideration in selecting the appropriate information management strategy is to assess not only the needs of the Nongame Wildlife Program but the needs of the entire Division of Fish and Wildlife and other Divisions within the Department for nongame resource information.

Actions to Date - Failure to address any one of the various aspects of the information management issue will result in the perpetuation of a cumbersome data storage and retrieval system that hinders the Nongame Wildlife Program's ability to provide information, identify resource needs, and design management actions. Consequently preliminary steps have been taken already to resolve this issue. The most significant action has been the incorporation of nongame wildlife resource data into the Minnesota Natural Heritage Program's data base.

The Natural Heritage data base is an integrated system of map, manual, and computer files designed to catalog individual occurrences of rare species and natural features throughout the state. The files grew from a need to develop and maintain a centralized source of ecological information. Such a data base, it was felt, would help insure that important natural

areas were identified and that public and private development projects would have the most up-to-date information available from which to plan.

Data that the Nongame Wildlife Program had collected on over 450 colonial waterbird nesting sites are catalogued in the computer and map files (details regarding the number of nesting pairs per species each year in the colony are maintained manually), as is occurrence information on nearly all of the currently listed state endangered, threatened, and special concern wildlife species. One of the primary responsibilities of the Nongame Zoologist position is to insure that information on rare nongame species catalogued in the Natural Heritage data base is continually maintained and up-dated.

Despite its ability to effectively manage important data for some rare species and natural features, the Natural Heritage data base does not provide a solution to all the data management needs of the Nongame Wildlife Program. Because it is a geographic-based information system, it is limited to efficiently cataloguing geographic information describing a species' occurrence, (e.g., the section, township, and range). Detailed information describing the historical distribution, reproductive success, and annual population size of a species cannot be efficiently managed by the data system. A new system must be developed that permits efficient organization, retrieval and analysis of the additional information. A similar problem exists with data collected from the volunteer observation program for common loons. An assortment of information describing the presence or absence of loons on a lake, their nesting success, and factors that may disturb the birds are incompatible with the Natural Heritage data base and now are coded into a data file specifically for loons.

Although the statewide distribution data for rare species are

effectively organized by the Heritage system, the data base is extremely cumbersome for use with common species. The Natural Heritage data base cannot easily manage information summarizing habitat requirements, food habits, population dynamics, and state and national distribution, etc. for common species. The Nongame Wildlife Program must assess which of these data are important to maintain and must select an appropriate system (See Data Acquisition Issue).

In the past 10-15 years, numerous data management information systems have been developed. Most widely used today is the "Procedure for Describing Fish and Wildlife," designed by the Eastern Energy and Land Use Team of the U.S. Fish and Wildlife Service. "Procedure" provides a method for organizing and describing state fish and wildlife information in a standard, consistent manner. Information describing each species taxonomy, distribution, legal status, habitat associations, food habits, management needs, as well as a wide variety of other data, are coded into the files. The entire system is designed to provide a readily retrievable source of up-to-date information for project planners, permit reviewers, resource managers, administrators, regulators, and researchers.

In 1980, the Nongame Wildlife Program initiated development of the Procedure data base in Minnesota with cooperative funding provided by the U.S. Forest Service and the U.S. Fish and Wildlife Service. However, in the fall of 1982, work was halted for several reasons. The foremost consideration was the rapid changes that were occurring in the Nongame Wildlife Program as a consequence of the new source of revenue. Coincident with this was the recognition that the Nongame Wildlife Program had some very specific data management needs (e.g., for colonial waterbirds and loons) that were a high priority but for which the Procedure data base was

not a solution. Furthermore, the expense of developing the data base into a useful decision-making tool, with accurate and current information, was high.

Although the decision was made not to pursue development of the Procedure data base, the experience gave the Nongame Wildlife Program an opportunity to work with a computerized data base system, learning both its advantages and disadvantages. If, in the future, development of a comprehensive data system is deemed a priority, "A Procedure for Describing Fish and Wildlife" should again be considered if it meets the needs of the Program and other potential users in the state and federal agencies. Again, the most important point is that the Nongame Wildlife Program first carefully delineate its own data management needs.

Actions necessary to resolve the administrative aspects of data management are still very preliminary. At present, nongame staff is recording the amount of time spent each day on different program functions such as public education, extension, survey, and technical projects. A cost-accounting code has been developed so that each program expenditure can be coded to a particular function. Within the coming year an accurate monthly report will be generated for each of the Program's project costs.

Future Considerations - The challenge for the Nongame Wildlife Program is to establish an information management system that will provide support for all of the program's functions, including budgeting, resource management, and strategic planning. Basic to the establishment of the appropriate data management system is the need to answer the simple question: "What information is needed and why?"

Opportunities to Resolve the Issue:

1. Design data handling systems specific for the Nongame Wildlife Program.
2. Support efforts to conduct a Division-wide assessment of the need for computerized data management systems, including the needs of the Nongame Wildlife Program and the Natural Heritage Program, to enhance the integration and coordination of such systems. Such an assessment should include input from USFWS and USFS.
3. Request assistance from the Wildlife/Forestry Task Force and the Bureau of Management Systems in the assessment and development of the Program's data management system.
4. Define a mechanism for incorporating newly compiled field data into the DNR environmental review process and the administrative, legislative, or management actions of appropriate public or private organizations.
5. Investigate the mechanisms and effectiveness of data management systems developed and existing outside the Division but within the state (Bell Museum of Natural History) or in other wildlife management agencies around the nation.
 - a) MAST systems - U.S. Fish and Wildlife Service.
 - b) Data star and report systems of Montana.
 - c) Forplan - U.S. Forest Service.
6. Ensure that the data management system selected is compatible with existing data systems within the DNR.
7. Support the establishment of a library within the Department of Natural Resources.
8. Encourage and participate in agency efforts to determine and publicize the economic values of the state's wildlife resources.

