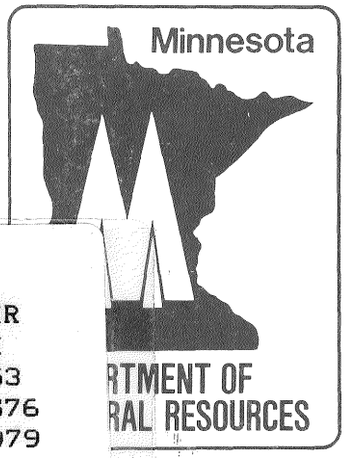
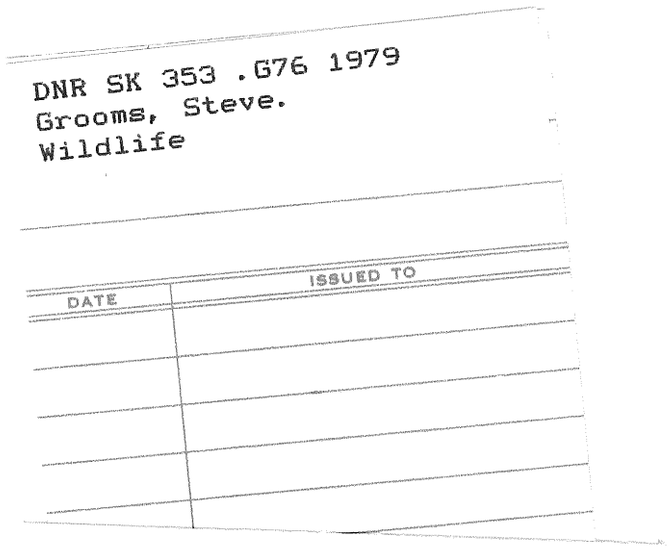
WILDLIFE



Natural Resources Management Series



WHY THESE MATERIALS?

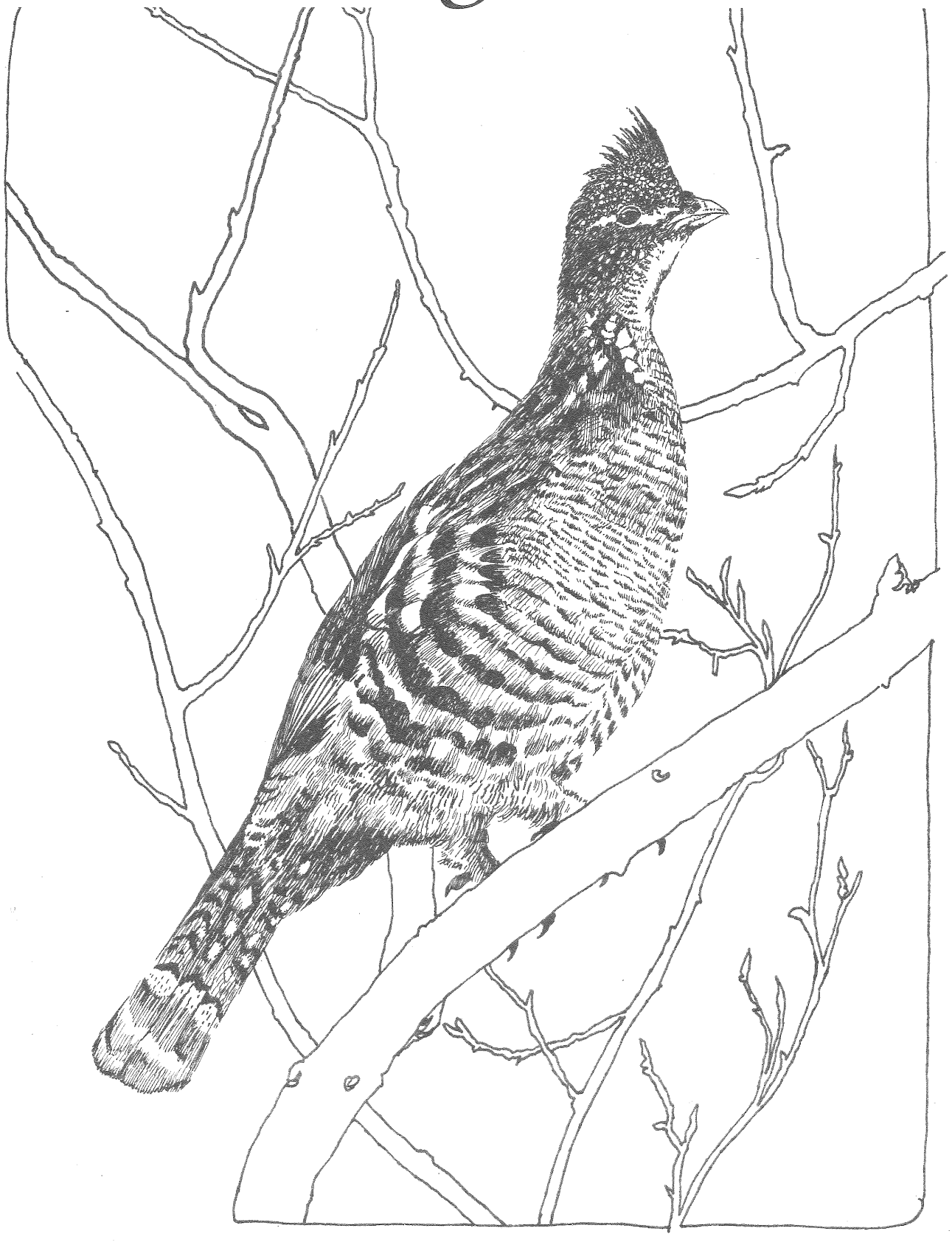
Many Minnesota educators have been frustrated in their attempts to teach biological/ecological concepts and their practical application. They have long wanted informal but in-depth materials about natural resource management in Minnesota. This Natural Resource Management Series is designed to fill that void.

WHO WILL USE THESE MATERIALS?

The Natural Resource Management Series is for secondary-level educators and students in traditional biology classes and in such electives as problems courses, environmental science, sportsman's biology, natural resources, etc. The series is intended for educators who want their students to gain a better understanding of Minnesota's natural resource management principles, practices, and concepts.

There are no specific activities for students in this series. Why? Because approach, content, and methods of teaching natural resources vary so widely across the state. Instead, this packet provides background information and reference material for discussion, lectures, and class activities of **your design.**

Principles of Wildlife Management



Let's imagine we own a small woodlot up north. There are six grouse living in our woods, half of them male and half female. Each hen will lay about a dozen eggs in spring. Now, if all the eggs hatch and nothing happens to our grouse, we would have 42 birds. And if all those grouse lived to nest next year, we would have 294 grouse. At this rate, assuming all our grouse had good hatches and all the birds survived, in only five years we would see our original flock of six birds become 100,842 grouse!

Alas, as all grouse hunters know, nature doesn't work that way. A woodlot with six birds one year may have no grouse or perhaps only as many as 12 birds five years later. Most of our hypothetical 100,842 grouse were never hatched. Some of them might have existed briefly as eggs, only to be eaten by a skunk or other predator. Some might have existed briefly as chicks, perishing in a cold spring rain. Most of the birds which survived long enough to fly never made it to spring when they could raise any young. Indeed, the life of a grouse is full of hazards.

Some woodlots never have any grouse while others nearby have many. Some years grouse seem almost non-existent, while other years they are wonderfully abundant. There must be some *reasons* for all this. If we knew these reasons, we might be able to help our woods hold more grouse.

After years of searching for those "reasons", wildlife managers can explain shifts in wildlife populations in terms of basic biological laws. These explanatory concepts make up the *principles* of wildlife management. If we learn these concepts, and if we are willing to invest some time and money, we might be able to control or *manage* our woodlot's grouse population.

Carrying Capacity

Any piece of land has a certain "carrying capacity". That is, the land is limited in the amount of food and shelter it can provide, thus limiting the number of animals that live upon it. A farmer with a barn big enough for ten cattle and a pasture with enough food for eight cattle, knows that the carrying capacity of his farm is eight cattle. If he tries to raise ten or more, he knows the cattle will not fare well, and some may not survive.

So it is with wildlife. We usually think of carrying capacity as it applies to just one species. We can say, for example, that a certain woods has a carrying capacity of about a dozen adult cottontail rabbits. It might have more one year and fewer another, but on the average the woods can provide food and shelter for only 12 rabbits.

The carrying capacity of land is the net result of a great many environmental factors. Food, water, escape cover, nesting cover, and other wildlife requirements work together to set the carrying capacity.

In Minnesota and other northern states, winter is the time of greatest hardship for most wildlife. Then, the carrying capacity is much less than during spring, summer and fall. In our state it is *winter* cover and *winter* food limitations which set the carrying capacity for most wildlife.

Sometimes an exceptionally high number of animals, a number well above the carrying capacity, manages to survive. When this happens, the animals will usually show signs of "stress" (like excessive aggressiveness or less reproductive success). Or disease may set in. Or, as sometimes happens with deer and rabbits, the animals may overbrowse their area, doing long-term damage to the vegetation which is their food and shelter. One way or another, the population is brought back within the land's carrying capacity.

Perhaps the population of a particular animal is lower than the land's carrying capacity. When this happens, the animals thrive. They find more than enough food and shelter, and they reproduce unusually well. Soon their numbers reach the carrying capacity of the habitat.

Limiting Factors

Carrying capacity is a rather sweeping concept. On a more specific level, any wildlife

population is usually held in check by one or more *limiting factors*. A limiting factor is an adverse condition that holds back a population against its natural tendency to increase. A limiting factor can be the *lack* of some essential element or the *abundance* of some element that is unfavorable to animals. In desert areas the scarcity of water can be a limiting factor. Of course, this is not a problem in Minnesota. Usually, our wildlife is limited by shortages of suitable nesting cover (ducks, pheasants) or shortages of available winter food and cover (grouse, deer).

The population of some species may be held in check by one limiting factor, or two or more will operate together to keep that species from overpopulating.

A classic way to improve a wildlife population is to identify the most stringent limiting factor, then reduce its influence. The key is to properly identify the factor which has the greatest limiting influence. For example, it makes little sense to trap foxes in an effort to increase a pheasant population if it is the absence of good winter cover which is depressing the pheasant flock.

Territorialism

Space itself can be a limiting factor. Many animals have their own notions of how dense their populations should be. They stake out territorial claims and defend them. You and I might think that an acre of thick grassy cover has plenty of room for a dozen nesting pheasants. But the birds seem to think that one nesting pheasant per acre is plenty. The roosters will crow and fight to make sure the saturation level is not exceeded.

Harvestable Surplus

All animal species produce more young than are necessary to replace the losses which occur among the adults each year. Many of these surplus young survive the summer, when life is easy. There are usually far more animals in the fall than are needed for maximum reproduction in the spring. In an average year many of these surplus animals will die during winter.

Part of this surplus, roughly one-third the fall population, may be removed by regulated hunting without hurting the all-important spring breeding population. These are animals which can provide food and recreation to hunters rather than dying by starvation, predation, disease, accidents or exposure to winter weather.

Managers try to use hunting regulations to keep wildlife populations in healthy balance with their habitat. Usually the harvest is set as high as it can be without bringing the population below the carrying capacity of the habitat (this is sometimes called the "maximum sustained yield").

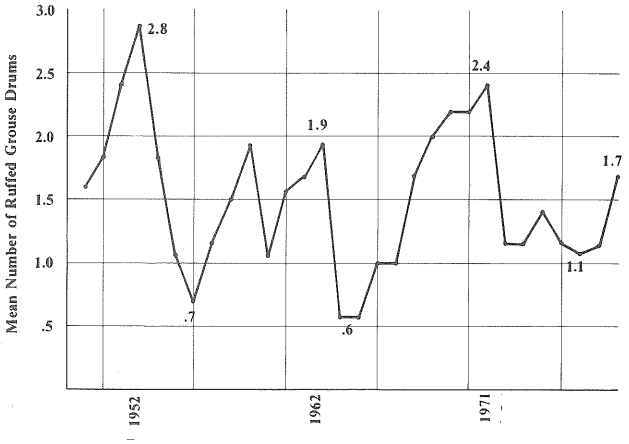
Sometimes it is prudent to curtail hunting of an animal population which has fallen on particularly bad times, like a deer herd reeling from five unusually harsh winters in a row. At other times it may be necessary to harvest a great many animals, for excessive populations are a threat to their habitat and themselves.

Of course, even with no hunting, wildlife populations bring themselves in line with the carrying capacity of the habitat. But the fluctuations in a wildlife population may be abrupt and drastic. If managers are careful, they can smooth out population ups-and-downs by adjusting hunting pressure in keeping with changes in the harvestable surplus.

Cycles

It is more common in wildlife populations to find "cycles" of scarcity and abundance than to find perfectly stable populations. There is always an annual cycle for each species, so that the population is lowest right after winter and highest in the spring when the young are born. But there are also long-term cycles--population trends that can be traced over a number of years.

Ruffed grouse drumming counts — an index to long-term population trends between 1949-1978 in Minnesota.



Not all population changes are cyclic, of course. Many wildlife populations have steadily increased or decreased over a period of many years. Such long term trends are almost always due to man's activities and their effects on habitat. For example, when Minnesota's early settlers plowed under the prairie, they helped the prairie chicken. Then, the spread of agriculture cut into prairie chicken habitat working in favor of the pheasant. Now the continued trend toward intensive farming is putting great pressure on the pheasant, while the Hungarian partridge is increasing.

But there is also a natural tendency for populations to swing up and down rhythmically—in "cycles". When the population of a species reaches an unusually high level, it is likely to be brought down by several forces.

Predators, finding plenty of food, will increase. Dense populations are susceptible to the ravages of disease or parasitism. The very presence of too many animals in an area may lead to breakdowns in normal social behavior. The animals may begin to fight or engage in self-defeating mating behavior. Eventually the habitat itself may be

injured, so the population literally "eats itself out of house and home." All these factors will depress a population.

Fortunately, it works the other way, too. Habitat that is under-occupied offers so much food and shelter that populations will increase. Predators, disease, parasitism, and other plagues will be less of a problem. Above all, reproduction will be especially successful, with more young animals being born and more surviving.

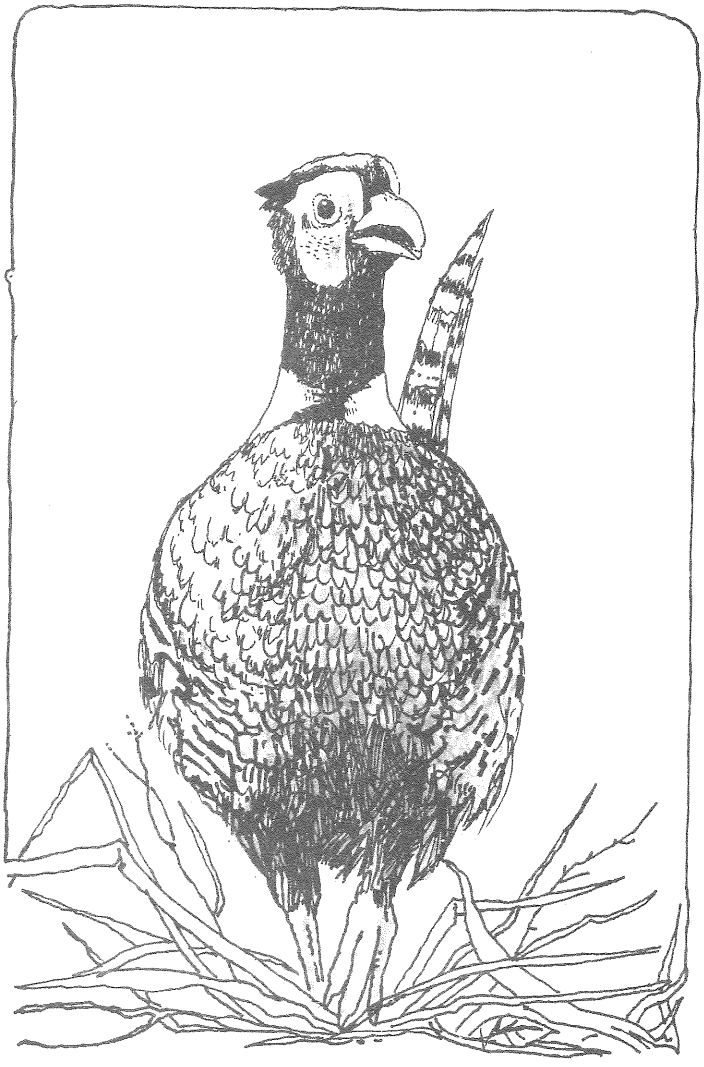
Some animals have cyclic rhythms of scarcity and abundance that are amazingly regular. Varying hares ("snowshoe rabbits") and grouse are famous examples, both tending to go through a ten-year cycle. The regularity of these cycles has researchers puzzled. It is easy enough to see why populations tend to go up and down, but scientists are uncertain why there should be such regular patterns.

Inter-dependence

One of wildlife management's more difficult and subtle principles is based on the fact that all plants and animals live in complex, inter-related communities. In these "ecosystems", all members affect and are affected by other members. So, the manager cannot deal with one species effectively without understanding how it is related to other species in the ecosystem.

Early attempts at management frequently failed, or even backfired, because managers did not realize they were dealing with large communities of living things, not just individual species. If we attempt to increase a pheasant population by removing predatory raccoons and foxes, we might create a condition made to order for skunks. Without competition from other predators, skunks can become a nuisance by ransacking pheasant nests. We might put a lot of money into fox and raccoon control, only to find that the pheasant population stays the same because skunks have increased. We might then discover that an abundance of diverse nesting cover will cause pheasant populations to increase tremendously without requiring any predator control.

In the world of wildlife management, things are rarely as simple as they may seem.



Written by Steve Grooms. Illustrated by Don Balfour. Published by the Education Section, Bureau of Information and Education, Minnesota Department of Natural Resources.

What Is Wildlife Management?

There is certainly nothing new about the strong interest in wildlife we see in America today. The very earliest settlers were intensely interested in wildlife, though at first more for profit than recreation. After the *Mayflower* deposited her load of Pilgrim colonists on our shores in 1620, she returned to England with a cargo of beaver hides.

Nor is there anything really new about game shortages. Unregulated hunting and trapping by the first colonists, along with the changes they made in the landscape, reduced populations of beaver, deer, wild turkeys, and other animals in remarkably short time. The first closed deer season was enacted in Rhode Island in 1646, more than a century before the Declaration of Independence! Found in the journals of early colonists are concerned statements about depleted game populations that read as if they were written today.

What is new, though, is the profession of wildlife manager. It is one of the youngest professions in existence. Its birth is usually dated at 1933, when Aldo Leopold brought out the first textbook on game management, named appropriately, *Game Management.* That original text still provides the foundation for educating today's wildlife managers. Yet the profession is relying more and more on a machine not mentioned in that text (because it had not been invented): the computer. Wildlife management is a young, exciting, and fast-changing profession.

But what is wildlife management? As the name implies, it is that profession which attempts to *manage* populations of certain animals living in the wild. To do that, the manager must be part farmer, part scientist, and part public servant.

The manager is like a farmer because both are involved with growing a "crop" of living things. Both worry about the well-being of animals under their care. Both deal with the question of how many animals should be harvested and in what ways. Many of the principles of agriculture and animal husbandry are central to the wildlife manager's training.

Of course, there are differences. Some of the wildlife manager's livestock are unpredictable (at times anyway), and may chase him up the nearest tree. All are elusive and shy. Some are born in Canada, spend their winters in Mexico, and are only in Minnesota for a few brief days in fall and spring. And the various animals under a Minnesota manager's care are spread out over 84,068 square miles. The "farm" and the "livestock" of the wildlife manager present some large challenges, to say the least.

As a scientist, the manager studies wildlife species, concentrating on their relationships with their habitat and with other species, particularly man. The central discipline of the manager is biology, particularly two specialized branches: population dynamics and ecology.

Wildlife management presents scientists with some unique challenges. Most wild animals make every effort to keep their distance from people, including scientists. If a wild animal is caged for study, then it is no longer a *wild* animal. Scientists prefer to work within a controlled environment, like a laboratory, where they can study one problem at a time. Yet the only true laboratory for

the wildlife biologist is the natural environment of the animal, with its unpredictable weather and vastness. It is a difficult place for a scientist to work.

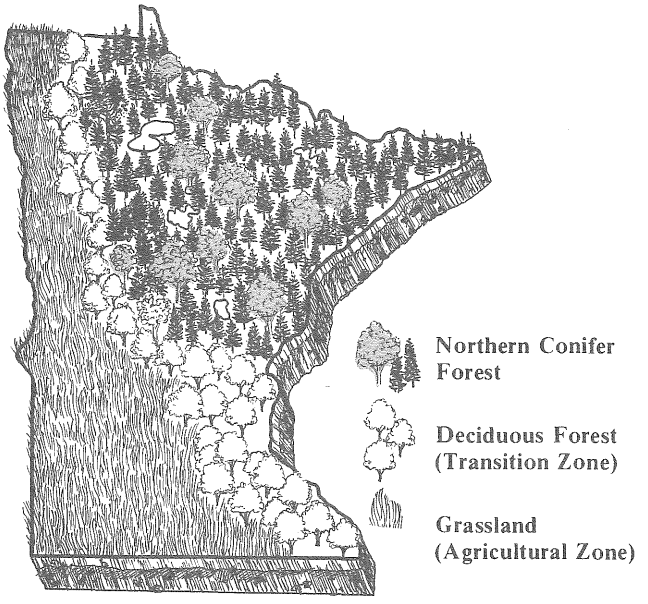
The manager is also a public servant. Most funds for wildlife management come from taxes and license fees paid by sportsmen, who are primarily interested in healthy populations of game animals. But bird watchers, photographers, and others are very interested in wildlife. If farmers are losing profits because waterfowl are eating their grain, they become interested, too. The wishes of all these groups are sometimes irreconcilable, and sometimes are based on an incomplete understanding of wildlife needs. Thus, the manager must educate the public while he serves them.

