Student Pages Table of Contents

Alphabetical Listing

Grasshopper Questions

Interesting Features
What are the features of a grasshopper?

Legs
How many legs does it have? Are they alike or different? Which legs are the jumping legs? Notice where the legs are attached to the grasshopper's body.

Wings
Look at the wings, if they are present. How many wings are there? Notice where they attach to the body.

Head
Look at the head. How many eyes do you see? Do they look like your eyes? Check carefully in front and below the large, compound eyes for three smaller, simpler eyes. Why do you think they have so many eyes? These eyes probably see light but may not be able to see shapes, sizes, and colors.

Mouth
Do you see a mouth? Does the grasshopper have lips? Try to feed the grasshopper a leaf to watch the mouth parts move. Hold the leaf up to the mouth just touching it. Do not try to put the leaf in the mouth, of the grasshopper. Try to describe the mouth parts and how they move.

Antennae
Where are the antennae? Are they each a long, string-like, single appendage, or are they made up of many parts? Can you count the parts? Do they all look alike in size, shape, and color? Why do you think a grasshopper needs the antennae? For what? Think about radio and television antennae.

Motion
We usually think that grasshoppers "hop." Do they also walk? How do they walk on the ground or floor? If possible, watch the grasshopper climb a small stick, weed stem, or blade of grass. Does it use all of its legs? Without hurting your grasshopper, place it on the ground and make it jump (if it is an adult with wings, it may fly instead). Follow it and make it hop or jump several times (at least five times). Does it hop the same distance each time? Measure or estimate the distance of each hop or flight. Does the grasshopper seem to get tired? What makes you think so?

Noise
Do grasshoppers make noises? If your grasshopper makes a noise, try to learn if it does it with its mouth or with some other part of its body.

Colors
Look at the whole grasshopper carefully. Is it the same color all over? Are the colors, shapes, and sizes the same on both sides? What is attractive about your grasshopper? Is it clean? Watch to see what the grasshopper does to clean or groom itself.

Habitat
Where does the grasshopper live? What does it eat? Do grasshoppers live in your neighborhood year-round? Suggest two reasons why grasshoppers might not be seen during the winter (such as freezing temperature, not enough food).

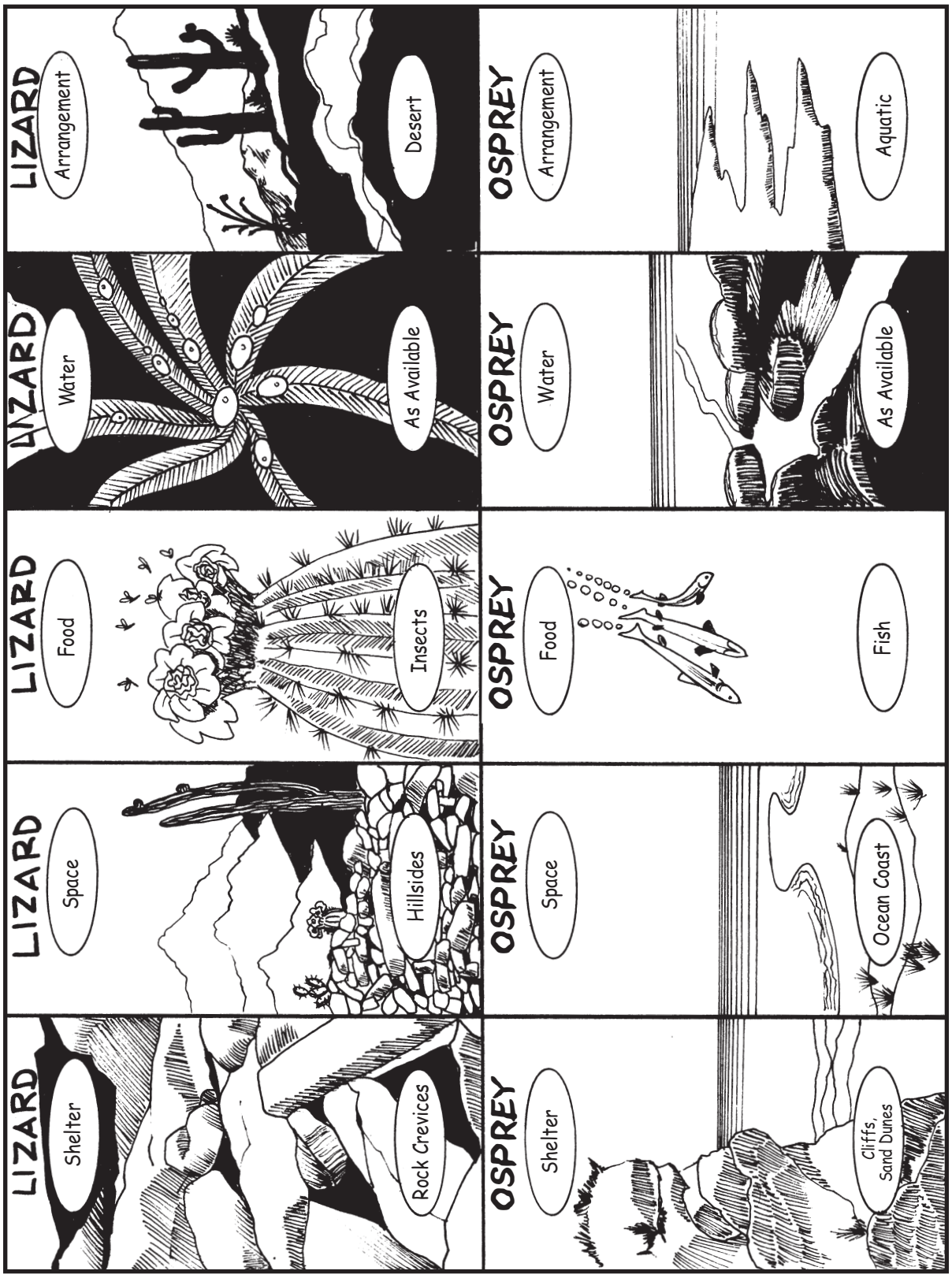
Conclusions
Did you think there were so many interesting things about grasshoppers? Do you think other insects might be as interesting? What other insects or small animals might be interesting to look at and learn more about?

Habitat Information Chart

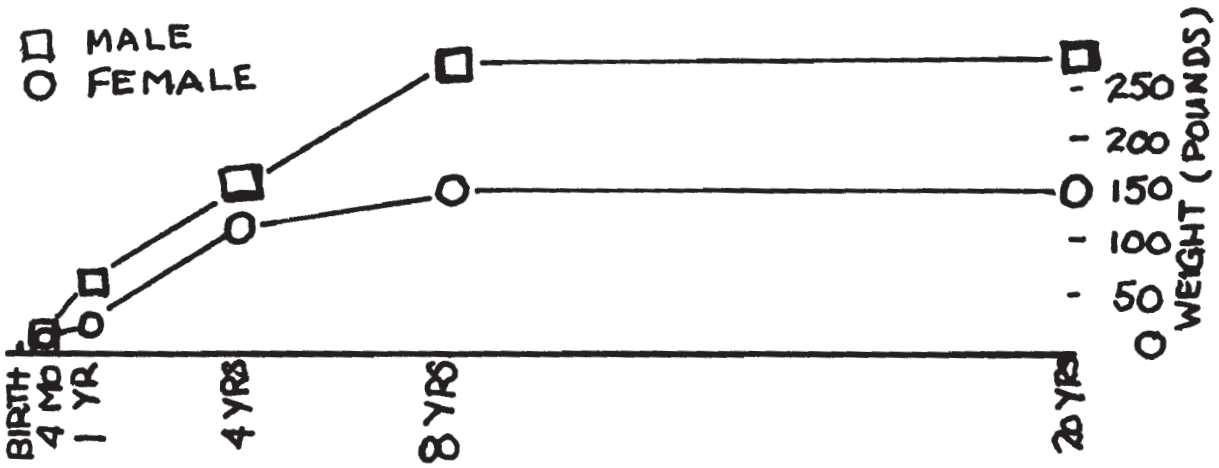
Animals

Habitat Components	Lizard	Osprey	Bear	Chipmunk
Food	Insects	Fish	Insects, Fish, Berries, Birds, Eggs, Mammals	Seeds, Berries
Water	Freshwater (as available)	Water (as available)	Rivers, Lakes, Streams	Freshwater (streams, ponds, dew)
Shelter	Rock Crevices	Cliffs, Sand Dunes	Caves	Burrows
Space	Hillsides	Ocean Coasts	Hills, Valleys	Hillsides
Arrangement	Deserts	Coasts and Inland	Woodland	Meadow Woodlot


CHIPMUNK
Shelter
Burrow
CHIPMUNK
Space
Hillsides
CHIPMUNK
Food
Seeds, Berries
CHIPMUNK
Water
Streams, Ponds, Dew
CHIPMUNK
Arrangement
Woodlands, Meadows
BEAR
Shelter
Caves
BEAR
Space
Hills, Valleys
BEAR
Food
Insects, Birds, Eggs, Seeds, Nuts, Berries, Fish, Mammals
BEAR
Water
Lakes, Streams, Snow
BEAR
Arrangement
Woodland


LIZARD
Shelter
Rock Crevices
LIZARD
Space
Hillsides
LIZARD
Food
Insects
LIZARD
Water
As Available
LIZARD
Arrangement
Desert
OSPREY
Shelter
Cliffs, Sand Dunes
OSPREY
Space
Ocean Coast
OSPREY
Food
Fish
OSPREY
Water
As Available
OSPREY
Arrangement
Aquatic

WEIGHT AND AGE RELATIONSHIPS FOR BLACK BEARS CHART



(Data are characteristic of black bears in the southwestern United States. There will be regional variations.)

Student Data Page

Part I: For use in completing chart on page 22

Black Bear Biology

The black bear (*Ursus americanus*) can be found in the United States, Canada, and Alaska. In the east, the black bear primarily inhabits forests and swamps. In the west, the black bear roams chiefly in mountainous areas. Black bears are primarily nocturnal but occasionally roam around during the mid-day.

A black bear's life span averages 20 to 25 years. Longevity and survival of the black bear depend upon the availability of a suitable habitat and its ability to avoid humans. An adult female bear is called a sow. An adult male bear is called a boar. A baby bear is called a cub. When a sow becomes sexually mature between 2 and 3 years old, she is capable of breeding and may have one to four cubs. Contrasted with human fetal development of about 9 months, the sow is pregnant for about 7 months.

The sow has her cub or cubs in the shelter or den where she spends the winter months. On average, a female black bear will have two cubs. The sow does not have a litter every year but every other year. At birth, a young cub weighs about 8 ounces—about the size of a guinea pig. Bear cubs stay in the den with their mother until they are able to move around very actively, usually until late April or early May.

Bears and humans are classified as mammals, which means that both are warm-blooded, nourish their young with milk, and are covered with varying amounts of hair. Bear cubs and humans survive solely on their mother's milk for the first few months of life. Cubs nurse while in the den and only for a short time after leaving the den in early spring. By the time berries ripen and grasses are plentiful, the cubs have learned to climb and can eat the available food sources. Soon the cubs will need to hunt and gather food for themselves without the help of the sow. At about 18 months of age, the cubs must go out searching for their own home range. The sow will allow the female cubs to stay within her home range. The male cubs, however, must find territory to claim as their own.