ENDANGERED AND THREATENED SPECIES

Issue Statement: THERE IS A NEED TO IDENTIFY AND MANAGE MINNESOTA'S NATIVE SPECIES THAT HAVE DECLINED IN NUMBER AND DISTRIBUTION AND ARE EXTIRPATED, ENDANGERED, THREATENED, OR OF SPECIAL CONCERN.

Minnesotans' desire to maintain populations of all wildlife is reflected in Minnesota's statutes to protect endangered and threatened species. Facilitating the recovery of extirpated, threatened, and endangered species and preventing the decline of other nongame populations is considered by many to be the first priority of the Nongame Wildlife Program. An effective program to recognize, monitor, manage, protect and/or restore these species is needed to maintain Minnesota's natural diversity.

Discussion: Managing rare species is an important component of responsible and balanced natural resource management. The federal government initiated both recognition and management for endangered species through legislation developed in the late 1960's which was revised and culminated in the Endangered Species Act of 1973 (16 USC, 1531 et sec). The purpose of the Act is to provide a program for the conservation of endangered species and to protect the ecosystems upon which they depend. The cause of the endangered species problem is recognized as economic growth and development proceeding with no consideration of the consequences to wildlife (Langer 1984).

Additionally, the federal law (Sec. 6) authorizes the establishment of cooperative agreements between state wildlife agencies and the U.S. Fish and Wildlife Service for cost-share funding for management of listed species, provided that the state can show that it has an "adequate and active program" for the conservation of endangered and threatened species. The

purpose of these Sec. 6 grants is to create incentives for states to increase efforts that lead to maintaining the diversity of species (Langer 1984).

Following the federal example, Minnesota established legislation mandating state protection for endangered species in 1971 and entered into a limited authorities cooperative agreement with the U.S. Fish and Wildlife Service for endangered animals in 1979. Minnesota's statute (97.488 Protection of Threatened and Endangered Species) has been revised twice, once in 1974 and again in 1981.

The state legislation designates the Commissioner of the Department of Natural Resources as the responsible agent for the identification and management of Minnesota's endangered and threatened species. A Commissioner's Order (No. 1901) regulating the taking, possession, and disposal of endangered species was developed in 1974 and is currently being revised to reflect legislative changes made in 1981. This order serves as the Commissioner's policy executing the legislative mandate to designate and manage Minnesota's endangered and threatened species.

Minnesota's law protects both plants and animals in one of three categories - endangered, threatened, or special concern. The law provides that designation of species within these categories shall be accomplished through a listing process including public review, and that the designated species list shall be reevaluated every three years. This listing process is similar to designated procedures mandated under federal law. Further, Minnesota's legislation stated that those species designated under the federal law of 1973 as endangered in Minnesota - the Peregrine Falcon, Timber Wolf, Bald Eagle, and Higgin's Eye Pearly Mussel - would constitute the state's official list until the Commissioner exercised his authority to

develop a more comprehensive state list.

The state law also provides that a volunteer technical committee of up to 30 individuals be appointed to assist in the establishment of this list and to make recommendations to the Commissioner of Natural Resources regarding restoration, recovery, habitat improvement, and habitat protection for designated species. The Commissioner is authorized to develop management programs for endangered species that may include research, census, law enforcement, habitat acquisition and maintenance, propagation, live-trapping, transportation, and regulated taking. Finally, the law permits exceptions to acts otherwise prohibited (Subd. 6). Because of these exceptions, the U.S. Fish and Wildlife Service has not yet approved Minnesota's application for a full authorities endangered/threatened plant cooperative agreement.

The first comprehensive list of state designated species became official in January 1984. It was developed by personnel of the Natural Heritage and Nongame Wildlife Programs working closely with the 30-member Endangered Species Technical Advisory Committee. A total of 287 native plants and animals have been listed: 57 species as endangered, 49 species as threatened, and 181 species as special concern (Mn. Dep. Nat. Resour. 1983c, 6 MCAR Sec. 1.5600, and 8 state Req. 995 (Oct 31, 1983)).

The establishment of a state list is a great step forward and the benefits are many. The educational value of the list is most significant. A state list acts as an early warning system, alerting natural resource managers and the public that certain species and the habitats they depend on are experiencing problems. These problems can then be addressed at a state level before they become of concern at the national level. In this manner, the list serves as a critical guide for establishing priorities for both

state and private management activities and conservation efforts.

Preventing the decline of populations of native species is seen by many as the first priority of wildlife management. It is certainly less expensive than subsequently attempting to restore populations of depleted species. Within the DNR, the Section of Wildlife coordinates the endangered species management effort. The Natural Heritage Program (with staff botanists) and the Nongame Wildlife Program (with a staff zoologist) together maintain a computer-based data system on rare species in Minnesota. Staff scientists are working to integrate the management needs of these species into ongoing practices of the Divisions of Fish and Wildlife, Forestry, Parks and Recreation, and other agencies. While the emphasis of all these efforts is on populations, the Nongame Wildlife Program also provides some funds to the Raptor Research and Rehabilitation Center at the University of Minnesota for the treatment of injured individuals of endangered and threatened bird species.

To date, the responsibility for developing a comprehensive strategy to conserve endangered species has not been assigned nor have the scope and goals of such an effort been defined. As these matters are addressed, it will be important to evaluate the efforts of others outside the DNR, including the Endangered Species Office of the U.S. Fish and Wildlife Service, the Sensitive Species Programs of the Chippewa and Superior National Forests, and the efforts of conservation groups such as The Nature Conservancy. The recent evaluation by Langer (1984) of endangered species conservation efforts in the upper Midwest has already developed much useful information in this regard.