All in all, it is a challenging profession. Wildlife management is a new science; there is much to be studied. Because of competing interests of different groups, managers are not always sure of what they should be trying to accomplish. Above all, they know it is difficult to sort out "cause and effect" relationships in wild populations, for plant and animal species are linked in a vast and complex network of relationships.

And if all this were not complicated enough, the picture is forever being changed by the activities of people. They dam rivers, drain marshes, and level forests. They attempt to exterminate some species, while introducing new ones that are not part of the original community. They fill the air and waters with exotic new chemicals which never existed in nature. They tear around in delicate ecosystem like a kid in a flower garden. People complicate the task of the manager . . . to say the least!

Written by Steve Grooms. Illustrated by Don Balfour. Published by the Education Section, Bureau of Information and Education, Minnesota Department of Natural Resources.

The Story of Minnesota Wildlife



When the first settlers arrived in Minnesota they found an astonishing richness and diversity of wildlife. The state is still blessed with a variety of wildlife, though the last century and a half has brought many changes.

It may not occur to modern Minnesotans that the towns of Buffalo and Elk River, located just north and west of Minneapolis, were named for animals once found there. But herds of elk and bison did roam throughout southwestern Minnesota. Immense flocks of passenger pigeons darkened the skies at Hastings, Chatfield, and Mankato. Indeed, the woodland caribou wandered over much of northern Minnesota at one time.

Today, these animals are gone. It is hard to imagine they once lived here.

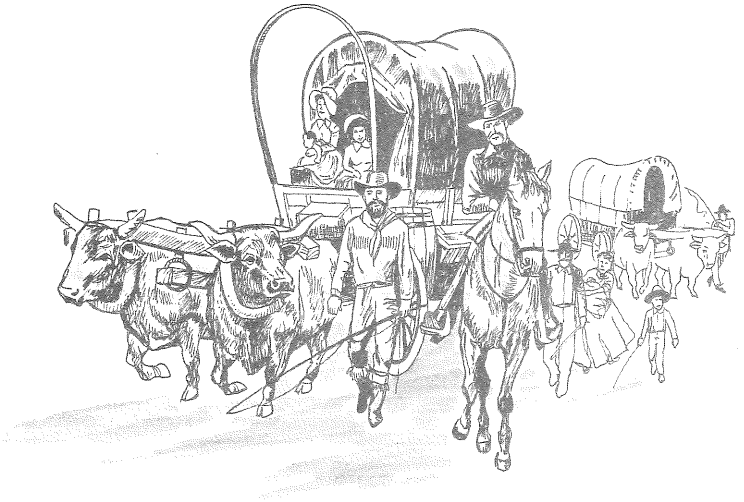
Later some species flourished that were accidentally or purposely introduced in Minnesota. The ringneck pheasant, Hungarian partridge, starling, and English sparrow were "exotic" species brought in from other lands. Others, like the prairie chicken and bobwhite quail, moved north into Minnesota when certain farming practices favored their growth. Quail hunting was said to be excellent in White Bear Lake and near Lyndale Avenue in Minneapolis.

The Three Biomes

Minnesota's exceptional wildlife diversity is the result of three great "biomes," unique ecological communities which met in our state.

Imagine a line drawn from the upper left corner of the state down through the center to the lower right corner. To the west and south of that line is the prairie, once a vast stretch of tall grasses occasionally broken by woods associated with river bottoms and marshes. To the north and east was the coniferous forest, a land of towering pines, of spruce, and fir. Between them along the line, but particularly in southeast Minnesota, was the hardwood forest. This was a transitional area, with elements of both prairie and coniferous forest, but mostly hardwood trees such as oaks, elms, and maples.

Each of these biomes had its own special communities of living things, its own pattern of plants and animals which were suited to its soil and climate. Even today these three great biomes exist, though each has been enormously changed by man.



The Age of Exploitation, 1800-1899

There was little settlement in Minnesota prior to 1851. At that time treaties were signed with the Indians, and whites felt safe in the new land. Sadly, even before the treaties were completed, buffalo were being driven from the territory. This was a time when the dominant attitude—almost the only attitude—toward wildlife was one of exploitation.

Exploitation took two forms: personal and commercial. Economic survival was very difficult for the pioneers and early settlers. They could scarcely afford to not harvest wild game.

Until the 1880s there were almost no restrictions on the taking of wild animals. There were no hunting seasons and no bag limits. Waterfowl were heavily hunted in the spring and big game animals were taken at all times of year. Nor were there any restrictions on hunting methods. Deer "shining" with torches was common, and passenger pigeons were killed by shaking the young "squabs" out of the nests.

This hunting pressure, with every animal "in season" every day of the year, took its toll. Much more harmful, though, was the effect of market hunting. Many wildlife species were freely sold throughout most of the 19th century. At first these sales were small-scale business affairs conducted through local butcher shops or hotels. But the spread of railroads and the invention of the refrigeration car suddenly made market hunting very big business, with markets as far away as Chicago. The first animal to collapse under the pressure of commercial hunting was the largest, the buffalo.

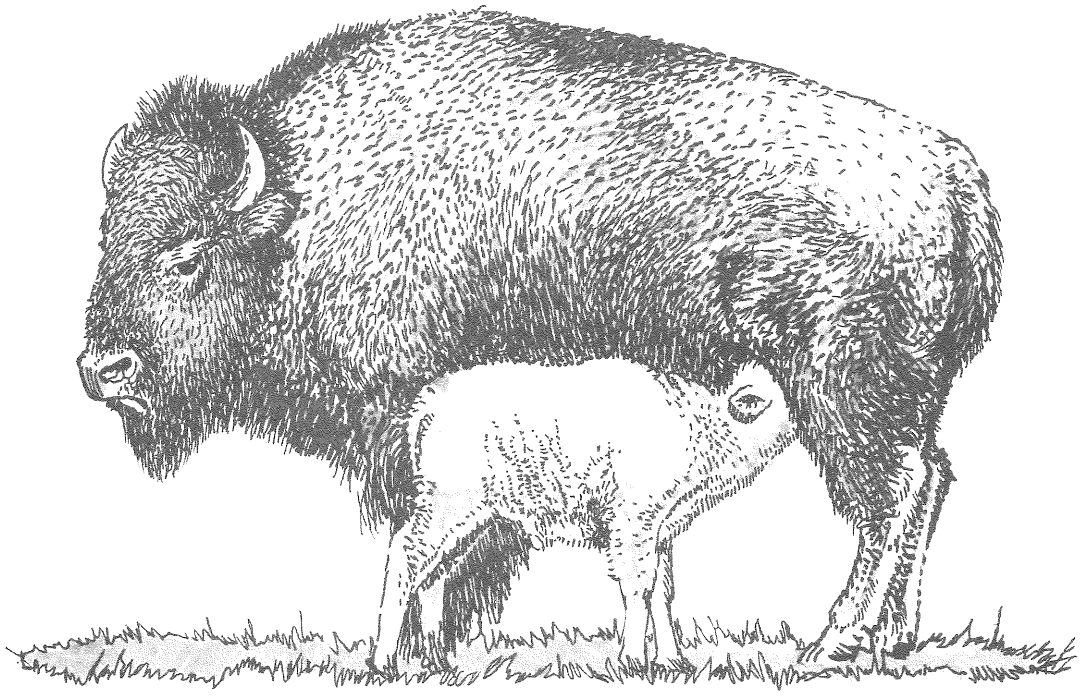
Let's trace the history of Minnesota wildlife and its management, starting with the 19th century, taking each biome in turn.

Prairie

In addition to the buffalo, the original wildlife of the prairies were elk, deer (in small numbers, closely associated with wooded areas), sharp-tailed grouse, and waterfowl. A combination of unregulated hunting and habitat modification changed this picture before the century was over.

Buffalo once swept in great herds across the prairie from the Mississippi to the Missouri rivers, from the Iowa border north to the Red River Valley. But the big bison were unable to stand up to massive market hunting that followed the railroads west. Their numbers had been severely reduced by the 1840s and they were gone from the state by 1850 except for an occasional straggler from herds to the west. In the 1860s, the sight of buffalo bones bleaching in the sun greeted travelers throughout western Minnesota.

Elk, too, were hunted relentlessly until they finally drifted north and west out of the state. Another factor in their disappearance was the conversion of prairie to farmland. There were still some elk in far northwestern Minnesota in the 1880s and 1890s, but they were the remnants of a

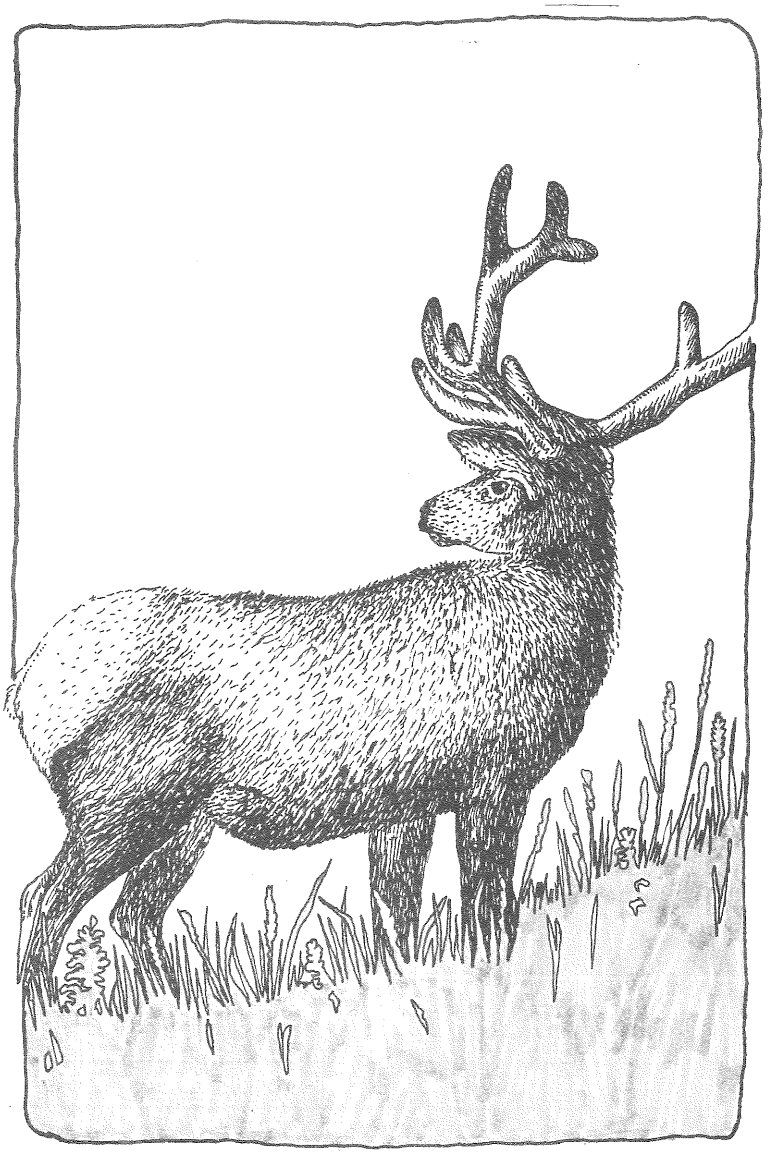


much larger population which had once reached from the Iowa border to considerably north of Mille Lacs lake.

Other changes were having their effect on prairie wildlife. Throughout the century early settlers struggled to convert the prairie to farmland. The fragile prairie ecosystem is disrupted once it is plowed and does not re-establish itself. Prairie is also dependent on occasional fires. The settlers succeeded in limiting fire as they cut up the prairie into farms. Very few Minnesotans today have had the pleasure of seeing a true tall grass prairie.

The conversion of prairie to farmland worked against the original prairie upland bird, the sharp-tailed grouse. At the same time it worked in favor of the prairie chicken and quail, both of which spread north out of Iowa. Prairie chickens thrived on the mixture of prairie and farmland that early farming offered them. Quail spread into the eastern portion of the prairie region, thriving on the close proximity of cover and food on small farms.

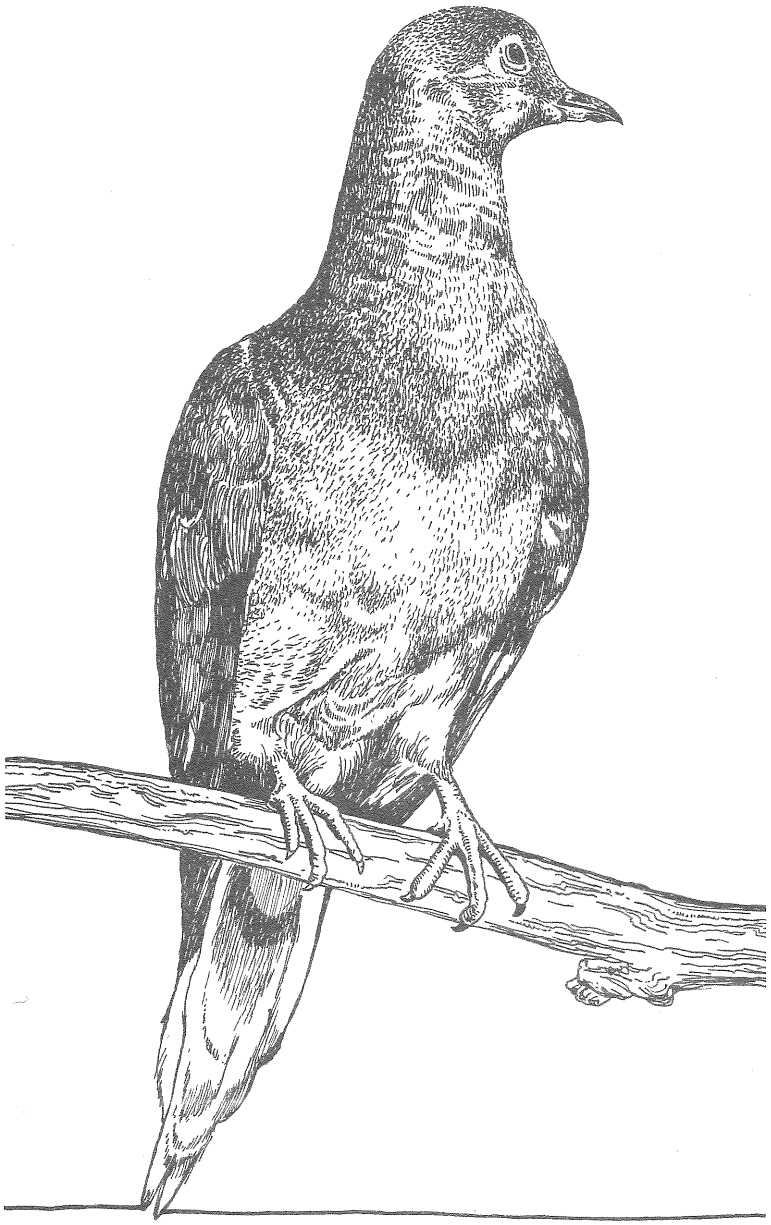
Sprinkled throughout the western side of the prairie region were thousands of marshes and potholes. The "prairie pothole" region was the greatest duck-producing area in the nation, though it was also important for other marsh and wildlife species.



Hardwood Forest

The hardwood forest had less of a unique character than the prairie and coniferous forest, yet it was the scene of one of the most dramatic wildlife stories of the century.

Major wildlife species in the hardwood forest biome were ruffed grouse, deer, squirrels, and



rabbits. Most conspicuously abundant of the animals, however, was the passenger pigeon, a bird which annually swept into the hardwood forests to nest in flocks so dense they defied description.

Pigeon hunting, both for personal consumption and for the market, was a major activity. Local newspapers kept people closely informed on the location and size of flocks. Entire towns would turn out when the time was right to collect squabs, and the whole proceeding had an air of great festivity. Soon, however, the great flocks failed. Destruction of their nesting areas was part of the problem, though the incredibly heavy harvest of young and adult pigeons was also a large factor. Before the 20th century had arrived, Minnesota had lost its last passenger pigeon.

Coniferous Forest

The original inhabitants of the tall pine forests were the caribou,moose, deer, bear, timber wolf, spruce grouse, and snowshoe rabbit.

The moose was the most prominant game animal. But they, along with the caribou, declined in numbers when subjected to unregulated hunting, much of it for the market. By the end of the century both animals were occasionally found in far northwestern Minnesota, though they once had been common as far south as the Itasca area.

Even without hunting, moose, bear, wolf and caribou would have been driven north by extensive lumbering near the end of the century. Tall white and red pines were logged off, to be eventually replaced by "second growth" tree types, primarily aspen. The lumbering also broke up the continuous forest, a change which favored some animals and worked against others. Bears became less numerous while deer and grouse, which had not been found in appreciable numbers, began to move in.

The Age of Conservation, 1900-1940

Early conservation efforts began late in the 19th century, and were met with considerable resistance. Game wardens were beaten or even killed when they attempted to enforce game laws against market hunting. Nevertheless, a new concern for wildlife began to grow among Minnesotans. More and more people were coming to recognize that unless more responsible use was made of wildlife, a beautiful and valuable natural resource would be lost from the state.

Where the 19th century settlers had simply seen wild game as inexpensive meat or a commodity they could sell, now wildlife was viewed more and more as a recreational resource. The new attitude helped bring an end to market hunting and fostered many new game laws which recognized hunting as a sport rather than a way of making money.

The age of conservation was best expressed in the many new game refuges and parks. These areas were to be havens for wildlife in the face of advancing civilization. To protect game animals,

bounties were set up to encourage the killing and trapping of such predators as the timber wolf. Experiments were conducted in artificial propagation (stocking), with mixed success.

This period saw a great turn-around in perceptions of wildlife. Because the public was responding to excessive exploitation of natural resources, this age sometimes erred by over-protecting species. Overly strict deer seasons were established. Still, modern Minnesotans should be grateful for the efforts of the early conservationists, for we continue to benefit from their legacy to us.

Prairie

Most of the original tallgrass prairie was buried by the plow as the new century began, yet more great changes were to come. Modern agriculture affected the land and its animal populations in many ways. Great numbers of marshes and potholes were drained to make more tillable land, and waterfowl suffered as a consequence The fabulous prairie pothole region was bled away, marsh by marsh.

Tractors and other new farm machinery made it possible to efficiently farm larger land units. The new farming caused some upland species to decline while others flourished. The mix of cornfields, hayfields, and waste areas was ideally suited for the ring-necked pheasant. The loss of grassy lands hurt the prairie chicken. Soon it was replaced by the pheasant as the most abundant upland bird (just as the sharp-tail had been replaced by the prairie chicken in an earlier time). Prairie chicken and sharp-tail populations fell off everywhere except in the northwest. Quail began to disappear as farmers turned increasingly to "clean farming ' practices, leaving too little cover for the small birds.

Hardwood Forest

The early 20th century saw important increases in the deer population in the old hardwood forest. Many forest areas were cleared and converted to farmland, which promoted the spread of the pheasant and cottontail rabbit, particularly in the southern end of the forest area.

Logging in the northern end of the hardwood

strip introduced many openings and encouraged the growth of aspen. Deer and grouse populations increased.

Coniferous Forest

The same effect was far more dramatic in the old coniferous forest. Deer and grouse had been almost unknown in the north, but logging changed the forest vegetation in ways that favored these animals. Grouse and deer populations soared as second growth forests sprang up in areas once dominated by the tall pines. The smaller trees let more sunlight through to the forest floor. This encouraged nutritious ground level shrubbery which deer thrive upon.

Through the first decades of the century, remnants of the caribou and moose herd persisted in northern Minnesota. Moose hunting was stopped in 1922, but moose populations remained very low for many years. By the 1930s hunting and poaching, plus land clearing and fencing, had reduced the caribou herd to just a few animals in the northwest. In spite of efforts to help them, Minnesota's caribou herd finally withered away.

The Era of Management, 1940 to the Present

The last several decades have seen the evolution of conservation into modern management. If the changes were more subtle than the change from exploitation to conservation, they were nevertheless important.

The management era is based on a far more complete scientific understanding of the needs of wildlife species. In particular, it is built upon a greater awareness of the many complex ways animal species relate to their habitat and the other species in it. Earlier management efforts tried to limit the deaths of game species. Modern managers were more ready to accept death as a normal process in nature, something which cannot be avoided. They were more interested in maintaining and developing healthy habitat for wildlife, knowing that the proper environment can support wild populations by allowing them to replenish their losses through natural reproduction.

Minnesota led the nation in the effort to secure habitat for wildlife. The "Save the Wetlands" campaign initiated by Richard Dorer, former director of Fish and Game, became a model for the nation. Many thousands of acres of wetlands and other natural areas were purchased by the state.

