

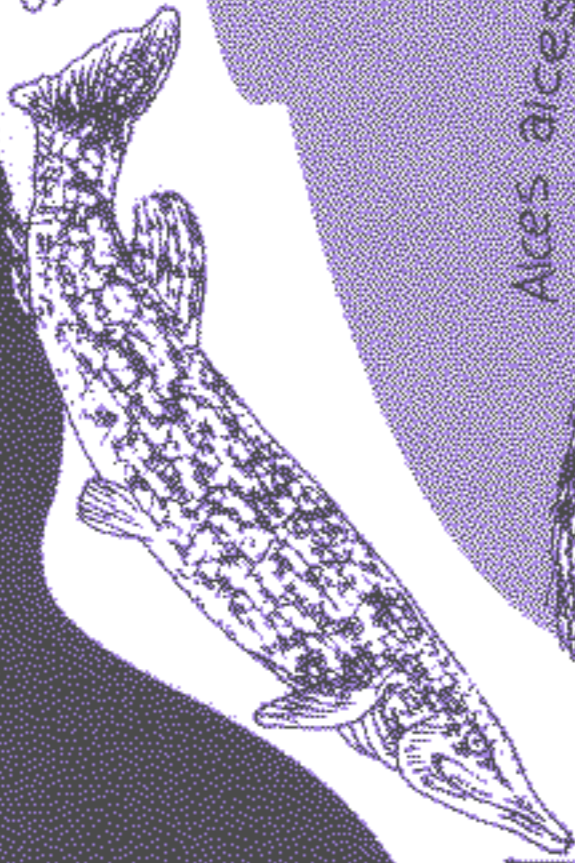


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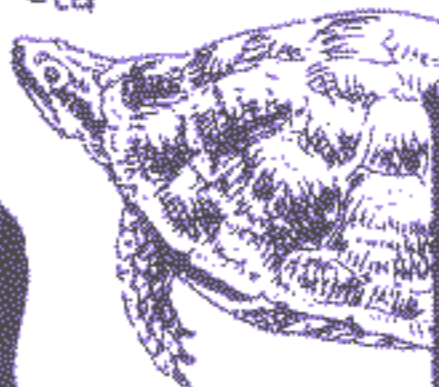


Basitarchia archippus

Esox lucius



Chrysemys picta



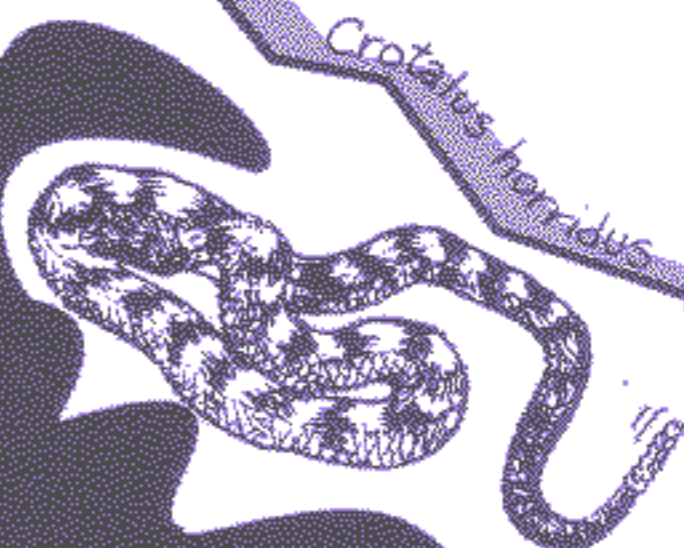
WILDLIFE

The Links of Life

DIVERSITY



Speotyto cunicularia



Crotalus horridus

Who is linked to Minnesota - and you?
Answers on back cover

Introduction

Welcome to Minnesota's Diverse Wildlife!

We all know the saying, “variety is the spice of life.” Here in Minnesota, our variety, or diversity, of plant and animal life is great. Did you know that there are 242 kinds of birds, 81 kinds of animals, 140 kinds of fish, and 48 kinds of reptiles and amphibians living in Minnesota? We have even more insects, more than scientists have been able to identify, at least 145 kinds of butterflies alone. This rich diversity is the “links of life” to the abundance of Minnesota’s wildlife.

Why should we care about preserving Minnesota’s wildlife? Because we hold the keys to the future, it will be our responsibility to care for the earth. Plants and animals are valuable to us in so many ways. Plants produce the chemicals that become part of the air we breathe. Some plants and animals produce compounds that can be used in drugs for treating heart disease and cancer. We’ve also discovered that they can serve as an early-warning system: chemicals that have killed plants and animals can also be threats to human life.

The first step to preserving our world is to learn about the life around us. A wildlife biologist named Aldo Leopold wrote, “The first rule of intelligent tinkering is to keep all the pieces.” In this book we’ll explore the pieces—the links of life—and learn about what they need and how they grow. We know you will enjoy learning more about the world around you, so that you and Minnesota’s wildlife continue to grow strong and healthy.

Sincerely,

Lauren Wemmer, M.S.

Stephan P. Carlson, Ph.D.

MINNESOTA'S WILDLIFE DIVERSITY

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Chapter 1

Wildlife Populations

Have you ever wondered how many mice live in the log pile in your yard? How many mice inhabit the old leaning barn down the road? The number of animals in a specific area is called a **population**.

There are different ways of calculating a population. A common method is to take a **census**. A census is an exact count of every animal in a population. It's most accurate when the animals are easy to see and are found in limited areas.

Sometimes it's impractical to count animal populations, so managers **sample** populations instead. Sampling is not an exact count — it's an estimate. In a sample, animals in just a portion of the total area are counted. This number is then used to calculate an estimated total population. For example, a sample of ducks on a pond would be estimated by counting the ones on half the pond and doubling that number. Yearly population samples or census

show if the wildlife population size is changing. This is important because if the population is decreasing, the habitat might need improvement or hunting might need to be restricted. If the population is increasing, hunting or food control might be increased.

Activity:

If there were 120 ducks on half the pond then there should be about _____ on the entire pond.

A. How Does Your Population Grow?

Wildlife managers need to know how a population grows. To be able to measure they must know how many animals are added to or subtracted from the population each year. By knowing how quickly the population grows or shrinks, the future size of the population can be predicted.

Wild Facts

How high can you count?

Every 10 years a human census is taken by the U.S. government to show how the population has changed. Knowing the population of cities and states is important when the government distributes money and resources. The census also helps to determine the number of representatives in Congress from each state.



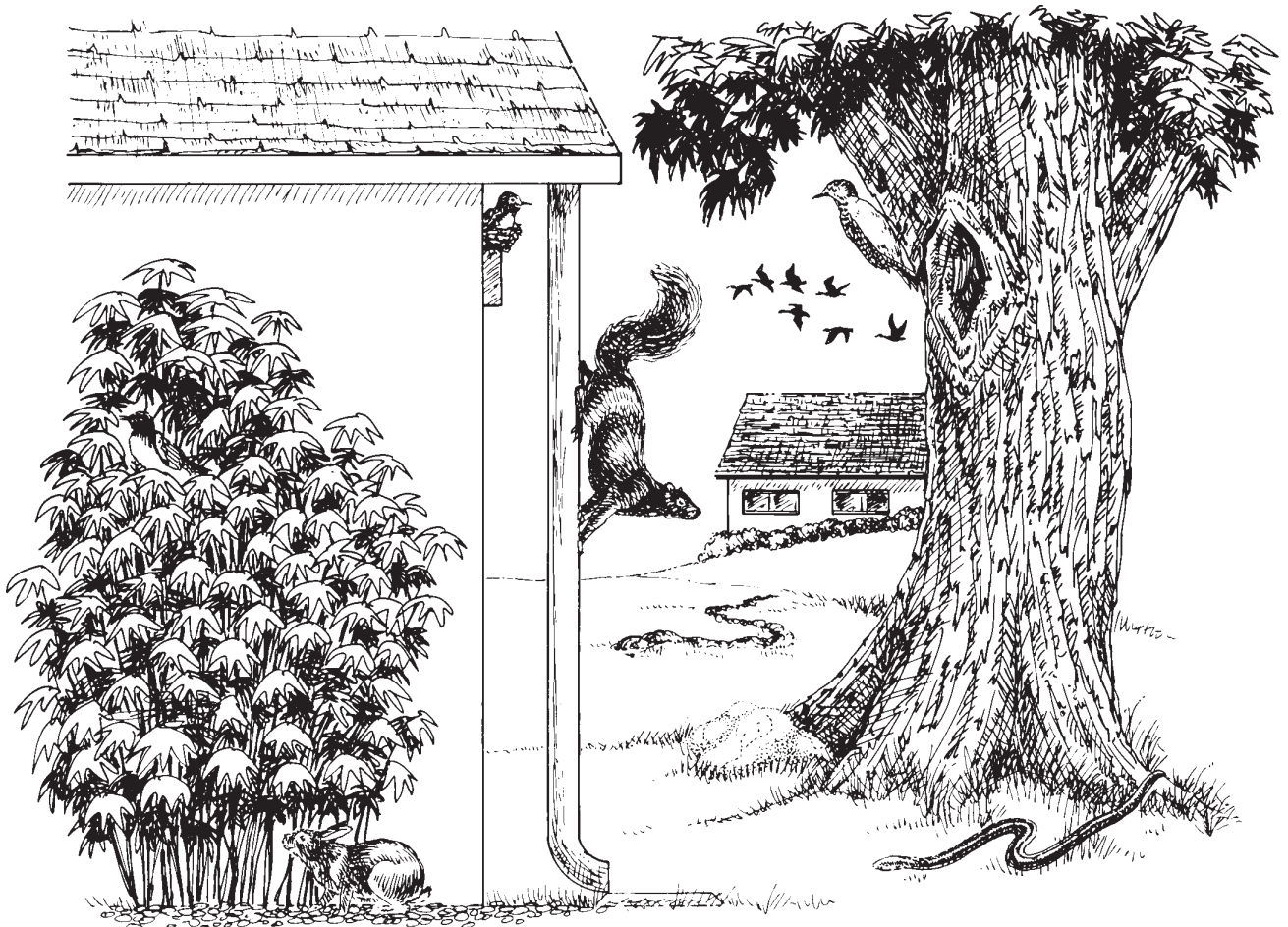
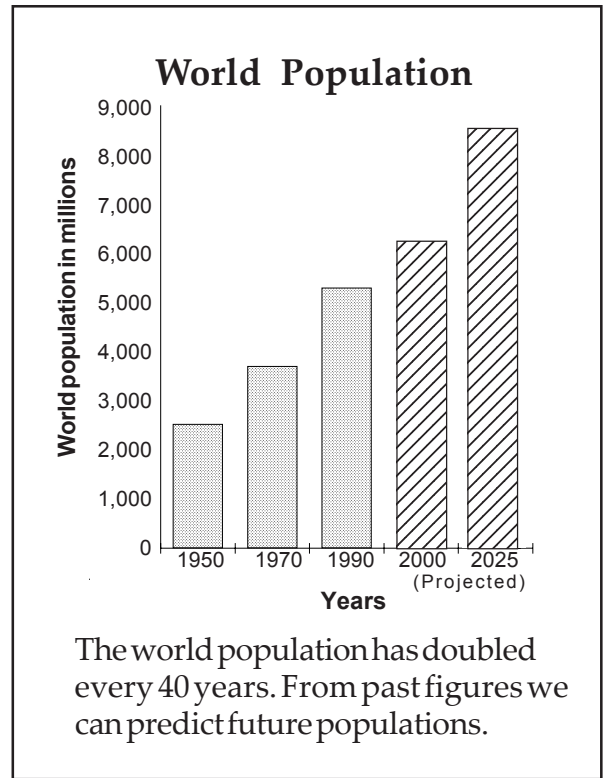
Activity 1: Population in Your Neighborhood

Conduct a census in your own backyard or neighborhood.

You will need:

- Notebook
- Pen or pencil
- Binoculars (optional)
- Record sheet from back of this booklet (Appendix A).

1. Choose a kind of animal that lives in your neighborhood. Pick a type that is easy to watch, like robins, ants, squirrels, or people.
2. Decide on the size of the area you are going to sample from the study area. If you choose large animals, such as people, use your whole block.
3. Count the number of animals in your sample area. If you choose a small animal like an ant, use a 10-foot by 10-foot area. Now, multiply your count by two. Is this number close to the total population? Why do you think the numbers are different? Which number is more accurate? Which population count was easier to make?



Activity 2: Turtle Town Tale

Let's calculate what the total population of Turtle Town will be after certain changes occur.

1. Two events increase populations:

- Birth
- Immigration

Every time an animal is born, it's added to the population. The total number of animals born to a population each year can be counted or estimated.

Rodents such as mice may have about five babies in a litter and have several litters per year. On the other hand, elephants have just one young every two years. Painted turtles lay from two to twenty eggs a year, but they don't all survive to become adults.

Another event that increases population is **immigration**, or when animals move into a new area. Animals leave their homes to find new ones if their old habitat is too crowded, if they can't find a mate, or if their old habitat is destroyed. Leaving an old habitat is called **emigration**.

2. Two events decrease populations:

- Death
- Emigration

When an animal dies it is subtracted from the population. Animals die from old age, starvation, disease, predation, or accidents. Sometimes the beginning of life is the most dangerous because young

animals are easier for predators to catch.

The original population in Turtle Town was 100 turtles. What is the population now? Did it increase, decrease, or stay the same?

$$\text{Population Growth} = \text{Birth} + \text{Immigration} - \text{Death} - \text{Emigration}$$

- Turtles hatched in Turtle Town this year = 100
- Turtles immigrating to Turtle Town this year = 10
- Turtles dying in Turtle Town this year = 50
- Turtles emigrating from Turtle Town this year = 50
- Population growth = $100 + 10 - 50 - 50 = 10$

The population was originally 100 and increased by 10 turtles.

There are now 110 turtles in Turtle Town, and the population is growing.