Black bears are omnivores, which means they eat both plant and animal material. In early spring, they tend to eat wetland plants, grasses, insects, and occasionally carrion (dead animal matter) or the protein-rich maggots found near the carrion. In late spring and early summer, bears feed on berries, grubs, and forbs (broad leafed plants). In late summer and early fall, bears feed mostly on nuts and acorns. In the fall season, bears must add much fat to their bodies in order to survive the winter months in their dens. Cub growth will vary throughout the country.

When black bear cubs reach one year of age, the female cubs weigh 30 to 50 pounds and the males weigh 50 to 70 pounds. A mature female bear weighs 150 to 185 pounds, and a male bear weighs about 275 pounds. (Sources: *Arkansas Black Bear: A Teacher's Guide for Kindergarten Through Sixth Grade*, Arkansas Game and Fish Commission; *WILD About Bear*, ID Dept of Fish and Game and; *A Field Guide to the Mammals*, Houghton Mifflin Co., 1980).

Part II: For use in completing the evaluation on page 20

Table A

Catfish in Lake Erie and the Ohio River

	AGE IN YEARS								
	1	2	3	4	5	6	7	8	9
Lake Erie catfish	69	115	160	205	244	278	305	336	366
Ohio River catfish	56	101	161	227	285	340	386	433	482

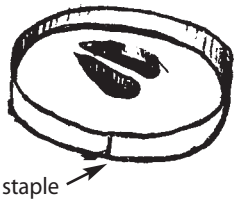
(size in mm)

Compare Yourself to a Black Bear

The average height of an adult male black bear standing upright:	**Your height:**
The weight of an adult male black bear:	**Your weight:**
The average weight of a 1-year-old male black bear:	**Your weight at 1 year of age:**
The average birth weight of a black bear cub:	**Your birth weight:**
The average number of cubs that a black bear has per litter:	**Average number of babies your mom had at one time:**
The length of time a cub stays with its mother:	**Number of years you probably will stay at home:**
The range of a black bear's life span:	**Average person's life span:**

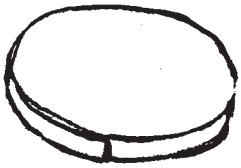
Clean track and spray with shellac or clear plastic

Circle the track with a cardboard dam

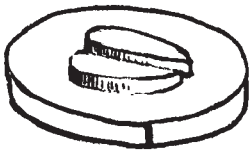


staple

Fill the dam with plaster



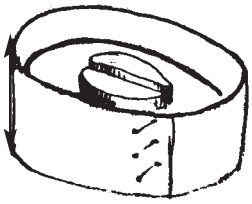
Once hardened, remove the dam and clean the plaster