Prairie

One glance at what was happening on the former prairie in the modern period shows why it was so important to purchase wildlife habitat. Minnesota's wetlands were being drained, burned, and cleared until only a small fraction of the prairie pothole country remained. The small pockets of cover on farmland were being cleared away, and intensive farming practices reduced the cover wildlife needed to survive bitter prairie winters.

Under these conditions, pheasant populations declined. Pheasants made a recovery when farm surpluses idled many acres of land in the 1950s. But with the recent return to full production, pheasant populations have dropped again. These losses have been partially offset by increases in Hungarian partridge populations.

Hardwood Forest

The northernmost end of the old hardwood forest area has become the home of Minnesota's sharp-tail grouse population, thanks in large part to extensive public land holdings in the northwest. Moose have increased so much that moose hunting seasons are now held.

The central portion of the hardwood forest continues to hold fairly high populations of grouse and deer.

Below the Twin Cities, in the southeastern end of the hardwood forest, deer and grouse maintain stable populations. Wild turkeys have been successfully introduced, and are multiplying in numbers.

Coniferous Forest

Deer flourished during the first several decades after northern forests were logged. Deer have had their ups and downs in recent times, but the trend is clearly downward. Logging has tapered off and modern fire suppression techniques have all but eliminated wildfire as an important habitat regenerator. Minnesota's northern forests are growing too mature again for good production of grouse and deer. Spruce and fir are replacing aspen as the dominant vegetation type.

Moose populations, however, are increasing. Managers are also looking at the prospects for reintroducing the woodland caribou.

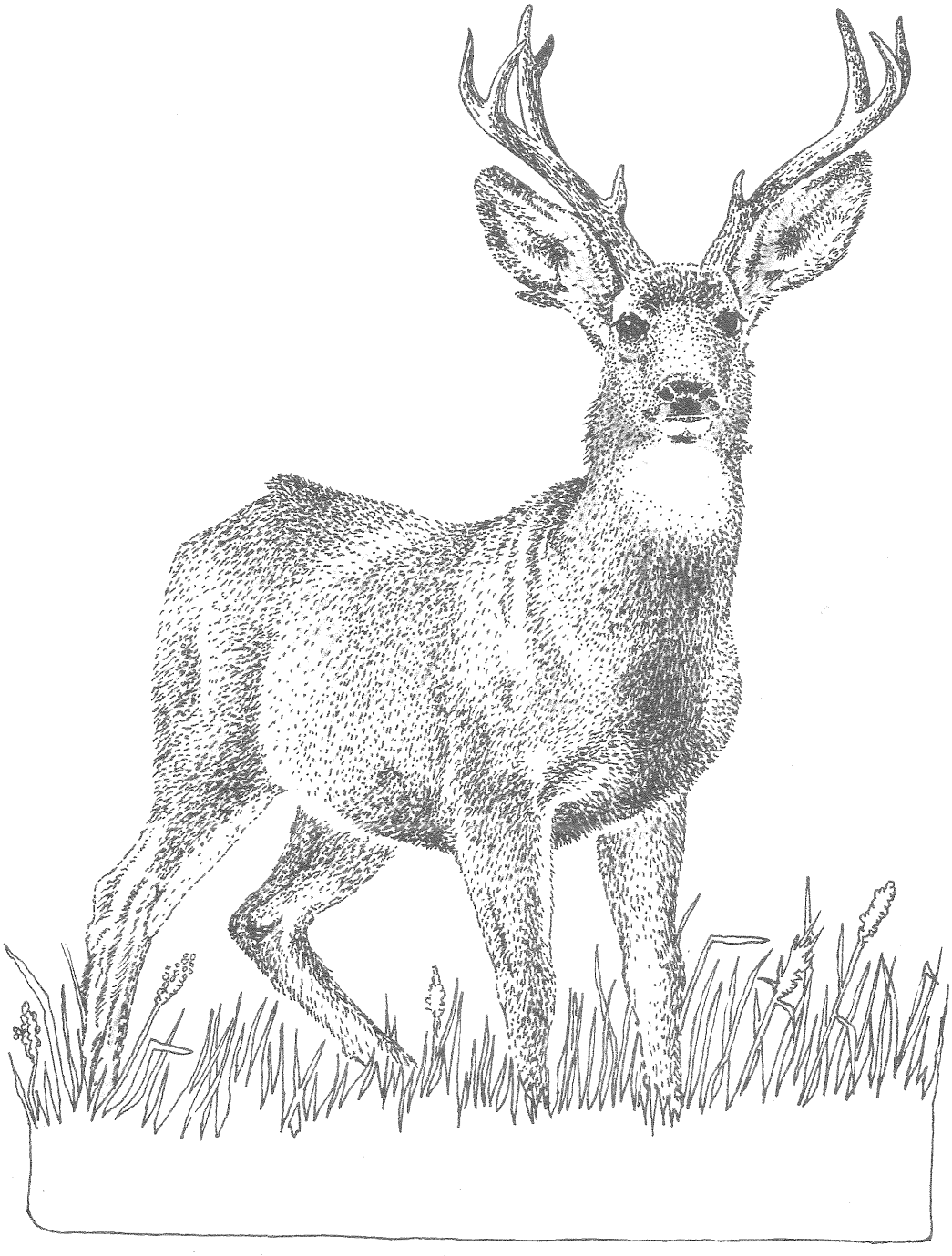
Overview

This quick trip through history has shown us that we cannot take our wildlife populations for granted. Without proper habitat and without responsible use, any wild population can fade away.

Yet, the story of the many changes in Minnesota's wildlife also contains some notes of hope. Not all changes have been bad, and the State continues to hold a fascinating variety of wildlife. We have good reason to expect that, with enlightened land use, this blessing will extend far into the future.

Written by Steve Grooms. Illustrated by Don Balfour. Published by the Education Section, Bureau of Information and Education, Minnesota Department of Natural Resources.

SETTING THE DEER SEASON IN FARMLAND MINNESOTA



Suppose it were up to you to set the deer hunting regulations for southern Minnesota. Where would you begin? How would you know the number of deer in the area. Or, how many—if any—should be taken by hunters? How many days should the season run? Should both bucks and does be hunted?

Hunters, non-hunters, businesspeople, and the Minnesota Department of Natural Resources (DNR) all have a stake in how the deer hunting season is set. The answers to the above questions must reflect the desires of Minnesotans and, more importantly, the well-being of the deer herd. Future generations should also be able to enjoy a healthy population of white-tailed deer.

The information in this section will provide you with a basic understanding of the methods used by the DNR in setting the deer season in southern Minnesota.

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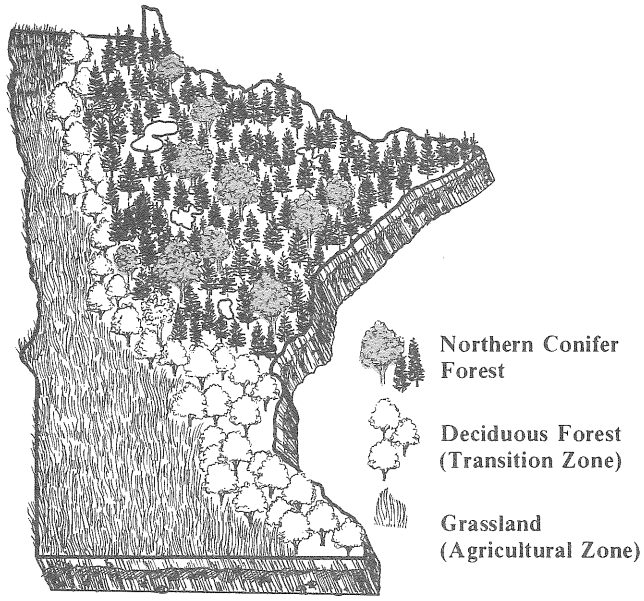


Nature—with the help of man—has divided Minnesota into three regions: the *northern forest,* the *agricultural* area, and the *transition* area of farmland and forest.

Habitat in these three areas differs considerably in the eyes of deer. Food, cover, and winter conditions vary greatly. This is why the DNR has divided the state into three basic deer management regions. We will concentrate on the agricultural or farming area in southern Minnesota.

In the mid-1800s, settlers carved farms from the prairie that covered southern Minnesota. The settlers shot deer for food. There were no regulations on deer hunting and by the 1880s, the southern deer had almost disappeared.

By the turn of the century, restrictive game laws had paved the way for deer to repopulate farmland country. An assortment of game laws were tried thereafter, including closed seasons, every other year seasons, and any-deer seasons. The length of the season was juggled in an effort to control deer populations. Because of these regulations (or in spite of them, some argue), the number of deer increased.

By the early 1940s the number of deer had increased to the point that crop damage complaints were frequent. Since then, the herd has shown marked increases and decreases, depending primarily on habitat conditions during the hunting seasons. If cover is heavy during this time, hunters have more difficulty spotting—and shooting—the animals.

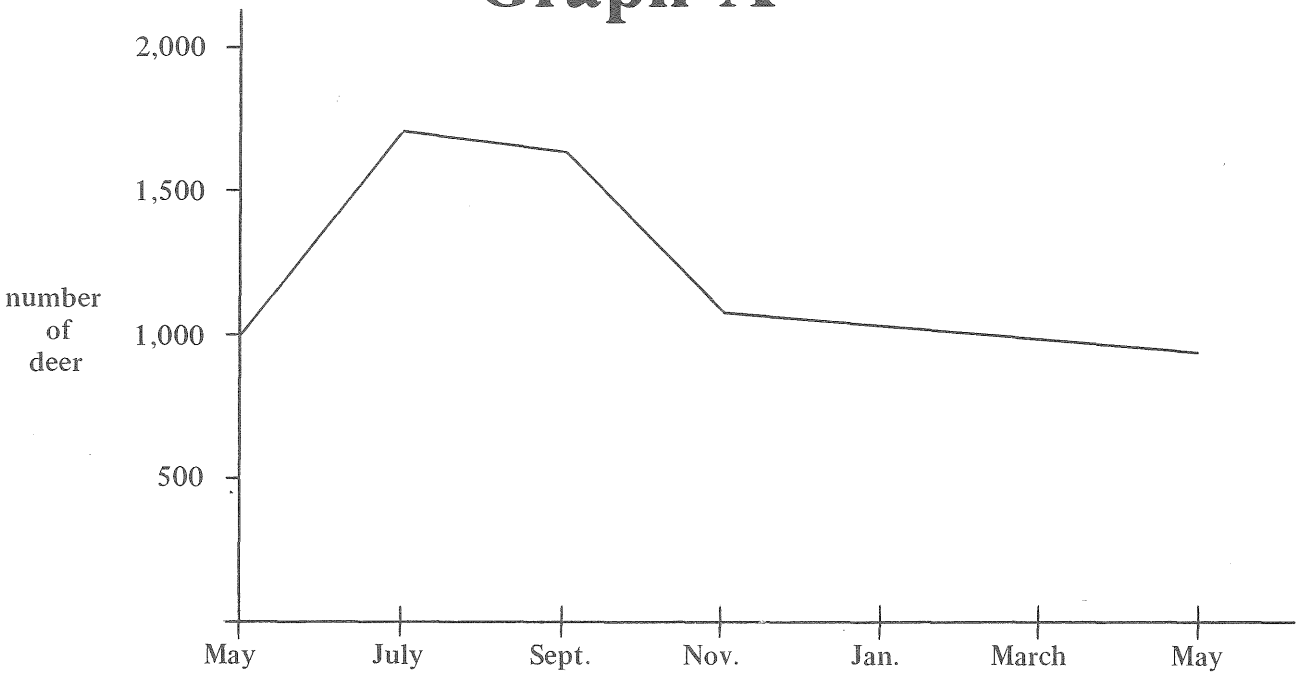
In the farm country, woodlots, marshes, and river bottoms provide the only year-round cover for deer. The white-tail feeds mainly on waste grain during fall and winter. In spring and summer, clover, grasses and farm crops are added to its diet. Deer can be very damaging to orchards and standing grain in areas where they become too abundant.

Conditions for deer can vary greatly within the agricultural area. One section may have too many deer, while another may have too few. For this reason, the DNR has divided the farming zone into small management areas. Let's examine one of these areas.

Our model deer management zone takes in about 1,000 square miles of Rice and Steel counties. Let's assume this area can support one deer per square mile, which is about the average density for Minnesota farmland. That gives us a spring population of 1,000 deer. But the number of deer will not remain constant. New fawns add to the population. Some of the animals are hit by cars, poached out of season, killed by mowers, dogs, or possibly disease.

If we followed the deer population for one year in our model area it would look something like graph A.

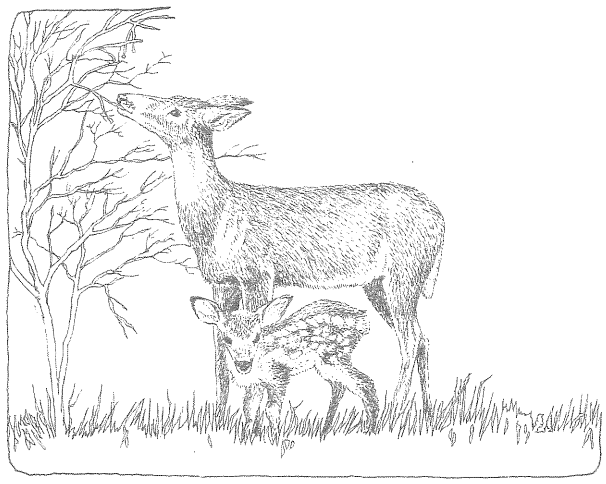
Graph A



1) new-born fawns
2) spring-summer mortality: accidents, poaching, dogs, mowers
3) hunting season: legal and illegal harvest
4) fall-winter mortality: accidents, poaching, predation, possibly malnutrition.

As you can see, the deer population increases rapidly between the middle of May and July when fawns are born. Except for the addition of new fawns, the deer herd faces nothing but losses for the rest of the year. Spring and summer are a relatively easy time for the animals, but even so, some deer will be lost to accidents or poaching.

Fall and winter losses are heavier than spring and summer losses. The hazards are similar to those in spring and summer, but are compounded because deer move around much more during the mating season, exposing them to a greater risk of accident. Severe winter cold increases the deer's need for more food to maintain body heat, but extensive fall plowing makes foraging for food more difficult. If the spring thaw is late, does will be delayed in feeding on the highly-nutritious new growth, causing a lower reproduction rate.



The largest population drop occurs during the hunting season. On a year to year basis, the deer harvest is the primary way man can manipulate the population.

Throughout the year, nature regulates the deer population, causing it to increase or decrease. Man, as part of nature, also has a great influence on deer. People make changes to the land which alter the habitat of white-tails. Most alterations are gradual and must be observed over a period of years. People also build fences that deer run into, accidentally hit deer with their cars, and poach some animals.

But the major influence of man on deer numbers is through regulated hunting. And it is through hunting regulations that wildlife managers try to maintain the deer population at a level which both the land and people can tolerate.

Let's go back to our model deer population of 1,000 animals in Rice and Steele counties and follow the herd for one year.

Chart A

POPULATION MODEL FOR MINNESOTA FARMLAND DEER
(stable population)

TIME OF YEAR	POPULATION	AGE/SEX MAKE UP OF HERD
mid-May	1000	400 males 600 females: 234 1-year-old females 138 2-year-old females 228 3+ year-old females
mid-May – July	1843	400 antlered males 600 adult & yearling females 422 male fawns 421 female fawns
July – September	1730	388 antlered males 576 adult & yearling females 400 male fawns 366 female fawns
October – mid-December (hunting season)	1154	148 antlered males 431 adult & yearling females 300 male fawns 275 female fawns
October – mid-December (illegal kill during hunting season)	1094	148 antlered males 405 adult & yearling females 282 male fawns 259 female fawns
mid-May	1001	392 males 609 females: 236 1-year-old females 141 2-year-old females 232 3+ year-old females

Hunting regulations used in model:

firearms
1) 3 day "buck only" season
2) 1 day "any deer" season (897 "any deer" permits issued)

bow & arrow
1) 1 month "any deer" season

METHODS USED TO COLLECT INFORMATION	HOW POPULATION GAINS AND LOSSES ARE ESTIMATED
1) Aerial surveys 2) Number of deer killed by cars 3) Conservation Officer and Wildlife Manager knowledge of winter conditions	Surveys count the number of deer in a small selected area and expand the results to estimate the population of a larger area (1,000 sq. mi. in model). Population trends—the ups and downs of the population—can be followed when surveys are done annually.
Conservation Officers and Wildlife Managers examine does killed by cars between January and June to determine: 1) Age of animal (from the teeth) 2) Pregnancy 3) Number of fetuses	From the does examined, wildlife biologists estimate the average number of fawns that will be produced by does of different ages. 1-year-old does produce .65 fawns each 2-year-old does produce 1.70 fawns each 3+ year-old does produce 2.00 fawns each
Spring/Summer deer mortality is estimated from Conservation Officer reports that include information on the number of deer killed by cars, number killed by dogs, number illegally taken, etc.	Summer is an easy time for deer. From the information gathered in the field, biologists estimate that 97% of the adult males and 96% of the adult and yearling females will survive the summer months. Of the fawns, 95% of the males and 87% of the females survive this period.
Information on the hunters' harvest is gathered from: 1) Registration of gun and bow-and-arrow kill 2) A mail survey (a random survey to determine the number of deer taken)	Information about the harvest allows Wildlife Managers to accurately estimate the number of deer harvested and provides a "success ratio" (the percentage of successful hunters in the area).
The illegal killing of deer is reported by Conservation Officers.	The number of illegal kills reported is corrected for undetected kills. By multiplying the number of bucks taken during a "bucks only" season by 0.25, the number of illegally killed does and fawns can be estimated.
Fall/Winter deer mortality information is gathered from Conservation Officer reports and knowledge of winter conditions in the area.	Winter is a more harsh time for deer than is summer. In this model, the winter is "moderate" with 92% of the 1-year-old females and 91% of the remainder of the herd surviving until spring.

Chart A follows the deer population through the year in our model area. The chart assumes that spring/summer and fall/winter mortality are moderate and allows for both bow-and-arrow and firearm hunting seasons, as well as an average reproduction rate.

Reading from left to right, the chart describes the time of year (beginning in spring before fawns are born), size of the herd, make-up of the herd by age and sex, methods used by wildlife managers and biologists to collect information about deer, and finally, how this information is used to estimate population gains and losses.

The population in the model is *stable.* This means that the mid-May population is about the same from one year to the next (1,000 at the beginning of each year). Or, to put it another way, population gains equal losses for the year. For the population to remain stable, the sex ratio (males to females) should be maintained at about the same level from year to year.

Chart B

POPULATION MODEL FOR MINNESOTA FARMLAND DEER
(stable population)

1) 1st year starting population		reproduction rate		fawns produced
males	400			
females				
1-year-old	234	x	.65	152
2-year-old	138	x	1.70	235
3+ year-old	228	x	2.00	456
	1000			843

2) summer population		spring/summer survival rate		
adult males	400	x	.97	= 388
adult females	600	x	.96	= 576
male fawns	422	x	.95	= 400
female fawns	421	x	.87	= 366
	1843			

3) fall population		harvest season survival rate			illegal kills		
adult males	388	x .38	=	148	– 0	=	148
adult females	576	x .75	=	431	– 26	=	405
male fawns	400	x .75	=	300	– 18	=	282
female fawns	366	x .75	=	275	– 16	=	259
	1730						

4) post-harvest population		fall / winter survival rate		
adult males	148	x	.91	= 139
adult females	405	x	.92	= 373
male fawns	282	x	.91	= 257
female fawns	259	x	.91	= 236
	1094			

5) 2nd year starting population	
males	392
females	
1-year-old	236
2-year-old	141
3+year-old	232
	1001

Chart B mathematically follows our model herd through the same year. Like chart A, it begins in spring just before the first fawns are born (1). By separating the females into different age groups (because of their different reproduction rates) and multiplying the number in each age group by the appropriate reproduction rate, we arrive at the number of fawns born in late spring and early summer. The fawns are split about 50-50 according to sex.

The summer population is the highest of the year (2). Although deer can find plenty to eat when the weather is warm, population losses do occur during this time. By multiplying the summer population by the survival rate (the percentage of deer, according to age and sex, that will survive between spring and fall), we arrive at the fall population (3).

The fall/winter survival (4) is figured the same way as the spring/summer survival, though

deer mortality is higher during this time. Deer that survive winter make up the next year's starting population (5).

Man has little control over reproduction, spring/summer survival or fall/winter survival rates (1, 2 and 4). Now let's take a closer look at the harvest (3), the one area of our model where man can exert control.

3) fall population			harvest season survival rate				illegal kills		
adult males	388	x	.38	=	148	–	0	=	148
adult females	576	x	.75	=	431	–	26	=	405
male fawns	400	x	.75	=	300	–	18	=	282
female fawns	366	x	.75	=	275	–	16	=	259

There are two things we must know in order to complete the above equation: the number of illegal kills and the harvest season survival rate.

Wildlife biologists estimate that the number of illegal kills is equal to a number equivalent to 25 percent of the bucks taken during the season. The number of illegal kills is distributed among the adult females, male fawns and female fawns according to their make-up in the fall population. We assume that no bucks are illegally killed because of the season structure.

EXAMPLE:

388 (adult males in fall population)–148 (adult males in post-harvest population) = 240 (adult males taken during hunting season). 240 x .25 = 60 (illegal kills).