What would the population be if there were:

- 50 births
- 50 turtles immigrated
- 100 died
- 20 emigrated

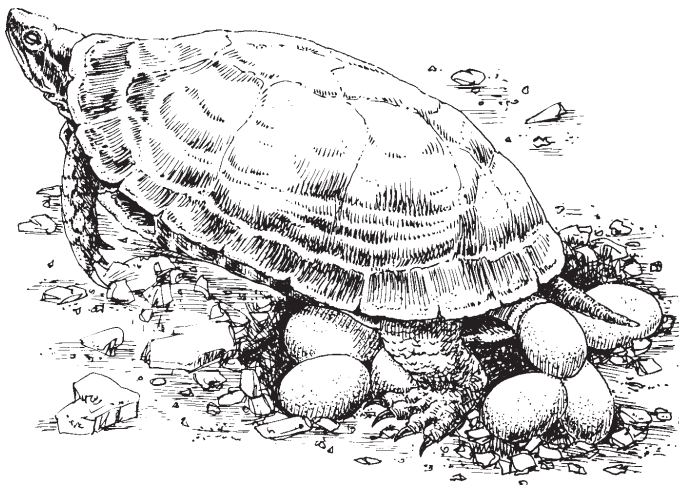
Answer: _____

The new population is: _____
(increasing, decreasing)

(See page 4 for answers)

"Minnesota's Population"

Births in MN in 1991	=	67,020
Deaths in MN in 1991	=	68,378
Total # people emigrating from MN in 1980-1985	=	418,600
Total # people immigrating to MN in 1980-1985	=	352,600



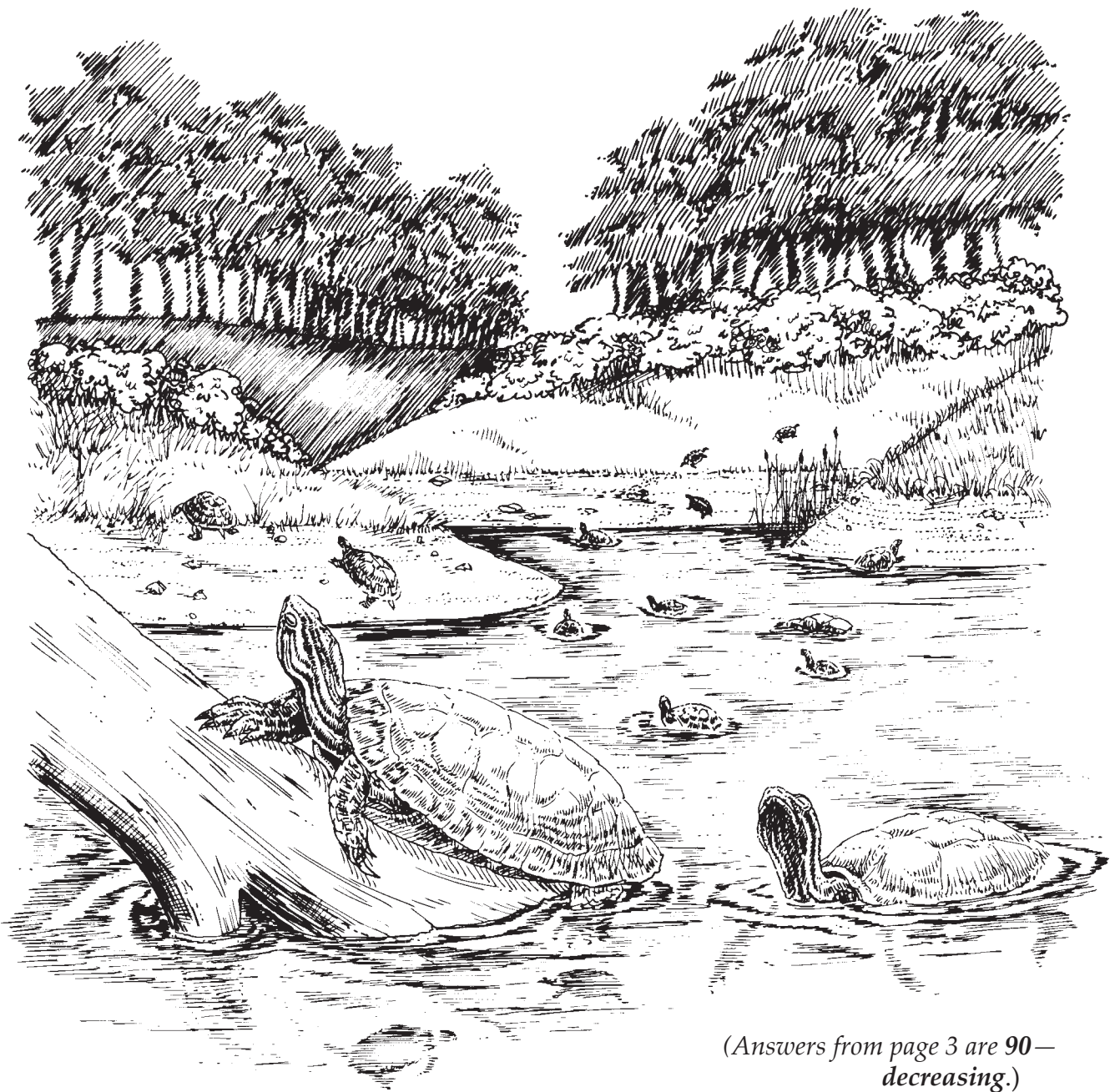
B. Carrying Capacity

A **habitat** is the place and conditions where an animal lives. Habitat provides the important needs of animal life: food, water, shelter, and space. But a specific area of habitat contains only limited supplies of these things and can support only a limited number of wildlife. Similarly, the earth can only support a certain number of people (although experts disagree on the estimated number, many estimate 15 to 20 billion). This number is the earth's carrying capacity. When a habitat's carrying capacity is exceeded, either the environment or the wildlife is harmed.

The carrying capacity of a habitat for wildlife often decreases in winter when there is less food and cover. In spring, when most animals are born, it increases as more food becomes available.

Turtles hatch out in late summer, which is a difficult time for turtles in Turtle Town because there usually is less water available. Small ponds dry up and larger ones shrink as the summer passes. The carrying capacity of an area may be the lowest for turtles at this time.

If there are more turtles than the carrying capacity of the habitat, some will have to leave the area or they will die.



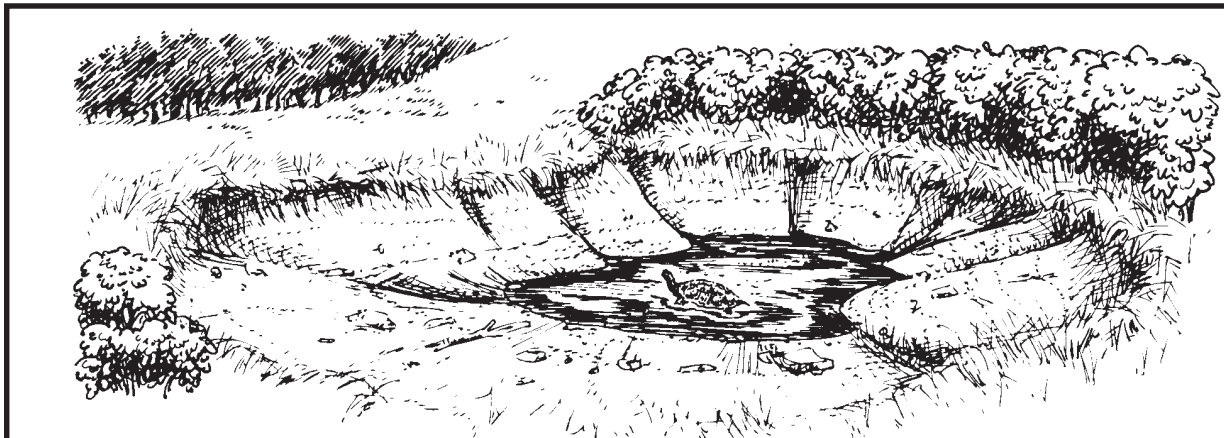
*(Answers from page 3 are 90—
decreasing.)*

Activity 3: Turtle Predictions

Fill in the blank next to each description with one or more of the four parts of the growth equation (birth, death, immigration, emigration) that you think will most likely happen to the turtle pond described.



Pond A being filled



Pond B drying up



Good food in pond C

C. Predators and Prey

Did you know that robins are predators? After rain, robins search grassy areas for worms. In the evenings, bats swiftly stalk insects. Hawks soar through the sky searching for mice to eat. Many animals hunt and kill other animals to eat. These animals are **predators**. The animals that are killed and eaten are called **prey**.

Which came first, the chicken or the egg? Predators and prey influence each other. If a prey population is high, more predators survive because they have more food. The carrying capacity for the predators increases. As the number of predators increases, they eat more and more prey and prey numbers drop. The carrying capacity of the predator then may decrease because they have over-hunted the area.

Activity 4: Who Preys with Whom?

Fill in the chart below of predators and prey. Add at least three new predator/prey relationships.

Predators	Prey/Predator	Prey
Hawk	Squirrels	Nuts
Robin	Worms	Soil
_____	Mice	_____
_____	Grasshoppers	_____
_____	Moose	_____
_____	Mosquitoes	_____



Wild Facts

Only the strong survive

Predators often catch and kill the weakest animals in the population. Biologists think that wolves tend to kill young, old, weak, or injured moose and deer because they are not able to swiftly escape wolf attacks. The wolf is actually strengthening the moose population by removing the old and sick and leaving the healthiest to have young.

D. Linked Together

All forms of life are interconnected in a "links of life." Predators depend on prey, and prey, in turn, depend on other prey or plants for food. Even plants need insects and animals to pollinate them. Some links are simple and some are complex. Each time a part of the link disappears, the system changes and becomes less stable. If an important link disappears, the whole system may even fall apart. A healthy environment is one that has all of its parts.

People also are part of the "links of life," and we depend on many other life forms for our survival. Plants produce oxygen that we need to breathe. Bacteria help to decompose the wastes we produce. Medicines often come from wild plants and animals.



A Caution to Everybody

Consider the auk;
Becoming extinct because he
forgot how to fly, and could only
walk.

Consider the man, who may
well become extinct

Because he forgot how to
walk and learned how to fly
before he thought.

- Ogden Nash

From: **I Wouldn't Have Missed It. Selected Poems of Ogden Nash.** Boston and Toronto: Little, Brown and Company (Canada) 1975.

Activity 5: The Food Chain

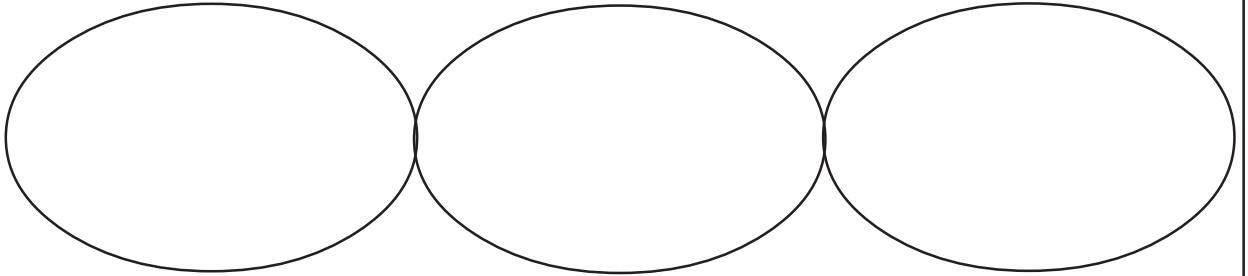
Draw a picture of what you ate for breakfast this morning. Now try to trace your food back to its original sources. Try to list at least one other animal that might use the sources of your food.

For example:

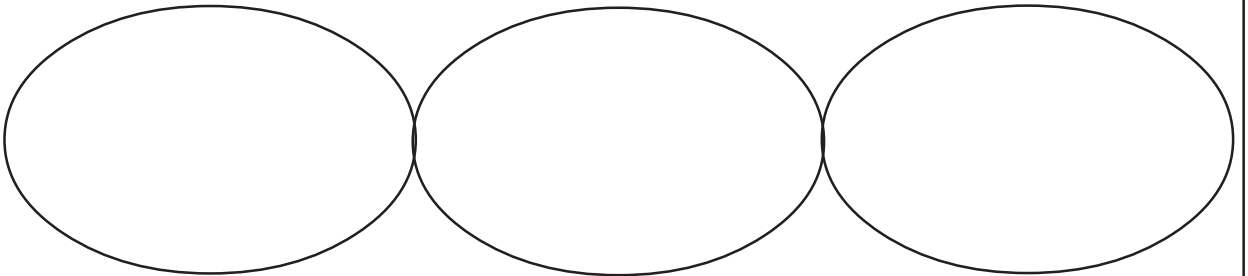
1. Eggs—chicken—fox
2. Toast—flour—wheat—beetle
3. Jelly—sugar—sugarcane plant
4. Applejelly—apple tree—worms

Do the same thing for lunch or dinner.

Breakfast



Lunch or Dinner



E. Population Cycles

A **population cycle** happens when populations of animals show a regular pattern of population increases and decreases. You can see how this works by graphing a white-tailed deer cycle in Activity 6.

Ducks, pheasants, songbirds, and many other animals have cycles that fluctuate up and down. An annual (yearly) population cycle mostly occurs in wildlife that have young only once a year. Turtles, mice, and some birds have young several times a year and do not have this same pattern of population change.

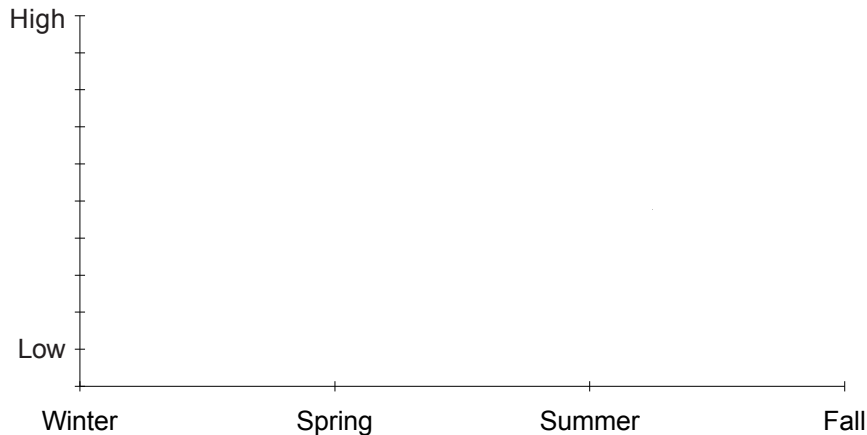
Some animals have population cycles of several years as well as an annual cycle. For example, ruffed grouse populations have a cycle of about 10 years. The population may start out low, then become high, and finally after 10 years be low again. No one

is certain why these populations cycle like this. There are probably many factors involved, including weather, disease, predators, and food sources. And not all animal groups cycle in a particular way.

Although humans reduce wildlife populations through hunting, not all human activity reduces animal populations. In some cases, animals are introduced into an area to increase the population. When game animals are added to the population every year, it is called **stocking**. Pheasants, quail, and a variety of fish are stocked in the Lake States. When animals are brought back to an area where they once lived, it is called a **reintroducing**. Moose, peregrine falcons, trumpeter swans, and wild turkeys have been reintroduced into the Lake States. Can you think of some situations when reintroducing would be a good wildlife management practice? Situations in which it would be bad?