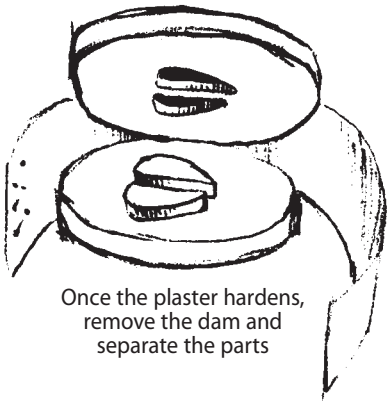
Coat the cast with petroleum jelly

Don't forget a petroleum jelly coating

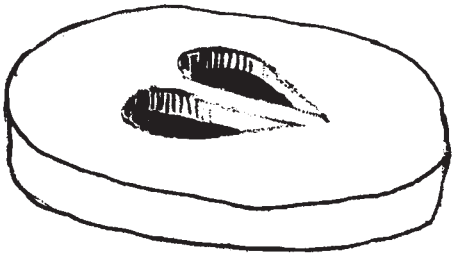
Twice the size of the first



Make a larger dam and fill with plaster

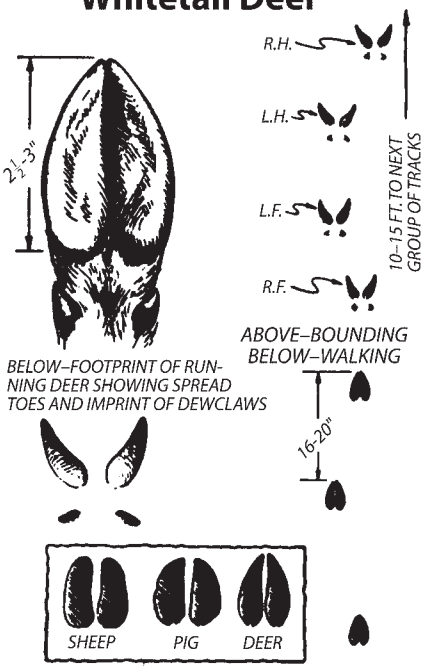


Once the plaster hardens, remove the dam and separate the parts

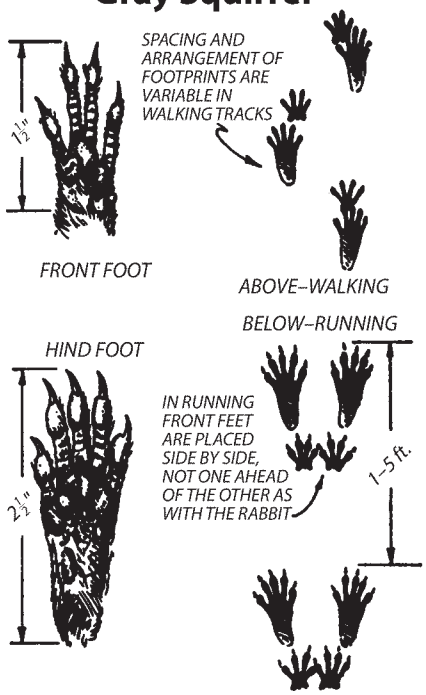


Paint the finished track so it looks realistic

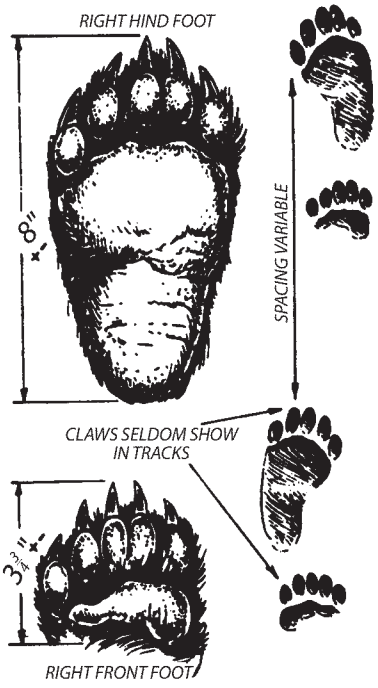
Whitetail Deer



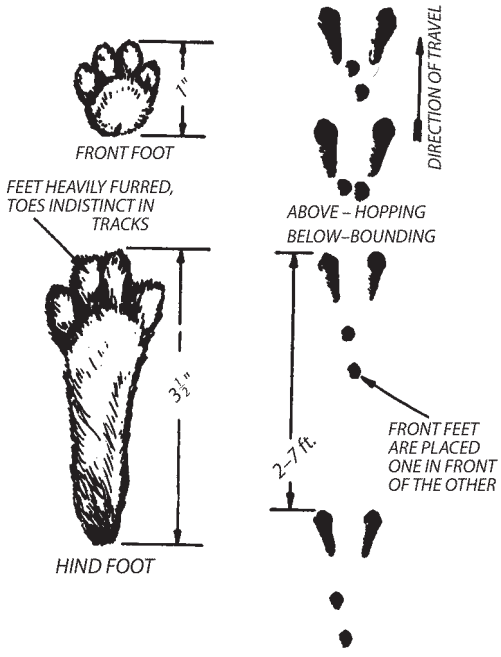
Gray Squirrel



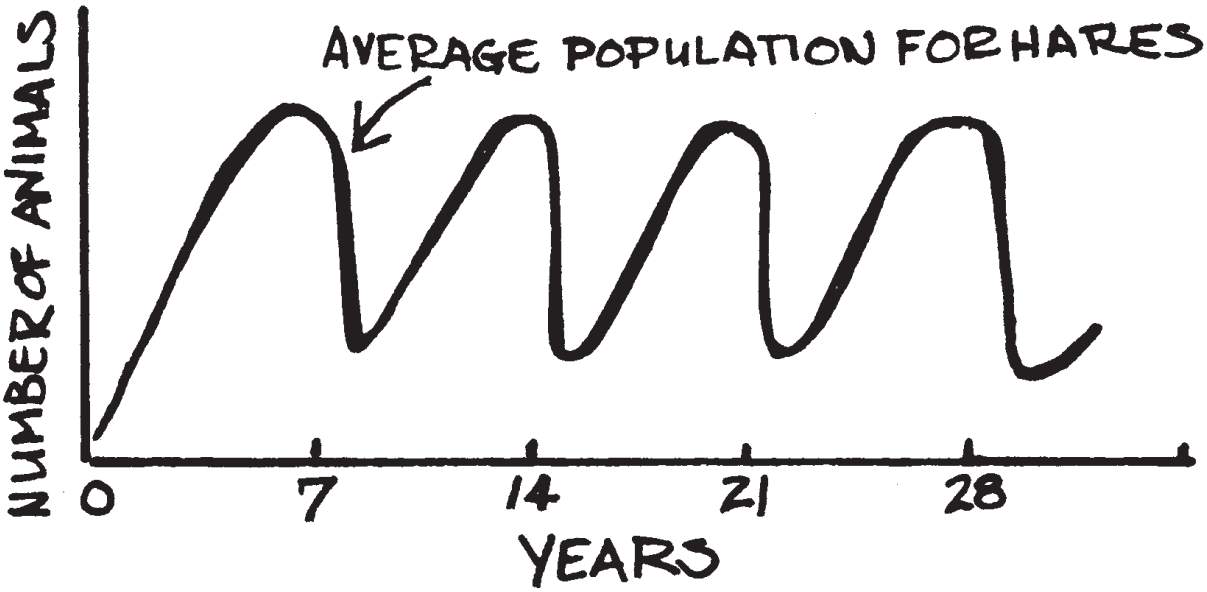
Black Bear

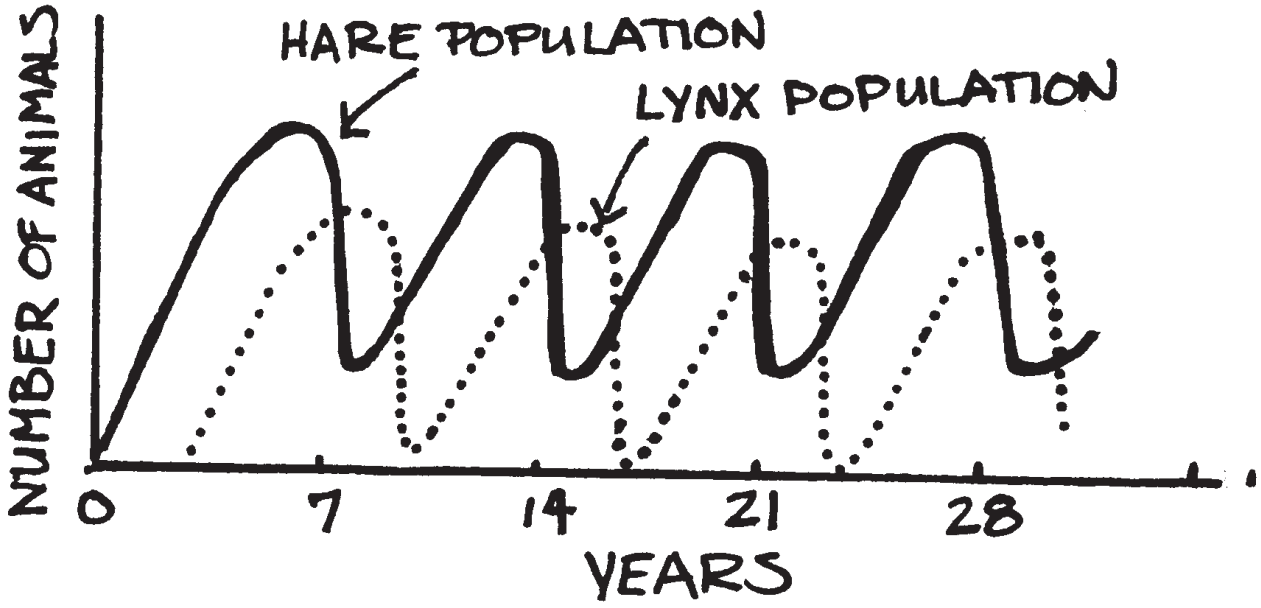


Cottontail Rabbit



Source: J. J. Shomon
Reprinted from *Virginia Wildlife Magazine*


AVERAGE POPULATION FOR HARES
NUMBER OF ANIMALS
0
7
14
21
28
YEARS


HARE POPULATION
LYNX POPULATION
NUMBER OF ANIMALS
0
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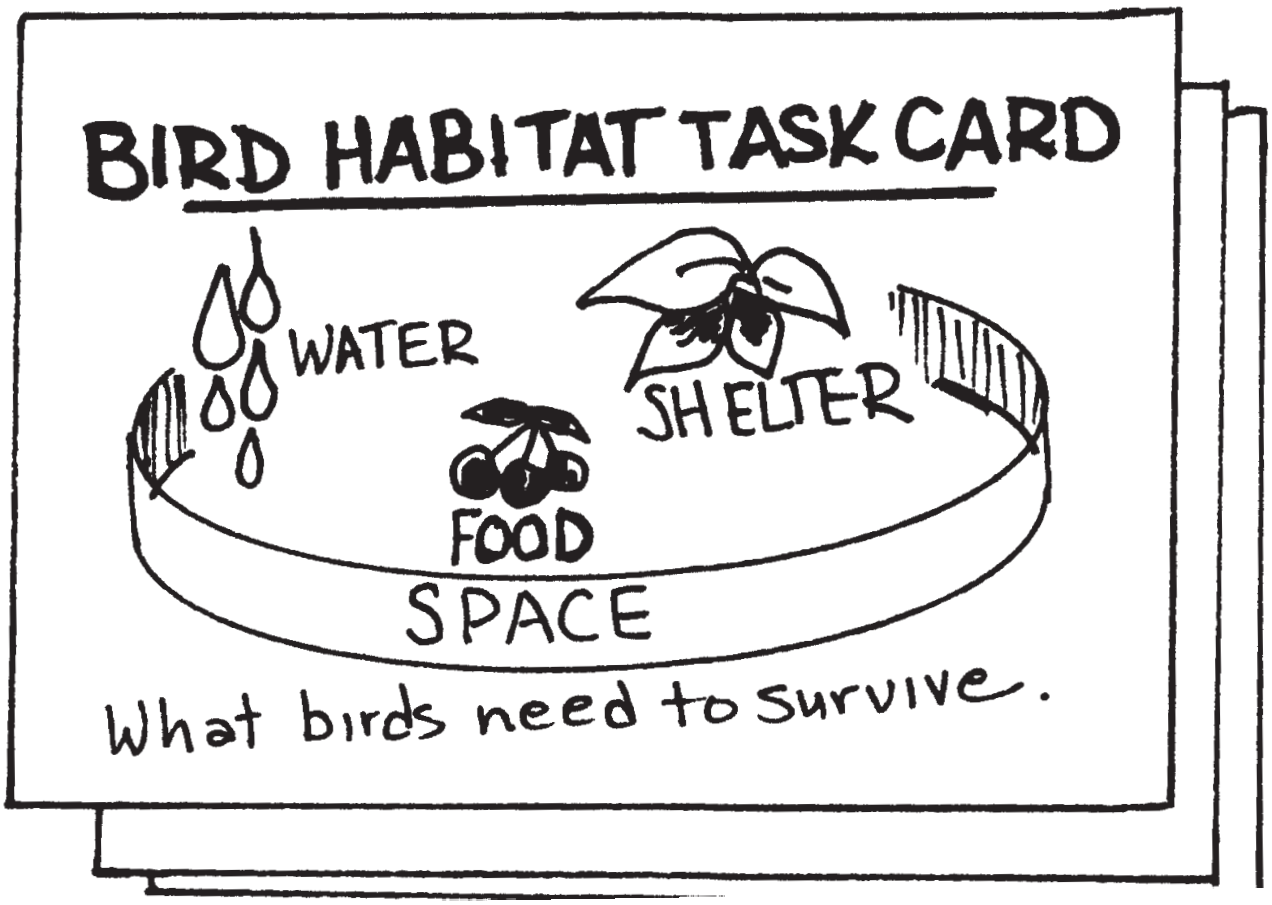
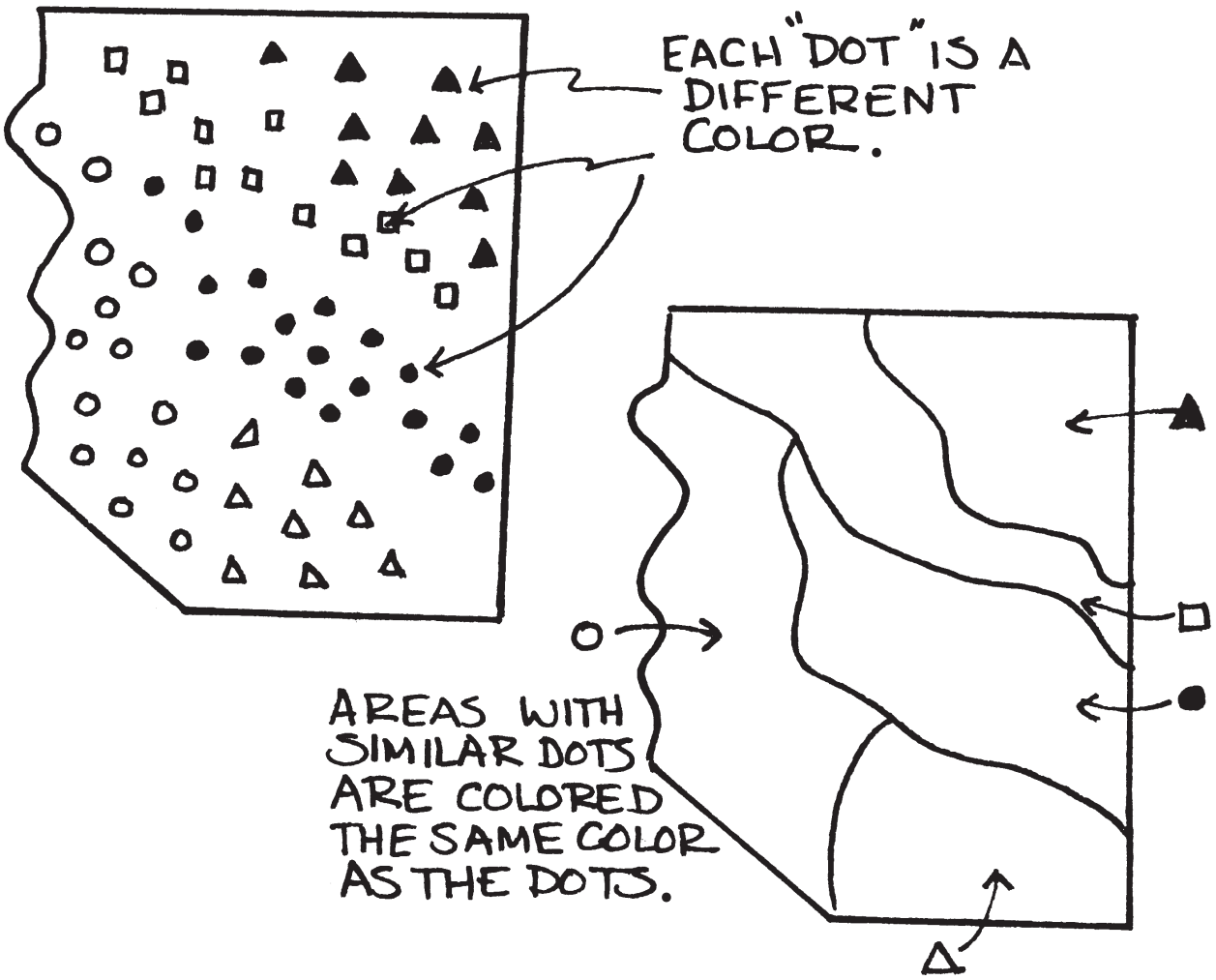
14
21
28
YEARS




EACH "DOT" IS A DIFFERENT COLOR.
AREAS WITH SIMILAR DOTS ARE COLORED THE SAME COLOR AS THE DOTS.

GROUP #1
HABITREKKING EVIDENCE LIST #1

Caution: You may bring back evidence, but be careful not to harm the wildlife or environment.

Find Evidence That

1. Humans, domesticated animals, and wildlife all need food, water, shelter, and space arranged so they can survive.
2. All living things are affected by their environment.
3. Animals—including people—depend on plants—either directly or indirectly.

GROUP #2
HABITREKKING EVIDENCE LIST #2

Caution: You may bring back evidence, but be careful not to harm the wildlife or environment.

Find Evidence That

1. Humans and wildlife share environments.
2. Wildlife is everywhere.
3. Wildlife can be in many forms and colors, and can have special features that help it live in its environment.

GROUP #3
HABITREKKING EVIDENCE LIST #3

Caution: You may bring back evidence, but be careful not to harm the wildlife or environment.

Find Evidence That

1. Humans and wildlife are subject to the same or similar environmental problems.
2. The health and well-being of both people and wildlife depend on a good environment.
3. Environmental pollution affects people, domesticated animals, and wildlife.

WILDLIFE TREASURE HUNT

This is a treasure hunt to look for evidence of wildlife.

CAUTION: Be careful not to harm any animals or their homes.

Find evidence that

1. Humans and wildlife share the same environment.
2. Humans and wildlife must adjust to their environment, move to a more suitable environment, or perish.
3. Wildlife is all around even if it's not seen or heard.
4. Wildlife can be many different sizes.
5. People and wildlife experience some of the same problems.
6. Both people and wildlife need places to live.