576 (adult females in fall population) ÷ 1342 (adult females, male and female fawns in fall population) = .43.

.43 x 60 = 26 (adult females illegally killed).

The harvest season survival rate is determined from the number of deer of each age and sex taken by both bow-and-arrow and firearm hunters. Let's say it's after the season and we know the number of deer harvested from registration figures and a random registration compliance survey. The results look like this:

	bow & arrow harvest		firearm harvest		total harvest
adult males	19	+	221	=	240
adult females	29	+	116	=	145
male fawns	20	+	80	=	100
female fawns	18	+	73	=	91

The harvest season survival rate is computed by subtracting the total harvest figure for each age and sex from the fall population for the same age and sex, then dividing the result by the latter figure.

EXAMPLE:

388 (adult males in fall population) – 240 (total harvest of adult males) = 148.

148 – 388 = .38 or 38% (harvest season survival rate for adult males).

Knowing the results of the harvest season doesn't help in setting regulations before the season starts. So, wildlife managers and biologists have devised a formula for estimating the harvest for a given set of regulations. In the model, for example, there was a one-month bow-and-arrow season, a three-day "bucks only"season, and a one-day "any deer" season.

The archery harvest can be estimated before the start of the season by multiplying the fall population by five percent (the average percentage of the fall population that will be harvested in a one-month bow-and-arrow season). If the archery season is shorter than one month, hunters will take a smaller percentage of the fall population. If the season is longer, the harvest percentage will be slightly larger.

The number of bucks that will be harvested

depends on the length of the season. In the model, there were four days of firearms' buck hunting (the three-day, bucks-only season plus the one-day, any-deer season). Biologists estimate that during a four-day season on bucks in this area, 38 percent of the fall population will be taken.

The number of does and fawns taken by firearms depends on the length of the "any-deer" season and the number of permits issued to hunters. From studying results of past seasons, biologists estimate the number of "any-deer" hunters that will be successful. For a one-day "any-deer" season in our model area, 30 percent of the permit hunters will take does or fawns. To harvest 269 does and fawns, 897 "any-deer" permits can be issued.

Wildlife managers have found that by adjusting the number of "any-deer" permits, they can manipulate the size of the herd so that it usually stays in the range between too many and too few deer.

Conditions change, of course. Our model is based on average survival and reproduction rates. A severe drought, for example, could reduce the number of does that become pregnant, thus lowering the reproduction rate. Pressure from various citizens' groups could force a longer or shorter season than is justified by the size of the herd or by area conditions. Remember, a change in any one of the factors in the model will produce a change in the population size.

Hunting regulations for the entire agricultural zone must take into account the population ups and downs of the many small areas within the zone. This can be done by setting some regulations for the entire area (such as a uniform bow-and-arrow and "bucks-only" season throughout the agricultural zone) and additional regulations geared to smaller areas within the zone (such as "any-deer" permit areas with the number of permits issued dependent upon the conditions within the smaller area).

As you can see, setting the deer hunting regulations is a very complex procedure. But, for the purposes of the game, on page , we'll simplify the process somewhat by concentrating only on our model 1,000 square-mile area in Rice and Steele counties.

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SETTING THE DEER SEASON: A GAME

It's spring, time to set the door hunting regulations for the coming fall season in the 1,000 square-mile model area in Rice and Steele counties. We know how the deer in the area fared during the past year from the population model (charts A & B). We also know what our starting spring population is from line 5 in chart B.

The game is to complete the formula on the next page. The reproduction, spring/summer survival and fall/winter survival rates are given, but it's up to you to fill in the harvest season factors needed to complete the model.

The first step is to agree on the herd size (5). Students playing the rolls of hunters, non-hunters, businesspeople, and others may argue that the herd size should increase, decrease, or remain stable. A compromise must be made to arrive at a single population figure for the end of the year.

Once the year-end figure is reached, hunting regulations can be set so the correct number of deer can be harvested. The final hunting regulations must take into account the desires of the various groups playing the game. Here again a compromise may be necessary.

The figures needed to complete the model are on page three.

Good luck!

Formula for Setting the Deer Season

1) 2nd year starting population		reproduction rate	fawns produced
males	392		
females			
1-year-old	236	x .65	
2-year-old	141	x 1.70	
3+ year-old	228	x 2.00	
	1001		

2) summer population		spring/summer survival rate
adult males	x	.97
adult females	x	.96
male fawns	x	.95
female fawns	x	.87

3) fall population	harvest season survival rate	illegal kills
adult males		
adult females		
male fawns		
female fawns		

4) post-harvest population	fall/winter survival rate	fall/winter survival rate
adult males	x .91	
adult females	x .92	
male fawns	x .91	
female fawns	x .91	

5) **end of year population**
- males
- females
  - 1-year-old
  - 2-year-old
  - 3+ year-old

SETTING THE HARVEST GAME FIGURES

BOW AND ARROW:

1 week season:	2% of the fall population will be harvested
2 week season:	3% of the fall population will be harvested
3 week season:	4% of the fall population will be harvested
4 week season:	5% of the fall population will be harvested
6 week season:	6% of the fall population will be harvested
8 week season:	7% of the fall population will be harvested

The bow-and-arrow harvest is distributed evenly through the herd so the same percentage of each age and sex will be harvested.

FIREARM:

Bucks only season:

1 day season:	27% of the fall male population will be harvested
2 day season:	40% of the fall male population will be harvested
3 day season:	51% of the fall male population will be harvested
4 day season:	57% of the fall male population will be harvested
5 day season:	61% of the fall male population will be harvested
6 day season:	64% of the fall male population will be harvested
7 day season:	66% of the fall male population will be harvested
8 day season:	67% of the fall male population will be harvested

Any deer season:

1 day season:	30% of the permit holders will take does or fawns
2 day season:	45% of the permit holders will take does or fawns
3 day season:	56% of the permit holders will take does or fawns

ILLEGAL KILLS:

A number equivalent to 25% of the bucks taken.

Social, Economic and Political Impacts on Management

How are wildlife management policies actually created? The process is not as straightforward and logical as we might have implied.

To see why, let's describe an ideal approach to making wildlife policy. Suppose a team of managers has been getting reports that some popular animal is declining in numbers. What should they do?

Ideally, they would first take stock of all relevent biological data. Census reports of all sorts would be checked against records showing the animal's population in previous years. If the data showed a significant decline, more data would be examined to pinpoint the problem. Recent weather, hunting success reports, predator population levels, and habitat assessments would be studied. Analysis of all this would define the problem. Then the managers would draw up a plan for corrective action, allocate money for its implementation, and monitor the recovery of the animal's population.

Although logical, the process just described is not possible in the "real world" of wildlife management. Things are just not that simple. Why?

There are two major reasons. We can call them the "money problem" and the "people problem." Together these factors put severe limits on what managers can actually do for wildlife.

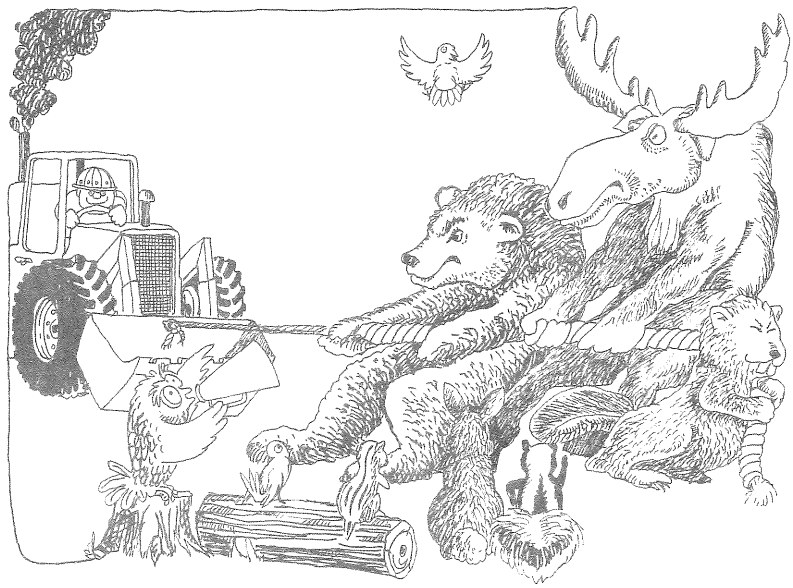
The Money Problem

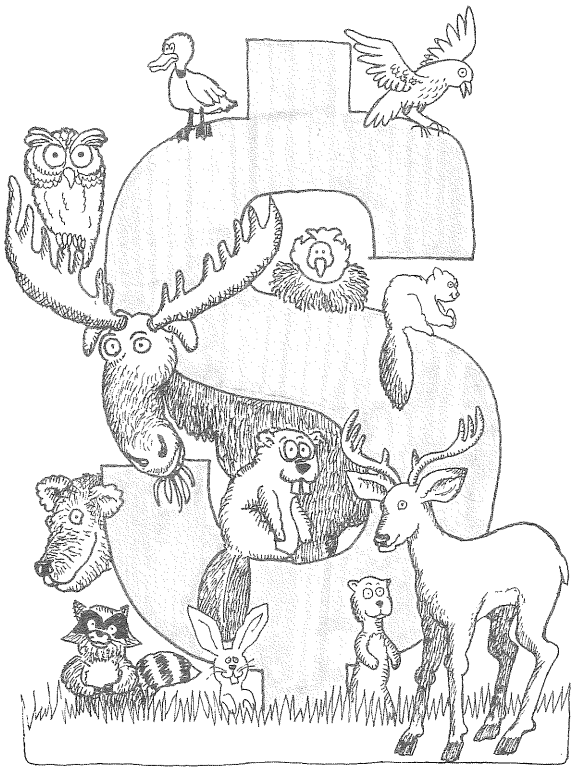
Wildlife agencies (like the U. S. Fish and Wildlife Service, or Minnesota's Department of Natural Resources) are funded by various fees or taxes. The amount of taxes is determined by politicians who also determine the operating budgets of wildlife agencies.

Wildlife agencies often have the scientific data and the vision needed to originate programs to benefit wildlife, but only enough funds to actually launch a handful of them. Or a program may be attempted, but with a level of funding which prevents it from having much impact.

"Tight money" also limits wildlife agencies by keeping the number of their employees at a bare minimum level. Both the planning and execution of their programs are hurt when there is too much work for too few hands.

If there is any segment of the public which is willing to be taxed for a good purpose, it would have to be sportsmen. Minnesota's sportsmen and their organizations have repeatedly proved their





readiness to pay for better wildlife management. The state's single-most impressive program, its habitat acquisiton program, has been largely funded by a special surcharge on hunting licenses. More recently, pressure from hunters caused the legislature to establish a new State Waterfowl Stamp. Required for duck and goose hunters, the stamp generates revenues for habitat improvement on shallow lakes.

The People Problem

With so little money to spend, wildlife managers would like to plan wisely to get maximum value from every dollar spent. But those plans are frequently changed because of the "people problem." This problem is concerned with public support (or lack of it) for the wildlife programs that professional managers feel will be effective.

People have many strong opinions about wildlife. Some groups hate wolves and would gladly see them exterminated; other groups who are just as vociferous in their opinions believe wolves should be protected and never, under any circumstances, shot or trapped. Either view is incompatible with any program to manage wolves, for management depends upon a certain amount of flexibility.

And there are many theories among the public as to why various animal populations are high or low. For example, many people find it difficult to understand how habitat quality affects wildlife populations. But they have no trouble understanding predation. Consequently predators get tagged with the blame for many problems they do not cause. There are major management controversies about many Minnesota wildlife species. Everyone with an interest in wildlife has his or her own pet theories, which frequently conflict with the more complex and comprehensive biological evidence of the managers.

Wildlife managers have their most serious problems, though, when the interests of wildlife come into conflict with economic interests. For example, county governments are financed by taxes on local property and economic activity. But most wildlife is the product of undeveloped land, of waste places, and wild areas. Thus county officials tend to see any land set aside for wildlife as "unproductive"—unproductive of taxes, though it is productive of wildlife.

Managers can encourage important groups of landowners (such as farmers or lumber companies) to allow practices favorable to wildlife, yet people will generally use their lands in ways that bring them the highest profit. This is entirely understandable, though frustrating to those who treasure wildlife.

All these forces—public attitudes theories, and economic interests which conflict with wildlife—are expressed as various types of political pressure on wildlife agencies. The pressure can be subtle or blunt. Sportsmen's groups frequently call managers to task for this program or that. Economic groups, such as farmers or land developers, know how to make their voices heard. Sometimes legislators simply pass laws which mandate certain wildlife policies, though professional managers and extensive research findings may disagree with them. One result of all this is that managers must divide their efforts and money, spending some directly for wildlife and some to defend their policies.

So wildlife management programs are usually compromises between an ideal program and a program which can be funded. Often the program takes into account people's attitudes, theories and economic self-interest.

The effects of these economic and political pressures are not always bad. Managers, if not prodded, can fall into ruts and fail to see the shortcomings of some programs. On the whole, though, managers could do a better job for wildlife if they lived in an ideal world—a world with bountiful budgets and little political pressure.

In the real world of wildlife management, the challenge is to do the best job possible within limits established by our society and the natural world.

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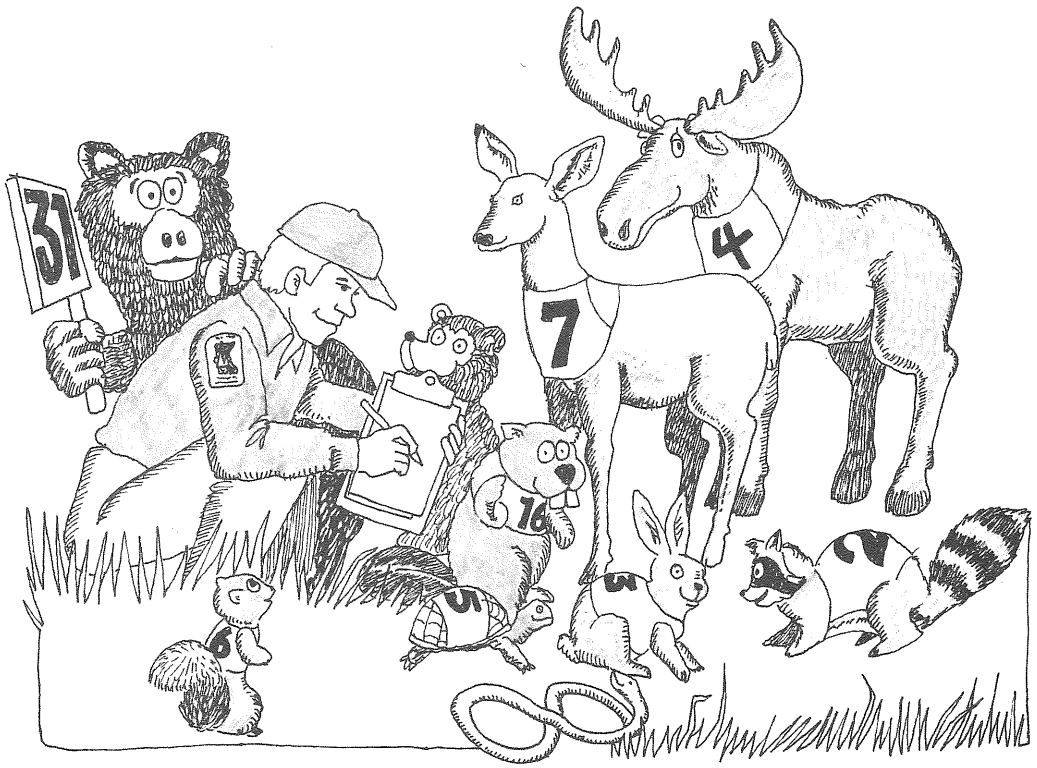


CENSUS AND SURVEY

One of the first things a wildlife manager must know before making any type of decision about wildlife or its habitat is: how many animals are there? This is where the census or survey comes into the picture.

These techniques for counting or estimating wildlife populations are similar to polls conducted by newspapers or politicians. By sampling a small number of individuals, the politician hopes to find out what most people think about a particular issue.

So it is with wildlife. The manager samples a small part of the population (or a small area) to arrive at an estimate for a larger population (or area). In some cases, all individual animals (or their droppings or calls) are counted in a given area and the results are expanded to estimate populations in a larger area.

By conducting the same type census or survey on a yearly basis, the wildlife manager is able to spot trends in animal populations. With this information, he can tell whether there are more or fewer animals than in previous years.

Following are examples of censuses or surveys conducted by the Minnesota Department of Natural Resources (DNR):

Deer pellet counts
Waterfowl breeding counts
Moose aerial counts
Roadside pheasant trend counts
Drumming grouse trend counts
Hunter harvest survey
Car kill survey
Turkey gobbling counts

DEER PELLET SURVEY

WHY: To estimate deer populations
WHEN: Late March to early May (as soon as the snow has melted)
WHERE: Northern Minnesota
HOW: Surveying small plots of ground for deer pellets (droppings) then expanding the results to make an estimate of the deer population for a larger area

EQUIPMENT NEEDED:

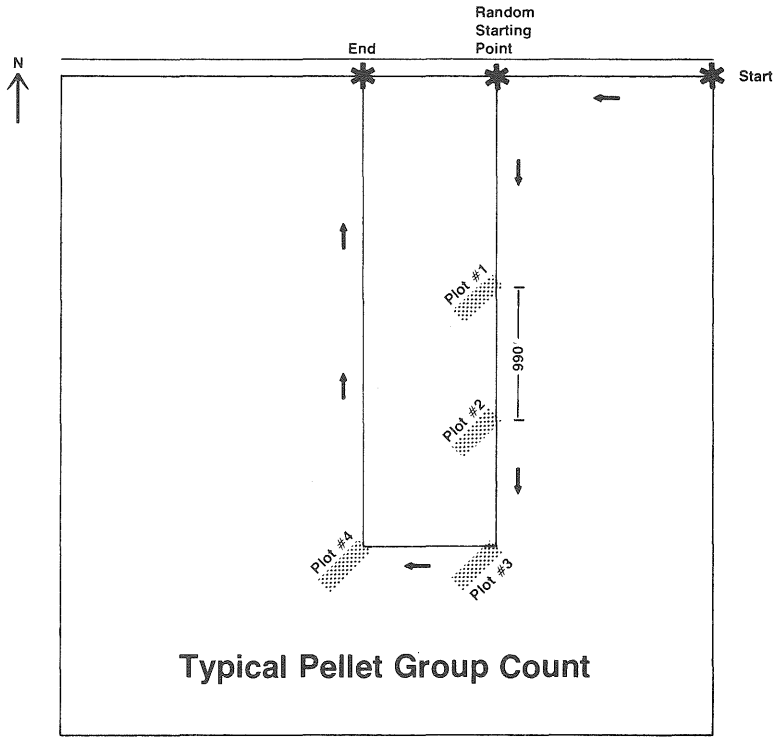
Maps	Forms
Compass	Rope for measuring plots
Clipboard	Markers for pellet groups

Imagine you're a wildlife manager. Word from the main office of the Department of Natural Resources (DNR) in St. Paul comes to you that a survey of the deer population in northern Minnesota is to be conducted in April and early May. Visions of spending seemingly endless days counting the white flags of bounding bucks, disappearing does, and fledgling fawns spring into your mind.

But your fears are unfounded, for within a few days the mailman has delivered a package to you from the DNR. Inside are a stack of forms and a few pages of instructions entitled: "Instructions for the Deer Pellet Survey." With a sigh of relief, you read the instructions.

The survey is designed to provide information on deer population trends for wildlife management purposes, such as for setting the details of the deer hunting season. The areas to be surveyed are broken down into sections (square miles) which are randomly selected in your area. The search is to begin at one of the corners of each chosen section. From the starting point, you are to walk a rectangular course through the section, stopping at four predetermined spots to measure off a plot of ground 72½ x 12 feet.

Within the plot, you are instructed to count the deer pellet groups (an average group contains 65 pellets) and record the number on the form supplied by the DNR. In addition, the form has blanks to record the number of moose pellet groups, ruffed grouse roosts, and hare pellet groups in each plot, as well as a space to jot down the size and type of trees and shrubs in the plot.



Typical Pellet Group Count

While walking between the plots on the course, you are also asked to record the remains of any dead deer you encounter and list their age, sex, cause of death.

The instructions also contain a reminder not to confuse deer pellets with those of other animals such as rabbits (which are light brown, slightly flattened spheres, generally smaller than deer

pellets), porcupines (which are slightly rougher and more curved than deer pellets) or moose (which are usually larger than deer pellets.)

The entire form is to be filled out in the field, so all that remains to be done after the survey has been completed is to sign the form and mail it back to the office.

Once your forms and those of the other wildlife managers are back at the DNR, a formula is applied to the numbers gathered in the field. In general, the formula uses the specific information gathered on the small plots and expands that information to arrive at an estimated deer population for larger areas.

In figuring the estimate, wildlife managers use facts that have been observed about deer in general. On the average, they know that a deer deposits about 13 groups of pellets every 24 hours and that the size of the group is 65 pellets. This information, coupled with the knowledge of the number of days since the complete leaf fall of the previous year (when most of the old pellet groups would have been covered with leaves) and the size of the area searched, gives the wildlife manager a good estimate of the deer population of a given area.