Activity 6: Plot the Deer Population Change

In winter, many deer die and the population is low because of cold weather and limited food supply. In the spring, when fawns are born, the population increases. Put an x on the line for spring at a high level. During the summer, most deer are healthy, but many young animals are vulnerable and die from predation. Put an x on the line for summer between medium and high population levels, and put an x for winter at the low population level. Draw a line connecting the x's to plot the yearly change in population.



Wild Fact

White-tailed deer in Minnesota

There are about a million deer in Minnesota. On average, deer live to be 7 to 15 years old. Of course, in areas of the state where hunting is high and winters are severe, the average life span is much less. Deer populations cycle every several years, but no one is really sure why. In the 1970s, in northern Minnesota, the deer population took a nosedive. Biologists believe that several severe winters in a row, increased hunting, and an increase in the number of wolves were responsible for this population crash.



F. Extinction—The Land of No Return

Extinction is a natural process that has been occurring since life began. As the earth changes in climate, disease, and food supply, some species can't adjust to changes and die off. New species take the places of the extinct ones. Over the earth's history extinction has occurred slowly. During the great dinosaur die-off, the rate of extinction was only one species every thousand years!

Why worry? If extinction is a natural process, why should we care about animals and plants disappearing?

In the last 300 years the human population has increased very quickly; consequently, the rates of extinction for other species have also increased. In fact, the extinction rate has increased more than 1,000 times since modern humans showed up.

Plants and animals do not suddenly become extinct. Instead, their numbers slowly decline. Scientists have names for the different stages that species go through as they head for extinction: rare, threatened, endangered, extirpated, and extinct.

Wild Fact

Spots and stripes

Maybe you or your dog has encountered a striped skunk, but did you know there are skunks with spots too? The spotted skunk, a smaller relative of the striped skunk, was once abundant in the Midwest but is now rarely seen in

Minnesota. Biologists believe that the conversion of small farms to large commercial farms is responsible for their disappearance. The two characteristics that distinguish spotted skunks from their striped relatives are their habits of living in colonies and doing handstands when they spray.



Hack Boxes for Peregrine Falcon

Stages to Extinction

- **Rare:** Plants and animals are rare when there are few of the animal or plant in the wild. Some animals are naturally rare, while others are rare because their habitat has been destroyed or they have been killed off. The river otter is naturally rare, even in areas with good habitat, because it does not like to be around humans. The ginseng plant was once common, but now it is rare because people gather it to sell for medicine.
- **Threatened:** A species is considered threatened when its numbers are seriously declining. The loggerhead shrike is a threatened bird in the Lake States because its prairie and scrub habitats are disappearing. The gray wolf is also threatened in the Lake States.
- **Endangered:** A species that is headed for extinction is endangered. Endangered species are unusual wherever they are found. Their populations are often small and declining. The peregrine falcon and piping plover are two endangered birds in the Midwest.
- **Extirpated:** An extirpated animal or plant species no longer exists in part of its home. Many animals are extirpated from parts of their original homes. Wolverines and mountain lions once lived in the northern forests of the Lake States, but now can only be found in Canada.
- **Extinct:** A species that is extinct has no living individuals. Dinosaurs were once numerous on earth but became extinct before modern man lived. Humans drove the passenger pigeon and heath hen to extinction by over-hunting. When a species becomes extinct, there is no way to bring it back. Passenger pigeons are now only found mounted in museums like the Bell Museum at

Wild Fact

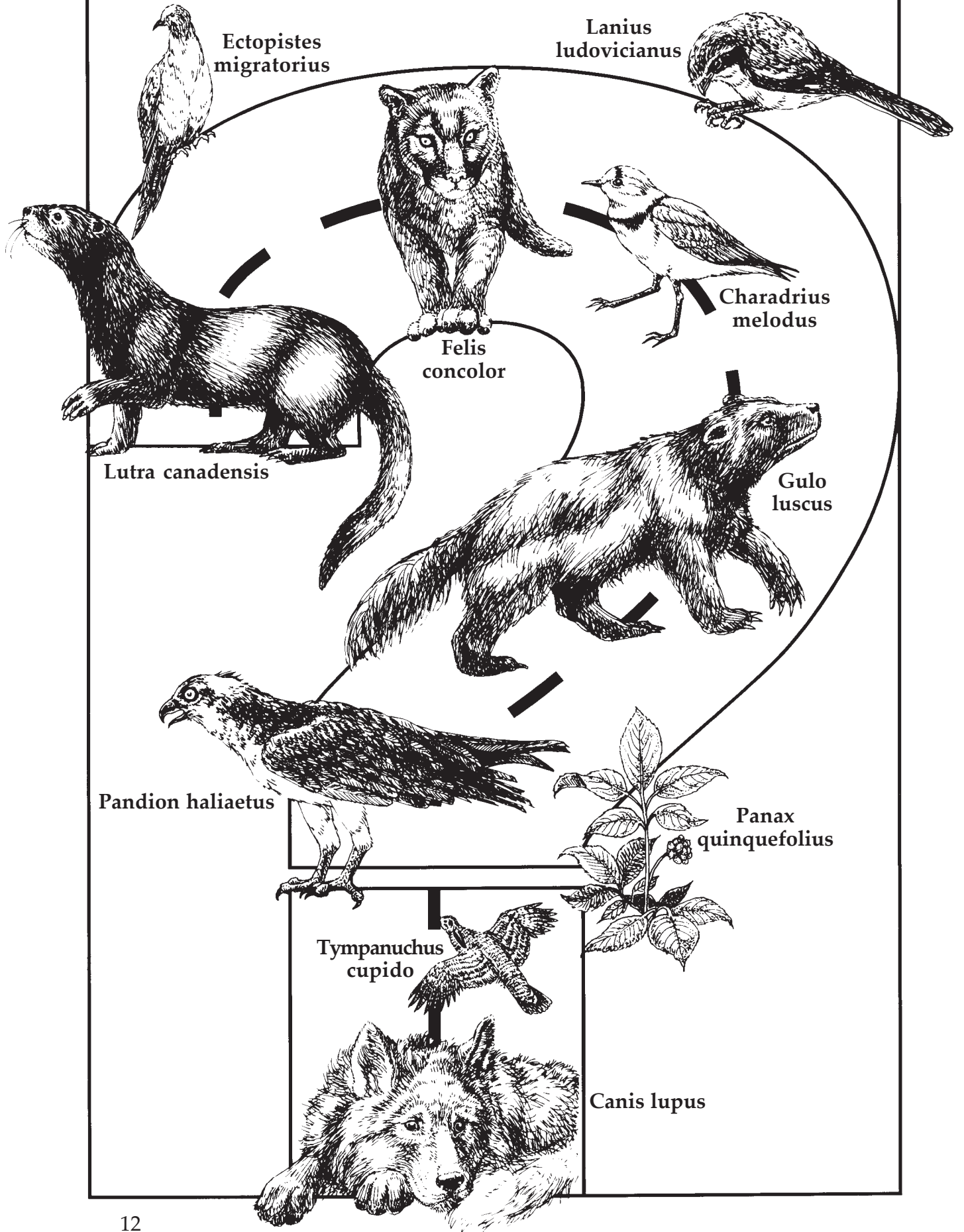
The passenger pigeons were once so numerous that clouds of them darkened the sky. The largest recorded flight was estimated to contain 2,230,270,000 birds! In the 1800s people hunted the pigeons for food and disrupted their nesting colonies to the point that by 1911 not a single pigeon existed in the wild. The last known passenger pigeon on the earth died in the Cincinnati Zoo in 1927.

Wild Fact

Endangered

Minnesota has 287 plant and animal species that are endangered, threatened, or of special concern because they are declining. Loss of habitat is the major reason these species are in danger of becoming extinct.

The Long and Winding Road to Extinction



Wild Fact

Extinct animals of Minnesota

caribou
passenger pigeon
trumpeter swan*
cougar*
elk
whooping crane

*reintroduced

the University of Minnesota.

How can we prevent species from becoming endangered or extinct?

1. **Protecting habitat.** Habitat loss is the major cause of extinction. Parks and wildlife refuges around the world protect some habitats. However, the amount of land protected worldwide is still too small to help many endangered species.
2. **Restoring habitat.** Habitats that have been altered by pollution, deforestation, or agriculture sometimes can be restored. In fact, many lakes and rivers are now cleaner than they were 20 years ago. People have restored some prairies and wetlands as well. Still, preserving habitat when it's healthy is easier than restoring damaged habitat.
3. **Laws.** In the U.S. and other countries, we're passing laws to help protect endangered species. In 1973, an agreement called the Convention on International Trade in Endangered Species (CITES) treaty was signed by 86 countries. This treaty bans the trade of products made from endangered species. If selling and buying these products is illegal, the hope is that

people will kill fewer animals. The United States Endangered Species Act, also passed in 1973, makes it illegal to kill or capture endangered or threatened species in the U.S. The law also protects some wildlife habitats.

4. **Captive breeding.** Another method of helping endangered species is to increase their numbers through captive breeding. Zoos and botanical gardens collect and raise rare animals and plants. Biologists try to get these species to breed in captivity. However, many wild animals and plants do not reproduce well in zoos and gardens. Although captive breeding can help, preserving habitat is the real key to saving endangered species.
5. **Research.** There is still a lot we do not know. Often we don't understand why a species is in trouble. Research can help us learn different ways to prevent extinctions.

Wild Fact

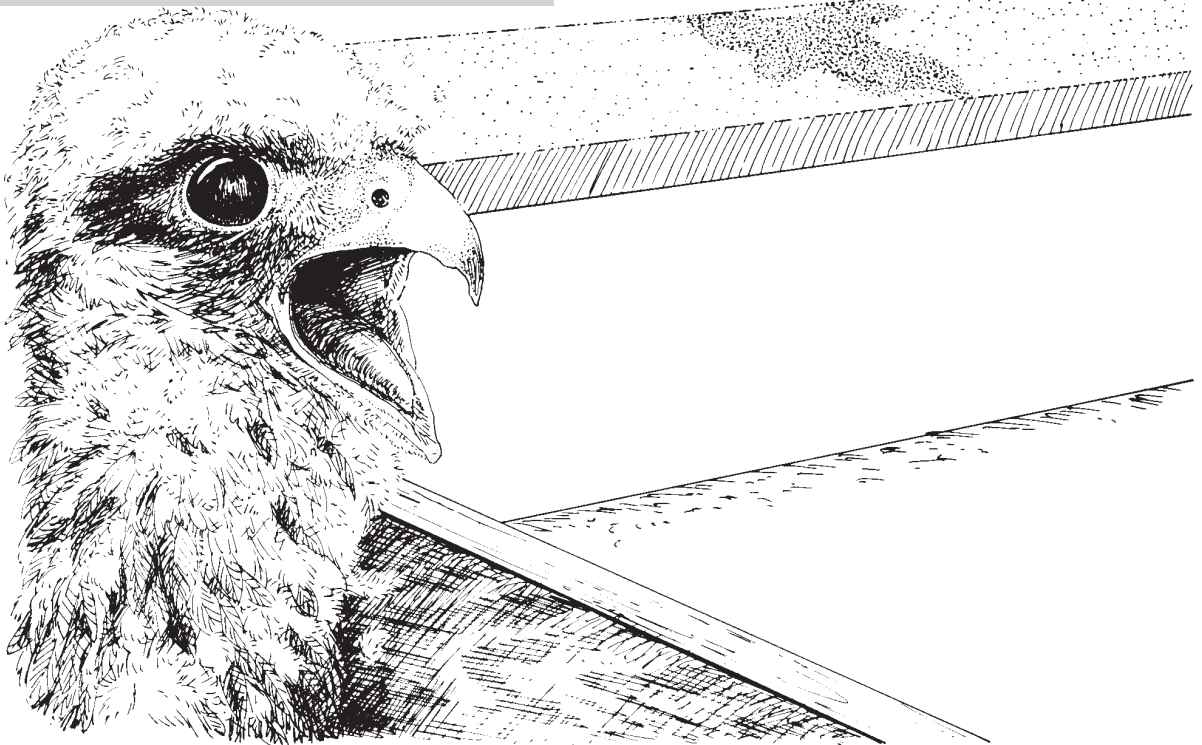
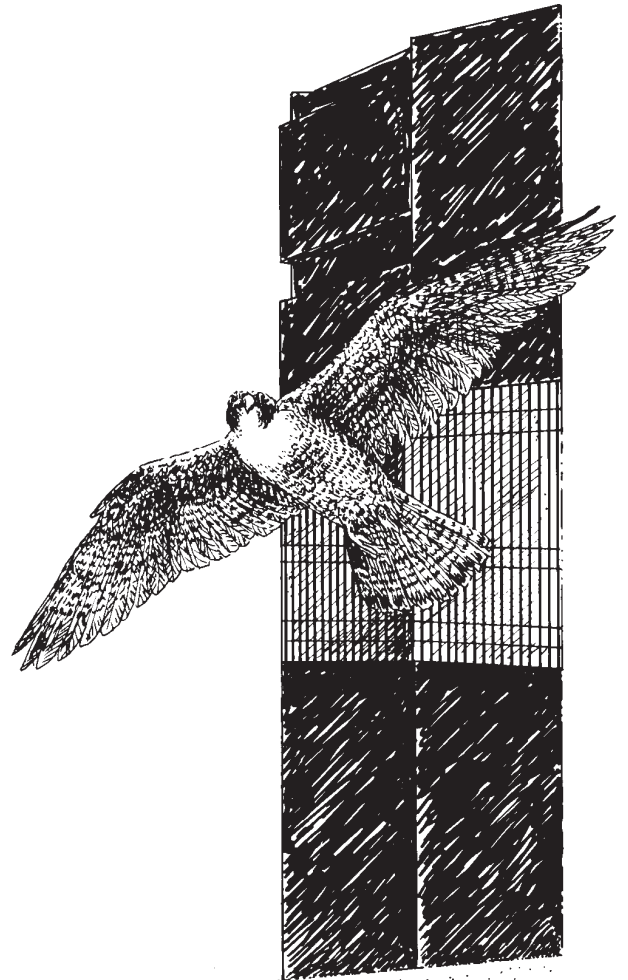
Captive breeding at the Minnesota Zoo

The Minnesota Zoo is the base camp of the CBSG, or Captive Breeding Specialist Group, and ISIS, the International Species Information System. ISIS compiles information on species in zoos for captive breeding purposes. The two groups are responsible for organizing captive breeding efforts in zoos across the United States including animals such as dolphins, whooping cranes, and panda bears.

Wild Fact

Peregrine falcon

In the 1960s peregrine falcons were in trouble. They were being poisoned by the insecticide DDT and were almost extinct in the eastern U.S. DDT was banned in 1972 to protect peregrine falcons, bald eagles, and other birds. Soon birds were eating prey free of DDT. However, there was still a problem. There were too few peregrine falcons left in the wild, so biologists worked for years to raise peregrines in captivity. When the young falcons were ready, they were set free on skyscrapers mimicking the high cliffs where they use to nest. Now there are more than 200 peregrines in the eastern and midwestern U.S. Peregrines are still endangered, but at least now they have a fighting chance at survival.