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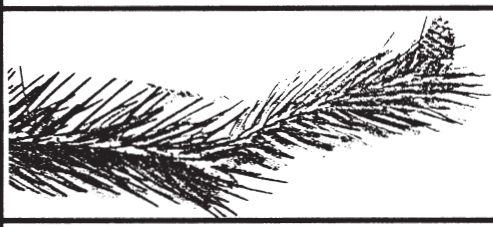
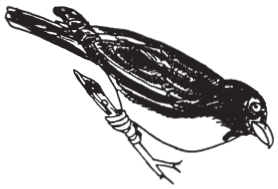
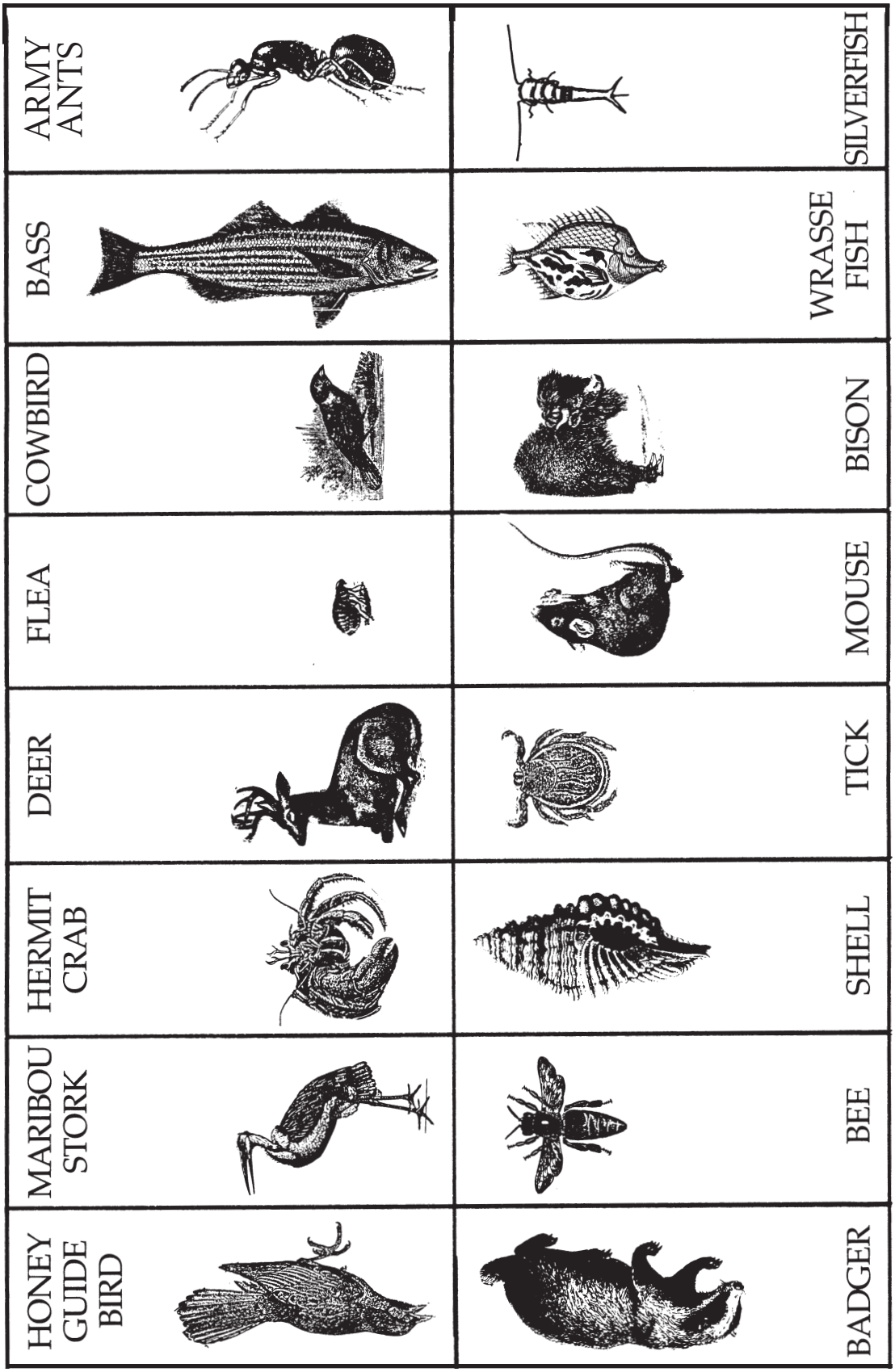
Animals	Relationship	Comments
Barnacle/Whale	Commensalism	Barnacles create home sites by attaching themselves to whales. This relationship neither harms nor benefits the whales.
Remora/Shark	Commensalism	Remoras attach themselves to a shark's body. They then travel with the shark and feed on the leftover food scraps from the shark's meals. This relationship neither harms nor benefits the shark.
Bee/Maribou stork	Commensalism	The stork uses its saw-like bill to cut up the dead animals it eats. As a result, the dead animal carcass is accessible to some bees for food and egg laying. This relationship neither harms nor benefits the stork.
Silverfish/Army ants	Commensalism	Silverfish live and hunt with army ants, and share the prey. They neither help nor harm the ants.
Hermit crab/Snail shell	Commensalism	Hermit crabs live in shells made and then abandoned by snails. This relationship neither harms nor benefits the snails.
Cowbird/Bison	Commensalism	As bison walk through grass, insects become active and are seen and eaten by cowbirds. This relationship neither harms nor benefits the bison.
Yucca plant/Yucca moth	Mutualism	Yucca flowers are pollinated by yucca moths. The moths lay their eggs in the flowers where the larvae hatch and eat some of the developing seeds. Both species benefit.
Honey guide bird/Badger	Mutualism	Honey guide birds alert and direct badgers to bee hives. The badgers then expose the hives and feed on the honey first. Next the honey guide birds eat. Both species benefit.
Ostrich/Gazelle	Mutualism	Ostriches and gazelles feed next to each other. They both watch for predators and alert each other to danger. Because the visual abilities of the two species are different, they each can identify threats that the other animal would not see as readily. Both species benefit.
Oxpecker/Rhinoceros	Mutualism	Oxpeckers feed on the ticks found on a rhinoceros. Both species benefit.
Wrasse fish/Black sea bass	Mutualism	Wrasse fish feed on the parasites found on the black sea bass's body. Both species benefit.
Mistletoe/Spruce tree	Parasitism	Mistletoe extracts water and nutrients from the spruce tree to the tree's detriment.
Cuckoo/Warbler	Parasitism	A cuckoo may lay its eggs in a warbler's nest. The cuckoo's young will displace the warbler's young, and the warbler will raise the cuckoo's young.
Mouse/Flea	Parasitism	A flea feeds on a mouse's blood to the mouse's detriment.
Deer/Tick	Parasitism	Ticks feed on deer blood to the deer's detriment.

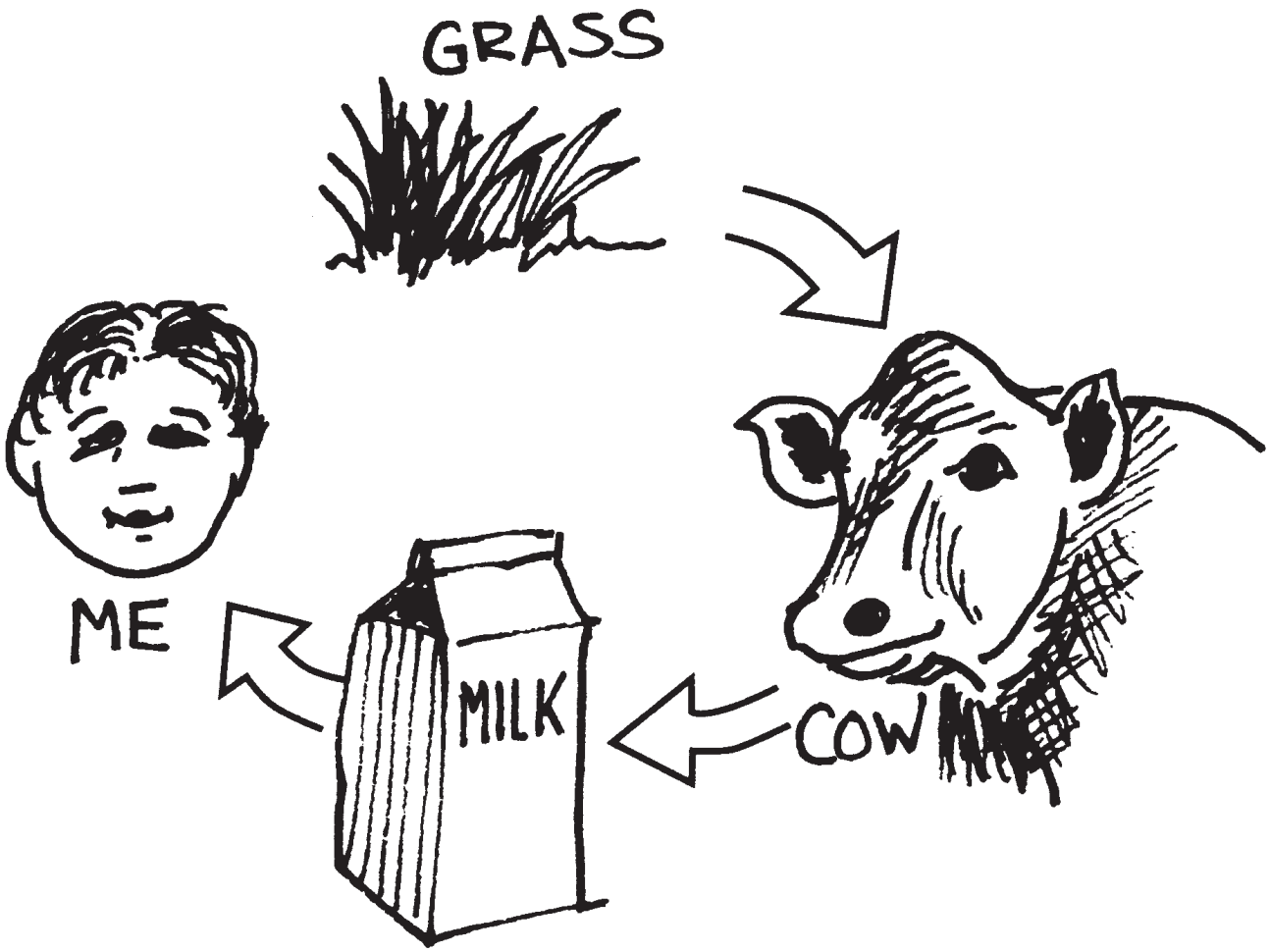
Master Cards

OSTRICH	WARBLER	YUCCA MOTH	WHALE	SPRUCE	RHINO	SHARK	GOODBUDDY CARD
							

GAZELLE	CUCKOO	YUCCA	BARNACLE	MISTLETOE	OXPECKER	REMORA
						

Master Cards




GRASS
ME
MILK
COW

One possible arrangement for the energy system in a classroom:

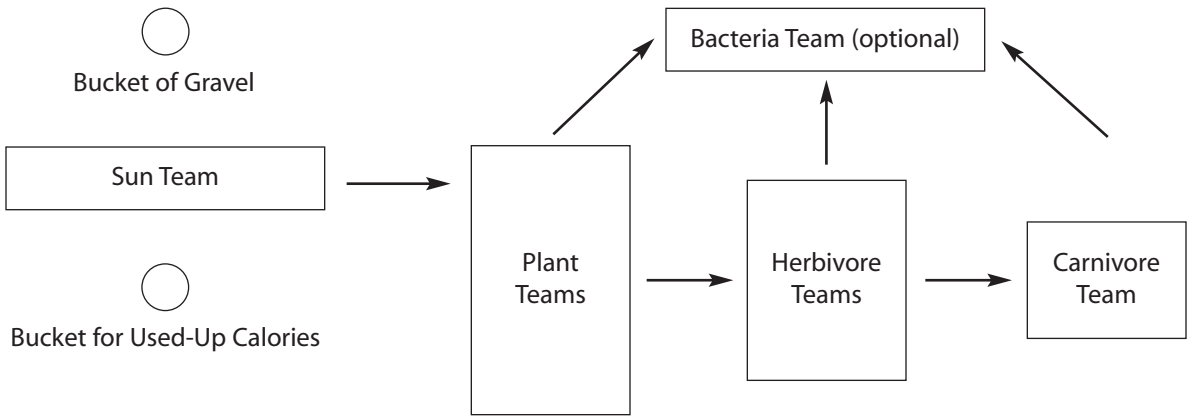


Diagram A

Total Growth Chart

	Round 1	**Round 2** (optional)	**Round 3** (optional)	
	Growth Calories	Growth Calories	Growth Calories	Nutrients
Carnivore				
Herbivore				
Plant				
Bacteria				

Plant Metabolism Cards

Unused Sunlight

Not all sunlight can be converted into organic matter.