In addition to helping estimate the deer population, the survey has other wildlife management uses. It can assist in the making of estimates of ruffed grouse, hare and moose populations, and in determining how the deer fared through the winter. By recording tree and shrub information, managers have a keener understanding of deer habitat. If the survey is done on a yearly basis, the information can be compared to that collected in previous years so population trends can be identified.

Besides its wildlife management uses, this survey is also a good excuse for a walk in the woods.

Written by Pat Hennessy. Illustrated by Don Balfour. Published by the Education Section, Bureau of Information and Education, Minnesota Department of Natural Resources.

WATERFOWL BREEDING SURVEY

WHY: To detect changes in the duck breeding population
WHEN: May
WHERE: Roads that pass near water
HOW: Count breeding pairs of ducks (also single males and females and groups) seen within one-eighth mile of either side of a road, and record the type of water area

EQUIPMENT NEEDED: Car
Forms
Duck identification chart
Field glasses

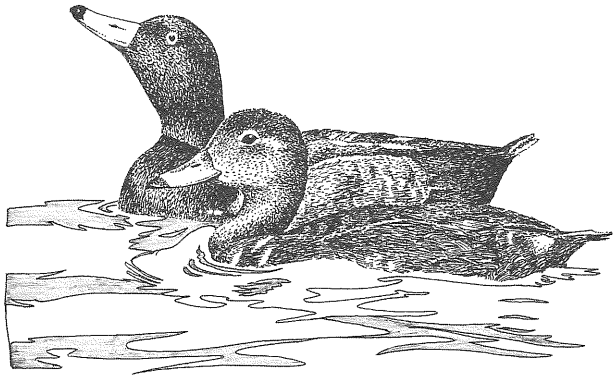
Imagine you're a new wildlife manager. You get a call from your boss at the Department of Natural Resources (DNR). He wants to know how many breeding pairs of ducks there are in your area. The first impulse may be to answer "quite a few," but you hold back as he begins to explain the job.

A part of the duck survey is done from the air, with a pilot and observer flying low to count the number and types of ducks seen along a selected course. Ground crews will double-check selected portions of the course and the findings of both air and ground crews will be compared. From their figures, an estimate of the number of ducks will be tabulated.

But there is another type of survey, one made from a car, that has been done for years. This will be your job. You are given a specific route to drive in May. Along the route you are to record all ducks seen within one-eighth mile of either side of the road. There are spaces on the form to jot down the number of pairs, lone males and females, or unpaired groups. These are recorded according to the species, including coot.

All water areas within your census strip are recorded according to whether they are temporary, seasonal, semi-permanent or permanent ponds, lakes, or rivers. The number of ducks seen in each type of water area is recorded.

At about every tenth water area, you are to to create a disturbance outside the car. This will cause the ducks to move so you can see those that may have been hidden at first. This information will give you an idea of the number of ducks that were hidden at the stops where no disturbance was created.



When your route has been completed and all information collected on the form, it is returned to the Wetland Wildlife Research people at the DNR for study and comparison with figures from other areas and similar information from other years.

From earlier surveys, the DNR has found that habitat is the key to duck populations. During wet years, when there are more temporary water-holding areas, the number of breeding ducks is higher than in dry years when many ponds dry up.

When wildlife managers drive their routes they also notice new drainage projects which create more land for crop production but less water area for breeding and rearing of ducks.

The two most common breeding ducks in Minnesota are the blue-winged teal and mallard, though some 20 different duck species nest in the state.

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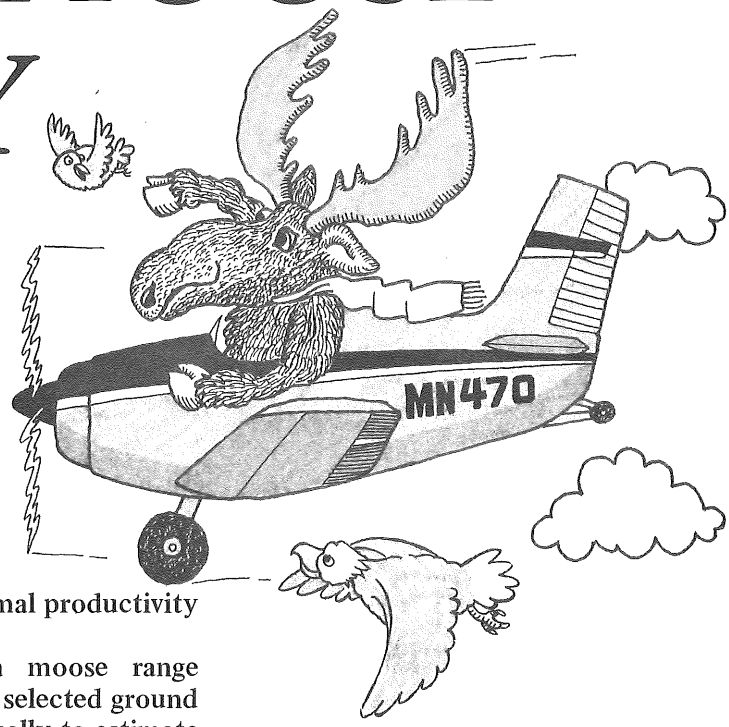
AERIAL MOOSE SURVEY



WHY: To determine the moose population and animal productivity
WHEN: Winter
WHERE: Northwestern and northeastern Minnesota moose range
HOW: By counting the number of moose by air on selected ground plots then expanding the figures mathematically to estimate total population.

EQUIPMENT NEEDED: Airplane
Maps
Forms

Picture yourself as a wildlife manager in northeastern Minnesota. It's winter and the hectic days of hunting season are over. You're looking forward to a slightly lighter workload for a few months, a good time to catch up on wildlife reading. The phone rings, breaking the silence. It's your boss from the Department of Natural Resources (DNR) regional office.

"I want you to conduct a survey on the moose population," he tells you, "and I also want to know how well the animals are reproducing." Instructions and forms for the survey will be sent to you, he says. As soon as he hangs up, you call a pilot friend who works for the U. S.Forest Service. After a short discussion, he agrees to fly the plane for the survey.

When the instructions come, you go over them with the pilot and a Conservation Officer who has agreed to go along as an observer. On a map of the area, you plot out the three-by-five mile areas that were randomly picked to be surveyed. There are about 40 survey plots in the northeastern moose range that are to be studied by air.

On the first clear day, you take off. At a low altitude, the dark moose are easily seen against the white snow. Each moose seen in the selected areas is noted on the form and a special notation is made for each calf.

Within a week your part of the survey is complete and, after mailing the forms to the DNR office in Grand Rapids, you are free to go back to other duties.

Once the forms reach the main office, they are studied along with information gathered in the northwestern Minnesota moose range. The information is plugged into a mathematical formula which expands the numbers of moose found in the small survey plots to reach an estimate for the entire moose herd.

The number of calves spotted is compared to the total population so reproductive success can be made. Both the figures on reproduction and population are compared with figures of earlier surveys to determine whether the herd is increasing or decreasing.

The survey results, along with other information on the moose herd, is used to aid the DNR in making decisions about such things as whether or not to open a moose hunting season.

Written by Pat Hennessy. Illustrated by Don Balfour. Published by the Education Section, Bureau of Information and Education, Minnesota Department of Natural Resources.

SPRING ROADSIDE PHEASANT COUNTS

WHY: To determine how pheasants (and other farmland wildlife) survived the winter and make up of the spring breeding population.

WHEN: Mid-May.

WHERE: Minnesota pheasant range (southern and western farming country).

HOW: By counting the number of pheasants (and rabbits, Hungarian partridge, deer, red fox and skunks) along two 25-mile routes in each county and comparing the results with those of earlier years.

EQUIPMENT NEEDED: Maps
Instructions and forms
Car

You are a wildlife manager stationed in the farming region of southern Minnesota. The sky is just beginning to turn pink in the east as your alarm clock rings. After a quick breakfast, you step outside to watch the sun peek up from behind a grove of trees.

You check the mid-May weather conditions: a clear sky, wind of less than 10 miles-per-hour. Running your boot through the grass, you notice that the dew leaves the leather quite wet. You have checked the five previous mornings, but this is the first morning that conditions are just right for making your spring roadside pheasant count. After gathering forms and maps supplied by Department of Natural Resources (DNR), you drive to the start of your route.

The roadside counts are conducted each May and August, with two or three routes being run in each of the 63 counties of Minnesota's pheasant range. Since 1956 the routes driven, dates, weather conditions, and times for the counts have been standardized so results can be compared with similar information from previous years with greater accuracy.

At sunrise you begin your route, driving at 15 to 20 miles-an-hour. On the seat next to you is the DNR form on which you have already noted the time, temperature, wind speed, sky cover, and amount of dew (the heavier the dew, the better.)

Each pheasant seen along the route is recorded according to sex and whether it was seen within or outside the road right-of-way. The road and both ditches are included in the right-of-way.

In addition to counting pheasants, you also note the number of Hungarian partridge, cottontail rabbits, deer, red fox, and skunks on the form. At the end of the route, you total the number of each animal species seen.

On the next day with suitable weather conditions, you will run the second route in your county. When both routes are completed, you will mail the two forms to the Farmland Wildlife Research Center in Madelia, Minnesota, where they will be combined with forms from other counties.

The forms will be studied at the research center to determine how well the different species survived the winter and to get an estimate of spring breeding populations. The figures can also be compared to those of previous years so wildlife biologists can tell whether different animals are increasing or decreasing in numbers.

The August roadside count is done in the same fashion as the spring count (except that in some counties three, 25-mile routes are run rather than two.) The results of the August count help biologists determine the reproductive success and adult breeder survival from spring to fall.

With this and other information in hand, wildlife biologists are better prepared to tell how such things as weather and habitat changes affect animal populations.

Written by Pat Hennessy. Illustrated by Don Balfour. Published by the Education Section, Bureau of Information and Education, Minnesota Department of Natural Resources.

RUFFED GROUSE DRUMMING COUNT

WHY: To estimate male ruffed grouse populations and compare the estimate with those of previous years to spot population trends

WHEN: Mid-April to mid-May

WHERE: Southeastern and northern Minnesota

HOW: By driving a selected route and stopping periodically to count the number of "drums" heard

EQUIPMENT NEEDED: Car
Thermometer
Forms and maps

The ruffed grouse is Minnesota's number one gamebird. The state's grouse population, among the best in the nation is found in the southeastern hardwood forest and most of the northern half of Minnesota. Each spring, the Department Natural Resources (DNR) monitors the grouse population—without ever seeing a bird.

Imagine you're the wildlife manager for a sizeable area of central Minnesota. You awaken in the pre-dawn of early May and check the weather. The temperature is more than 35 degrees and there is hardly any wind. It doesn't look like rain.

After making your observations, you decide that it's a perfect day to begin your ruffed grouse drumming count survey. You have already read the survey instructions provided by the DNR office and marked the stops you'll make along the survey route by painting numbers on trees or poles near the road.

You gather the survey forms and drive to the first stop. It's now five minutes after a beautiful sunrise. As you step out of the car, you check your watch, for at each stop you are to listen for drumming grouse for exactly four minutes.

The drumming you are listening for is done by the male grouse. He will stand on a log (or perhaps a rock or raised root) and beat the air rapidly with his wings, creating a sound similar to that of an old farm tractor just starting up. The drumming is intended to attract a mate and to tell other male grouse to "stay away from my log!" Each drum lasts about two seconds and is repeated about every four minutes. The sound can be heard for about one-quarter of a mile.

On your form, you record the number of drums heard in four minutes, the type and size of the vegetation, the exact mileage, and the stop number. This is repeated at each of the 10 stops.

After you have completed the survey routes in your area, you mail the forms back to the DNR where wildlife biologists use the information to estimate the status of the male ruffed grouse population. By comparing the results of the survey with findings from previous years, biologists can also estimate whether the grouse population is rising or falling. (Often, ruffed grouse populations rise and fall at 10 year intervals.) This information is used to make recommendations for hunting seasons.

Written by Pat Hennessy. Illustrated by Don Balfour. Published by the Education Section, Bureau of Information and Education, Minnesota Department of Natural Resources.

HUNTER HARVEST SURVEY

WHY: To determine the number of animals taken by hunters each year as an aid in setting future hunting seasons
WHEN: After the hunting season closes
WHERE: Statewide
HOW: Through hunters' report cards and game registration

Let's pretend you are a wildlife manager. You are stationed in central Minnesota and it's your day off. You do a little shopping in town before you stop at a cafe for lunch. The fellow at the counter next to you starts a conversation. You tell him that you are a wildlife manager and the talk centers on surveys conducted by your employer, the Department of Natural Resources (DNR).

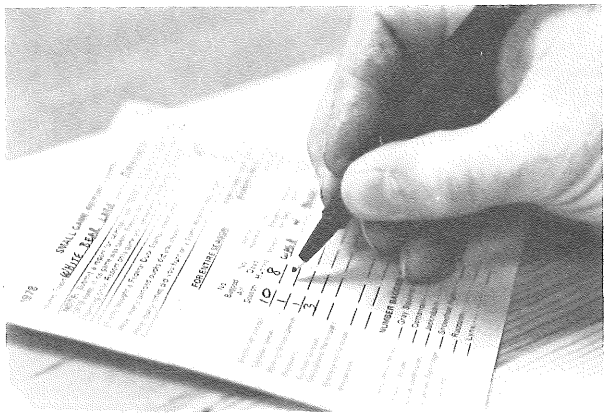
"I think your surveys are a lot of bunk," he says, "especially the one about how many deer are shot in the state every year. I don't know how you guys figure it, but however you do, I don't think it's right."

In addition to managing wildlife, a large part of your job is answering questions posed by interested people. You launch into an explanation.

First, you tell the man, it may be true that deer harvest figures for the state, or even for a region or county of the state, may not match the figures for small areas within the state, region, or county. The DNR can tell you, for example, about how many deer were taken in a given county, but not how many were taken on each section of land within the county.

The yearly estimate of the number of deer harvested by licensed hunters is the longest standing survey in Minnesota, you continue. It started as a simple tally of information gathered from hunters' report cards.

Today, questionnaires are mailed to about 1,600 randomly-selected deer hunters asking them about their sucess, area hunted, number of days



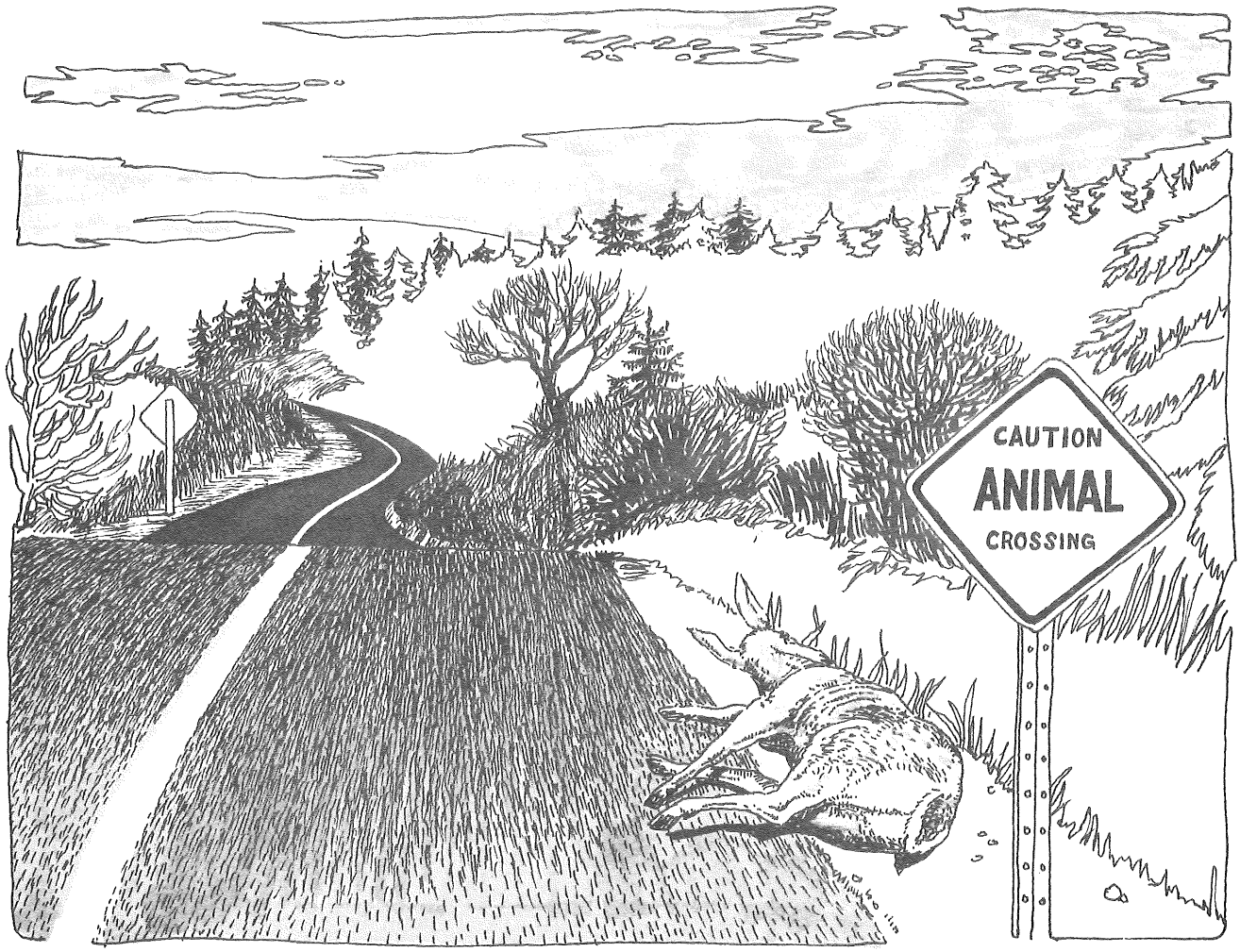
spent hunting, and so forth. Estimates of hunter success are not made until at least 90 percent of the questionnaires are returned. Statistically, this survey has a narrow margin of error (+ or – 2.5 percent.) Knowing the number of licenses sold, it is then possible to estimate the total number of deer harvested.

Finally, you tell the man, these surveys, along with other information gathered during the year through additional surveys (deer pellet counts and hunter check station statistics, for example) help the DNR in setting future deer hunting seasons.

"I still don't think those numbers are very accurate," the man says as he slides off his stool to leave the cafe. But, it seems to you, his last comment lacks the conviction of his first statement.

Written by Pat Hennessy. Illustrated by Don Balfour. Published by the Education Section, Bureau of Information and Education, Minnesota Department of Natural Resources.

CAR KILL SURVEYS



WHY: To determine the number of big game animals killed on Minnesota roads each year
WHEN: Year-round
WHERE: Statewide
HOW: Reports are filed by conservation officers on big game animals killed in car accidents.

Imagine you're a Conservation Officer. It's about 10 o'clock at night and you're driving home after a long day. Highway 61 along the north shore of Lake Superior is icy in spots, and the cold north wind blows snow through your headlight beams. Ahead, you can make out the flashing emergency lights of a stopped car. Pulling in behind the car, you stop to investigate.

The car has hit a deer, and the driver is examining the dead animal on the shoulder of the road. After you identify yourself, the man explains what has happened. He didn't see the animal until it was too late to stop. Although he swerved to avoid the deer, the road was icy and the right front fender struck the deer, killing it almost instantly.

"What are you going to do with it?" he asks you. First, you inform the man, you are going to clean the deer. Then you'll probably drop it off tomorrow at a nearby market where the meat will be sold on consignment, with a small percentage of the money going to the market and the rest to the Department of Natural Resources (DNR).

"Oh," he says, "I thought maybe I could buy it." You think it over for a moment. Normally, you try and dispose of the meat in such a way as to benefit the most people possible. But there has been many road kills this year and most of the

needy groups and individuals in your area already have venison. So, you agree to sell the deer to the driver.

After cleaning the animal, you deposit the deer's innards between some rocks, well away from the road. Usually you bury the inner remains, but the ground is too rocky in this area. Scavengers, such as ravens, fox, or coyotes will soon devour the remains. The man makes out a check to the state treasurer and you issue him a receipt before you load the deer into his trunk and, after you advise him to drive slower in deer crossing areas, you both depart.

As you continue the ride home you think about the thousands of deer killed on Minnesota roads. About ten times as many deer are killed by cars each year as are illegally taken by hunters each year. The number of car kills increases as more miles are driven on Minnesota highways.

There are some methods that can reduce the number of deer-car collisions. One is the deer-proof fence, but it is expensive, must have scattered openings, and is often an eyesore. Removing vegetation that grows too close to the road can help motorists see deer more easily. Often, highways run near deer feeding yards, creating a greater risk of accidents. These and other areas where many deer are killed can be posted with warning signs.

When you reach home, you fill out a report on the deer kill. You send the report and the man's check to the central office of the DNR in St. Paul. Your report, along with reports on moose and bear killed, are totaled each year to give the DNR an idea of the number of big game animals killed by cars throughout the state.

Written by Pat Hennessy. Illustrated by Don Balfour. Published by the Education Section, Bureau of Information and Education, Minnesota Department of Natural Resources.

WILDLIFE MANAGEMENT TECHNIQUES

Given the need for wildlife management, what techniques do managers have at their disposal to accomplish an objective, such as increasing the number of deer?