The process of identifying endangered and threatened species has already been established by legislative mandate. The issue facing the

Nongame Wildlife Program is, therefore, one of determining how it can most effectively focus its personnel and monies to accomplish the inventory, monitoring, management, or recovery needed by these listed species. Where should the Program's emphasis be placed, particularly with regard to the efforts being expended by other groups and agencies.

Some guidance in this regard may be found in a statement by Odum (1982) that "a nongame program that provides for continual monitoring of the nongame resource is by far the best endangered species program a state can have."

Some efforts are underway to restore selected wildlife species in Minnesota. Two statewide programs have been initiated. Since 1982, a total of 35 peregrine falcons have been released in Minnesota and 16 trumpeter swans have been reared for eventual release. These projects involve cooperation among a variety of agencies and organizations.

On a regional scale, a number of extirpated populations have been restocked by Division of Fish and Wildlife personnel. From 1977-1980, approximately 90 prairie chickens were released at the Lac qui Parle Wildlife Management area near Watson, Minnesota. Twenty-three river otters from northern Minnesota were relocated in the Minnesota River drainage from Ortonville to Watson. The Hennepin County Park Reserve District initiated an osprey restoration project in Hennepin County in 1984. A number of future opportunities for wildlife restoration have also been identified and await evaluation (Mn. Dep. Nat. Resour. 1981).

Failure on the part of the Nongame Wildlife Program to address this issue might result in the extirpation of certain wildlife species, the destruction of habitat essential for the survival of the state's listed species, and a loss of citizen confidence in the DNR's commitment to its

legal mandates.

Opportunities to Resolve the Issue:

1. Assign responsibility for coordination of the Department's endangered species effort including the definition of goals and scope of DNR's commitment to endangered species management.
2. Update Commissioner's Order #1901 to reflect the 1981 legislative changes.
3. Promote awareness and appreciation of listed species among other agency personnel and the general public, especially private landowners. Encourage understanding of causes for these species' declines and the remedial actions needed to restore populations.
4. Develop a priority system to guide allocation decisions for listing, recovery, research, and protection activities. See Langer's (1984) discussion of the federal allocation model.
5. Implement the priority activities cooperatively with other programs (particularly the Natural Heritage and Scientific and Natural Areas Programs) which are similarly mandated to protect and manage the species.
6. Adopt cooperative agreements with nongame programs in adjacent states to manage endangered, threatened, or special concern species.
7. Develop Program actions which initiate or support qualified projects for the propagation, management, rehabilitation, or recovery of declining or extirpated species.

8. Identify and implement legislative or policy changes needed to enable the State to qualify for an unlimited authorities cooperative agreement for plants and animals including invertebrates.
9. Identify species which are in need of restoration, assess the feasibility and priority of such restoration and develop a long-term strategy for such actions.
10. Develop ongoing surveys of Minnesota flora and fauna to:
 - a) periodically re-evaluate and update status of species presently on the endangered, threatened, or special concern lists;
 - b) update those lists as warranted by current data;
 - c) develop a complete Minnesota checklist for all biota to provide a baseline for further studies.
11. Assess the feasibility and appropriateness of future reintroduction efforts for such species as swallow-tailed kites, woodland caribou, or whooping cranes which have been listed as extirpated statewide.

WILDLIFE HABITAT

Issue Statement: HIGH QUALITY HABITAT IS THE KEY TO WILDLIFE SURVIVAL.

Human land use decisions that convert, degrade, fragment, or contaminate wildlife habitats counteract or preclude actions to conserve wildlife populations. There is a need to sustain existing habitat management and protection programs and implement new actions that recognize nongame resource needs in order to minimize adverse land use and maintain habitat for wildlife.

Discussion: Minnesota's wildlife species diversity is unparalleled in the upper Midwest. This is a consequence of Minnesota's position in the heart of the continent where three major biomes - the tall grass prairie, eastern deciduous forest, and northern coniferous forest - converge, creating a wide variety of wildlife habitats. Man's use of the lands and natural resources of the state has altered these habitats, creating many of the present problems in wildlife conservation.

Habitat Destruction - The specific land use actions and their consequences for the wildlife resource in Minnesota have previously been discussed (Mn. Dep. Nat. Resour. 1983b). A number of habitat types have been converted to other uses and thus lost to wildlife because of land use practices. For example, almost all native prairie in the south central and southeastern Minnesota has been converted to agricultural land. Remnant prairies remain on railroad rights-of-way or in association with dry, rocky pastureland. In southwestern and northwestern Minnesota, native prairie habitat may still be found as isolated parcels on the beach ridges or rougher land where droughty soils and topography limit row crops.

Nevertheless, intensive grazing of these areas has severely degraded the native prairies, reducing their utilization by wildlife. Throughout the state, the implementation of strict fire suppression and prevention programs has allowed aspen and shrub to take over the remnant prairie.

Wildlife habitat is also facing numerous threats less obvious than direct loss. Degradation of northern softwater lakes from acid precipitation continues at an accelerating rate. Ground water, especially in the southern part of the state, is becoming increasingly contaminated with unknown consequences for wildlife. Lead shot contamination, with dire consequences to waterfowl, birds of prey, and other wildlife, continues. The need for a national regulatory mechanism to deal with lead shot toxicity is being neglected, and the federal government has not shown leadership in implementing a nontoxic steel shot program. Minnesota initiated its own steel shot program in 1977.