Place two calories in this bowl.

Reproduction

Plant uses energy to produce seeds.

Place three calories in this bowl.

Growth

Plant uses energy to grow.

Place one calorie in this bowl.

Photosynthesis

Plant absorbs energy from the sun and produces organic matter.

Place three calories in this bowl.

Respiration

Plants burn energy in the process of photosysthesis.

Place one calorie in this bowl.

Herbivore Metabolism Cards

Digestion

Herbivore uses energy to break down consumed food.

Place two calories in this bowl.

Movement

Herbivore uses energy to search for water.

Place three calories in this bowl.

Reproduction

Herbivore uses energy to create nest and raise young.

Place three calories in this bowl.

Growth

Herbivore uses energy to grow.

Place one calorie in this bowl.

Respiration

Herbivore uses energy to watch for predators.

Place one calorie in this bowl.

Carnivore Metabolism Cards

Digestion

Carnivore uses energy to break down consumed food.

Place two calories in this bowl.

Movement

Carnivore uses energy to search for prey and to hunt food.

Place three calories in this bowl.

Respiration

Carnivore uses energy to build a shelter.

Place one calorie in this bowl.

Reproduction

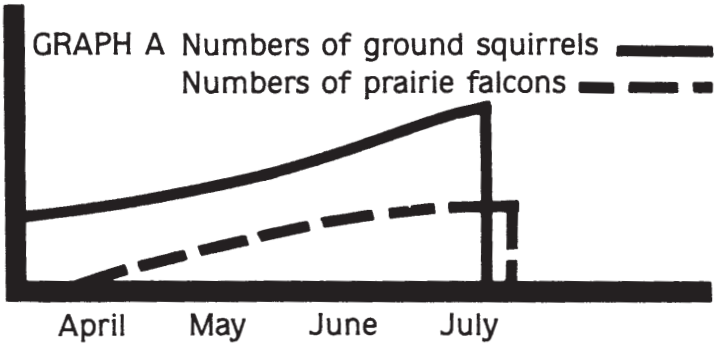
Carnivore uses energy for extensive courtship display and extra hunting to raise young.

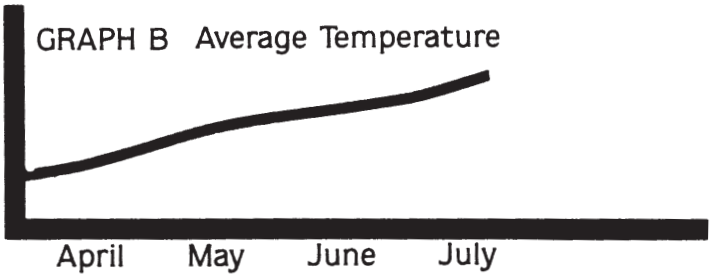
Place three calories in this bowl.

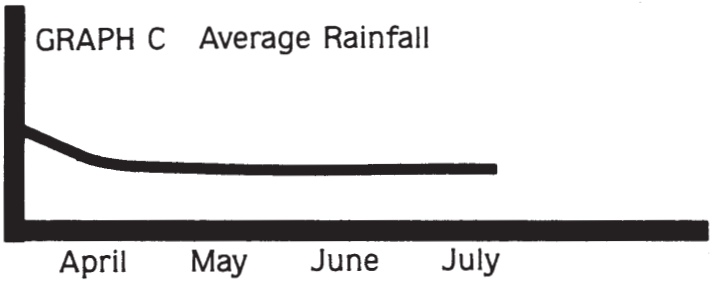
Growth

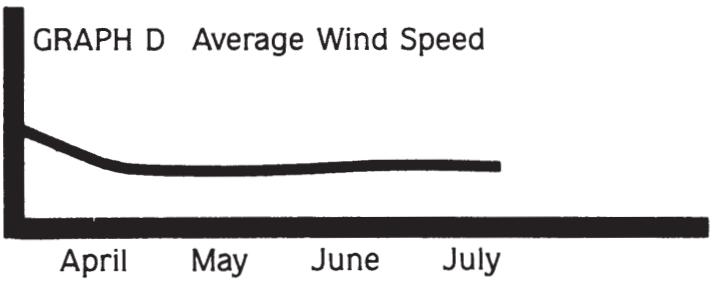
Carnivore uses energy to grow.

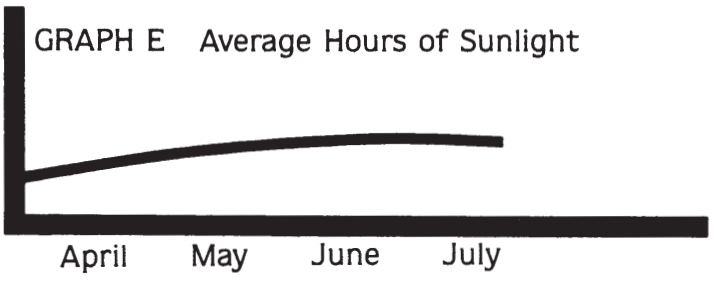
Place one calorie in this bowl.

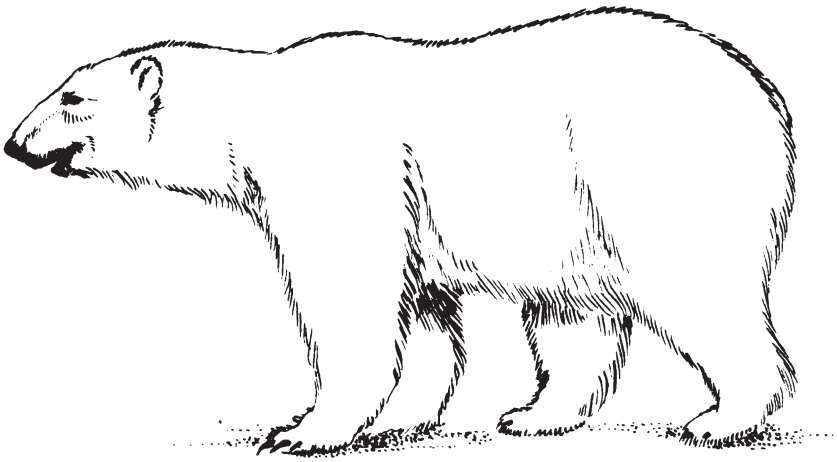

GRAPH A Numbers of ground squirrels
Numbers of prairie falcons
April
May
June
July