One technique is habitat manipulation—changing the habitat so it can produce more wildlife. Habitat manipulation includes such techniques as: prescribed burning, timber harvesting, manipulating water levels, planting food plots, trees and shrubs, and improving nesting cover.

Another technique is to protect desirable or critical habitats from development. This can best be done by acquiring lands and incorporate them into the wildlife management areas system. Certain regulations can also be implemented to protect threatened areas.

Regulations established for hunting seasons accomplish several management objectives. Regulations are intended to maintain animal populations at desired levels, distribute the harvest as evenly as possible, provide quality and safe recreation.

Predator control, stocking, and refuges are techniques that have been used in the past but have very limited use now. Predator control is done only in specific areas and is aimed at individual, nuisance animals. Refuges are used primarily for waterfowl and then only under certain conditions. Stocking has been shown to be very costly and often produces negative results.

Wildlife management is a complex issue that deals with complex systems. Managers must have a good understanding of the techniques and their impacts since it is possible to have unexpected results. Introduction of such unpopular species as the house sparrow, starling, and carp are examples. The manipulation of habitats can sometimes have adverse affects if managers do not fully understand ecological principles.

Modern wildlife managers have the benefit of excellent training from universities with wildlife-oriented curricula. They also have access to considerable research and management information gathered by other states, and the U.S. and Canadian Federal governments. With a good background in these fundamentals, a much better understanding, of cause and affect relationships are understood.

Written by Pat Hennessy. Illustrated by Don Balfour. Published by the Education Section, Bureau of Information and Education, Minnesota Department of Natural Resources.

PRESCRIBED BURNING FORESTS

WHY: To improve the habitat of certain animals by creating forest openings
WHEN: Spring
WHERE: Forests in the northern portion of Minnesota
HOW: By setting carefully planned fires at selected sites when the weather conditions are favorable.

Smokey the bear would have had a fit. Here was a group of conservation workers setting fire to a forest. They set piles of brush afire along a road, then stood back and watched as the flames swept through the trees.

But these men weren't set on destruction. Rather, their intention was to improve forest vegetation for wildlife. Many trees of the woods were old. Their leaves shaded the ground below so that little sunlight reached the forest floor to spur new growth. The old forest has few inhabitants because they get little nourishment from the tall trees and sparse underbrush. New growth would provide more nutritious food and create better cover for a wide variety of animals. So, a fire was set to kill the old trees so new growth could start.

Wildlife managers call this method of improving habitat controlled or prescribed burning. It is a technique they use to benefit ruffed grouse, deer, moose, bear, beaver, and many songbirds. Still others, such as sharptails and prairie chickens, rely on habitat that is created and maintained by fire. But, like most changes in the environment, the habitat of some species (grey squirrels and some songbirds, for example) is destroyed by burning.

The animals themselves are seldom injured by the fire. They will run or fly ahead of the flames, find "cold spots" which don't burn, or in the case of small mammals, crawl into tunnels in the ground.

Prescribed burning requires considerable planning and preparation. Fire lanes must be cleared or cut beforehand. Local fire departments and neighboring people are also notified. In some cases, dried brush is piled around the base of trees so they'll catch fire more readily.

The burning is usually done in the spring after there have been at least five consecutive rain-free days. Weather conditions are watched closely. The wind should be light (from 8 to 15 miles-per-hour) and the humidity should be between 30 and 45 percent, with temperatures in the 55 to 75 degree range.

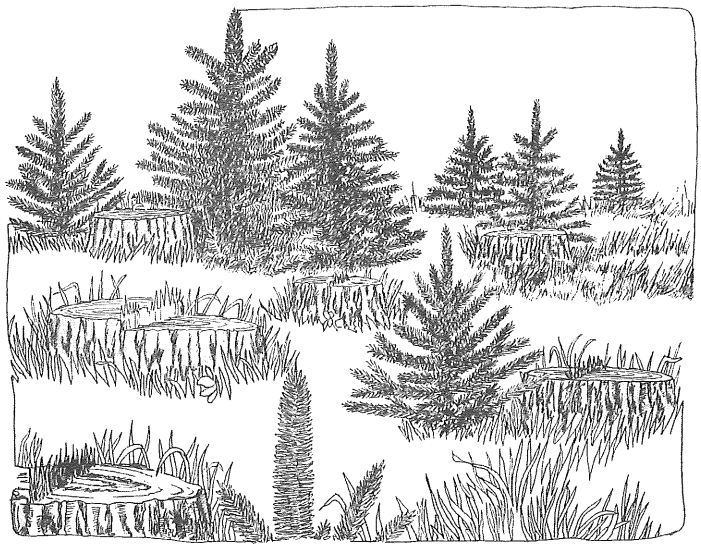
A good-sized crew, perhaps 15 or more workers, is on hand for the actual burning. Bulldozers, shovels, pump trucks, radios and pickup trucks equipped for fire fighting are used to keep the flames within intended boundaries. Despite the preparation, manpower, and equipment, prescribed burning is one of the least expensive (per acre) and most beneficial wildlife habitat management techniques.

Even under favorable conditions, however, controlled burns can get out of hand and spread to other areas of the forest. For this reason, prescribed burning should never be done by anyone except conservation workers who have the knowledge and equipment to handle the job properly.

Smokey the bear still has the right idea when it comes to any other type of fire in the woods.

Written by Pat Hennessy. Illustrated by Don Balfour. Published by the Education Section, Bureau of Information and Education, Minnesota Department of Natural Resources.

TIMBER HARVEST



WHY: To improve the habitat of certain animals by creating forest openings
WHEN: Year-round
WHERE: The forests of northern Minnesota
HOW: By contracting with loggers to clear-cut small areas throughout the forest

To the human eye, a recently clear-cut area of forest is not as pleasing as a magnificent stand of pine or the splash of color on autumn maples.

But to many forest creatures an endless stretch of same-aged trees makes a poor home. Clear-cutting is one answer. When large trees are cut down, sunlight and rainfall reach the ground bringing new life to the forest floor. Flowering plants, bushes and tiny trees sprout and the woodland supermarket is open for browsing by deer, ruffed grouse, bear, and an assortment of other creatures.

In Minnesota, much of the northern forest has grown too old to be ideal habitat for many wildlife species. Over the years, wildlife managers have devised a few techniques for reducing the amount of mature timber, thereby improving wildlife habitat.

One technique involves the cutting or harvesting of timber. Wildlife managers encourage foresters to conduct timber harvesting in a way that is beneficial to wildlife. They encourage clear-cutting aspen and dispersing small sized (not over 40 acres) cuttings throughout the forest.

Wildlife managers are also shifting the loggers' attitude toward aspen. Years ago, aspen was a "weed" tree. Now it is regarded as the most valuable tree in the woods for wildlife and timber.

In most cases, this habitat improvement technique can be accomplished by selling timber to loggers. New forest openings can also be created by contracting with loggers to simply cut all the trees in a selected area and leave the felled trees where they drop. But this method costs more because loggers must be paid to cut the trees rather than paying for the right to remove the timber.

Like most wildlife management techniques that create change, the habitat of some species is destroyed when habitat is improved for others. In this case, the large trees that provide homes for horned owls, squirrels, and a few songbirds are cut down to create forest openings that attract other species (woodcock, ruffed grouse, snowshoe hares, deer, black bear, beaver, and dozens of songbirds and small mammals.)

Young forests have a greater diversity of plants and animals than do old forests. The type and age of a forest determines the number and species of animals that survive.

A clear-cut piece of forest may not fill the human eye with beauty, but it does wonders for the health and welfare of the animals which make the forest—and its openings—home.

Written by Pat Hennessy. Illustrated by Don Balfour. Published by the Education Section, Bureau of Information and Education, Minnesota Department of Natural Resources.

WATER LEVEL MANIPULATION

WHY: To improve the habitat of some animals (especially waterfowl) by preserving or creating marshes, swamps and ponds
WHEN: Summer and fall
WHERE: Primarily in the southern agricultural region of Minnesota
HOW: By using dikes to raise or lower water levels for optimum growth of certain plants and to obtain proper water depths so ducks can feed with ease

Beauty, the saying goes, is in the eye of the beholder. To a man or woman, beauty could be represented by a new car, a painting, or a new coat. But to a high-flying duck, beauty could easily be the sight of a small pond below.

Ducks, as we know, appreciate water. They enjoy splashing down into lakes and rivers, as well as small potholes, marshes, swamps, and even an occasional bog. Ducks find beauty in temporary wetlands created by spring snow melt, where they can rest before continuing north. Some pairs court and breed in and near these small ponds before they dry up.

But true beauty to a duck is a deeper, more permanent marsh. Here, a duck can find the necessities and pleasures of life within a short flight. Migrating ducks can rest and feed as well as court and breed within the confines of the marsh. During the summer, swamps and marshes provide food and rest areas for both adults and ducklings. They can also escape behind the cover of pond vegetation when trouble threatens.

Many waterfowl nests are constructed from marsh plants, including cattails, bullrushes, and grasses. Marsh plants that grow underwater (sago pondweed and wild celery), float (lesser duckweed) or grow above water, (wild rice) are favored waterfowl foods. Ducks, and especially ducklings, get needed protein from insect larvae, insects, and small crustaceans found in shallow water.

Unfortunately for ducks, many people do not find marshes beautiful. To some farmers, wetlands are of little value because crops can't be planted in water. Over the years, farmers have put more and more acreage into crop production by draining marshes and ponds.

In the past, state and federal governments have encouraged wetland drainage through certain agencies which share drainage costs with the farmer. Strange as it may seem, other government and private agencies have been preserving and creating the same types of wetlands for waterfowl.

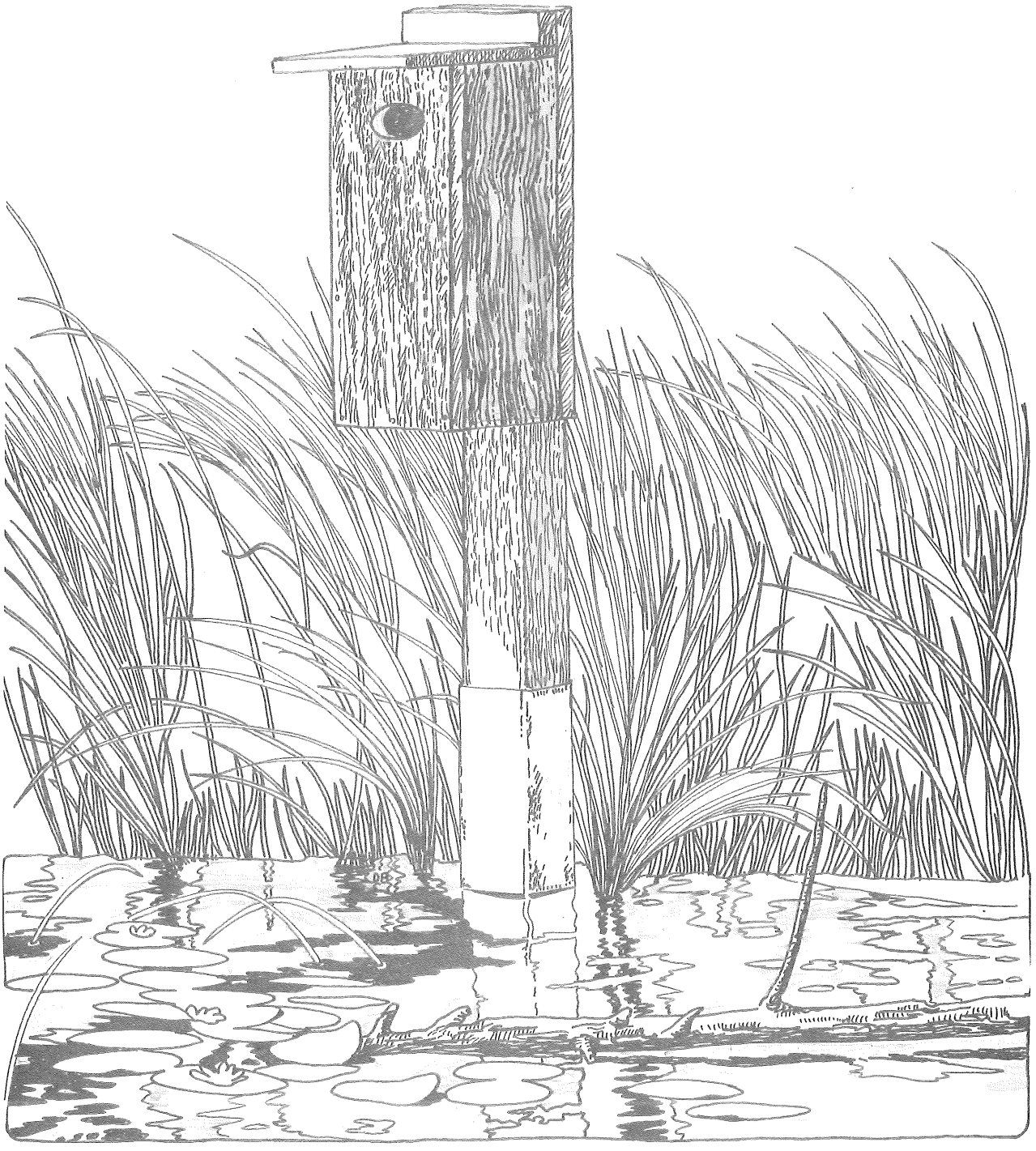
Today, state and federal governments are taking steps to preserve wetlands. The federal Water Bank and acquisition programs have saved millions of acres of wetlands. Minnesota had the first wetlands acquisition program in the United States.

The Minnesota Department of Natural Resources and the U. S. Department of Agriculture assist in the preserving of wetlands and encourage the construction of water impoundments—blocking the flow of water with a dike—to create a pond with the objective of duplicating a natural marsh. Money collected from sportsmen and others has been used to buy marshes and swamps and to construct similar man-made wetlands.

But whether a marsh is natural or man-made, its beauty (or lack of it) is certainly in the eye of the beholder.

Written by Pat Hennessy. Illustrated by Don Balfour. Published by the Education Section, Bureau of Information and Education, Minnesota Department of Natural Resources.

ARTIFICIAL NEST BOXES

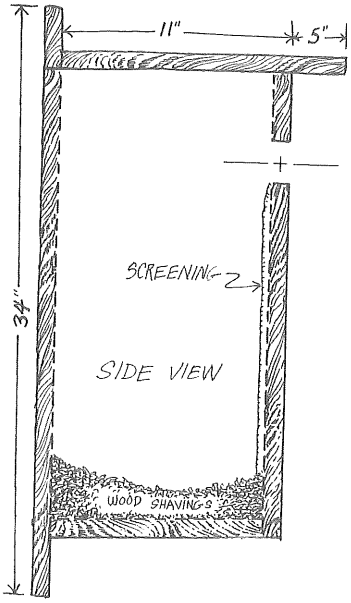


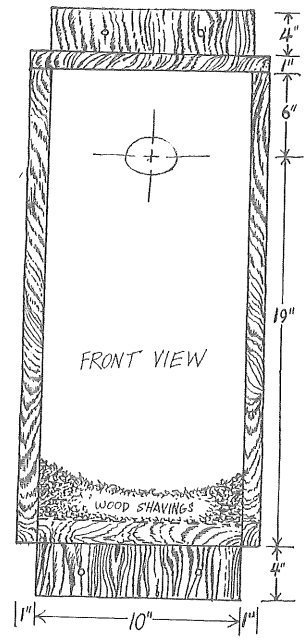
WHY: To increase the number of safe nesting sites available to wildlife

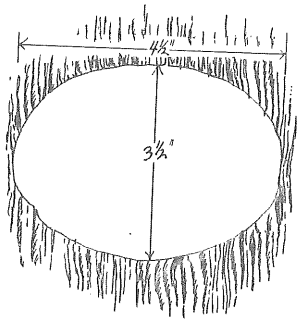
WHEN: Before the nesting season in the spring

WHERE: Throughout Minnesota

HOW: By constructing nest structures and placing them in suitable settings







One of the chief problems facing waterfowl returning north after the winter is finding a suitable spot to nest. Ducks build their nests on or near the water with materials that are often found nearby: bullrushes, cattails or grasses. But one group of ducks nests in trees. The most common tree-nesting duck in Minnesota is the wood duck, though American goldeneyes, common and hooded mergansers, and an occasional bufflehead also nest in the state.

The problem for these ducks is to find a suitable nest tree near water. The tree cavity must be large enough to safely contain the eggs. Sometimes, natural growth of the tree will provide such a cavity, but often, tree-nesting ducks borrow homes built by woodpeckers or other animals.

Within hours after her young hatch, the female will urge her ducklings to climb out of the nest and into the water, where they will remain—with an occasional venture onto dry land—until ready to fly.

In many areas, a solution to the nesting site problem is to provide man-made nest boxes. The Minnesota Department of Natural Resources and many conservation organizations and sportsman's clubs erect boxes near waterfowl nesting areas.

Nest boxes come in a variety of shapes and sizes. All are easy to build.

Here are a few guidelines for building a nest box: It can be made from either wood, metal, or fiberglass and should be about 24 inches deep and 12 inches square with a rectangular or oval opening of about 3½ x 4½ inches. The box should be well off the ground (at least 10 feet) and much consideration should be given to protecting the nest from predators, such as racoons. This can be accomplished by placing the box on a metal pole or by encircling the tree with a piece of sheet metal 38 inches wide. Sawdust or wood shavings makes good bedding inside the box.

The nest box should be placed out of direct sunlight, if possible, as there is some evidence that extreme heat may destroy clutches in certain types of boxes. There should also be a clear flight lane between the nest box and the water.

Duck nesting boxes may also be used by bees, hornets, small mammals and other birds, such as tree swallows or starlings (dyeing the bedding red will discourage starlings from using the nest). The shavings inside the box should be changed yearly.

The construction, placement, and maintenance of nest boxes is a good wildlife management technique for improving the habitat—and the numbers—of some of the most colorful waterfowl in Minnesota.

Written by Pat Hennessy. Illustrated by Don Balfour. Published by the Education Section, Bureau of Information and Education, Minnesota Department of Natural Resources.

FOOD PLOTS

WHY: To provide food (and sometimes shelter) for selected animals during difficult times
WHEN: Planted in the spring, but usually used most heavily by animals during winter
WHERE: Primarily in the southern agricultural zone
HOW: By planting food—corn, sorghum or other grain—near sheltered areas

The ring-necked pheasant, originally imported from Asia, was brought to Minnesota in 1905. By 1922, the ring-neck was well established in the state and by the early 1940s, the statewide fall population was more than five million. From that point on, however, pheasant numbers declined. Today, there are probably fewer than a million birds in the state each fall.

A major reason for the decline in pheasant numbers has been the change in farming techniques. Modern, intensive farming has altered good pheasant habitat. More and more land is under the plow and is left black over the winter. Undisturbed grassland nesting cover has been virtually eliminated in much of the prime pheasant range and row crops (corn and soybeans) have almost entirely replaced small grains in many parts of the state.

In an attempt to slow or reverse the decline in pheasant numbers, state and federal governments have initiated projects aimed at improving habitat and providing food during winter, the most difficult time of year for pheasants.

One pheasant management project provides winter food (and some protection from wind and snow) for the birds. This food plot program was started in 1962. Federal and state agencies developed a cost-sharing practice with farmers under which corn, sorghum, or other grain is left standing near good cover throughout winter.

Through experimentation and study of food plots, wildlife biologists have made some recommendations as to the size, makeup,and placement of food plots in Minnesota's farming region.

Pheasants need protection from winter's cold winds, so food plots should be planted near, and on the south and east sides of trees and shrub-covered areas. This type of food plot is often rows of corn left in a plot at least two acres in size. Where cover is not as heavy, sorghum is usually planted adjacent to corn to provide better cover. This "mixed" food plot should total at least two acres.

The planting of food plots is a wildlife management technique which falls under the heading of "habitat manipulation." By controlling certain elements of an animal's habitat (in this case, winter food and cover), the wildlife manager hopes to bolster the population of a desired species (pheasants in this example).

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NEST COVER

WHY: To create or preserve areas used heavily for wildlife nesting
WHEN: Good nesting cover is essential in the spring and early summer (April-August)
WHERE: Primarily in the southern agricultural zone where intensive farming techniques have destroyed most of the wildlife nesting cover
HOW: By leaving nesting cover unmolested during the nesting season (until after July 31) or planting good nesting vegetation where little or none existed before

Question. Which is the most important source of safe pheasant nesting cover in Minnesota?

1) grain fields
2) pastures
3) alfalfa fields
4) unmowed roadsides

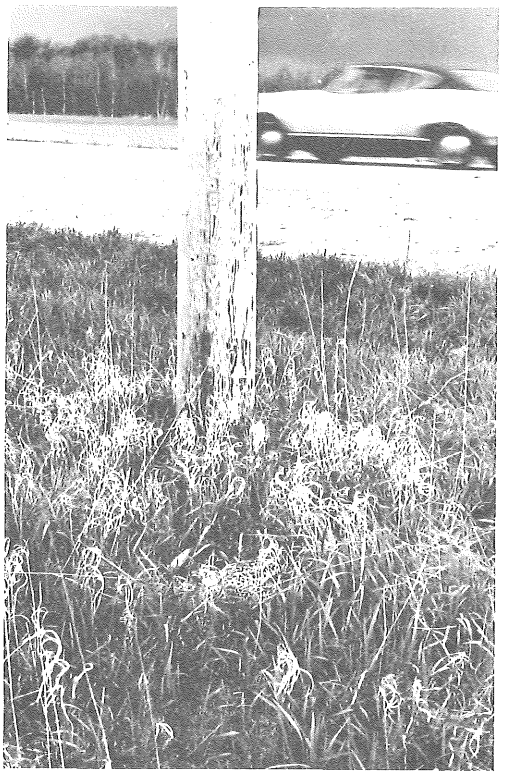
If you answered number four, unmowed roadsides, you are correct. Studies indicate that unmowed roadsides contain more than twice the number of wildlife nests per acre as any other kinds of nesting cover in agricultural zones—even if the other types of cover are available.