The wholesale application of herbicides for weed control on land and water and pesticide spraying for mosquitoes and other insects annually take their toll on wildlife and wildlife habitats. Exotic species, such as purple loosestrife, a European plant species, pose additional threats to certain habitats. All of these threats are interrelated and cumulative. They are also technically complex and/or are politically sensitive because they involve important economic issues and/or human health and welfare considerations.

The consequences for wildlife because of such conversion, degradation, and fragmentation of habitats is substantial. The Marbled Godwit and Greater Prairie Chicken are gone from most Minnesota prairies due to a lack of prairie parcels of sufficient size or quality. Other species like the Piping Plover have declined because their sandy beach habitat has been

preempted by recreational use, lake shore cabins, industrial development, and other non-compatible activities.

Fortunately, certain wildlife habitats have remained better protected than others due to their location or value for wildlife. The extensive peatlands of the north have not been converted to agriculture because of limitations caused by cold climatic conditions, saturated soils, and a short growing period. Current administrative policy, however, favors peatland development for alternative energy sources. Prairie potholes, though greatly diminished in extent, remain a sizeable habitat component in Minnesota because of state and federal programs to protect waterfowl habitat.

Habitat Protection Through Acquisition - Historically, habitat protection for wildlife consisted primarily of public land acquisition. Today, there are approximately 12 million acres of public land in Minnesota, located predominately in the northern, forested region of the state. Most of this property came into public ownership as a result of congressional land grants, county bankruptcies due to ill-advised drainage projects and tax forfeiture in the 1920's, and the establishment of state and national forests. The land remains forested, although the composition of the forest communities changes.

The first significant land acquisition effort in Minnesota specifically for wildlife began in 1951. It involved the acquisition of prairie marshes in western Minnesota through the Section of Wildlife's "Save the Wetlands Program," the first program in the nation to protect small wetlands. Subsequently the U.S. Fish and Wildlife Service began acquiring Waterfowl Production Areas. The approximately 545,000 acres of wetlands preserved represent the single largest acreage of acquired lands in Minnesota. This

acquisition effort was possible because of dedicated funds derived from federal duck stamp monies and state small game hunting license surcharge, and cigarette tax monies.

Though such acquisition focused on waterfowl, the network of protected wetlands and adjacent uplands perpetuates habitat for numerous nongame species. However, some wetland species like the American Bittern declined when acquired habitat did not meet the critical size or composition necessary to sustain breeding populations.

In the 1960's, smaller acquisition efforts were initiated. These efforts on the part of private nonprofit organizations like The Nature Conservancy resulted in the protection of substantial acreages of native prairie habitat. Efforts by programs such as the DNR's Natural Heritage and Scientific and Natural Area Programs have also resulted in the identification and acquisition of habitats critical to certain nongame species, plant species, and plant communities ranked as statewide priorities. Though the primary focus was protection of plant communities, wildlife habitat was also protected.

Four areas of value primarily for nongame species have been acquired as a result of efforts by Division personnel with cooperative financing from the Division of Fish and Wildlife's Game and Fish Fund, the Nongame Wildlife Fund, the Minnesota Wildlife Heritage Foundation, and The Nature Conservancy. The Howard Lake heronry on Lamprey Pass WMA (Anoka Co.), Shelley Island in Cotton Lake (Becker Co.), and the Common Tern and Piping Plover nesting habitat on Hearing Island (Duluth Harbor, St. Louis Co.) are consequently now administered as wildlife management areas. Pine and Curry Islands in Lake of the Woods were acquired through land exchange. These lands are administered as a Scientific and Natural Area because of their

utilization for nesting by the Piping Plover, an endangered species.

Nongame Wildlife Program personnel have evaluated numerous other parcels for nongame resource values and as potential acquisitions.

Alternative measures have been implemented to protect the wildlife values on some of these tracts such as the Long Lake heronry posted by the DNR under landowner easement to prohibit trespass during the nesting season.

In 1975, the Minnesota Legislature enacted the Resource 2000 program. This program provides funds, financed by general revenue bond sales, for acquisition and improvement of natural resource lands. The Resource 2000 program has accelerated the acquisition of lands for wildlife habitat purposes. However, the most recent legislation (Chapter 344, Session laws of 1982) re-authorizing the expenditures of bonding monies for land acquisition requires that existing state land, equivalent in acreage to the amount acquired, must be offered for sale. This legislation represents a compromise between consequence of an aversion to existing state land ownership on the part of some citizens and the need for additional acquisition.

Other Protection Alternatives - Acquisition has not been the only alternative for protecting wildlife habitat. The U.S. Fish and Wildlife Service protects some wetlands through an easement program. Legislative actions like tax credits for native prairie and wetlands have postponed the destruction of certain wildlife habitats, at least for the time being. In addition, the Water Bank Program administered by the DNR has set aside wetlands and adjacent uplands through ten year lease agreements. The Department's Protected Waters and Wetlands Inventory program has also protected important habitat through regulatory control of draining, filling, vegetation removal, pumping, and development projects.

Similarly, new laws regulating the discharge of toxic substances into the water, air, and land have the effect of limiting negative impacts to remaining habitats. Section 404 of the Clean Water Act administered by the Army Corp of Engineers has protected considerable riparian habitat. The exercise of State regulatory authority over water appropriations and over wetland drainage also has benefited wetland wildlife. National and state legislation mandating assessment of the environmental consequences of major development actions has been another innovative mechanism used to protect wildlife habitat when information is available to identify a site's significance for endangered, threatened, and other wildlife resources. Too often, however, sufficient information does not exist to assure comprehensive evaluation and consideration of a site's values for wildlife (See Issue on Data Acquisition).