Reintroduction of Peregrine Falcons in Minneapolis

Career Considerations

One important way to save endangered species is by breeding them in captivity. Some animals are easy to breed and raise in captivity, but others are much more difficult. Zoologists and zoo vets who do captive breeding have training in biology, ecology, genetics, and reproductive physiology.

Wild Fact

Saving calvaria trees

The calvaria tree was found to have a unique relationship with the dodo bird.

The dodo bird became extinct in the 1600s. This bird weighed up to 50 pounds and lived on islands in the Indian Ocean. The dodos made easy meals for sailors because they could not fly. Three hundred years after dodos went extinct, a scientist discovered that calvaria trees could only grow if the seeds were eaten by a dodo bird. With no dodos left, the scientist introduced the tree seeds to turkeys! The turkeys were found to process the seeds much like the dodos and the calvaria trees were able to survive.

Additional Activities

Research a plant or animal that is threatened or endangered in your area.

Design a newspaper, radio, or television announcement to tell people about that species. Explain what can be done to save the species and why people should want to save it.

Know your products. You can help endangered species by learning about them and by thinking about how your actions affect wildlife and habitat. Consider the products you use every day. What natural products, or raw materials, are used to make them, and what habitats are affected when the products are made? Do they come from endangered species habitats?

Nest search: Search for birds' nests in your neighborhood. Nests are an indicator of bird populations since most pairs of birds in an area build nests. Do not disturb nesting birds or remove nests from trees, even if they seem to be abandoned. Tally the number of nests you find. Multiply the number by two (for two birds in a pair) to estimate the number of birds in the area.

Sample garbanzo bugs. It's best to try this in some natural area with grasses, bushes, trees, and other plants around. You'll need dried beans and a wire hanger. Make a frame with a hanger by bending it into a circular shape. Toss two handfuls of beans gently into the air (you don't want the beans to land too far apart). Now toss the frame onto the ground in the area where the beans landed. Count the beans that are found inside the frame and record the count. Toss the frame and count the beans a total of eight times. It doesn't matter if the frame lands near or on the same place more than once. Add all your counts together and divide by eight. This is the average number of garbanzo bugs that "live" in the area of the hanger. Estimate the number of hangers that could fit in the area and multiply this number by the average number of bugs in the hanger to get a total population estimate.

Fair Ideas

Follow an animal population and graph its change from year to year. Get information from the Department of Natural Resources (DNR). Explain why it is changing.

Species Display: Make a display showing the life cycle and habitat needs of an endangered or threatened species. Illustrate how the activities of humans affect the species. Include information about the reasons the species is in trouble and what is being done to try to save it.

Minnesota State Fair

4-H Forest Resources Premium List rules are:

1. The exhibit should not exceed 12" deep x 18" wide x 22" high.
2. Exhibits should include a project title and your name.

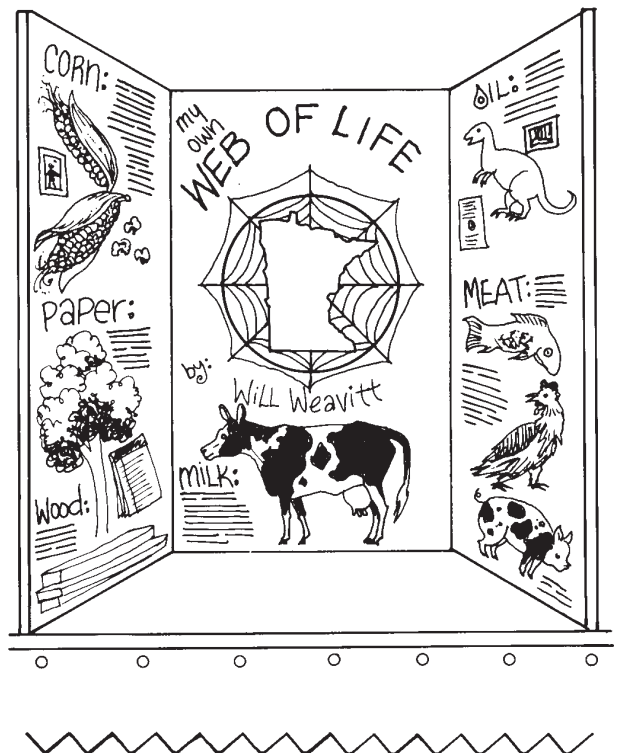
See the booklet *State Fair Premium Guidelines*, available from your local county extension educator, for information.

TIPS FOR MAKING A THREE-SIDED DISPLAY:

- It's a good idea to get your leader, parent, or other adult to help you.
- Use a material such as hardboard, particleboard, or plywood. Poster board is not as sturdy.
- Open displayed dimensions should not exceed 12 inches deep by 18 inches wide by 22 inches high.
- Use hinges to attach the sections to each other.
- Paint or cover the background with adhesive paper, if you'd like.

Endangered Species Book: Make a book describing 10 threatened or endangered species. List information about each species such as its habitat needs and why it is threatened or endangered. Include a drawing or picture of the animal. You may want to have themes such as Minnesota Endangered Species, Endangered Birds, or Endangered Prairie Species.

Personal Web of Life: Make a mobile or three-sided display that illustrates at least five components of your own web of life the different animal and plant products that you often use. Describe what animals or plant each comes from and how your use of the resource might affect the world. Include drawings, photographs, or examples of the resources in the web. You might also want to include a map of North America or the world to illustrate where the products come from.



Chapter 2

Diversity, the Spice of Life

Perhaps you have heard the saying “variety is the spice of life.” When scientists refer to variety in nature they call it **biological diversity** or **biodiversity**. They are usually referring to the number of different types of living things or **species** (a group of animals or plants that resemble each other and breed among themselves). But there are many ways to think of diversity — you can find diversity in just about anything.

Diversity makes life interesting. Wouldn't life be boring if there were only one kind of tree? If all the flowers were one color? If everyone looked alike? Diversity can also tell us if an environment is healthy, and healthy environments are better places to live. Diversity can be useful to humans because some of the species can be used to make medicines, foods, or clothing. Because new species are being discovered all the time all over the world, there are probably other uses for wildlife that we do not even know about yet.

Diversity can apply to plants and habitats just as well as to wildlife. Some habitats are more diverse than others and have more types of plants. Habitats that are more

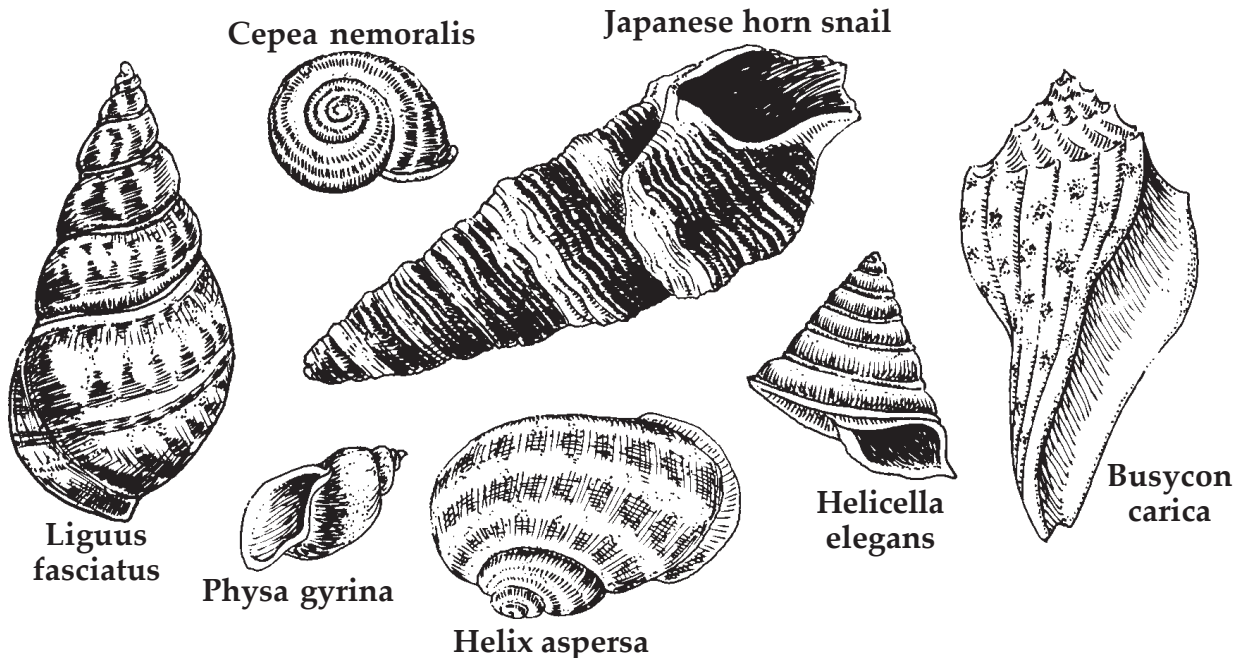
diverse usually have more wildlife associated with them.

Biologists often use diversity to measure the health of habitats and environments. For example, the number of bird species in a forest can often indicate how complex and natural a forest is. Often, the more natural a forest is, the more diverse and healthy it is.

Wild Fact

Numbers of species in Minnesota

Bird:	242
Mammal:	81
Fish:	140
Reptile/Amphibians:	48
Insects:	Unknown but there are 145 species of butterflies alone!



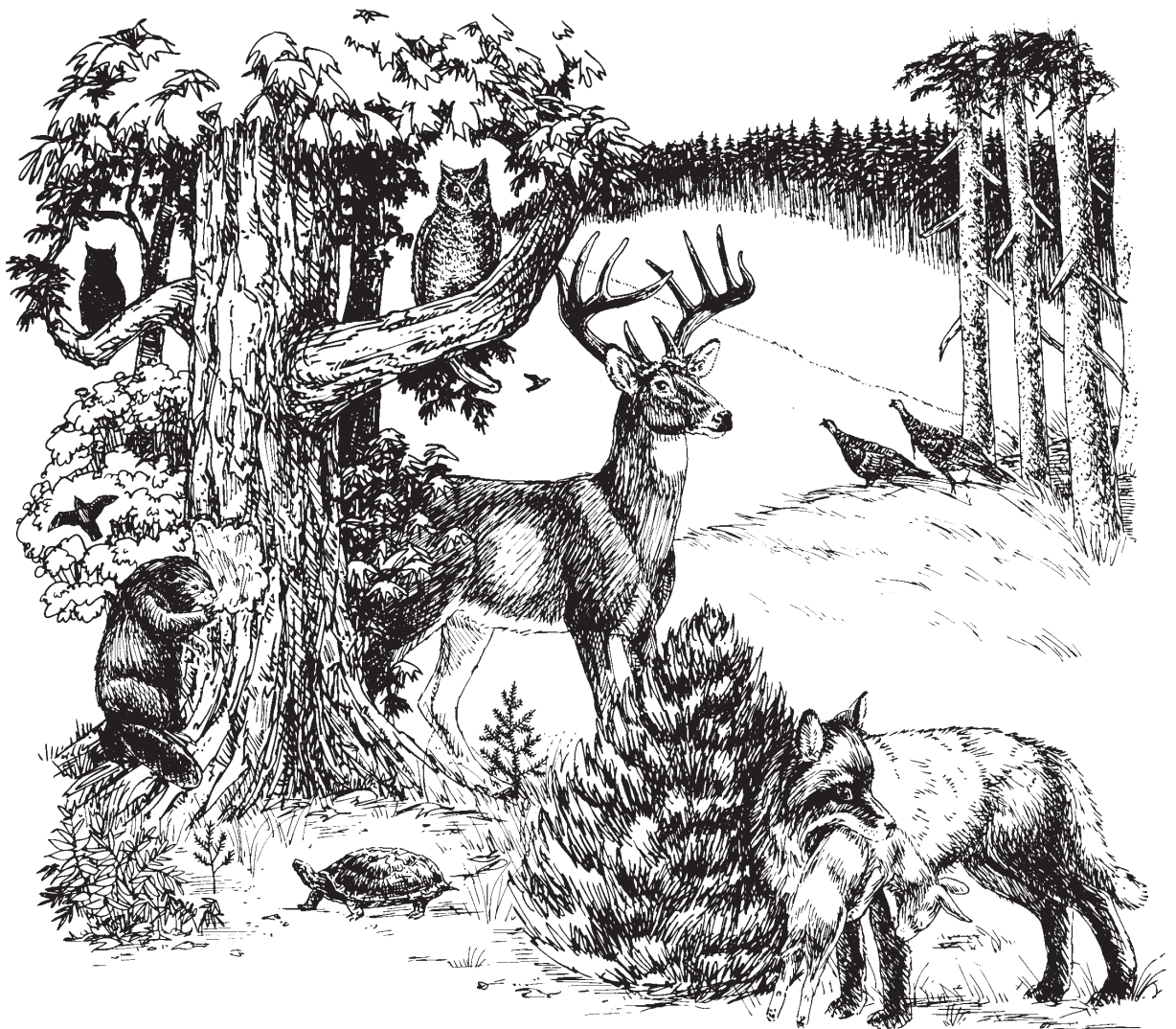
Wild Fact

The Pitohui

The Pitohui is a colorful bird of the New Guinean rain forest. Very recently it was discovered that its colorful feathers contain a poison that may help repel predators. This is the only case of a poisonous bird known. The poison is useful in making a drug that helps heart attack victims.



Pitohui dichrous



Natural Verse Plantation Forests

Activity 7: Bountiful Butterflies

You are a wildlife manager and you are given the task of deciding if the butterfly reserve or the old field has a higher diversity of butterflies. Which is more diverse, the reserve or the field? Which do you think is better for butterflies?