Shortly after the turn of the century, when the pheasant was first brought into the state, birds found many suitable nesting sites throughout the farming region of Minnesota. But changes in agriculture over the years—and especially since World War Two—put more acreage under cultivation. Farmers began shifting from the planting of small grains and grasses to row crops, resulting in a decline of pheasant (and other wildlife) populations.

Today, the more than 300,000 acres of roadsides in Minnesota's agricultural zone comprise the only major source of permanent nesting cover for farm country wildlife.

Pheasants usually nest in late April or early May, laying an average of 12 eggs over a period of days. It takes 22-24 days in incubation (warming by body heat) for the eggs to hatch. If a nest is destroyed or the hen pheasant is forced to leave the nest, she may re-nest up to three times. To insure a good hatch, it is important that nesting cover be undisturbed for 35 to 40 days. It should not be mowed or cut until after July 31, *if at all.*

The Minnesota Department of Natural Resources (DNR) has become increasingly interested in preserving and improving roadside habitat. Roadsides play an important part in insuring the future of pheasants, rabbits, Hungarian partridge meadowlarks, and many other songbirds.



Besides studying the affects of roadsides on animal populations, the DNR has experimented with seeding roadsides to improve habitat. The DNR has cooperated with the Minnesota Department of Transportation to publish brochures on the importance of roadsides to wildlife.

Here are a few tips for improving roadside wildlife habitat.

1) Refrain from mowing, burning, plowing, or driving in roadsides between May 1 and July 31.

2) Spot spray or clip only where noxious weeds are a problem.

3) Inform landowners and others about the value of roadside habitat to wildlife. Encourage them to leave roadside ditches undisturbed between May 1 and July 31.

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WILDLIFE HARVEST REGULATIONS

to maintain populations

Every year the Department of Natural Resources publishes hunting and trapping regulations for the upcoming season. The regulations describe legal and illegal methods for taking wildlife, in addition to setting season lengths and bag limits on the number of animals each hunter or trapper can take.

Why have these regulations? For two reasons: First, and most important, is to maintain the species at population levels that insure an optimum spring breeding population. This, of course, means protecting the species from over-hunting.

The second reason is to distribute the harvest opportunity as equally as possible.

Wildlife managers know that too many animals of a certain species can be just as bad as having too few.

Too many deer, for example, can overbrowse an area so that the herd has a difficult time finding food during winter. Many of the animals will be weakened from hunger and the does will produce fewer and weaker fawns whose chance for survival will be reduced.

Too few deer, on the other hand, will not produce enough young to bring the population up to the 'carrying capacity" (the number of animals the land can support) of their habitat.

Wildlife managers use hunting and trapping regulations to keep wildlife populations in healthy balance with their habitat. Proper regulations help insure that there are neither too many nor too few animals in the population.

But how do wildlife managers know how many—if any—animals of a given species should be harvested each year?

Let's take deer, for example. The first step is to determine the hunting success for the previous year. From check station data and mail surveys, the DNR estimates the number of deer taken in different areas of the state. Next, information collected from deer examined at roadside hunter check stations reveals how last winter's conditions effected the herd and the survival rates for deer of different ages.

Wildlife managers also make careful observations during the following winter as to the depth, density, and hardness of the snow as well as weather conditions. Poor weather and heavy snow will limit the range of deer in the winter, hindering their ability to feed, and weakening their condition.

After the snow has melted, managers survey selected parcels of land for deer pellets, or make aerial deer counts (in the agricultural area). This information is plugged into a mathematical formula which gives managers a springtime estimate of the deer population.

Information collected throughout the year, coupled with knowledge of the deer habitat, provides wildlife managers with a good estimate of how many deer can be harvested during the fall hunting season without damaging the herd's abilityto maintain itself.

Hunting regulations can then be set which try to keep deer in healthy balance with their habitat.

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WILDLIFE HARVEST REGULATIONS

distributing the harvest as evenly as possible

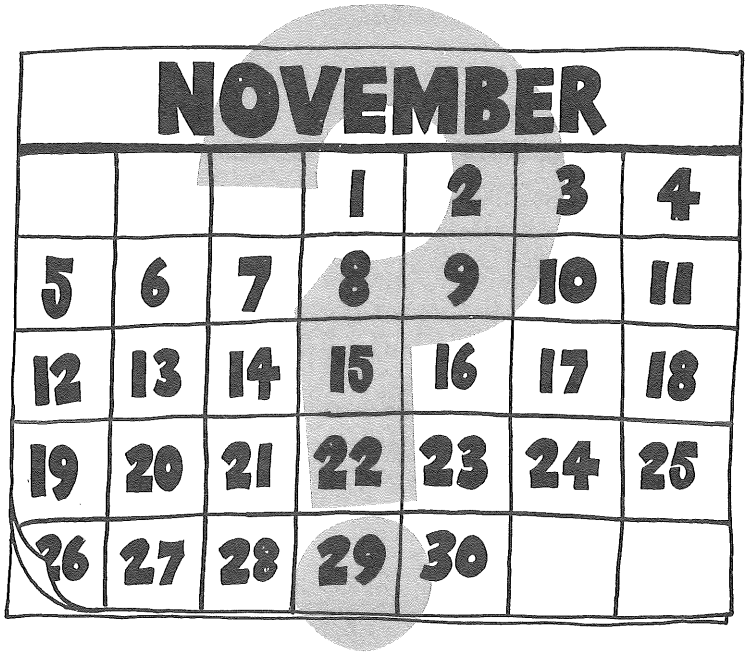
WHY: To distribute hunted wildlife fairly among hunters while providing maximum recreation
WHEN: During the hunting season
WHERE: Throughout Minnesota
HOW: By setting wildlife hunting seasons, limits, and regulations so as to distribute the harvest opportunity for hunters as evenly as possible

There is a saying among wildlife managers and others that 25 percent of the hunters get 75 percent of the wildlife during open seasons. There may be a certain amount of truth in the saying because experienced and knowledgeable hunters should be more successful. But whether it is knowledge, skill, or just plain luck that allows the hunters to take most of the game, it is not a matter of great concern to the wildlife manager.

What does concern the manager is that the *opportunity* for each hunter to take his or her game is as equal as possible. This does not mean that wildlife managers can guarantee a fair share for every hunter, but simply that hunting regulations are devised with equal opportunity in mind.

Take pheasant hunting, for example. Wildlife managers have learned that up to 90 percent of the rooster pheasants in the population can be harvested each fall without reducing pheasant production the following year.

The hen is the key to a healthy pheasant population. A continuing supply of young is assured only when a plentiful number of hens



survive the winter. One rooster for every 15 hens is ample for reproduction, so the number of roosters available during breeding season is much less important than the number of hens.

Over the years, wildlife managers have made other observations about pheasants, hunters and their success, and the agricultural zone where the birds are found.

- Rarely do Minnesota hunters take more than 60 percent of the roosters during the season.
- The lion's share (75 to 85 percent) of the pheasants taken are bagged in the first nine days of a 30 to 40-day season.
- Farmers usually don't have their corn harvested until the last week in October, so they only have time to hunt late in the fall.

With these things in mind, wildlife managers recommend:

1) a roosters-only season each fall;
2) a season as long as possible, regardless of the number of pheasants; and
3) a bag limit, adjusted from year to year according to the pheasant populations, so as to distribute available birds among Minnesota hunters.

If pheasants are plentiful, a large bag limit will provide birds for all. If they are scarce, a smaller limit will give some assurance that the "easy-to-get" birds won't be shot on the first weekend of the season, thus distributing them among hunters, notably farmers, over a longer period.

By setting hunting regulations according to these guidelines, the more skillful (or luckier?) hunter maystill get more birds, but other hunters are at least given a chance at the elusive and tasty pheasant..

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REFUGES

WHY: To provide a place for waterfowl to feed and rest without being disturbed by man
WHEN: Throughout the year
WHERE: Throughout Minnesota
HOW: By purchasing suitable wildlife habitat and managing it for wildlife

The refuge concept is among the oldest tools of wildlife management, dating back to 1536 A.D. That year, Henry VIII, King of England, designated an area near his Westminster Palace to be closed to the shooting of pheasants, herons, and partridges.

Today, the refuge concept is still used by wildlife managers, though it is not the panacea for solving wildlife problems that many people once thought. Sometimes a refuge benefits wildlife—sometimes it does not. For instance, King Henry's refuge is now downtown London! The pheasants, herons, and partidge have long since been replaced by buildings and streets.

Our story of King Henry's refuge is a dramatic example of what can happen to wildlife if the habitat is removed. Still, there are other, more subtle situations which can affect a refuge and its wildlife, often to the detriment of both.

Game refuges have been used in Minnesota since the early 1920s. They have been established on privately-owned parcels as well as public lands. There are very visible yet very subtle differences between the two types.

Because the State does not control the land within a refuge on private land, benefits of the refuge can be eliminated virtually overnight through habitat destruction. Once the habitat is removed, wildlife no longer can survive.

Public refuges, on the other hand, are purchased and managed for wildlife. Recreation activities and developments that would be detrimental to wildlife habitat are not allowed on these sites. However, hunting and trapping, while sometimes restricted, are many times allowed because these uses are an integral part of modern wildlife management, plus they provide quality recreation for thousands of Minnesotans.

State Game Refuges

State Game Refuge boundaries are marked with black and white signs. These refuges are established by three methods: Request of all landowners; public hearing; or when over 50 percent of the land is in public ownership. Of course, a refuge is established only when it is of value to wildlife and not to solve trespass problems.

Minnesota has some 100 State Game Refuges ranging from an 80-acre waterfowl refuge in Cass County to the huge 284-square-mile McGrath Game Refuge in Aitkin and Mille Lacs counties. Most refuges are on private lands. Exceptions are the 65 state parks managed by DNR.

Each year, many refuges are open to hunting and trapping, often to control certain game species. The white-tailed deer is an example of a game mammal whose numbers should be controlled by hunting; beaver is typical of the furbearer types that can be regulated by trapping.

Refuges open to hunting and trapping are listed in the annual hunting regulations. Any refuge not listed in the regulations is closed to the taking of any wild animal and to the carrying of firearms. Permission to hunt or trap on private lands within refuges open to hunting or trapping must be obtained from the landowner.

Two other types of refuges are *State Goose* and *State Waterfowl Refuges*. The lakes and wetlands in these refuges provide feeding and resting areas for waterfowl. These refuges are closed to goose hunting to protect resident Canada goose flocks or all waterfowl hunting to protect migrating birds. Goose and waterfowl refuges are open to hunting and trapping of other game and furbearing wildlife.

Public Refuges

National Wildlife Refuges are owned and managed by the U.S. Fish and Wildlife Service. Seven federal refuges exist in Minnesota totaling more than 150,000 acres. Newest of them is the Minnesota Valley National Wildlife Refuge located on the southern edge of the Minneapolis-St. Paul metropolitan area.

National refuges are purchased with funds generated by Federal Duck Stamp sales; accordingly, all are managed primarily for waterfowl. Usually, portions of each National Wildlife Refuge are open to hunting of certain game species.

State Game Refuges or *State Wildlife Sanctuaries*, which prohibit trespass, have been established within 15 of the more than 1,000 Wildlife Management Areas (open to hunting and trapping) managed by DNR's Section of Wildlife. The WMA system encompasses some one million acres, most providing wetlands for waterfowl and other marsh-oriented wildlife.

WMAs were purchased with money derived from a $2 surcharge on the state small game hunting license though in recent years, some lands have been purchased with general tax revenues.

Refuges within WMAs will soon be officially designated as Wildlife Sanctuaries. These sites will be closed to trespassing during all or part of the year (closure dates will be printed on signs posted on

sanctuary boundaries). Otherwise, WMAs are open to hunting, trapping, bird watching, hiking, and other uses compatible with wildlife management objectives.

The federal government operates a program similar to the DNR's system of WMA's. Called *Waterfowl Production Areas*, these lands are also purchased to protect small wetlands from drainage and provide breeding areas for water-oriented wildlife. WPAs are open to public use, including hunting and trapping.

Within 23 carefully-selected WMAs and WPAs, federal and state officials have established *State Duck Refuges*. These refuges, all with excellent wetlands, are located in five western counties. They are closed from September 1 through the hunting season to provide protection for waterfowl.

Many publicly-managed refuges are established in wetland areas because of their value to waterfowl. However, most offer diverse habitats that benefit many different animals. Species seen in public refuges represent the majority of Minnesota wildlife, from flying squirrels to bald eagles.

Properly-applied refuges can be of great benefit to wildlife, not only deer and waterfowl but to endangered species as well. But even with these populations, natural habitat must be adequate. The words of Aldo Leopold, famous conservationist-philosopher, provide insight into the true value of a refuge: "Wildlife to be conserved, must be positively produced, not negatively protected."

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STOCKING

to establish a new population

WHY: To introduce new species of animals into an area
WHEN: Depends upon the species
WHERE: Statewide, depending upon the species
HOW: By transporting wild-trapped or game farm raised animals to a new location

Are there wild turkeys in Minnesota? If that question were asked around the turn of the century, the answer would have been a definite "no." But the same question today brings the opposite answer.

How did the wild turkey get here? They were stocked in the southeastern part of Minnesota by the Department of Natural Resources (DNR).

Stocking of wildlife can be done for one of two reasons: (1) to establish a species in an area where it is not naturally found; or (2) to provide additional game for hunters's bags. The turkey introduction falls under the first classification.

An assortment of groups and agencies have tried to establish a wild turkey population in Minnesota since 1926. But in the early efforts the turkeys failed to survive and didn't reproduce well, if at all. This was probably because pen-raised turkeys were used in early stocking efforts.

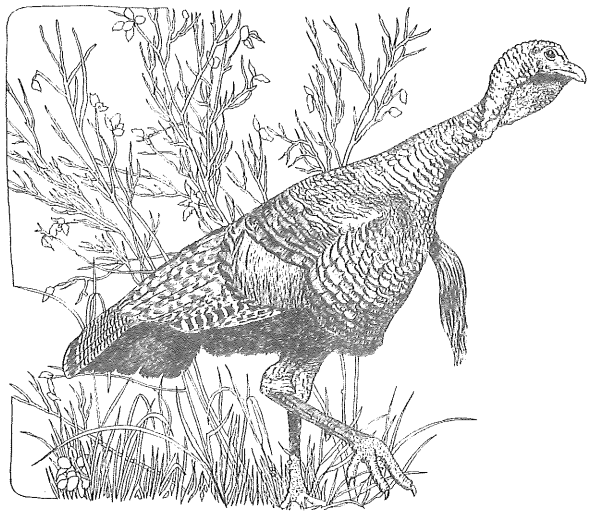
But in the mid-1960s, the DNR tried a different approach. Wild turkeys trapped in the Black Hills of South Dakota and in Arkansas were released in Whitewater Wildlife Management Area northwest of Winona. Later, wild-trapped turkeys were stocked further south in Houston County. The birds were released where there was a mixture of hardwood forest and farmed openings. These turkeys flourished. From a nucleus of 69 birds, the population grew to about 4,500 during the first ten years in their new home. It now appears that wild turkeys are well established in Minnesota.

Stocking a new species is not as simple as trapping them in one area and releasing them in another, however. It requires careful study and planning. The new habitat, for example, must contain food and cover which the animals can use.

In the recently stocked area, the new species may have few or no natural enemies to keep the population in check. In this case, the animal may overrun the area, becoming a nuisance.

Animals imported from other countries may also carry diseases unknown to American species. Wild and domestic animals could become infected if strict precautions are not observed.

Minnesota has benefited from the stocking of some other imported species. The ring-necked pheasant and the Hungarian partridge are examples of birds from across the seas which now occur in Minnesota. However, most attempts to establish a new species are unsuccessful.



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STOCKING

to provide additional game for the bag

WHY: To provide additional wildlife for hunters where the species already exists
WHEN: Usually in the fall, just before hunting season
WHERE: In areas already inhabited by the species
HOW: By rearing animals in captivity, then releasing them in areas where they are hunted

To a wildlife manager, stocking animals can mean one of two things: (1) introducing a species into an area; or (2) adding more animals of a certain species to an area where it is established.

Both types of stocking have been used with ring-necked pheasants. These colorful birds were first introduced into Minnesota in 1905. By the mid-1920s, pheasants flourished in the agricultural region of the state and a hunting season was opened for the birds. Pheasant numbers continued to climb until the early 1940s when the fall population was estimated at more than five million. Then pheasant numbers began to decline.

Throughout the periods of population increase and decline, game farms incubated eggs, reared chicks, and stocked birds. But no amount of stocking could bring the population back to the peak levels of the early 1940s.

Why? Because the carrying capacity of the land—the amount of food and cover it could provide for pheasants—was greatly reduced. Farming techniques changed. There was a shift away from small grains (like wheat) to row crops (like corn). Farmers began plowing fields in fall, creating black seas of dirt which offered no cover or food or birds during tough winter months.

As nesting and winter cover dwindled, the land supported fewer and fewer birds. Newly-stocked pheasants fell easy prey to predators, the elements, and hunters, while their wild counterparts claimed the best available food and cover areas.

It became obvious to wildlife managers that pheasant stocking had become a "put-and-take" situation. Game farm pheasants were "put" into an area only to be "taken" within a short period by the hazards of the wild or by hunters. Very few of the new arrivals survived their first winter. Yet private and public organizations continued to stock pheasants.

If pheasants are stocked just before the hunting season, hunters can harvest a good share of the birds before they die of other causes. This stocking insures better hunting, but it is expensive. The cost per pheasant harvested may be as much as $20.

In recent years, wildlife managers have shifted their emphasis from stocking to habitat improvement. Improving habitat is the only long-range method of increasing pheasant numbers, and wildlife populations in general.

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PREDATOR CONTROL:

Big Game

WHY: Primarily to protect domestic animals from predators, such as wolves and fox
WHEN: Year-round
WHERE: Statewide
HOW: By trapping or shooting "problem" predators that have been taking domestic stock or poultry

Mention the word predator and the average Minnesotan would probably think of the timber wolf. The wolf is the seldom seen—but much talked about—resident of Minnesota's far-north woods. Minnesota is the only state in the U. S. (except Alaska) where this largest member of the dog family is found in sizeable numbers.

An adult timber wolf may measure up to five feet from nose to tail and may weigh as much as 100 pounds. They usually hunt and travel in packs of three to five individuals which may roam 35 to 40 miles in a single day or night.

Wolves avoid people, yet they are considered a nuisance animal by many Minnesotans. It's the wolves' meat diet that gets them in trouble. Their primary food is deer, a fact that displeases some hunters. Wolves also eat porcupines, rabbits, mice, and ruffed grouse—and an occasional domestic animal, which does nothing to endear them to northern farmers.

Years ago, bounties were paid out of public funds for killing wolves and other predators. At first glance, the bounty system seems like a good idea. But it has two big drawbacks: in most cases, it is costly and it doesn't eliminate the problem.

Shooting or trapping of some predators for bounties simply provides more space and food for others to grow up and replace them. Besides, predators play an important role in the natural scheme of things. Wolves, for example, may help to keep deer in check so they won't over-browse the forest in inaccessible areas. By sacrificing a few deer to wolves, the remainder of the herd will have more food.

This concept of wolves as "natural regulators" holds true for other predators as well—most of the time.

Occasionally, of course, a fox will slip into a chicken coop or a coyote may leap a fence to dine on a lamb. In cases like these, the guilty animal can be shot or trapped. This approach to controlling predators is now used in Minnesota. It is known as "direct predator control" and allows state and federal wildlife officers to respond to complaints from citizens by removing nuisance animals. This method has replaced the bounty system in Minnesota as a less expensive and more effective means of predator control.