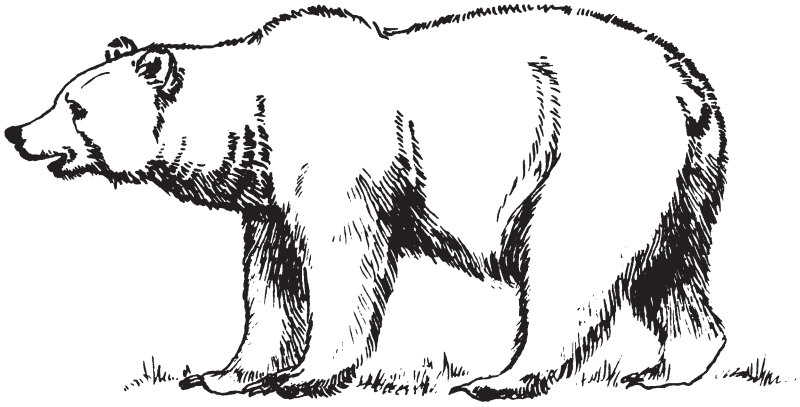

GRAPH B Average Temperature
April
May
June
July

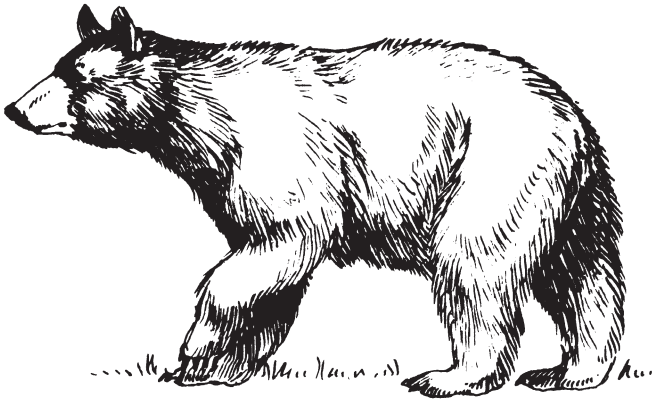

GRAPH C Average Rainfall
April
May
June
July


GRAPH D Average Wind Speed
April
May
June
July

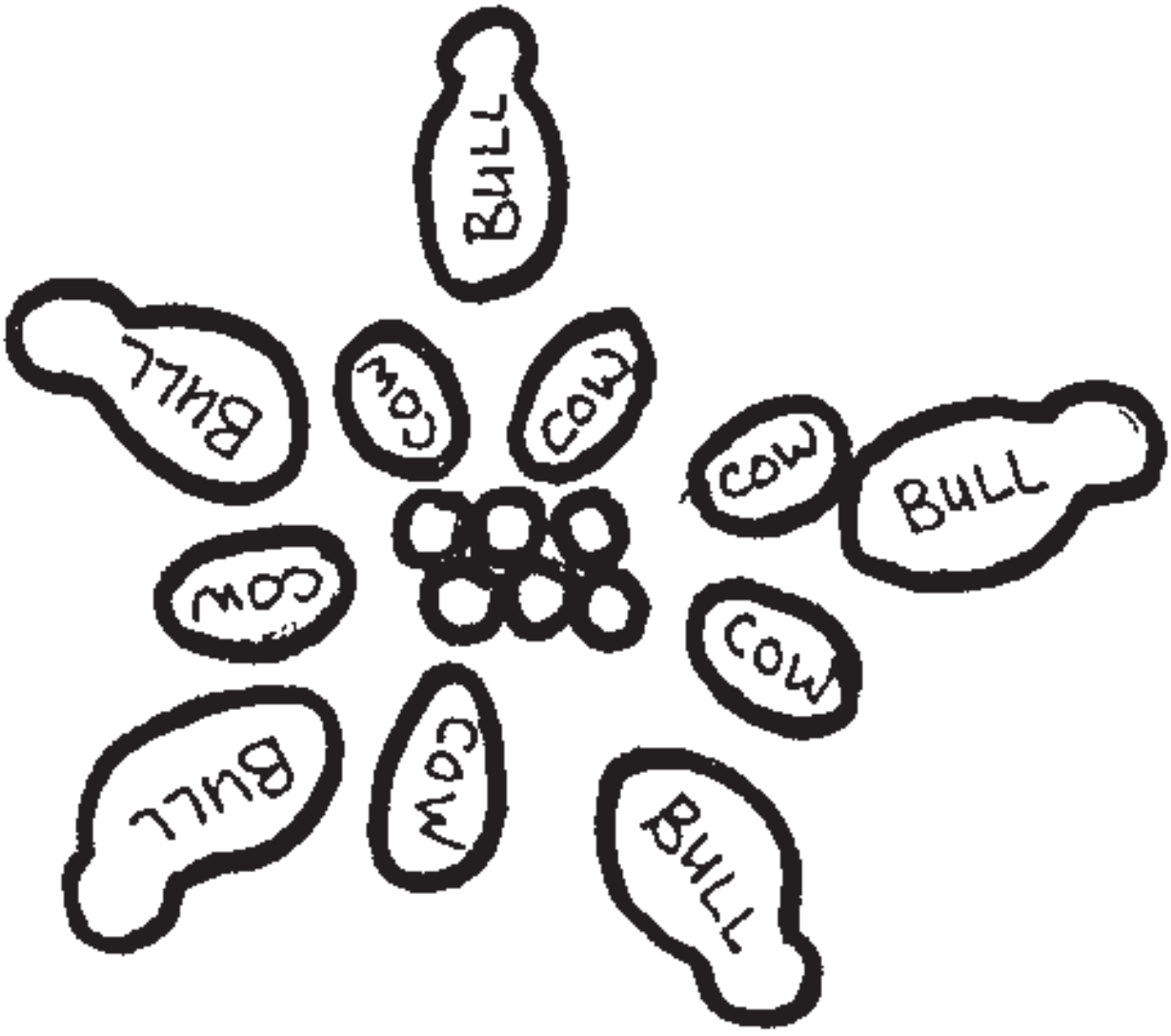

GRAPH E Average Hours of Sunlight
April
May
June
July







Adaptation	Bird	Advantage
Beaks		
• Pouch-like	Pelican	Can hold the fish it eats
• Long, thin	Avocet	Can probe shallow water and mud for the insects it eats
• Pointed	Woodpecker	Can break and probe bark of trees for the insects it eats
• Curved	Hawk	Can tear solid tissue for the meat it eats
• Short, stout	Finch	Can crack the seeds and nuts it eats
• Slender, long	Hummingbird	Can probe the flowers for nectar it eats
Feet		
• Webbed	Duck	Aids in walking on mud
• Long toes	Crane, Heron	Aids in walking on mud
• Clawed	Hawk, Eagle	Can grasp food when hunting prey
• Grasping	Chicken	Aids in sitting on branches, roosting, protection
Legs		
• Flexor tendons	Chicken	Aids in perching, grasping
• Long, powerful	Ostrich	Aids running
• Long, slender	Heron, Crane	Aids wading
• Powerful muscles	Eagle, Hawk	Aids lifting, carrying prey
Wings		
• Large	Eagle	Aids flying with prey, soaring while hunting
Coloration		
• Bright plumage	Male birds	Attraction in courtship, mating rituals
• Dull plumage	Female birds	Aids in camouflage while nesting
• Change of plumage with seasons	Owl, Ptarmigan	Provides camouflage protection (brown in summer, white in winter)


BULL
BULL
COW
COW
COW
BULL
COW
COW
BULL
BULL

I'm Thirsty

Animals can have incredible adaptations in order to survive in their environments. Use the following hypothetical example of the desert bighorn sheep: The desert bighorn live in dry, sparsely vegetated areas of the southwestern United States. Temperatures on summer days are frequently over 100° F (37.8° C). During the hottest months of summer, ewes (females) and lambs come to waterholes almost daily. The male sheep (rams) sometimes do not come to water for nearly a week at a time. Rams may roam 20 miles (32 kilometers) away from the available water supply. Add 20 miles (32 kilometers) to the approximately 5 miles (8 kilometers) traveled per day, and rams may travel almost 75 miles (120 kilometers) before they drink again. Rams are believed to drink approximately 4 gallons (15.2 liters) of water when they do come to water, while an ewe drinks approximately 1 gallon (3.8 liters) and a lamb drinks 2 pints (940 milliliters).

Questions for Students

1. How many miles to the gallon (or kilometers per liter) does a ram get?
2. How many gallons (or liters) of water would a ram drink in a month?
3. How many gallons (or liters) of water would a ewe drink in a month?
4. How many gallons (or liters) of water would a lamb drink in a month?
5. How much water must be available in a waterhole for 10 rams, 16 ewes, and 7 lambs in order for them to survive the months of June, July, and August?
6. What rate of inflow would a waterfall have to have to sustain the population given above if water evaporated at a rate of 10 gallons (38 liters) per day?

Table A

Field Investigation Data

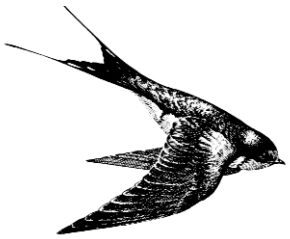
	Recent Fire Area	Fire 10–15 Years Ago	No Recorded Fire
Soil Data			
Plant Species			
Associated Wildlife/ Evidence of Wildlife			
Wildlife Observed			

Table B

Consequences to Species

	Short-Term Benefit	Long-Term Benefit	Short-Term Harm	Long-Term Harm
Plants				
Animals				

Animal Cards



1.

This bird likes to fly close to the ground and lives in open or semi-open areas. It builds nests of mud and grass.

2.

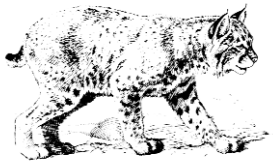
This mammal lives in deserts, forests, and grasslands near rocky outcrops. It feeds on crickets, grasshoppers, scorpions, and spiders.

3.

This mammal feeds on the inner layer of tree bark with the help of its large front teeth. It blocks streams and rivers with its dam.

4.

This mammal must be sure-footed to reach the sparse grass upon which it feeds.



5.

This mammal hunts at night and makes its den in rock crevices and hollow logs.

6.

This amphibian is an incredibly small wood toad.

7.

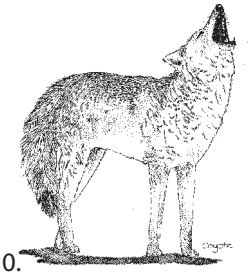
This bird hunts at night. It lives in underground burrows of animals.

8.

This insect's larvae feed on crops of alfalfa.

9.

This animal feeds on seeds and acorns near streams and is common around camp sites.



10.

This mammal eats small rodents, rabbits, and birds. It also eats the remains of animals killed by wolves and mountain lions.

Animal Cards

11.

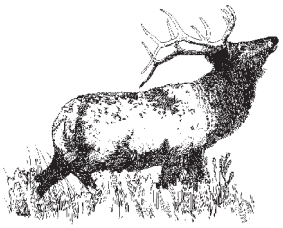
This mammal nests in the ground, in trees, and in stumps. It eats seeds, nuts, and acorns, and it stores its food.

12.

This tick feeds on the blood of mammals.

13.

This insect lays its eggs in water. The mature insect can be seen flying and using its large wings.



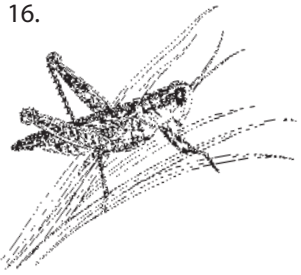
14.

This mammal's haunting mating calls echo through the high-country in late fall.

15.

This bird hunts large rodents, such as rabbits, during the day. It uses its keen eyesight to locate prey as it soars in the sky.

16.



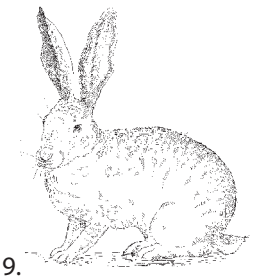
This insect eats large amounts of vegetation. It lives in places that produce lots of green plants.

17.

This bird uses its long legs to walk through still water and to hunt fish and water snakes.

18.

This bird hunts at night for rodents and snakes. It gets its name from the two tufts of feathers on the top of its head.



19.

This mammal uses its strong hind legs to escape predators.

20.

This mammal gets the water it needs from the plants it eats.

Animal Cards

21.

This mammal can live in many kinds of places near water. It often nests in the burrows of other animals or under wood or rock piles.

22.

This mammal is a good swimmer. It often feeds on grasses, seeds, and bark.

23.

This mammal is an excellent swimmer. It eats eggs, frogs, crayfish, birds, and fish.

24.

This large mammal eats twigs and bark in winter and water plants in summer in areas where beavers are common.

25.

This insect feeds on the blood of many animals. It lays its eggs in still water.

26.

This mammal eats brush and sparse grasses. Its name comes from its large ears.

27.

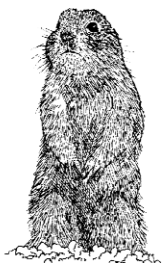
This mammal eats mostly aquatic plants but it may also eat frogs, clams, and other aquatic animals.

28.

Once nearly extinct, this fast predatory bird has made a remarkable recovery since the ban of the pesticide DDT.

29.

This mammal eats the bark of pine trees. It protects itself with its sharp, pointed quills.



30.

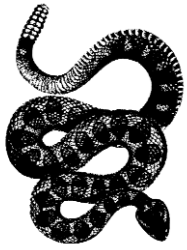
This mammal's burrow provides homes for other animals, including burrowing owls.

Animal Cards

31. This mammal runs incredibly fast in the wide-open spaces it lives in.

32. This mammal eats many foods and may dunk the food in water before eating. It often lives in hollow logs.

33. This brightly colored fish has been stocked in many areas and has moved into the territories of many native species.

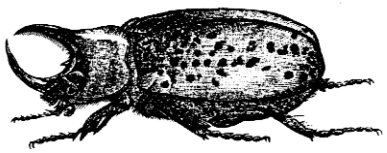


34. This reptile warns intruders to stay away with its rattling sound.

35. This mammal uses its hunting skills to catch deer mice and other small mammals.

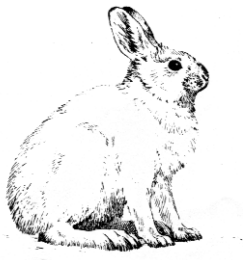
36. This bird roosts in flocks near open water or in open areas.