Field A—Butterfly Reserve



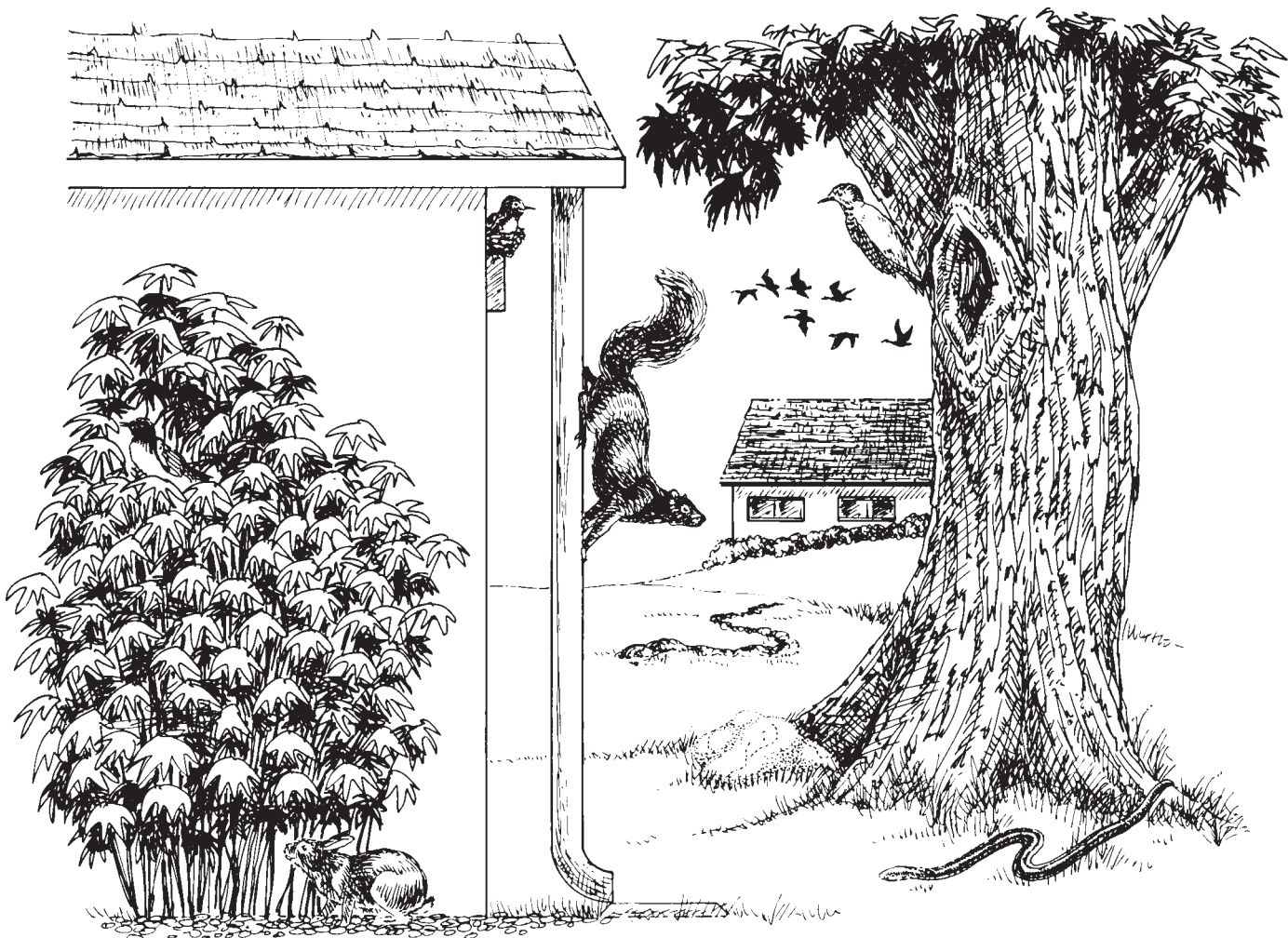
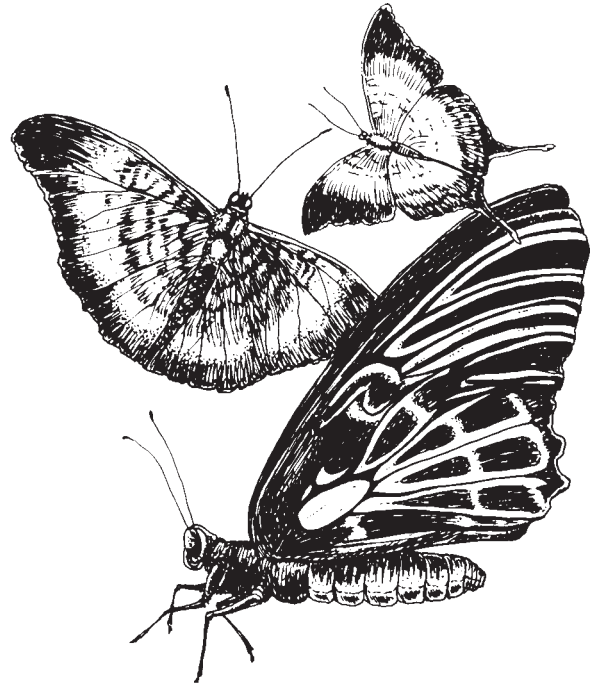
Field B—Old Field

(Answer on the next page)

Wild Fact

How many is many?

No one knows exactly how many species there are on earth—many plant and insect species have not yet been discovered. Every year biologists discover new species. Scientists estimate that there are from 5 to 30 million species on earth. Tropical rain forests have more species than any other ecosystem.



(Answer from page 19 is Field A)

A. Minnesota's Diverse Biomes

Minnesota is a state that is rich in diversity because three different biomes come together in it. **Biomes** are large areas that thrive in a particular climate or rainfall region and provide a particular habitat to certain plants and animals. The prairie biome in the western part of the state is open, without many trees. The hardwoods biome in the middle section of the state is made up of deciduous (trees that lose their leaves in winter) hardwood forests while forests in northern Minnesota have more conifers (trees with needles and cones) and peatlands. Within these three different major biomes exists a diversity of habitats.

1. The Prairie Biome

Over 8 million acres of prairie once covered the western half of Minnesota. The fertile soil of prairies supported grasses up to six feet tall in some areas. Unfortunately, because this soil is also excellent for farming, over 99 percent of Minnesota's prairie has been converted to agricultural land. Wetlands are also a major habitat of the prairie biome.

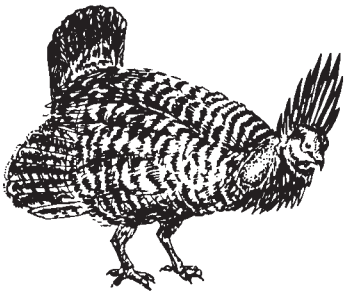
Minnesota's prairie species include:

Plant:	prairie-fringed orchid
Bird:	burrowing owl
Mammal:	prairie vole
Reptile/ Amphibian:	gopher snake
Insect:	karner blue butterfly

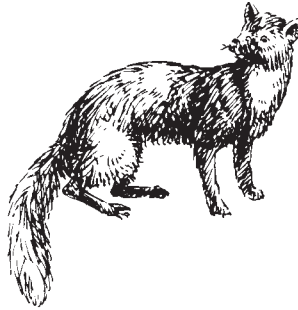
Activity 8:

Match the animals to their proper biomes by drawing lines.

greater prairie chicken



pine marten



wood turtle



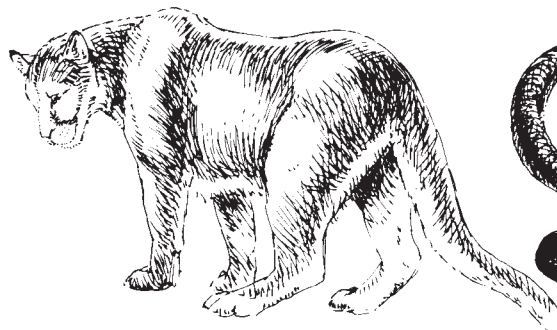
prairie

hardwoods

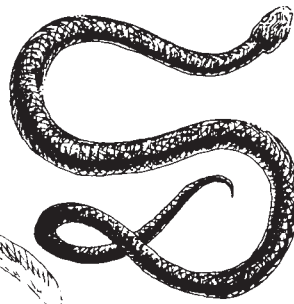
northern forest



northern pocket gopher



mountain lion



rat snake

2. The Hardwoods Biome

Before people settled the Midwest, the hardwood forest extended in a belt from west central to southeastern Minnesota. The forest was made up of deciduous trees such as elm, basswood, sugar maple, and red oak. Most of this forest was cleared so people could farm and build houses, but some large patches still exist at Nerstrand Woods State Park near Faribault, Minnesota.

Minnesota's hardwoods species include:

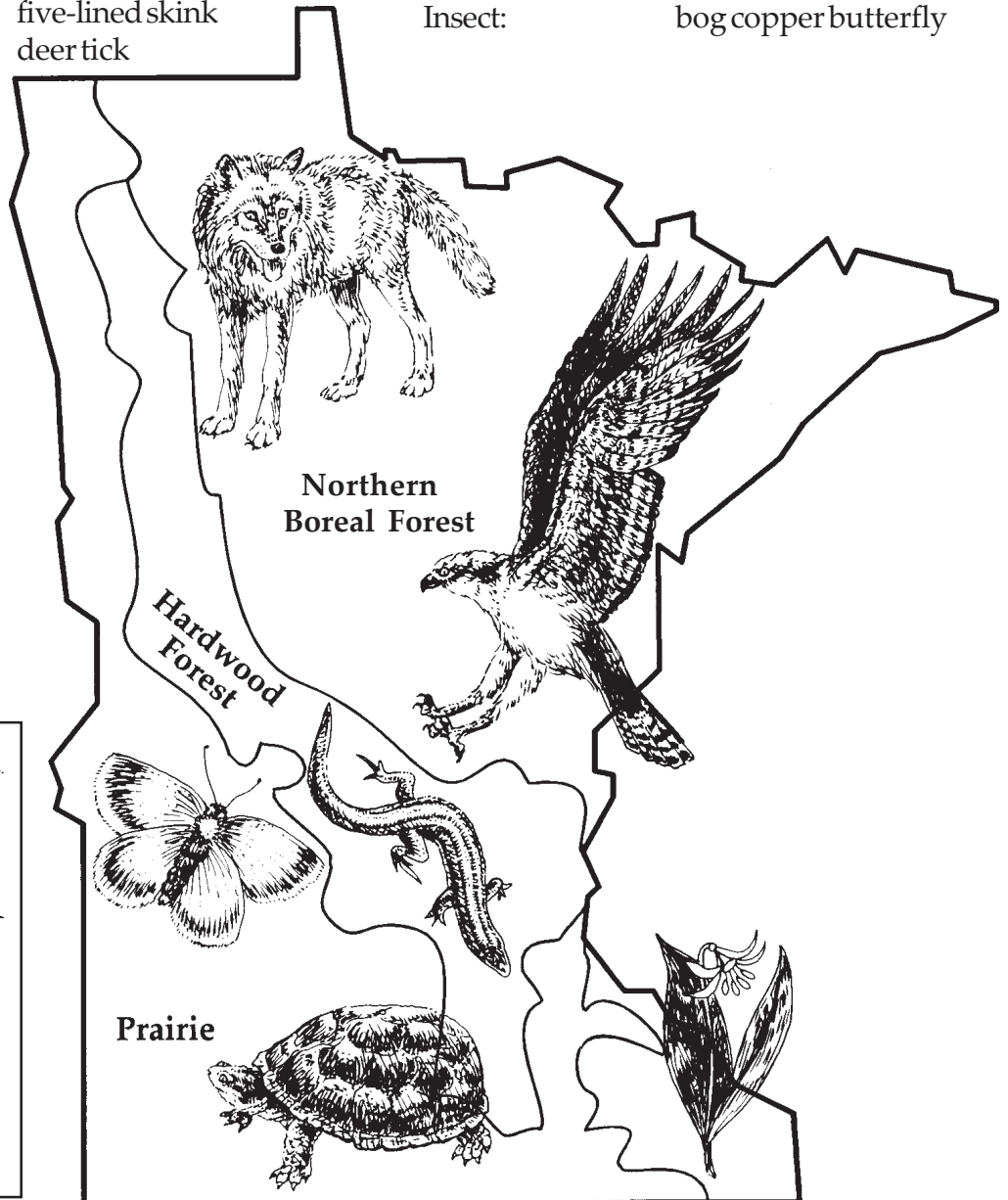
Plant:	dwarf trout lily
Bird:	red-shouldered hawk
Mammal:	woodland vole
Reptile/ Amphibian:	five-lined skink
Insect:	deer tick

3. The Northern (Boreal) Forest Biome

The northern forests of the Lake States were originally huge forests of pine, spruce, and cedar. Logging in the 1800s changed the forests' composition and now much of the pine has been replaced by aspen and birch trees. Peatlands (swamps, marshes, and bogs) are also found in abundance in the northern forest.

Minnesota's northern forest species include:

Plant:	lichen
Bird:	osprey
Mammal:	gray wolf
Reptile/ Amphibian:	spring peepers
Insect:	bog copper butterfly



Activity 8:
Match the animals to their proper biomes by drawing lines.

greater prairie chicken pine marten wood turtle

prairie hardwoods northern forest

northern pocket gopher mountain lion rat snake

(Answer to page 21)

B. Threats to Diversity

Humans threaten wildlife and biological diversity in the following ways:

Habitat Destruction. Habitat loss is the major reason that plants and animals become extinct because expanding human populations use more food and more space for living. When people take away habitat by clearing forests, filling marshes, and damming rivers, they remove habitats that other species need.