The management of public lands is an important activity of tremendous consequence to wildlife habitat and hence to nongame species. For the most part, public land management has been directed to wildlife habitat enhancement within the constraints of state, federal, and county objectives to derive economic returns from the lands. Such economic returns historically have been viewed as coming from timber resources, mineral resources, recreational activities and other resource commodities like peat. When wildlife enhancement on these lands was incorporated into forest management or other land use plans, it traditionally has been for game species. In the past, the management orientation on lands acquired specifically for wildlife habitat has also has been primarily for game species.

Many nongame species have benefited from management actions carried out on public lands for forestry or traditional wildlife objectives.

Nevertheless, actions directed to game species have also probably had negative impacts on some nongame species because of the traditional emphasis placed on increasing edge and setting back successional stages of community types.

Management emphasis on public land has shifted within the last 25 years as federal lands have come under comprehensive legal mandates to consider the needs of all wildlife. Similarly, in the last few years, state forest land managers have developed comprehensive procedures to build wildlife needs (including nongame) into the state's land management programs (Mn. Dep. Nat. Resour. 1982b). Some county land management programs have hired professional wildlife personnel to give wildlife increasing emphasis in land management programs. The potential of such a comprehensive approach for the enhancement of wildlife habitat is vast, and the progress to date has been encouraging. Specific management activities undertaken by Nongame Wildlife Program personnel and Department land managers to benefit nongame species have included such actions as the creation and protection of nest sites for piping plovers and common terns, nest platforms to restore a great blue heron rookery, prairie burning, and the establishment of bluebird nest box trails.

Habitat on Private Lands - Despite existing state and federal land use restrictions, environmental standards, and habitat acquisition or management programs, increasing amounts of wildlife habitat are degraded, altered or lost without consideration for wildlife species. Though public agencies can exercise more control over activities on public lands, it is the private land base (75% of the total) where the least control occurs. Consequently, active habitat management on public lands and the continued acquisition of additional wildlife habitat, though critical, will only go part way toward

providing for the optimum in wildlife habitat.

If wildlife habitat is to be maintained on private lands, other actions need to be identified, developed, implemented, and maintained. Such alternatives might include comprehensive local land use zoning and planning, new legislative regulations, increased enforcement, landowner education, tax incentives, and private land management programs. Cooperation with other county, state and federal programs needs to be strengthened, and policies and guidelines need to be adopted for the management of private lands consistent with enhancing the future for wildlife species.

Additionally, an ignorance of the possible economic value of wildlife also contributes to habitat loss, degradation, and conversion of private land for other purposes. Admittedly, powerful economic pressures influence private landowners, especially in the agricultural zone. As a result, many landowners will not give consideration to wildlife in land use decisions. By placing wildlife in a more favorable economic position, managers might provide enough incentive to sway some landowners' attitudes.

Future Considerations - A review of past acquisition and habitat management activities reveals a number of important considerations which must be addressed as the Nongame Wildlife Program develops a strategy to effectively contribute to the efforts to maintain and enhance wildlife habitat. The Nongame Wildlife Program itself cannot, nor should it be expected to, acquire all parcels of significance to the nongame resource in Minnesota. Land acquisition is expensive.

Perhaps other DNR programs, federal agencies or private organizations, either alone or in cooperation with the Nongame Wildlife Program, should acquire land necessary for the nongame resource. The most important role for the Nongame Wildlife Program relative to habitat protection may be to

define the habitat needs of priority nongame species, identify sites which require protection, and subsequently refer such sites to others for protection in the public interest. Perhaps the Program's role should be to answer basic questions on the needs of rare species such as minimum acreage requirements, etc. and to provide management assistance to enhance habitat for nongame species. The impact the Nongame Wildlife Program could have on enhancing and protecting habitat for nongame species may be greater if it concentrates on providing this technical and management assistance to existing land acquisition programs and land management agencies.

The Nongame Wildlife Program needs to assess where the opportunity for significant improvement of habitat management and protection lies (on public or private lands) and where the Program's efforts should be focused. For instance, are current nongame wildlife conservation efforts paying enough attention to habitat loss and degradation on private lands? The Nongame Wildlife Program must determine how it can contribute on private lands relative to past accomplishments and the current activities of the Section of Wildlife and other agencies. What percent of money and time should be devoted to such efforts considering that there are no long term assurances that existing landowners will abide by the guidance provided? A major question is whether this service should be available for all habitats or whether it should focus only on specific critical habitats for rare species.

Such technical assistance or acquisition recommendations still may not assure protection of critical resources, as some sites may not meet the criteria of other acquisition programs. In some cases, therefore, it may be necessary for the Nongame Wildlife Program to initiate acquisition. Such actions should be on a case by case basis and adhere to Nongame Wildlife Program acquisition guidelines yet to be established. A failure on the part

of the Nongame Wildlife Program to participate in wildlife habitat protection and management programs may result in the decline or loss of populations of some nongame species.

Wildlife is a product of the land. The challenge is to maintain more wildlife on less habitat. Depending on land ownership, a number of alternatives appear to exist. On public lands, land management and interagency coordination are of utmost importance. On private lands, techniques for habitat protection including technical assistance and landowner education, legislatively mandated land use regulations, and financial incentives are important opportunities. In some instances, acquisition of critical sites on private land may also be desirable. When addressing the issue of wildlife habitat, the Nongame Wildlife Program must develop a strategy considerate of all alternatives.