37. This fish-eating mammal lives along streams, lakes, marshes, and rivers.



38. This insect does not develop large wings because of high winds.

39. This mammal comes out at night, and it sleeps in ground burrows, wood, or rock piles.



40. This mammal changes color with the seasons, which allows it to escape predators.

Animal Cards

41.

This popular catch for anglers is very colorful.

42.

This spider looks dangerous, but it hunts only insects.

This amphibian lives in or near water its entire life. It lives in mud at the bottom of the water during winter.

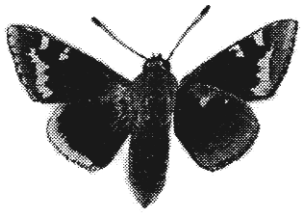
43.

44.

This bird survives the extremely cold winters by roosting in snow drifts and by eating energy-rich willow buds. Its plumage is snow-white in the winter and mottled brown in the summer.

45.

This bird eats insects that live under the bark of trees.

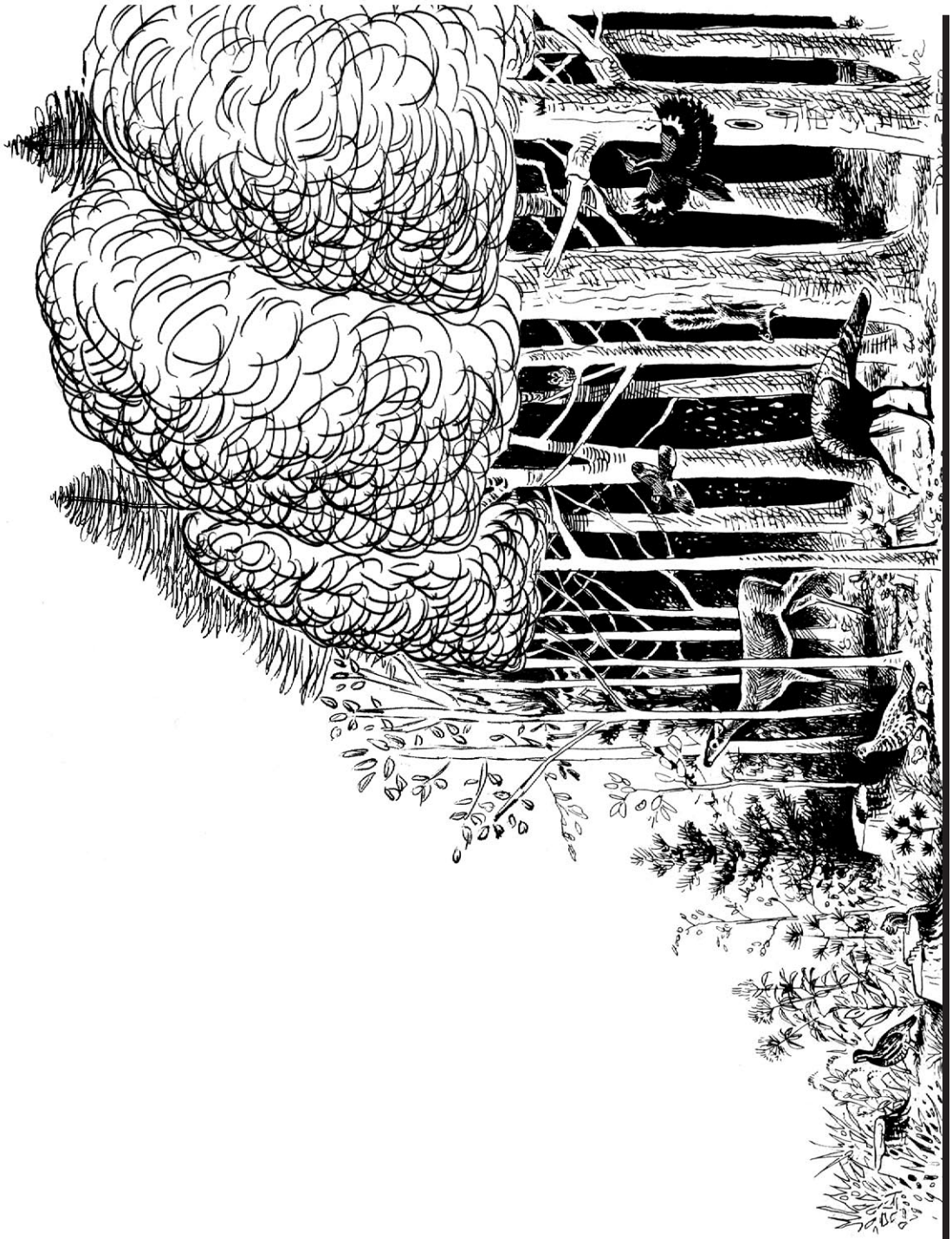


46.

Larvae of this insect feed on yucca flowers.

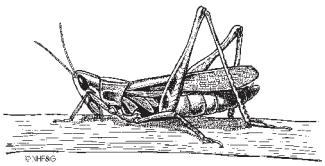
Animal Name	State or Province						National						Factors Affecting Animal's Status
	Extinct	Endangered	Critically Endangered	Threatened	Rare	Peripheral	Extinct	Endangered	Critically Endangered	Threatened	Rare	Peripheral	

Forest Diagram



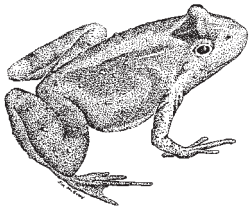
Sample Animals

Cardinal



Grasshopper

Garter Snake

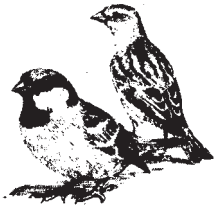


Toad

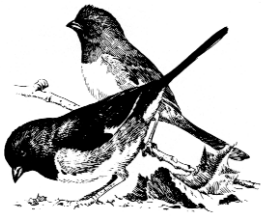
Owl

Robin

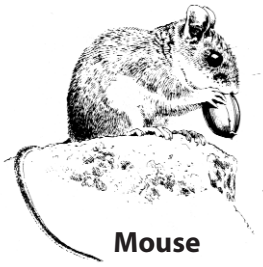
Bear



Sparrow

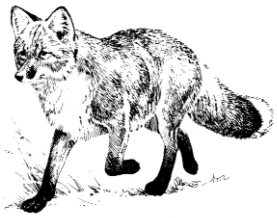


Songbird

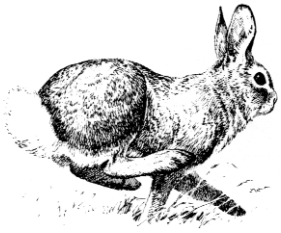


Mouse

Squirrel

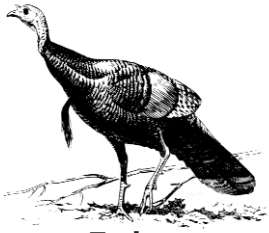


Fox



Rabbit

Deer



Turkey

Quail

Descriptions of Three Successional Stages

NOTE: An area of the forest has been clean harvested and abandoned. A fire occurred on the site after it was abandoned.

3 to 5 Years

The first plants to invade prefer bright sunlight. The fire released many of the nutrients in stumps and branches left behind during the cutting of the area. Grasses—such as broom straw, golden rod, and other herbaceous plants—have taken over the area. The area is also green with sprouts from tree stumps that were not killed by the fire. Woody shrubs—such as blackberry, wild grape, sumac, and viburnums—are beginning to grow. Here and there, a young coniferous tree—such as red cedar or field pine—is beginning to reach above the grasses.

15 to 25 Years

The overall vegetation is dense as the plant community converts from shrubby field to forest. Maples, birches, oaks, and other hardwoods join pines and cedars. Few acorns and other nuts are being produced. Vertical layers are becoming distinct. At 25 years, the young hardwoods are approximately 40 feet tall and starting to shade out "sun-loving" shrubs such as blackberries and brambles. Other shrubs more tolerant of shade—such as blueberry, serviceberry, and spice bush—may continue to grow, although the blueberry will not produce as many berries. Hemlock and white pine, which thrive in under-story shade, may begin to grow.

More Than 100 Years

As taller plants occupy the site, less light is available on the surface of the forest. Plants tolerant of shading will out-compete plants that are intolerant of shading, and gradually the composition of the forest will change to favor shade-tolerant species. Distinct layers can be identified in mature forests. The canopy layer consists of trees 60 to 100 feet high, including mixed oaks, hickories, sugar maple, beech, birch, or other hardwoods, or hemlock and white pine. An understory layer 30 to 40 feet high has trees such as dogwood, hornbeam, and saplings. Below this understory, a shrub layer about 3 to 4 feet high, might include blackberry, arrowwood, spicebush, blueberry, or huckleberry. Poison ivy, Virginia creeper, and Japanese honeysuckle are vines that span all layers. An herbaceous (nonwoody) layer of perennial, annual, and biennial plants is found at the forest floor.

Descriptions of Plants and Animals

Grass/Herb: Grasses and herbs cannot tolerate excessive shade. They grow quickly, but have nonwoody stems and do not reach a great height.

Shrub: Shrubs have woody stems and are usually intermediate in height between grasses and trees. They can tolerate some shade.

Sapling: Saplings are trees that have not reached full height. They may be the size of large shrubs.

Mature tree: These trees have reached their full height and form the canopy layers.

Songbird: Songbirds in this area live in mature trees.

Squirrel: Squirrels build their nests in trees but are seen on the ground and moving through tree branches. They eat fruit, berries, and nuts.

Garter snake: This snake lives in grassy areas and shrubs. It eats toads, earthworms, small birds, and mammals.

Toad: Toads live in meadows and shrub lands. They eat insects and other invertebrates.

Wild turkey: Turkeys roost in trees and need clearings and brushy fields for nesting.

Mouse: Mice live in burrows and eat berries, grains, and insects.

Owl: Owls in this area nest in trees but hunt the ground for mice and shrews.

Black bear: Bears live in the thick forest where they have plenty of cover. They eat a variety of plant and animal matter.

Deer: Deer eat grasses, shrubs, and crops. They prefer an edge community where they can hide but also venture periodically into open areas to browse.

Grasshopper: Grasshoppers live in grassy areas and eat grass, clover, and other herbs.

Rabbit: Rabbits live in edge communities where there is plenty of shrub cover to hide, plus grasses and other herbs to eat.

Quail: Quail nest in shrub areas where they have cover, but they may feed in more open, grassy spaces that supply many insects.

Sparrow: Sparrows nest in shrub and tree areas where they have cover but may feed in more open spaces that supply many insects.

Cardinal: Cardinals are red to brownish-red birds that nest in the high branches of shrubs or low branches of trees. They feed on berries, seeds, and insects gathered from plants or from the ground.

Robin: Robins live in edge communities where there are open grassy spaces, shrubs, and small trees. They build their nests in the branches of younger trees and eat berries, worms, and insects.

Fox: Foxes live in burrows called dens. They prefer some ground cover for hunting, and they feed on birds, mice, rabbits, insects, and berries.

Student Guide Page

This guide may be given to the student groups as they are working on their designs to ensure that the discussion points are incorporated into student learning.

I. Topography

Consider the topography of your site.