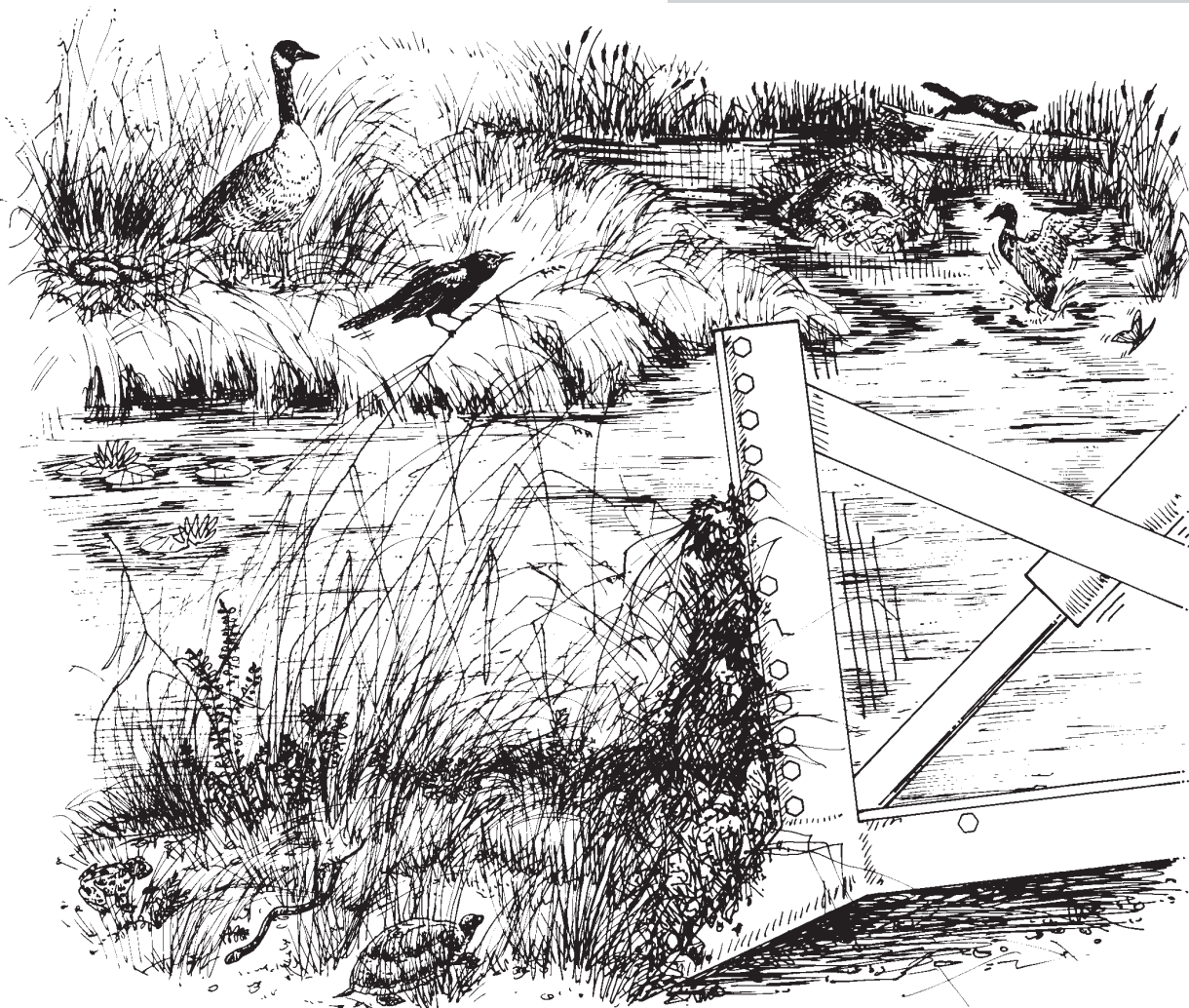


Wild Fact



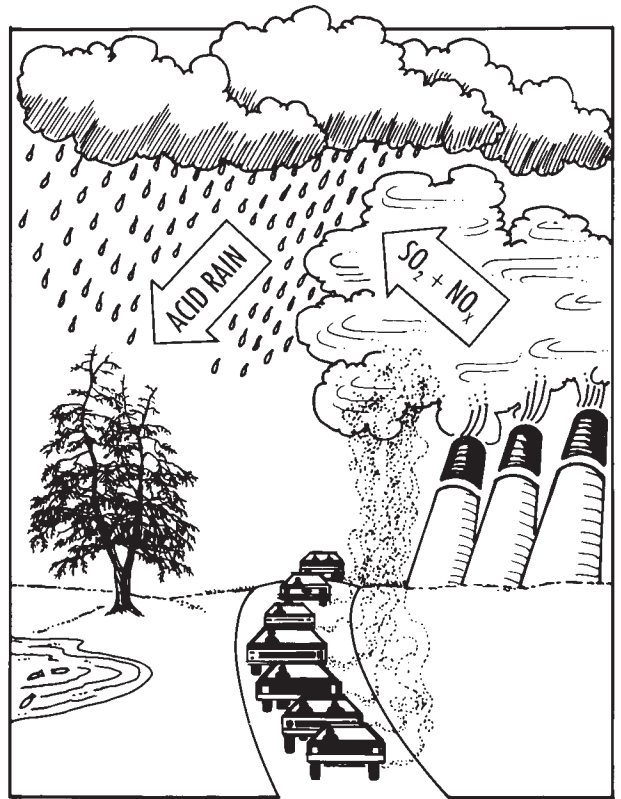
**Rachel Carson
(1907-1964)**

Rachel Carson was a biologist who was concerned about the contamination and pollution of our environment. She wrote a book called *Silent Spring* to warn the public of the dangers of these contaminants. Her work spurred an environmental movement to control the use of these chemicals.



Habitat Fragmentation. When habitats are destroyed, large areas are broken up into many smaller ones. **Habitat edge**, the space between two different plant communities, is greatly increased. Some species do well in edge, but others are negatively affected. For example, the woodland song birds need large tracks of undisturbed forest for successful reproduction. The brown-headed cowbird is a bird that prefers edges. Rather than making its own nests, the brown-headed cowbird lays its eggs in the nests of other birds to be raised. The other birds raising brown-headed cowbird young often cannot produce any of their own young or their young are eaten by predators who like edge areas. The populations of the woodland song birds are harmed by habitat fragmentation.

Contamination. Pollution can destroy habitats by poisoning the animals and plants. When a pollutant enters a habitat, it's called a **contaminant**. Contaminants can find their way into the links of life. The chemical DDT, a pesticide, accumulates in fish and small mammals eaten by birds such as the bald eagle and peregrine falcon. DDT causes eggshells to become thin and break from the weight of the bird, before the young can hatch. Even though



the United States no longer allows the use of this chemical, people in other countries still use it. Many birds winter in some of these countries and return to Minnesota.

Water and air pollution, including acid rain, also hurt many forms of life. Mercury is a problem pollutant in Minnesota lakes. Fish and the animals they eat become contaminated by mercury in these aquatic habitats. The birds and mammals (including humans!) that feed on these fish may also be affected.



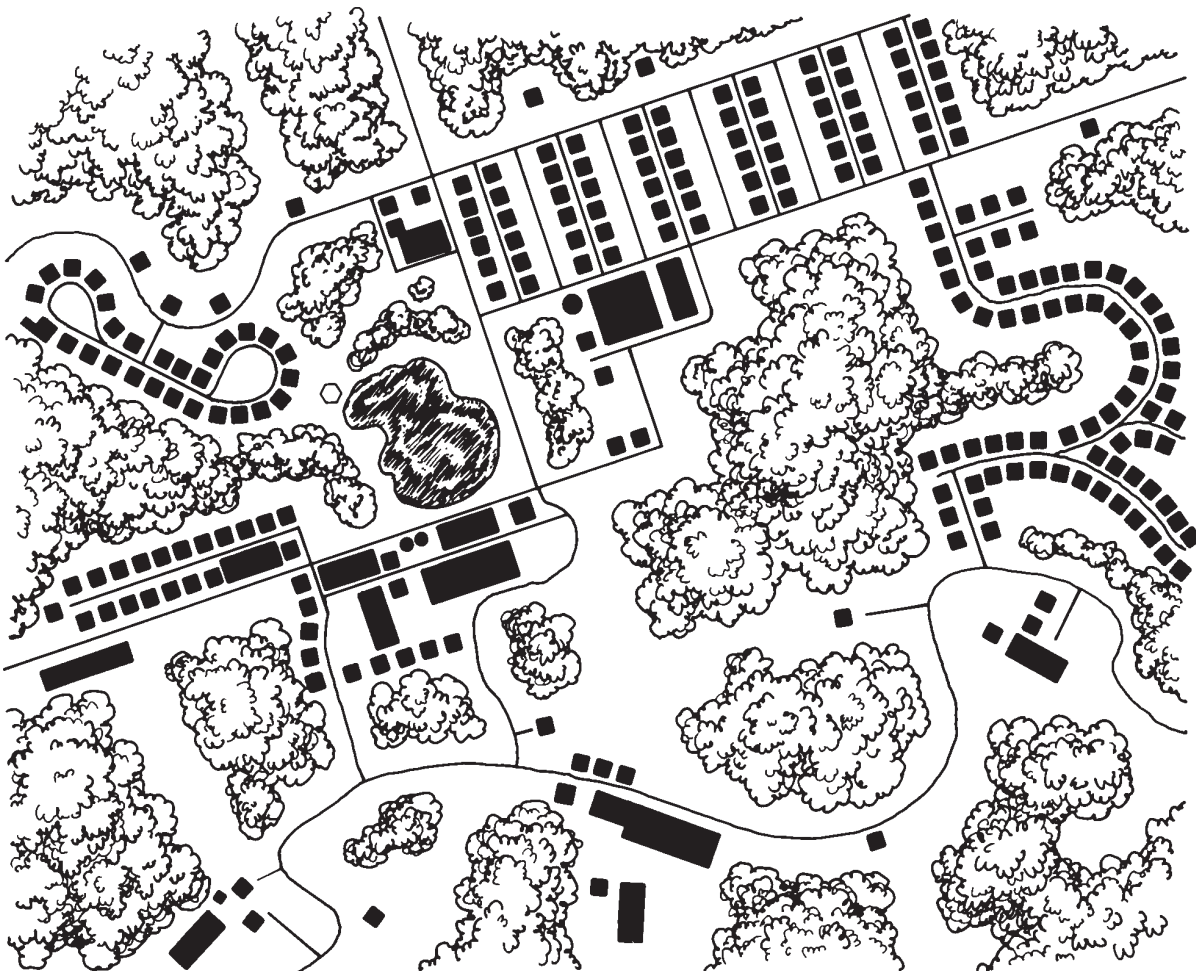
Over-exploitation. During our country's early history, few laws controlled hunting and people knew little about wildlife management. Species such as the passenger pigeon, the white-tailed deer, and American bison were over-hunted. Currently, in the U.S. and many other countries, hunting is regulated by law to keep populations of game species healthy.

Many rare plants and animals become extinct because of illegal hunting and trade. Although it is illegal in most countries to harm endangered species, people still kill them for money. For example, rhinoceros horns, coats made from jaguar and tiger skins, and objects made from turtle shells and ivory are illegally sold for large profits. Tropical bird species that are rare in the wild are often captured and taken for pets. Up to 50 percent of the birds captured for pets die before they ever get to the market!

Introduced species. People have also interfered with the links of life by bringing species to places they don't belong. Sometimes this is done on purpose (house sparrow, pheasants) and sometimes by accident (rats). Introduced species, which are known as **exotics**, can harm native species in many ways:

- they compete for the same food
- they compete for nest and home sites
- they eat the native animals or plants
- they can change the habitat of native species

There are many exotic animals and plants in the U.S. For example, people brought starlings from Europe to get rid of the Japanese beetles that were destroying their plants. But starlings compete with native birds and displace them from many areas. English house sparrows are also exotics. They have caused eastern bluebirds to become less common by taking their nest sites.



Activity 9: What Contaminants Do to Wildlife

What happens to bird feathers and eggs when they are covered with oil?
You will need:

- 3 hard-boiled eggs
- cooking oil or petroleum jelly (motor oil may work better for this activity, but if you use it make sure to dispose of it properly at a service station or garage that accepts soiled oil)
- shallow pan or tray
- a small magnifying glass
- a feather (not down)
- a jar that will hold oil and eggs
- a tablespoon
- a ruler

1. Oil Measurement. Start by covering the bottom of the shallow pan with water. Pour three to seven drops of cooking oil into the pan (count the drops). Measure the approximate area covered by the oil.

_____ drops of oil in pan (=A)
those drops covered _____ square inches (=B)
_____ number of drops in one tablespoon (=C)
16 tablespoons (T) = 1 cup
16 cups = 1 gallon

Calculate the area that one gallon of oil would cover using the following formula:

$B \times (A/C) \times 16 \times 16 = \text{_____} = \text{area covered by one gallon.}$

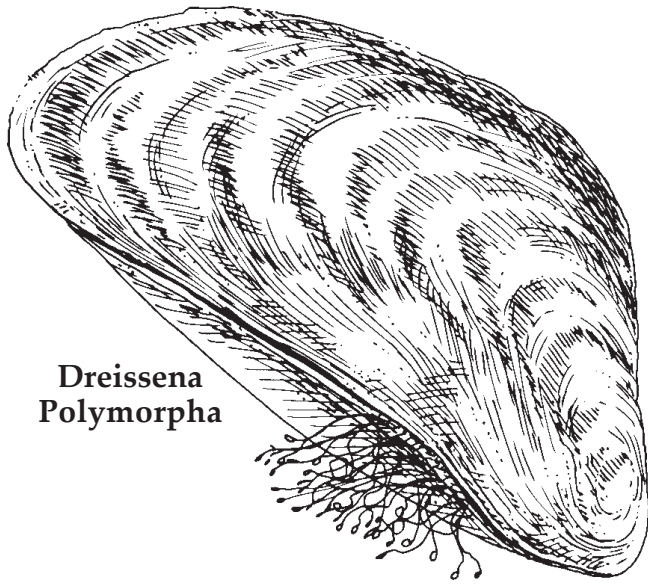
What area would 1,000 gallons cover? (Ships can carry 300,000 gallons and tankers over a million [1,000,000] gallons of oil.)

2. Oil on an Egg. Next put the three hard-boiled eggs into the jar with the oil. Take one out after 5 minutes and peel it. What do you see? Take one out after 15 minutes and peel the shell. What do you see?

Take one out after 30 minutes and peel the shell. What do you see? What does this tell you about the effects of oil spills on birds nesting near or on the shores of oceans?

3. Oil on a Feather. Next look closely at the feather with the magnifying glass. Draw what you see. Dip the feather in water. Take it out and look at it under the lens. What do you see? Did the oil change the feather? How do you think oil spills affect birds that live in oceans or on coasts?

Adapted from *Project Wild*, "No Water Off a Duck's Back." Used with permission.



**Dreissena
Polymorpha**

Wild Fact

Zebra mussel

The zebra mussel is an introduced clam that attaches to boats and is transported from one water body to another. Zebra mussels cover the bottoms of lakes and filter a lot of food out of the water that native species need. Zebra mussels are thought to have contributed to the decline of 40 species of native clams and fish in the Midwest.

Activity 10: "A Search for Exotics"

You will need:

- pen or pencil
- record sheet at the end of this booklet (Appendix B)

Some possible exotics in your neighborhood:

1. House sparrow
2. Starling
3. Pheasant
4. Purple loosestrife
5. Eurasian water milfoil
6. Black rat
7. House mouse
8. Gypsy moth
9. Rock dove (pigeon)

Additional Activities

Become an ecowarrior: Get involved with agencies or groups that help eradicate exotic species like Eurasian water milfoil and purple loosestrife. Look for areas in your neighborhood that have been invaded by these species, get permission and directions on how to get rid of the invaders, and become an ecowarrior. Call the Department of Natural Resources for information.

Become active in groups that work to preserve habitat and protect wildlife. Hunters, scientists, environmentalists, and other people concerned about conservation often work together to help wildlife. Find out what groups are active in your area and get involved. Try calling the Minnesota Deer-Hunters Association, Ducks Unlimited, National Audubon Society, Sierra Club, Nature Conservancy, or Pheasants Forever.

Survey your neighborhood and decide whether there is an area that needs cleanup or improvement. First get permission from the county or landowner to clean or improve the area. Make a game plan and follow it through. Evaluate the results of your work.

Conduct a spring amphibian diversity survey. Survey your local wetlands for frogs and toads in the early Spring both morning and late evening. Learn to identify frog calls from a tape and bring a field guide with you in case you see some. Record all species you hear and see if you can estimate the number of individuals calling in a 5-minute period. Keep records of each wetland and return every 4 weeks to the sites. Use a sheet at the end of this guide. Did amphibian diversity change over the spring?