Opportunities to Resolve the Issue:

1. Identify the location, quantity, and quality of habitats important for endangered, threatened, and special concern nongame species as well as other important habitats on a statewide basis. Monitor these habitats in order to quickly respond to negative changes that may occur. Develop a priority system to guide subsequent protection, enhancement, or development efforts.
2. Coordinate the identification of these critical habitats by working closely with the establishment of field inventory priorities for Natural Heritage staff plant ecologists.
3. Establish acquisition criteria and procedures to guide Nongame Wildlife Program.
4. Implement measures to protect key critical nongame wildlife

) habitats, focusing on those habitats for endangered, threatened, or special concern species, including fee or easement acquisition or other protection techniques.

5. Use the DNR and other agencies' environmental review processes and procedures to optimize input and alert developers to the significance of nongame species. Focus the review process on alternatives and mitigation to enhance projects.
6. Encourage the Division of Fish and Wildlife to consider a Wildlife Protection Act to establish state policy for the protection and enhancement of wildlife with legislative mandates to implement the policy. As a part of this policy effort, assess the legal mechanisms that offer protection to wildlife and its habitats through land use planning regulations, tax incentives for habitat protection or enhancement, land retirement programs, and removal of financial subsidies that ultimately degrade wildlife habitat with the idea of seeking their implementation in Minnesota.
7. Take the lead in promoting the adoption of the necessary regulations and Commissioner's Orders within the Department of Natural Resources to carry out all of the mandates of the state Endangered Species Act.
8. Promote state legislation or regulation to further the control of toxic substances in the air and water, to deal with problems such as lead shot, and to preclude the introductions and/or propagation of undesirable exotic species into Minnesota.
9. Encourage the federal government to assume vigorous toxic shot and acid precipitation prevention programs.
10. Promote the maintenance of a strong federal Endangered Species Act,

become an advocate for nongame appropriations under the Fish and Wildlife Conservation Act of 1980, and develop working agreements with federal agencies concerning nongame species management on federal lands.

11. Develop agreements with adjacent states concerning nongame species management.
12. Develop and implement formal working agreements and guidelines with other land management agencies or DNR Divisions to provide direction (such as the Private Forest Management Program of the Division of Forestry) and management assistance (technical services, seasonal crews, equipment, and management funds) concerning nongame species habitat needs on public and private lands.
13. Whenever possible, promote the implementation of an ecosystem approach to natural resource lands management by linking lands under various ownerships through cooperatively designed and implemented acquisition and/or management plans.
14. Participation in a technical services program that can advise private landowners or other agencies on public services (technical assistance guidelines), subsidies available (tax credits), and protection mechanisms (leases, easements) to 1) avoid adverse actions which degrade or eliminate wildlife habitat or otherwise substantially threaten nongame wildlife populations, 2) mitigate unavoidable loss of habitats, and 3) improve existing habitat, including urban and backyard habitats and small woodlots. Cooperate, particularly with the U.S.D.A. Extension Service and the U.S. Soil Conservation in this regard.

15. Develop, as a part of a broader public awareness program, educational materials to promote an understanding of the necessity of adequate habitat for maintaining wildlife populations. This effort should include information on the status of wildlife habitat and what the public can do to positively influence attitudes on the retention and maintenance of wildlife habitat in their own community and statewide.
16. Assess the applicability of the Habitat Evaluation Procedures (HEP) (U.S. Dep. Inter. 1980) or other procedures in order to establish the value of lands maintained as wildlife habitat.
17. Participate in existing programs throughout the state which demonstrate good wildlife habitat management practices, particularly for woodlots and agricultural lands.

NONGAME WILDLIFE PROGRAM FUNDING

Issue Statement: THE NONGAME WILDLIFE PROGRAM IS FINANCED BY VOLUNTARY DONATIONS TO THE NONGAME WILDLIFE CHECKOFF FUND AND HAS GENERATED SIGNIFICANT SUPPORT FROM MINNESOTA CITIZENS. LONG-TERM PROGRAM STABILITY AND SUCCESS WILL DEPEND ON EXPANDED FUNDING TO INCLUDE ADDITIONAL REVENUE SOURCES.

Except for some administrative support, the Nongame Wildlife Program is financed almost entirely from a single source, citizen donations to the Nongame Wildlife Fund. Additional state and federal monies or other funding have been limited. As a result, the program's funding is vulnerable to fluctuations and the Program is unable to finance all actions required to meet resource needs. It is necessary to develop adequate, stable, long-term financing for the Nongame Wildlife Program based on more than one funding source.

Discussion: Minnesota's Nongame Wildlife Program began in February, 1977. Funding was derived from the Game and Fish Fund and totalled less than \$35,000 annually for four years from 1977 to 1980. Additionally, donations from sportsmen's groups and conservation clubs helped initiate restoration projects for the trumpeter swan and the river otter.

In the spring of 1980, the Minnesota Legislature established a nongame wildlife checkoff provision on Minnesota's income tax and property tax forms. The nongame wildlife checkoff (Minn. Stat. Sec. 290.431) initiated a new era for Minnesota's Nongame Wildlife Program.

The legislation provided that Minnesota taxpayers could donate \$1.00 or more, up to the total amount of their refund, on state income tax forms

and/or property tax forms. The amount of money donated was deducted from the refund due the taxpayers and credited to the Nongame Wildlife Fund.

In 1981, the state legislature amended the nongame checkoff law to allow taxpayers not receiving a refund to contribute by adding a donation to the amount of taxes due. The amendment also provides that the Nongame Wildlife Fund account is subject to overview by the Legislative Commission on Minnesota Resources (LCMR). Biennial budgets must be approved by the LCMR, and any land acquisitions require individual LCMR approval. Semiannual summaries of biennial budget status are also required.