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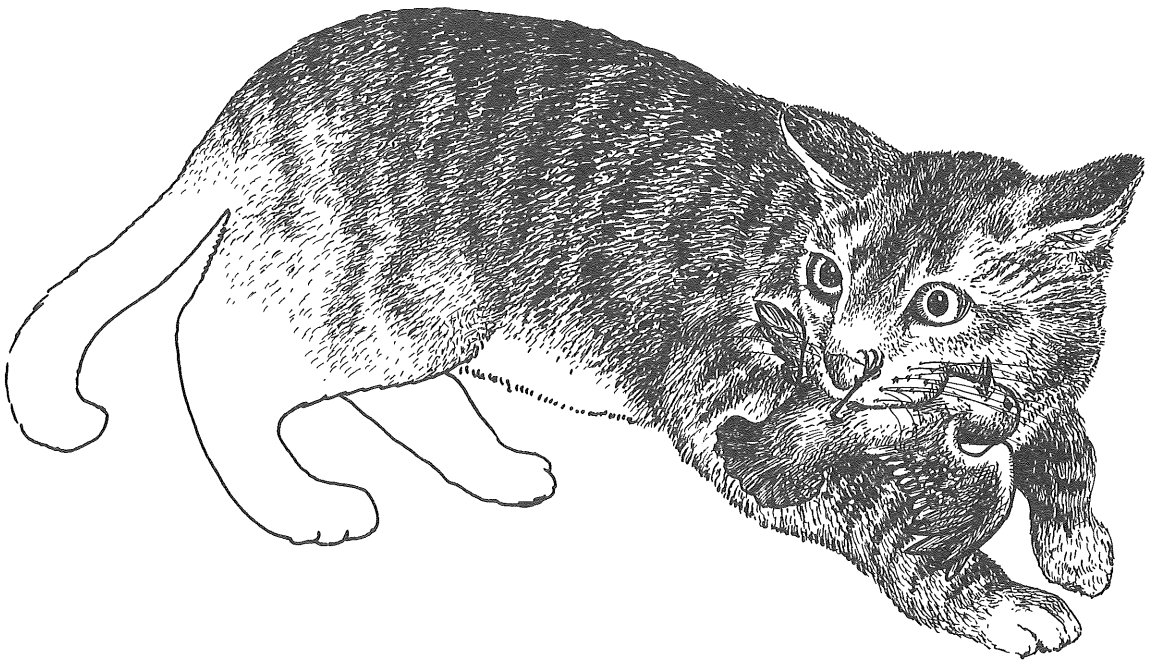
PREDATOR CONTROL:

small game



WHY: To protect small wildlife
WHEN: Year-round
WHERE: Statewide
HOW: By keeping domestic pets at home

Ralph and Alice are holding a family conference in their Minneapolis apartment. The conversation centers on their plans to move into a different apartment. Their new home will be ideal in every respect, except for one detail. The landlord doesn't allow animals and Ralph and Alice have a cat. The cat's name is Fred.

Let's eavesdrop on their conversation . . .

"What are we going to do with Fred?" Alice asks. "I've already tried all of our friends and neighbors and none of them want to take him."

"We could put him to sleep," Ralph replies quietly.

"Ralph! We couldn't!"

"Well," Ralph pauses, "I just don't know what else we can do with him."

"We could give him to the humane society," Alice tries. They are both silent for a few moments as they consider this proposal.

"I've got it!" Alice suddenly exclaims. "Let's set Fred free . . . out in the woods. He can find plenty to eat and . . . "

"That's a good idea," Ralph agrees. After a brief discussion about the best spot to drop off Fred, the couple hurries off to a piece of woods north of the city. After a few parting words, they set the cat free and it scampers into the trees. Ralph and Alice drive back to Minneapolis.

It is now two months later. The woods where Fred lives is turning cold as winter approaches. The cat is stretched out on the limb of a maple tree. There is a wild look in his eyes as he scans the forest. The cat begins licking a back leg, which hangs uselessly from his body. The leg was broken in a fight with a badger earlier in the day. The cat

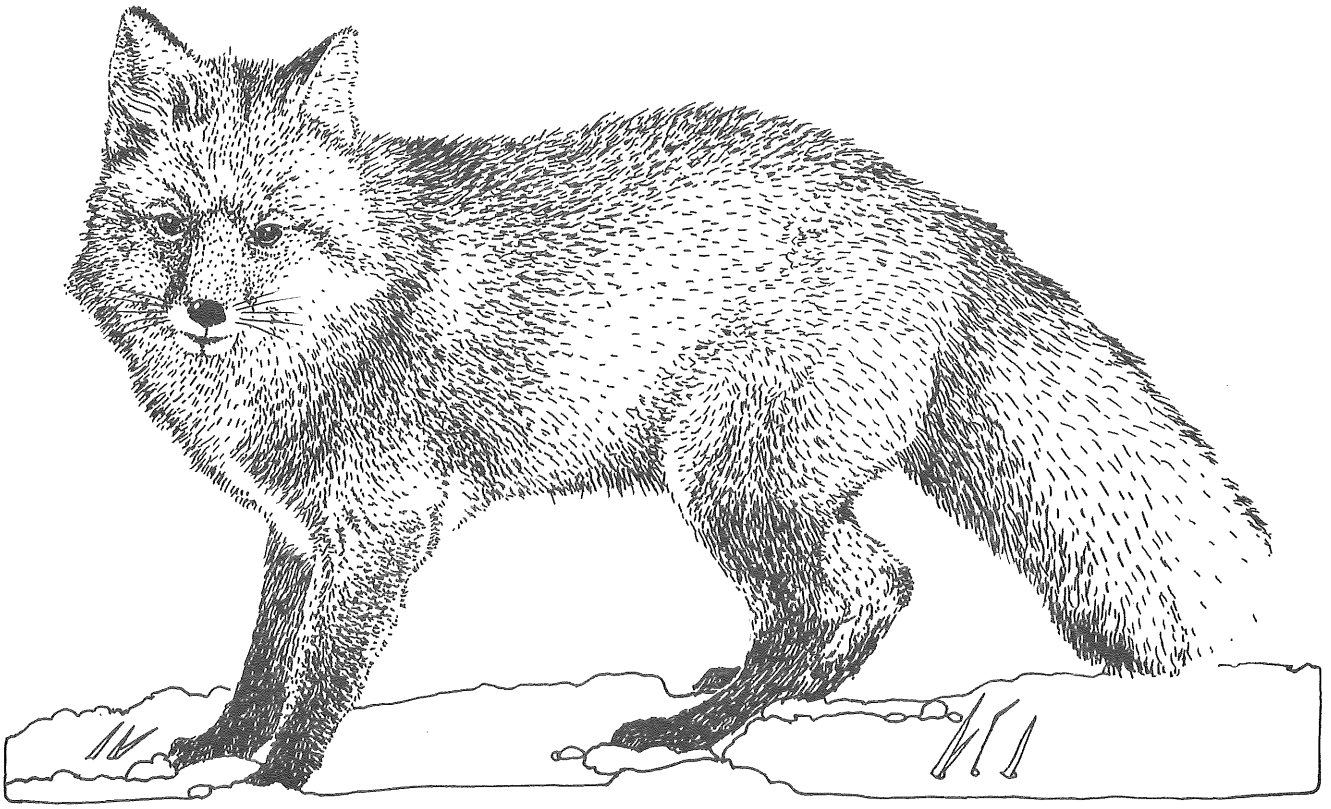
was able to escape, but he will be unable to feed himself.

Although Fred's days are numbered, he left his mark on the woods. During his two months of "freedom," Fred killed a sizeable share of the small wildlife in the woods. Songbirds, ruffed grouse, squirrels, rabbits, chipmunks and mice made up most of his diet.

Ralph and Alice think about Fred from time to time. They think of him as being free. But if they could see the damage Fred wrought on wildlife in the woods, or his pathetic condition, perhaps they would have chosen the humane society or put the cat to sleep instead of setting him "free."

Domestic cats create havoc with the natural inhabitants of woods and grasslands. Even cats that have a home with plenty of food will kill small animals (often songbirds) if they are allowed to roam.

The best place for a domestic cat, Ralph and Alice would have to agree, is indoors—in the home—not in the woods.



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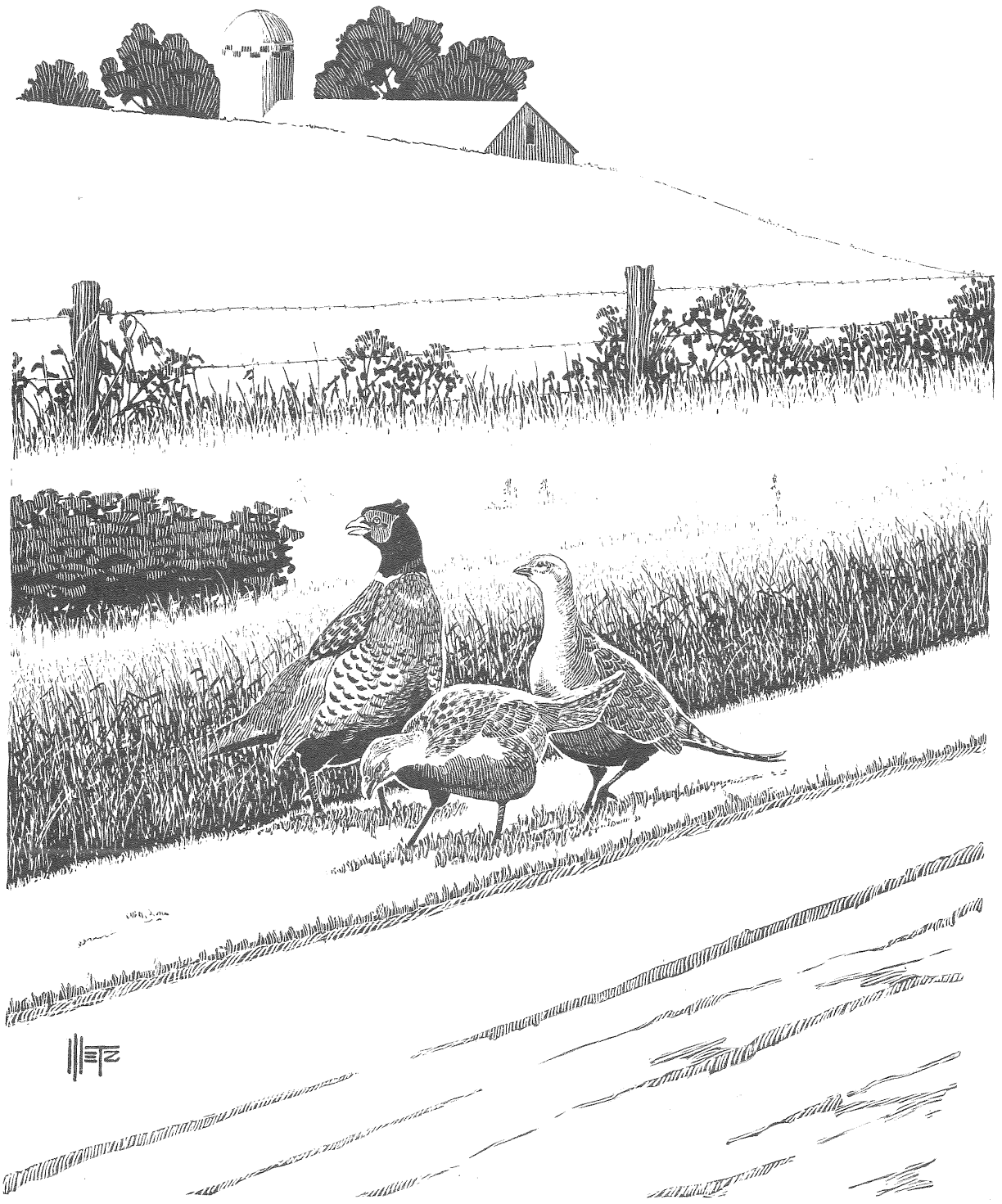
Managing Minnesota's Farmland Roadsides

A Case Study in Wildlife Management



In many areas of Minnesota, habitat changes are benefiting wildlife. However, there is one large area of the state wildlife habitat has been significantly reduced. Much of southwest and western Minnesota—the former "prairie pothole" region—has come under intensive agricultural development. Here, almost everything in the way of cover which has been systematically eliminated, and wildlife species have suffered as a consequence.

The list of changes are familiar. Marshes have been drained, burned, and filled. Woodlots have been cleared. Diverse agriculture has been replaced by extensive plantings of row crops, primarily corn and soybeans, which offer poor shelter for wildlife. Fall plowing has sharply reduced the amount and quality of food and shelter in cultivated areas. Chemical fertilizers have reduced the need for crop rotation, a system which left hay fields available to wildlife. Because farmers are using much larger machinery to work their fields, they are eliminating fences and the strips of weedy vegetation that grew along them.

Many wildlife populations have suffered because of these trends. But the most conspicuous loser has been the ring-necked pheasant. While the pheasant is not native to Minnesota, it flourished in the mix of waste areas and cornfields which typified our farmland areas in the 1940s and 1950s. Within several years after being introduced, the ringneck became the most popular game bird in Minnesota. In 1958, hunters shot about 1,500,000 pheasants. In recent years, however, the harvest has been right around 200,000 to 300,000 birds—about one sixth of the former level. The drastic drop in pheasant populations has been one of the most dramatic—and disappointing—stories in the history of Minnesota's wildlife.

Solutions

Surely, someone should do something to reverse this situation. But what can be done?

Wildlife researchers are quite sure that lack of habitat—particularly nesting, roosting, and winter cover—is the problem. Predators do not take an unacceptable number of pheasants. Even if they did, predator control provides only short-term relief while costing a great deal of money. "Stocking" (raising and releasing pheasants) is also expensive, and does no good in the long term when there is no habitat to sustain the birds. Poaching is minimal, and research shows that sport hunting has no adverse effect on pheasant populations because only excess roosters are harvested.

The obvious solution is improve pheasant habitat. But in the pheasant range, almost all land is in private ownership, and under cultivation. Managers can plead with farmers to leave cover for pheasants, but farmers are businessmen who must make a living. In recent years, farmers have been converting every square foot of land to crop production because of economic pressures.

Are wildlife agencies, then, powerless to help farmland wildlife, particularly pheasants? Not necessarily. Habitat acquisition programs save some important areas for wildlife. These areas account for much of the wildlife produced in some Minnesota counties. But there is not nearly enough money to secure as much wildlife habitat as would be desirable.

Potential of Roadsides

Yet there may be another answer. Following the lead of research done in Illinois, Minnesota wildlife managers have become intrigued with the possibility of managing roadsides—"ditches" to many of us—for wildlife. Ditches are the only lands (except publicly-owned wildlife lands) which may not, by state law, be cultivated. Yet roadsides are far more than just a "last resort" refuge for wildlife. They offer an exciting opportunity to assure a place in Minnesota's agricultural counties for both game and non-game wildlife species.

Wildlife researchers once believed that roadsides were only used for nesting when other cover was not available. Now they know that many nesting animals favor roadsides over other cover types and nesting success in roadsides can be quite high.

Minnesota's pheasant range has more than 300,000 acres of roadside habitat—quite a sizable area. In spite of many adverse conditions in many areas, roadsides currently produce half of Minnesota's pheasants.

Yet the potential goes far beyond that. Wildlife production in roadsides continues good though only three out of every ten miles of roadside cover provides good cover for wildlife. If those other seven miles could provide suitable nesting cover, current roadside production could be doubled. Studies conducted in Illinois prove this to be a realistic goal.

Why is 70 percent of Minnesota's roadside acreage unsuitable for wildlife? Ditches are burned, sprayed with herbicides, gouged up by farming operations, mowed and used as shortest routes to fields. Of all these practices, the most harmful is untimely mowing.

Although mowing threatens all roadside nesting wildlife, researchers are more knowledgeable about its impact on pheasants. At best, untimely mowing eliminates cover, disrupts the nest, destroys the eggs and forces the hen to nest somewhere else . . . if she can find a place. But if mowing comes just before her chicks hatch, the hen will often refuse to abandon her nest. Then she will be destroyed along with her nest.

Local pheasant populations are poorer each time a hen is lost because along with her the dozen chicks she might have added are also lost.

Minnesota farmers who use roadsides as a source of hay usually try to mow three times a year. It often works out that the first mowing coincides with the most critical period of pheasant nesting in June.

Mowing constitutes a direct threat to roadside wildlife, but careless farming, burning, and herbicide spraying do a lot of damage too.No animal can

live, let alone reproduce, in a roadside which is devoid of vegetation. When herbicides are indiscriminately spread over roadsides, valuable cover is destroyed. Burning can have a similar effect. Careless farming can flatten the cover when heavy farm machinery is driven into roadsides. Or sometimes machinery is allowed to sweep into roadsides while being turned, scraping the soil and encouraging undesirable vegetation to spring up.

Roadside wildlife production would increase markedly if these practices could be discontinued.

Beyond that, it is possible to actually manage roadsides for wildlife. This does not require a great deal of public expenditure. Brome and alfalfa can be planted to create ideal nesting cover. Roadsides with these plants are also visually attractive. Brome and alfalfa will eventually dominate the roadside, crowding out undesirable "noxious" weeds such as Canadian thistle. This reduces the need for expensive mowing and spraying operations to control these plants. Soil erosion would be reduced and the roadsides could serve as an emergency reservoir of hay for farmers.

Legal Problems

Sounds good, doesn't it? So why don't Minnesota wildlife managers seed farmland roadsides to create havens for wildlife? The answer to that question is complex. To see why, we should first ask who owns Minnesota's roadsides.

If (as in some states) roadsides were all publicly owned, it would be administratively simple for the state to establish a uniform roadside management policy. But there are four kinds of roads and highways in Minnesota: federal, state, county, and township.

The state controls roadside management along all federal highways and about half the mileage along state highways. But local governmental units, county and township boards, manage 90 percent of the roadside acres in Minnesota's farmland counties. This situation is further complicated by the fact that true ownership of the roadsides is sometimes held by a governmental unit and sometimes by the adjacent landowner.

It amounts to this: almost all farmland roadside acres in Minnesota are controlled by township boards, county boards, and individual landowners. There are about 50 county boards in the pheasant range, over 1,000 township boards, and over 100,000 landowners. Wildlife managers can not direct them to manage roadsides in any particular way. Some would eagerly cooperate with a wildlife-oriented roadside program, and some would oppose it. The tangled jurisdictional control of roadsides makes it difficult to implement any kind of policy.

Another problem is a state law which requires those responsible for roadside management to eradicate noxious plants. The state publishes an official list of noxious weeds which must be suppressed. It is often convenient for those doing the controlling to mow or spray all vegetation, whether or not the plants are on the list. Wildlife suffers.

Opposition

Why do local governments and landowners oppose wildlife roadside habitat programs? There are economic reasons for mowing roadsides, and there is a whole set of attitudes which lead to antagonism toward such a program. That is to say, there is a "money problem" and a "people problem."

The hay growing in roadsides is not a valuable crop, but it is an important one for some farmers who feed cattle. Few farmers make a profit growing and harvesting hay, yet it is needed. Most farmers have converted their lands to cash-producing row crops. Often they get most of their hay from roadsides. They may regret that mowing disrupts pheasant and songbird nesting, if they are aware of it, but they understandably think of their cattle first.

Many farmers and local officials spray or mow roadsides to make them look tidy. Not everyone agrees, however, that a close-cropped roadside is more attractive than one with a lush stand of alfalfa and brome. Yet, to many people an unmowed roadside looks unkept. Many miles of roadside are mowed for essentially the same reason city dwellers cut their lawns.

Good habitat — this grassy roadside provides lush nesting cover.

Poor habitat — Above, a burned roadside and at right, road edge that is being cropped.

Farmers are also reluctant to allow tall growths of hay to stand for long periods of time, because this makes roadsides "unproductive." Everything in a farmer's training makes him eager to see land producing crops of some sort.

Tradition is another problem. Unlike states where roadsides are public land, in Minnesota the tradition calls for roadsides to be mowed by the adjacent landowner. Because farmers think of roadsides as extensions of their own property, they feel free to drive over roadsides with their equipment.

When wildlife researchers tell local governments they can save money on weed control by managing roadsides for wildlife, another problem arises; that is, distrust of state officials, especially wildlife professionals. Farmers and local board members are very independent people. Some view "expert advice" from state government spokesmen with a measure of disbelief, and guard their right to run things their own way.

County boards, in particular, frequently find themselves in opposition to state government. And the reluctance to cooperate is particularly marked toward wildlife officials. Wildlife managers have long made themselves unpopular by opposing wetland drainage projects and criticizing farmers for using their lands in ways which hurt wildlife. It is hardly surprising that farmers, township and county boards are dubious when biologists tell them that wildlife-oriented roadside management will cut their noxious plant control expenses.

Future Prospects

In view of all the problems, it might appear that Minnesota's roadsides will continue to produce less than half as much wildlife as they could. Yet, in spite of the problems, the future is not quite that discouraging.

A landowner opinion poll reveals that about two thirds of the landowners in the pheasant range would cooperate with a wildlife-oriented roadside program. Most of those who would not cooperate indicated they could not accept the appearance of unmowed roadsides. A smaller group said that they need roadside hay for economic reasons. Those who need the hay for cattle will probably continue to mow in future years, but they represent only one landowner in ten. Those who oppose unmowed roadsides for aesthetic reasons might find, when they become accustomed to them, that their objections will fade.

County and township boards which spray or mow to control noxious plants represent a different kind of problem. Demonstration projects are underway to show the effectiveness of noxious plant suppression through planting alfalfa and brome. If these projects show a real cost savings over traditional weed control practices, many county and township boards will be quick to ease pressure on their budgets.

Currently, the Minnesota Department of Transportation makes allowances for the needs of wildlife in its management of roadsides along federal and state highways. Extensive mowing is held back until after July 31, when about 90 percent of the hen pheasants have successfully hatched their broods.

Research and public information efforts continue. Since much of the existing research has been done in other states, it must be duplicated here to show how well it will work in Minnesota. And many Minnesotans still have not heard how important roadsides are to the future of wildlife.

Roadsides cannot by themselves keep rural Minnesota supplied with all the beauty and recreation that songbirds, rabbits, and pheasants provide. But without help from roadside habitat, Minnesota's farmland wildlife faces a very grim struggle for survival. Proper management of roadsides could do a great deal to tip the odds in favor of wildlife.

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