Take a trip to the Bell Museum of Natural History at the University of Minnesota. Tour the dioramas to get a feeling of the great diversity of Minnesota's natural history.

Fair Projects/Exhibit Ideas

Make a display of leaves, stems, and flowers of introduced plants in your area. Identify and label the different plants and describe the habitats in which they are found. Explain the negative effects these invaders have on native plants.

Research the Native American medicinal uses of wildlife species found in Minnesota. Prepare an exhibit that tells a story about the plants and wildlife Native Americans used, including whether and how we still use them today. (See *Medicinal and Food Plants of the North American Indians* by Lothian Lynas, 1972.)

Make a collage of the diversity of different birds' eggs and nests. *Do not use real ones; it is illegal to collect them without a permit.* Use field guides to draw pictures of the eggs and nests. Look in wildlife magazines for pictures to cut out or take your own pictures. Label the eggs and nests with the name of the bird that makes up the exhibit.

Design a habitat reserve to protect threatened and endangered species from extinction. Make a model or large map of the imaginary or real area. Draw or model the habitat types that are important to the species. Include a list of the different methods to help protect species.

Make a three-sided display that illustrates how our everyday activities affect threatened or other wildlife. For example, when we drive cars we pollute air. Cars also cause a demand for oil that increases the destruction of habitat and the chance that oil may spill into oceans and rivers.

Make a three-sided display that shows the problems cause by introduced species. Choose one to three introduced species that live in your area. Show how these species may harm native animals and plants. Your state conservation agency (Department of Natural Resources or Department of Conservation) should have information on this topic.

Chapter 3

Stewardship Projects and Habitat Management

A. Improving the World for Wildlife

Everybody needs a place to call home. Where would you be without a home? You wouldn't have any protection from hunger, cold wind, or predators. Your home habitat needs to be intact for you to survive.

Without appropriate habitat, animals too fail to thrive. Their populations fall and they become vulnerable to disease and death. If we keep wildlife homes healthy, we will have healthy wildlife.

You can do something to help wildlife by becoming a steward of wildlife and the land they inhabit. A **steward** is someone who looks over and cares for something. One way to care for wildlife is to manage habitat. Some types of management are very simple things that you can do yourself; others are more complex and need to be done by professional wildlife managers.

B. Becoming a Steward of the Land

Here are the steps you can do to become a steward:

1. **Observe and learn** about different types of management.
2. **Evaluate** your yard, a park, roadside, vacant lot, or any habitat near you for its wildlife potential. Catalog the species you find there. Note the types and arrangement of vegetation.
3. **Make a plan** for how you would like to improve the habitat for a specific species or for overall diversity. Define your goals. Remember that it is easier to work with what you already have. Your plan should be simple and improve on the
4. **Carry out** the management action(s). Remember to get permission from the appropriate people if you wish to do a stewardship activity on land that is not your own.
5. **Evaluate** the success of your actions. Watch the areas you have managed carefully over time. Some management actions may take a long time to start working. Did you accomplish your goals?

Wild Fact



Aldo Leopold
(1887-1948)

Aldo Leopold was the father of modern day wildlife management. His study of wildlife biology led him to form the concept of wildlife management and the idea of the land ethic — an individual responsibility for the health of the land.

6. **Keep track** of continuing process. You'll get much enjoyment from watching the results of your management efforts through the years and getting in touch with the environment. Planning doesn't have to, and shouldn't, stop after step 5. You can take what you have learned from this process and apply it over and over again, improving your management as you go.

Examples of stewardship projects you can do:

- establish a bluebird trail
- construct and put up nest boxes for kestrels, wrens, wood ducks
- plant some native prairie
- create a reptile hibernaculum (safe areas for wintering)
- construct and put up bat roosts

Wild Fact—Saving Minnesota's Endangered Species:



The Natural Heritage Program is responsible for field inventory, research, and promoting the wise stewardship of Minnesota's native plants and threatened natural communities.

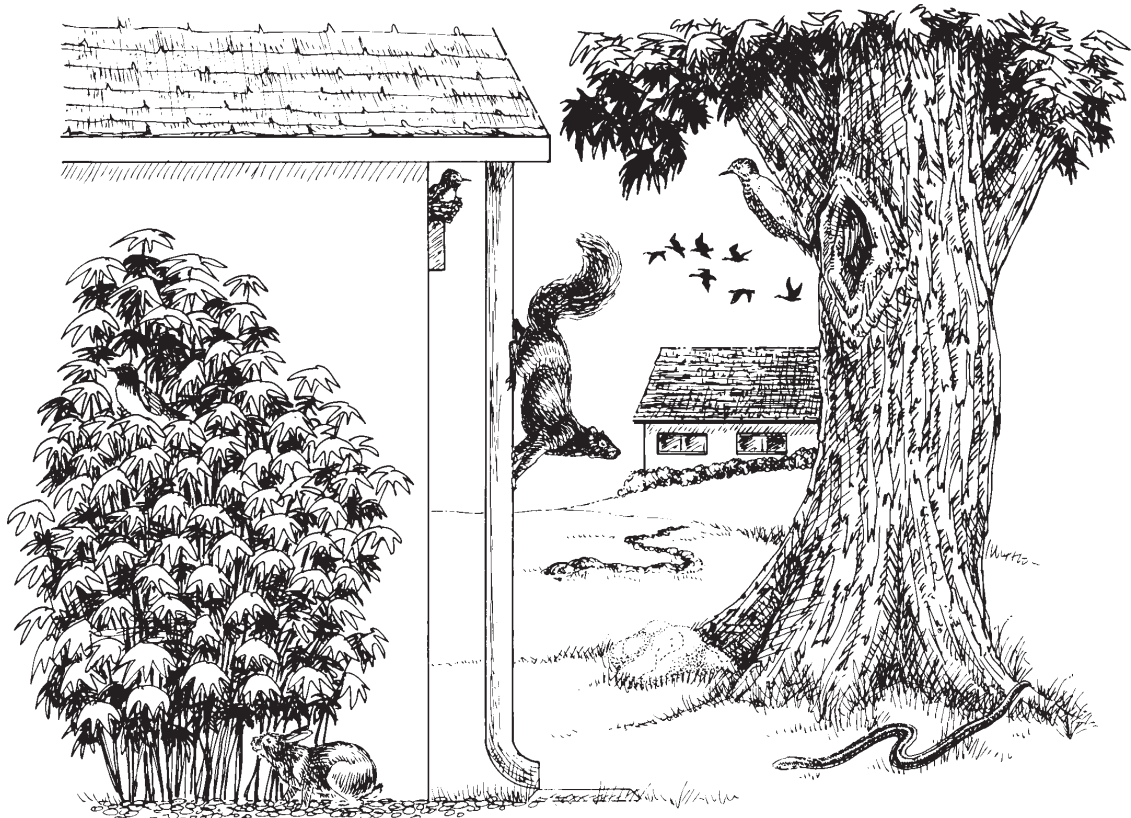


Minnesota's Nongame Wildlife Program has been entrusted with the responsibility of protecting and managing over 500 nongame wildlife species or birds, mammals, reptiles, amphibians, fish, and invertebrates.



The goals of the Scientific and Natural Areas (SNA) Program are to protect and maintain critical habitat for endangered species through a state system of natural areas.

For more information, contact the
Minnesota Department of Natural Resources: (612) 296-3344, or 1-800-652-9747.



Activity 11: Habitat Management in Your Neighborhood

Many people manage habitat in their own backyards. Take a walk around your neighborhood. List the different types of habitat management you see, the animals that could be affected, and how they might be affected.

Habitat management	Animals that are affected/how
<u>planting sunflowers</u>	<u>birds eat the seed, bees collect pollen, insects may feed on leaves</u>
<u>vegetable gardening</u>	_____
<u>feeding birds</u>	_____
<u>woodpile</u>	_____

Draw a diagram in the box below of the area to be changed and how you would change it.

C. Forest Stewardship

You can combine stewardship actions. Here are some examples to manage forests for diversity:

Harvest timber. Timber harvest is often accomplished by clearing all the trees (called clearcutting). Clearcutting changes the woodland back to shrubs for 8 to 10 years. Shrubs and other plants that grow after harvest are food for white-tailed deer, moose, rabbits, woodchucks, and ruffed grouse.

Provide/maintain snags. Snags are dead trees that are still standing. Sometimes they are purposely left in an area after harvest. They are used for nesting and perching sites and as a source of food by over 43 different bird species and 26 mammal species. The insects found in snags provide fast energy for hungry animals. Snags are a critical component of wildlife habitat.

Maintain permanent openings. Animals also need areas without trees. Wildlife eat many of the grasses, flowering plants, and shrubs that grow in open areas. Woodcocks and sharp-tailed grouse need

Wild Fact

Pileated woodpecker

Pileated woodpeckers depend on snags for food and cover. They make holes 10 to 12 inches deep in the snags for their nests. Carpenter ants are their most important food source. Pileated woodpeckers use their long, sticky tongue and sharp bill to remove ants from dead trees.

openings to find a mate, and many song birds eat insects found in openings. Open areas are sometimes planted with alfalfa, clover, or grasses as ground cover for food for wildlife.



Preserve old growth. Certain song-birds, fishers, rodents, and other animals do best in large old-growth forests. The edge between old-growth forests and younger forests or openings can be dangerous for these species, so old-growth areas are most productive when they are large and continu-

Lake States Tree Species and Age at Which Old Growth Begins

Species	Old Growth Begins (Years)
Red and White Pine	180
Jack Pine	70-90
Balsam Fir	60
White Spruce	150
Swamp Conifer	150
Aspen	60-68
Oak	150
Birch	100-110
Lowland Hardwoods	150
Northern Hardwoods	150

ous.

Plant trees and /or shrubs. Certain species of trees and shrubs provide good sources of food and cover for animals. For example, blackberry and raspberry provide food for birds, small mammals, deer, and bears among other species.

Create and maintain reptile hibernacula (safe areas for wintering). Hibernacula can be easily created by digging a pit and filling it loosely with rocks and leaves, then mounding it over with soil.

Provide nesting or roosting areas. Woodlands near water are good habitat for bats and hole-nesting ducks like wood ducks. It is simple to build bat houses that provide roosting areas for bats and nest boxes for wood ducks. Other wildlife may use the nest boxes as well. In wooded areas without a lot of snags, small hole-nesting birds like wrens and chickadees will benefit from nest boxes.

D. Wetland Stewardship

Wetlands are also known as bogs, marshes, cedar swamps, and potholes. They have wet soils or standing water for part or all of most years. Cattails, wild rice, tamarack, and cedar trees all grow in wetlands.

The type of wildlife that uses a wetland habitat depends on the location, the amount of water, and the type of plants growing there. Moose, beaver, and wood ducks use wetlands that are in or near woods. Waterfowl, mink, raccoons, and muskrat use wetlands surrounded by grasses and open areas.

Changing water levels. In natural wetlands the water level varies from year to year and from season to season. In the spring many wetlands are full of water from snow melt and from spring rains. In the summer when the climate is hot and dry, water levels usually fall.

Wild Fact

Wetland destruction

Humans are destroying hundreds of thousands of acres of wetland habitats every year. In the U.S., some Midwestern states have lost more than 99 percent of their wetlands. People destroy wetlands to make more farmland, make space for buildings, and to try to get rid of mosquitoes. As wetland habitats are destroyed, wildlife populations that use them shrink.

Controlled flooding. Areas that are dry may be flooded in the spring to provide nesting and feeding sites. In the summer, these areas are drained to allow the soil to dry. Finally, in the autumn the areas may be reflooded to provide feeding areas and hiding cover for migrating birds.

Plantings. Managers plant water plants such as wild celery, pondweeds, and wild rice to produce food for wildlife. The seeds, stems, and roots are eaten by ducks, geese, muskrats, and swans. They also provide habitat for small fish, water insects, and other wetland invertebrates.

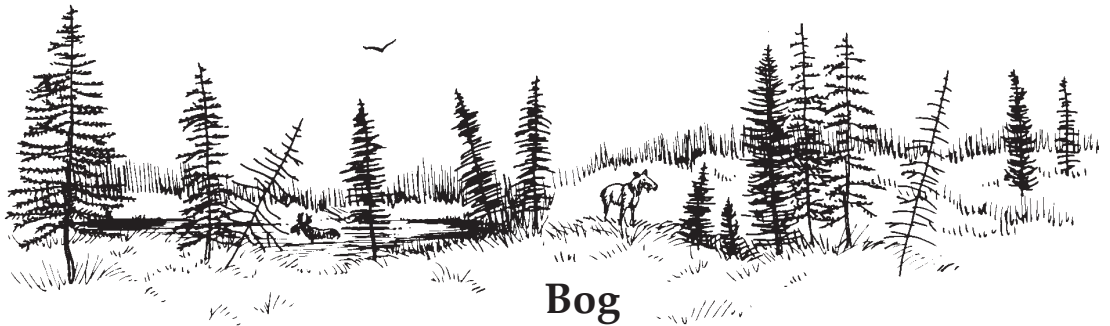
Wild Facts

Upland habitats

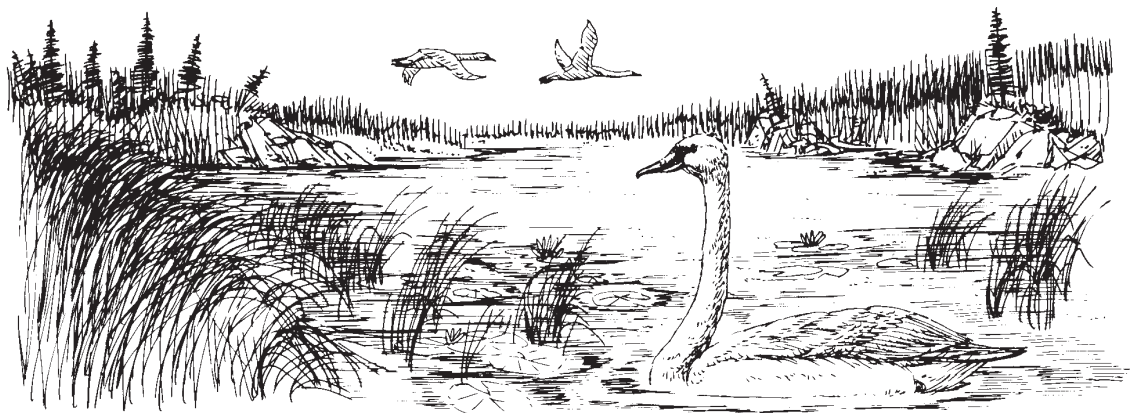
Uplands—habitats that are not usually flooded—are also important to wetland wildlife. Dry fields, forests, and shrubby areas are all uplands. Many species of ducks and geese nest in grassy fields or prairie areas. Many songbirds nest in wetlands but use upland habitats for feeding. Turtles spend most of their time in water, but they need sandy upland areas for laying their eggs.