Money accrued by the Department of Revenue from the checkoff is transferred to the DNR on June 30 and January 1. To date, the amount transferred on each date has been approximately \$400,000 and \$200,000, respectively. The money spent in a given fiscal year, July 1 to June 30, consists of the January 1 payment accrued from donations of the last half of the previous calendar year and the June 30 payment accrued from donations of the first half of the current calendar year.

Minnesota also allows taxpayers to donate to the Nongame Wildlife Fund on their property tax refund returns (M1-PR forms). This source of revenue is important for the NWP as the percentage of total checkoff revenue derived from property tax returns has increased during the past 3 years from 8.6% to 20.1%. One reason for this may be that persons who do not receive a refund on their income tax returns may use the property tax form to make a donation from that refund.

The amount of money contributed to the Nongame Wildlife Fund raised in Minnesota has totalled over \$1,750,000 during the period 1980 - 1982 (Table 1). In 1980 and 1981, more Minnesota taxpayers donated to the Nongame Wildlife Checkoff than did taxpayers in any other state. The total amount

Table 1. Summary of total donations to the Minnesota Nongame Wildlife Checkoff 1980-1982.

<u>Tax Year</u>	<u>1980</u>	<u>1981</u>	<u>1982</u>
Total Donations (\$)	\$ 523,743.65	\$ 619,253.43	\$ 616,665.28
Total Donations (#)	154,376	194,092	200,154
Average Donation	\$ 3.39	\$ 3.19	\$ 3.07
Donation Rate	8.87%	11.51%	11.74%
% Taxpayers Receiving	82.00%	71.80%	62.9%

Refund

of money raised ranked second only to Colorado during the same period. For tax year 1982, both the number of donations and total donations ranked second to New York among 20 states with a wildlife checkoff on their state income tax forms.

Colorado's checkoff income more than doubled during its first four years (U.S. Dep. Inter. 1982a). A similar pattern is not occurring in Minnesota where the level of income was approximately the same in 1981 and 1982. This trend may be partly due to the state income tax surcharge which was implemented for the 1982 tax year and lowered the percentage of taxpayers receiving refunds. While taxpayers can make donations either from their refund or by adding to the taxes due, most persons donate from their refund.

It is very encouraging to see that the number of donations has continued to increase during the first three years of the program. In contrast, the average donation decreased slightly from \$3.39 to \$3.07 - the lowest average in the nation. One explanation for the low average may be the way the checkoff is worded on the tax forms.

In 1981, 61.6% of all donors to the checkoff donated exactly one dollar - suggesting that they may be misinterpreting the nongame wildlife checkoff to be a one dollar checkoff. Most other states have a format which presents several checkoff boxes for specified amounts and a blank for write-in of another amount.

It is also possible that many people are willing to give just one dollar. This factor may explain the state's high overall donation rate. The percentage of people donating to the Nongame Wildlife Fund in Minnesota is more than twice the national average - 11.7% vs. 5.5% (Nongame Wildl. Assoc. N. Am. 1982).

There are two distinct groups among taxpayers: people who prepare their own tax returns, and those who go to tax preparers. There is a large difference between the donation rates of the two groups. In 1983, the donation rate was 13.4% for self-prepared M-1 Income Tax forms and only 5.9% for forms prepared by tax practitioners. On M1-PR Property Tax forms, the donation rate was 10.3% on self-prepared forms and only 2.0% on forms prepared by tax preparers.

It would appear that some tax-preparers impose a bias against the checkoff by omitting reference to it during the tax preparation process or by discouraging their clients from giving. Some prefer to skip the checkoff item because it takes too much time to explain to a client who is unfamiliar with the Nongame Wildlife Fund.

While it is anticipated that the nongame wildlife checkoff will remain a permanent feature on Minnesota's income tax and property tax forms, it is possible that legislative action could: 1) eliminate the checkoff (Boggis 1984), 2) divert funds to unrelated uses in state government, 3) add new checkoff items to the tax form for other purposes and thereby dilute the

effectiveness of the nongame wildlife checkoff (Applegate 1984, Boggis 1984), or 4) appropriate funds to wildlife-related activities which fall within the scope of the Nongame Wildlife Program but are of low priority.

During the past three years, there have been four proposed legislative actions which could have adversely affected the Nongame Wildlife Checkoff Fund. There was so much public opposition to the actions that the proposals were substantially modified or never implemented. A serious problem associated with such legislative proposals is that they can cause the public to lose faith that their donations will be used in the best interest of wildlife. Such a loss of faith may result in a decline in citizen participation.

In response to the intense debate which followed the most recent controversial proposal, Representative Skoglund introduced an amendment that prevents attempted diversions of checkoff money to unrelated purposes.^{1/} The amendment was passed.

The Department of Revenue has taken the position that any additional checkoffs would complicate the tax form and should be avoided. However, in 1984 two additional checkoff proposals were introduced in the Legislature. They did not pass, but they may be reintroduced in 1985. Oregon experienced approximately a 25% decline in nongame checkoff revenue when second checkoff was added to the tax forms in 1982.

Declines in funding need to be avoided to prevent the reduction or elimination of current projects. Maintenance of current revenues cannot be

^{1/} Laws of Minnesota 1983, Chap. 342. Art. 1, Sec. 35, amending Minn. Stat. Sec. 290.431

assured without diligent effort to prevent loss due to: 1) change in taxation laws or procedures, 2) legislative adjustments to dedicated funds, and 3) a decline in citizen participation in the checkoff due to economics or other factors.

Several actions need to be taken to prevent declines in funding. Continuing coordination with the Department of Revenue is essential to maintain good liaison during annual adjustments in income tax and property tax form design, wording and format. The Minnesota Legislature in general and the LCMR particularly need to be kept advised about the Nongame Wildlife Program's utilization of checkoff donations and the continuing high level of citizen support and involvement.