Marsh



Bog



Wetland

E. Prairie Stewardship

Prairies come in different types depending on the amount of water in the soil, the type of soil, how often fires occur, and other factors. There are wet prairies, dry prairies, long grass prairies, and short grass prairies, among other types.

Grasses and nonwoody plants are the most important vegetation in prairie habitats. Fires and grazing are important for prairies because they kill trees and shrubs that would otherwise turn a prairie into a forest. Native prairie plants survive fires and grazing because they have deep, large roots. Many of these native plants also have seeds that sprout after fires.

Fires are very rare now so there are fewer acres of prairie left. Prairie soils are also good for growing corn, soybeans, and other crops. Most of the prairie habitat in the Lake States has been turned into farmland. The wildlife species that once flourished in these prairies are becoming scarce.

Things you can do to revitalize the prairie include:

Prescribed burns (planned burns). Spring is a good time to burn, because this is the time non-native plants start growing. Fires also remove the previous year's dead plants so that new growth gets full sunlight. Burning is dangerous and must be done under professional guidance.

Mowing as an alternative to burning prairie. Timing is important for both mowing and burning prairies. Mowing should be done before birds start nesting so their nests are not destroyed.

Grazing. In some prairies bison and other grazing animals are part of habitat management. These animals kill shrubs and trees before they grow large. Grazing often hurts the non-native plants more than the native ones. One problem is that bison are a lot of work! Managers must feed and water them, build fences, and provide a large area for them to graze. There are only a few prairies where buffalo can be used as a part of habitat management.



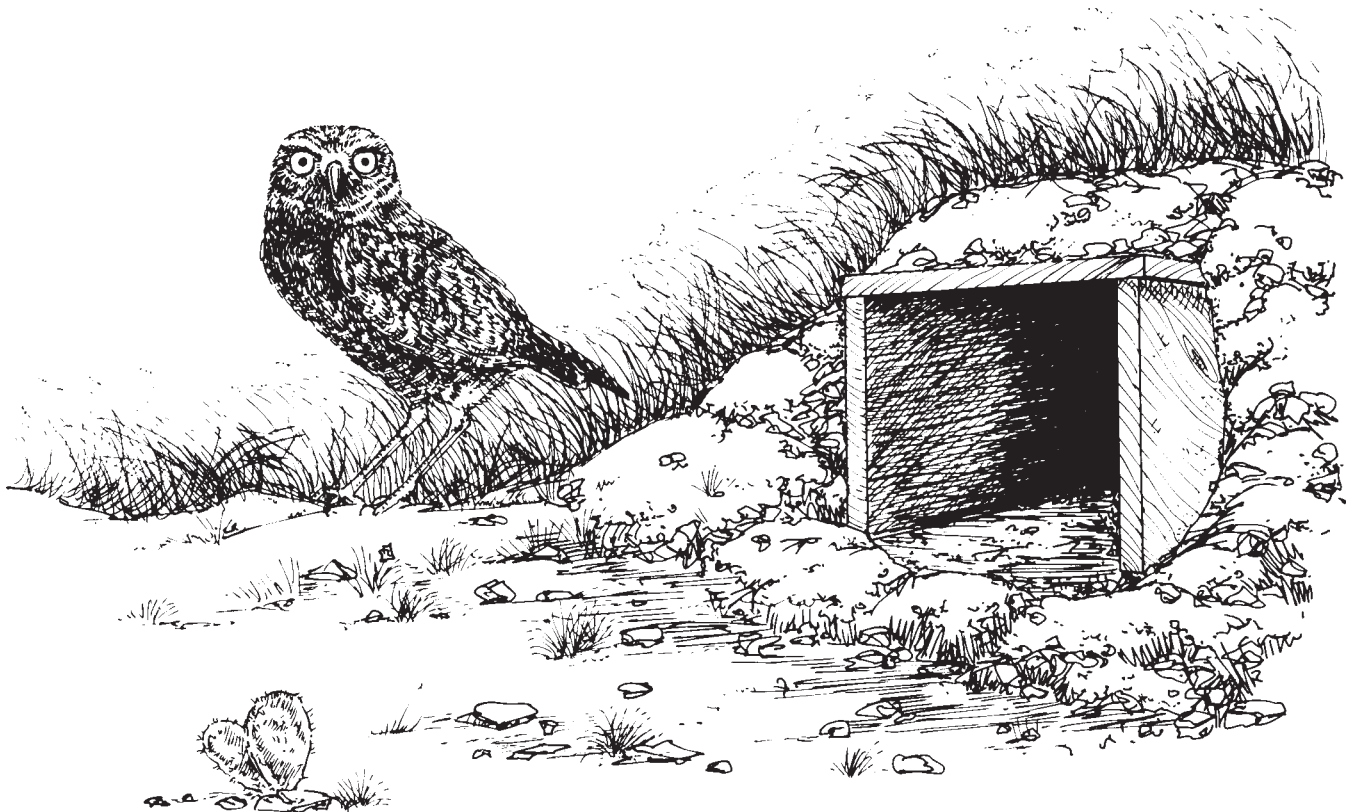
Provide habitat. Managers help some prairie animals by building nest boxes for them. Building nest boxes is a simple action that anyone can do. Bluebirds and burrowing owls are two that use artificial structures. Burrowing owls are adapted to living in old burrows of prairie dogs. Prairie dogs are rare now, partly because they are shot by people who think they are pests. Managers trying to get burrowing owls to move into prairie are burying wooden boxes underground to make nest sites for them.

Bluebirds use tree cavities and wooden fence posts to nest; however, there are fewer trees and wooden fence posts in prairie areas now. Also, non-native birds are competing for the smaller number of cavities. Managers and landowners have put up thousands of nest boxes for bluebirds in the eastern U.S. The population of these popular birds is increasing through this form of stewardship.

Wild Facts

American settlers

When the settlers from Europe first came to North America, they thought of the prairies as deserts where nothing could grow. They were afraid of the prairie because there were no trees or protection from wind, so they moved into the wooded areas first. At this same time there were many tribes of American Indians who existed by hunting prairie animals such as bison and deer and gathering the plants of the prairie for foods and medicines.



F. Farmland Stewardship

Farms today are mostly “monocultures” large areas of land planted to rows of a single crop. To keep these crops healthy, large amounts of pesticides and fertilizers are used. When it rains these chemicals create runoff with the soil into streams and wetlands and can harm the wildlife.

Farmers can reduce runoff by leaving or creating buffer areas of trees and shrubs around wetland areas.

Rows of trees planted around the cropland, called **shelterbelts**, keep the wind from blowing soil away and blowing down the crops.

Many different types of animals use these shelterbelts for food and cover, such as songbirds who nest and feed there. Shelterbelt areas provide winter cover for pheasants and other animals that are active in the winter.

Ditches are home to pheasants, goldfinches, cottontails, woodchucks, and other animals. Roadsides can support at least 40 different wildlife species, and if left undisturbed, can produce at least 25 to 50 percent of all pheasants raised in Minnesota. However, these areas can be death traps if they are mowed, burned, or plowed before young are hatched or born. Roadsides should not be mowed until at least July 15 or as late as August 30 if possible.

Rural residents can grow food plots for wildlife. Some farmers leave several rows of a crop standing on the outside of fields. These crops make great food for waterfowl while they are getting ready to fly south, or for deer and other wildlife that stay in the area during the winter. They also provide cover during bad winter weather.





G. Urban Habitat Stewardship

Plant gardens. Gardens can provide food for people, but also for rabbits, squirrels, raccoons, deer, voles, insects, many kinds of birds, and other animals. Snakes, rabbits, voles, and others may use a garden as cover to protect them from the sun and from predators.

Water the lawn. Slugs and insects do well in moist lawns. Raccoons, skunks, moles, and birds eat those insects. Robins often search for worms under sprinklers.

Plant shrubs. Several bird species use shrubs for nesting and roosting. Evergreen shrubs give birds, squirrels, and other animals cover in the winter. Voles eat the bark on shrubs sometimes.

Bird baths, decks on the house, bird feeders, bird houses, woodpiles, garages, attics, tree trimmings, and many other things that people have in their yards influence wildlife habitat.

Career Considerations

Wildlife managers have the job of managing an area for the benefit of wildlife. They often take care of several different species in the area. Wildlife managers are in charge of estimating population size of species and deciding what methods of management should be used. They also educate the public, enforce wildlife laws, and manage people.

Additional Activities

Study animals in shelterbelts. This project will take many hours over several weeks. Count, identify, and record the number of birds and nests you find. You should visit the shelterbelt at different times of the day at least five to 10 times. Do different species of birds and mammals use shelterbelts? Are there more birds in one kind of tree than in another? You can also compare two shelterbelt areas to one another, or a shelterbelt with a field, lawn, or roadside. Which has more diverse wildlife?

Plant trees, shrubs, and flowers for wildlife in a public area in your town or city. Talk with the city administrators in charge of the area you want to work in. Purchase or transplant plants that provide food or cover for wildlife that might use the area. Set up a display near the area to teach people what they can do in their yards to make a habitat for wildlife.

Set up an interpretive nature trail through a nearby park. Create signs at stops along the trail that give information on the wildlife or habitat found there.

Fair Projects/Exhibit Ideas

Make a display that shows your yard before and after you do some habitat management. (If you don't have a yard that is good for wildlife, you could make up a yard and show what could be done if you had the space or use a nearby park or vacant lot.) Map the location of the buildings, trees, shrubs, and gardens. Indicate on the map what plants you are adding and what kinds of wildlife use them. Take before and after pictures of your yard. The books, *Landscaping for Wildlife* and *Woodworking for Wildlife* by Carol Henderson (available from the DNR), give information that would be useful for this project.

Make a book illustrating different plants that provide food and shelter for wildlife in your area. Find out how to care for these and what animals use them. Include some drawings or photographs of the different plants.

Do some roadside plantings of native grasses to benefit wildlife in your area. Take pictures of the process and make a three-sided display that shows what you did, to teach others how to do it.

Interview professionals in the field of wildlife (wildlife managers working for DNR, Nature Conservancy, or the U.S. Fish and Wildlife Service) about their jobs. Make a display that illustrates their different job activities.

Appendix A

Population in Your Neighborhood Record Sheet

_____ Census/Survey
(name of animal you are counting)

Your name _____

Weather _____

Time of day _____

Number of animals actually seen _____

Size of the sampling area _____ by _____

Number of animals not seen but suspected _____

Number of insects seen _____

Plants/plantings related to the animal _____

Comments: _____

Appendix B

Search for Exotics Record Sheet

Name _____ Date _____ State _____

County _____ City or town _____

Species _____

Location _____

How it lives _____

Native species in the area _____

Name _____ Date _____ State _____

County _____ City or town _____

Species _____

Location _____

How it lives _____

Native species in the area _____

Name _____ Date _____ State _____

County _____ City or town _____

Species _____

Location _____

How it lives _____

Native species in the area _____

Appendix C

Diversity Survey Sheet

Name _____

Date _____

Location _____ City/County _____ State _____

Time _____ Weather conditions _____

Time spent on survey _____

Species List	# Individuals seen or heard
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

Total # species _____ Total # individuals _____

Comments _____

Glossary of Terms

Biodiversity *n.* Variety of living things or species in nature.

Biome *n.* A major regional or global biotic community, such as a grassland or desert, characterized chiefly by the dominant forms of plant life and the prevailing climate.

Captive breeding *n.* The process of breeding species (especially endangered species) in captivity such as a zoo or research center.

Census *n.* An official, usually periodic counting of a population, often including the collection of related demographic information.

Contaminant *n.* A pollutant that enters a species' habitat.

Ecosystem *n.* An ecological community together with its environment, functioning as a unit.

Emigrate *v.* To leave one country or region to settle in another.

Endangered *adj.* A species faced with the danger of extinction.

Exotic *adj.* **1.** From another part of the world; foreign. **2.** Intriguingly unusual or different; excitingly strange. — **exotic** *n.* One that is exotic.

Exploit *n.* **1.** To employ to the greatest possible advantage. **2.** To make use of selfishly or unethically.

Extinct *adj.* No longer existing or living.

Extirpate *vt.* **1.** To pull up by the roots. **2.** To destroy totally; exterminate.

Food chain *n.* A succession of organisms in an ecological community that constitutes a continuation of food energy from one organism to another as each consumes a lower member and in turn is preyed upon by a higher member.

Habitat *n.* **1.** The area or type of environment in which an organism or ecological community normally lives or occurs. **2.** The place in which a person or thing is most likely to be found.

Habitat contamination *n.* When pollution enters a habitat and poisons plants and animals.

Habitat edge *n.* The space between two different plant communities.

Habitat fragmentation *n.* When habitats are destroyed and large areas of the land are broken up into smaller ones.

Hibernacula *n.* A safe wintering place for reptiles.

Immigrate *v.* To enter and settle in a country or region not native to the species.

Introduced species *n.* Species brought into a habitat from another region, country, or area that are not native to that area.

Monoculture *n.* The cultivation of a single crop on a farm or in a region or country.

Population *n. Ecology.* All the organisms that constitute a specific group or occur in a specified habitat.

Predator *n.* An organism that lives by preying on other organisms.

Prey *n.* **1.** An animal hunted or caught for food; quarry. **2.** One that is defenseless, especially in the face of attack; a victim. **3.** The act or practice of preying. — **prey** *intr.v.* **preyed, preying, preys.** To hunt, catch, or eat as prey.

Rare *adj.* Infrequently occurring; uncommon.

Reintroduction *v.* When animals are brought back to an area where they once lived.

Sample *n.* **1.a.** A portion, piece, or segment that is representative of a whole. **b.** An entity that is representative of a class; a specimen. **2. Statistics.** A set of elements drawn from and analyzed to estimate the characteristics of a population. In this sense, also called sampling.

Shelterbelt *n.* Rows of trees planted around cropland that act as a windbreak for crops and habitat for wildlife.

Snags *n.* Dead trees that are still standing, which can be used for nesting and perching sites as well as food by birds and mammals.

Species *n.* A class of individuals or objects grouped by virtue of their common attributes and assigned a common name; a kind, variety, or type.

Steward *n.* A person who looks over and cares for something such as wildlife habitat.

Stock *n.* To provide or furnish with a stock of something; to fill (a stream, for example) with fish.

Threatened *v.* A species whose numbers are declining rapidly.

Timberharvest *v.* Also known as clearcutting. The process of cutting back trees to allow shrubs and plants to grow to provide food for wildlife.

Upland *n.* The elevated areas of a country, region, or tract of land.

Wetland *n.* A lowland area, such as a marsh or swamp, that is saturated with moisture, especially when regarded as the natural habitat of wildlife.



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