One action which would help place program costs and expenses in perspective for legislators and other interested individuals is to develop a better understanding of the financial contribution which nongame species make to Minnesota's economy, including a quantification of citizen demand for these resources. The documentation of a considerable monetary return to the state's economy from resource-related activities should encourage private and public support for the Nongame Wildlife Program.

The best way to maintain or increase citizen participation is to operate a progressive, diversified nongame program that has broad appeal to Minnesota's citizens. The most effective promotional efforts must be determined (Applegate 1984) and implemented. Further, the relationship between promotional and educational efforts needs clarification. A determination needs to be made regarding the appropriateness of promotional efforts serving an educational function.

It may be that not all citizens interested in the resource contribute to the Nongame Wildlife Fund either by choice, because they do not know how

to contribute, or for other, unknown reasons. Consequently, there is a need to identify the audience and evaluate the effectiveness of current checkoff promotion efforts in order to target missing citizen participants and increase revenue.

The vulnerability of a program funded solely by a voluntary source of revenue, the allocation of which is entirely dependent on the Legislature, is clear. The cause of the situation is, in part, the absence of direct state and federal financing for nongame resource programs. The consequence to the resource of this restricted financing is a politically vulnerable management program which could collapse within a short period.

If checkoff donations remain the sole alternative for Nongame Wildlife Program funding, the amount of revenue can be expected to level off. It may even decline (John Torres, pers. comm.). Therefore, there is a need to broaden the long-term funding base. New revenue sources need to be identified that will supplement or match checkoff revenue. These sources could be derived in part through cooperative funding of special projects with other agencies statewide.

Such cooperation has been undertaken to some extent already for the otter and peregrine restoration programs and in conjunction with Nongame Wildlife Program land acquisition. Another possibility is cost-sharing special projects with nongame checkoff programs in adjacent states.

Other forms of financing to broaden and stabilize nongame program funding include the appropriation of money through the Fish and Wildlife Conservation Act of 1980, increased appropriations through Section 6 of the federal Endangered Species Act, or allocation of Pittman-Robertson and Dingell-Johnson funds to directly finance some nongame projects. The Fish and Wildlife Conservation Act of 1980 calls for an assessment of 18

alternatives for funding the act. The U.S. Fish and Wildlife Service will complete this study by December, 1984 (U.S. Off. Fed. Register 1983b). Among the most viable possibilities are excise taxes on bird seed, bird feeders, bird houses, field guides, and similar products.

There has been inadequate funding to the states from Section 6 of the Endangered Species Act during the past 3 years. The Nongame Wildlife Program has received a total of only \$20,000 during the past 2 years for peregrine falcon restoration work. This amount needs to be increased substantially in order to adequately address the needs of those nongame species which are threatened or endangered. Projects for federally listed species should be funded largely by federal monies (see Langer 1984).

Currently, funding is generated annually. Securing longer term funding may be a more desirable approach, and alternatives to accomplish this should also be investigated.

Finally, the funding strategies of other state checkoff programs need to be reviewed to determine the opportunity for adapting successful funding strategies from other states (Bevill 1984).

In summary, the Nongame Wildlife Program must continue to offer an effective and popular program to Minnesota citizens that will result in continued citizen interest and financial support. Responsiveness to public preferences, and the ability to influence those preferences, will become increasingly important as the novelty of the wildlife checkoff decreases (Boggis 1984). Biological integrity must be maintained at the same time that funding aspects remain creative, efficient, and cost-effective. Concurrently, a broadening of the Fund's base of support must be accomplished to insure a future for the State's initiative to protect and manage the resource.

Opportunities to Resolve the Issue:

1. Employ market research techniques in the development of a checkoff promotion strategy based on:
 - a) a determination of the most effective promotional techniques;
 - b) a description of the present participants and delineation of new contributors;
 - c) a determination of motivation for current citizen participation;
 - d) an identification of weak links in the existing promotion network and of opportunities for additional organizations/individuals to participate in promotion.
2. See opportunity 11 page 17 on economic studies.
3. Establish a task force to develop information on the economic values of wildlife for use in benefit/cost analysis and mitigation assessment. (See issues on Wildlife Habitat and Data Acquisition).
4. Investigate the applicability of the Habitat Evaluation Procedures or other procedures in order to establish the value of lands maintained as wildlife habitat.
5. Enhance capability of limited dollars by seeking funding from other agencies and organizations to directly finance or cost share particular programs of mutual interest and benefit such as research and habitat protection.
6. Encourage appropriation and expansion of federal aid funding to states for nongame wildlife management through Section 6 of the Endangered Species Act. Urge Congressional support to fund the Fish and Wildlife Conservation Act of 1980 to provide

nongame funds to the states.

7. Investigate and evaluate new methods to broaden the long-term funding base of the Nongame Wildlife Program, such as General Fund or corporate monies to match citizen donations.
8. Review the funding strategies of other state agencies for ideas of methods to expand financing of programs which benefit the nongame resource in Minnesota.
9. Keep the Legislature informed about nongame resources, the Nongame Wildlife Fund and citizen interest and participation in these programs through an annual report.
10. Investigate and implement new wording on the tax forms to encourage an increase in average donations up to the national average.
11. Develop a strategy to increase tax preparers' awareness and support for the tax checkoff so that the overall donation rate could be raised to a level characteristic of people who make out their own tax forms.
12. Establish a contingency fund to finance Nongame Wildlife Program activities through any temporary periods of decline in check-off receipts.

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