A. Locate hills.

B. Locate lowlands.

C. Locate sources of water.

D. Locate areas of moist soils.

E. Locate areas of dry soils.

II. Plants

A. Using the following chart, decide which plants would be most suitable for the site when considering the plant's requirements for space, soil, sunlight, water, and temperature:

Plant	Space	Soil	Sunlight	Water	Temperature

B. What improvements could be made to allow for a greater variety of species? (e.g., water sources?)

C. Consider two plants having the same requirements. How will competition between them be handled?

III. Animals

A. Using the following chart, decide which animals would be best suited for the site when considering the animal's requirements for space, food, shelter, and water?

Animal	Space	Food	Shelter	Water

B. What improvements could be made to allow for a greater variety of species? (e.g., water sources?)

C. Consider two animals having the same requirements. How can this competition be avoided?

IV. Interactions

A. Consider consumption of one organism by another. Can overpredation be avoided?

B. Which plant communities will be best at supporting which animals?

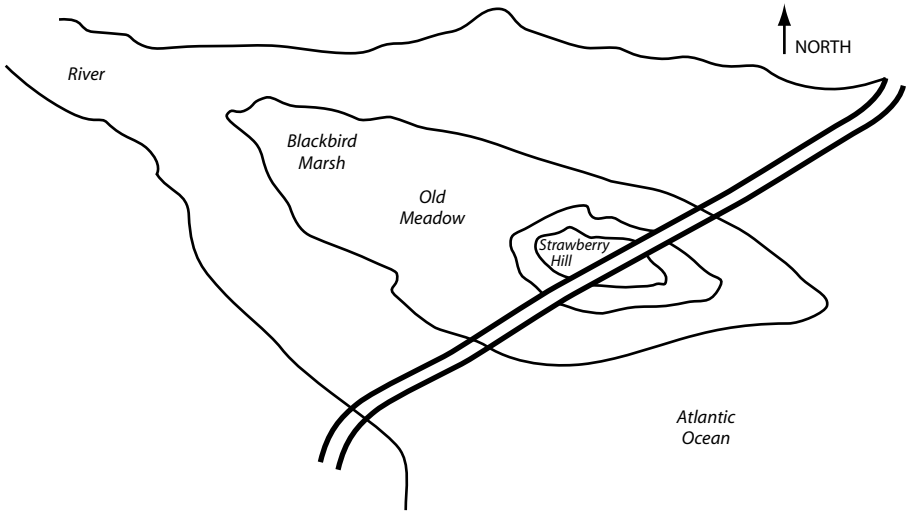
Island Scenario
Belle Island

A 1,000-year flood has destroyed the plants and animals on Belle Island. The 20-acre island is in the middle of a tidal river. (Tidal rivers are open to the ocean and experience daily tidal fluctuations.) It has a large hill on the ocean side of the island (the side affected by the tides), and there is a low area capable of sustaining a marsh on the opposite side of the island. The island also has a flat plain that was formerly a meadow. The island has been used in many different ways since Europeans settled the area; originally it was used as a plantation. Later, industries powered by hydro-electricity were located on the island. Before the flood, the island was overgrown with a mixture of native and non-native plants and was inhabited by a variety of native and non-native wildlife.

List of Native and Non-Native Species Originally Found on the Island

Native	Non-Native	Native	Non-Native
Trees	**Trees**	**Animals**	**Animals**
Red oaks	Empress tree	Aquatic turtles	Starlings
River birch	Tree-of-heaven	Frogs	English sparrows
Pine		Snakes	Pigeons
Vines	**Vines**	Raccoons	Norway rats
Virginia creeper	Japanese honeysuckle	Deer	Nutria
Trumpet vine	Kudzu	Opossum	House cats
Poison ivy		Great blue heron	Stray dogs
Other Plants	**Other Plants**	Osprey	Carp
Jack-in-the-pulpit	Cordgrass	Cardinal	Striped bass
Cattails	Crabgrass	Dragonfly	
Wild rice	Dandelions	Mayfly	
	Purple loosestrife	Mosquito	
		Bluegill	

Belle Island



Shopping Center Scenario
Acme Acres

An abandoned shopping area is being torn down to make room for a new park. The area is currently 20 acres of asphalt and concrete that has been neglected for more than 10 years.

The city would like to develop a complete working ecosystem that benefits the people of the community by providing a natural setting that will attract wildlife. Different community needs and uses for the site have been identified and are being suggested to the city planning committee. Community members said that whatever the site is used for, the ecosystem that is established on the site must be healthy and sustainable.

List of Urban Species Normally Found in Surrounding Sites

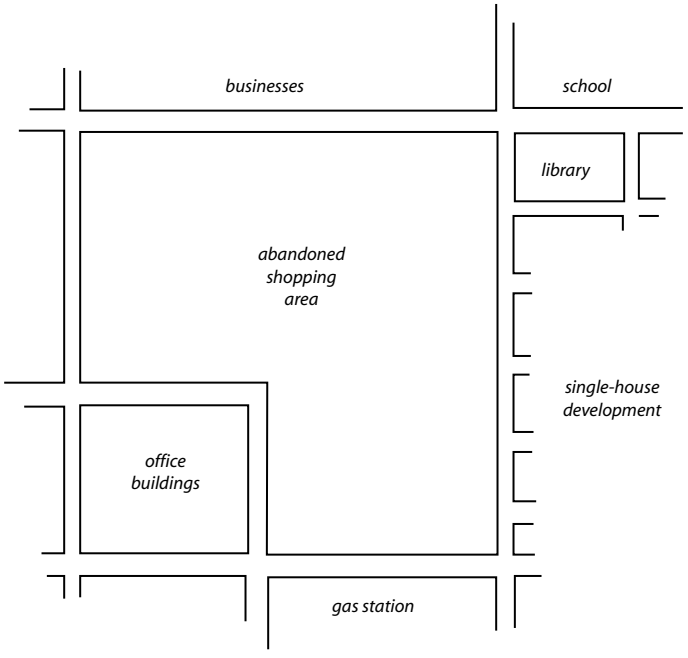
Trees
Empress tree
Tree-of-heaven
Elm

Vines
Japanese honeysuckle
English ivy
Poison ivy

Other Plants
Crab grass
Dandelions
Milkweed
Lily of the valley

Animals
Starlings
English sparrows
Pigeons
Norway rats
House cats
Stray dogs
Carp/Goldfish
Crows
Raccoons
Gray squirrels
Bats
Mosquitoes
Ants

Acme Acres



Key to Genetic Characteristics

Yellow	camouflage
Black	precise vision
Orange	accurate sense of smell
Pink	strong claws and forearms
Dark blue	healthy jaw formation
Green	agility
Purple	acute hearing
Red	healthy rate of reproduction
White	immunity to canine distemper

Key to Environmental Situations

1. A farmer has been trying to protect his wheat fields by exterminating prairie dogs. Very little prey is available. Given the genetic makeup, how would your population survive?

2. A golden eagle hunts from high above and will prey on available animals such as the black-footed ferret. Does your population have the gene for precise vision to avoid being captured? Given the genetic makeup, how would your population survive?

3. Black-footed ferret kits disperse from their home territory and are able to establish new populations in nearby prairie dog towns. Given the genetic makeup, how would your population survive?

4. An interstate highway has been built near your prairie dog town. How does this road affect your black-footed ferret population? Given the genetic makeup, how would your population survive?

5. Ranchers are allowing their dogs to run loose. Will your population's genes protect it against canine distemper, assuming the dogs carry it? Given the genetic makeup, how would your population survive?

6. A new generation of captive-born black-footed ferret kits has been preconditioned to live in the wild and are ready to be released at a nearby reintroduction site. Given the genetic makeup, how would your population survive?

7. A plague has hit your prairie dog town, and most of the prairie dogs die from the disease. How does your black-footed ferret population adapt to a reduction in food supply? Given the genetic makeup, how would your population survive?

8. As a coyote silently prowls nearby, only its odor might warn of its presence. Does your population have the gene for an acute sense of smell to warn about the coyote?

9. Black-footed ferrets eat prairie dogs and use prairie dog burrows for shelter. Does your ferret population have the agility gene to catch an aggressive prairie dog in its dark, narrow, winding tunnel system? Given the genetic makeup, how would your population survive?

10. Black-footed ferrets are nocturnal creatures that leave their burrows at night to feed. Does your ferret population have the camouflage gene to keep well hidden from the great horned owl hunting for its dinner? Given the genetic makeup, how would your population survive?

11. A badger is moving quietly around the prairie dog town. Does your population have the gene for acute hearing to avoid this predator? Given the genetic makeup, how would your population survive?

12. A prairie dog colony has just been established in a state park only a few miles away. How does the colony affect your populations of ferrets? Given the genetic makeup, how would your population survive?

13. It will be difficult for your population to take over and adapt to prairie dog burrows without the gene for strong claws and forelegs. Given the genetic makeup, how would your population survive?

14. Humans who are building homes have wiped out a prairie dog town 10 miles away. The surviving black-footed ferrets from that area are moving into your territory. Given the genetic makeup, how would your population survive?

Black-Footed Ferret Bottleneck Scenario

Names of Team Members_____

On your Key to Genetic Characteristics, circle the **COLORS and GENES** that your population received through the bottleneck.

1. **Calculate the percentage of genetic diversity (heterozygosity) of your population.**

   Nine genes (colors) represent 100 percent genetic diversity in the original population.

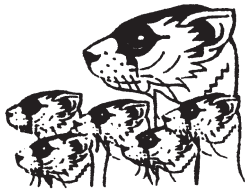
   _____ genes received ÷ 9 original genes = _____(decimal) x 100 = _____%

2. **List the genetic characteristics (colors) that your population received through the bottleneck.**

3. **List the genetic characteristics that your population lost when it came through the bottleneck.** (colors not received)

4. **Using the five environmental situations, write a prediction about what will happen to your population during the coming year.**

   Is the population genetically equipped to survive in its environment? How well or how poorly? How does a high or low percentage of genetic diversity affect the population's survival? How do random changes in the environment affect the population?



	SHELTER	APPEARANCE	ACTIONS	FOOD	LOCOMOTION
REAL					
IMAGINARY					

Museum Search for Wildlife Chart

Place a check after the name of the animals found on the Museum Search for Wildlife.

Animal Group	Domestic Animals (Tame)	Wildlife (Untamed)

Prairie Memoirs

Memoir I: From the Stories of Johnny Kincaid

I was a scrawny kid who'd come to the Great Plains from Chicago looking for wealth and adventure in the spring of 1870. I didn't know what I would do when I got there, but I knew I would do something adventurous. When I arrived in Dodge City, I was penniless, tired, and hungry. I wandered the street, alone and scared. A huge man, about 6'4" with arms as big as two men and shoulders of steel, sauntered up to me. He wore buckskins and had a rifle flung across his shoulder. I was impressed.

He introduced himself as Sure Eye Jones (to this day, I do not know his real name). He asked if I was looking for work. He explained that he needed a skinner to go with him on a hunt the next day. He said he'd cover all my grub and pay me handsomely for each buffalo hide. I didn't know at that time what a skinner was, but it sounded like a good deal to me. Besides, I was desperate.

We headed out into the prairie land the next day looking for the big herd. Another man named Doug McKinnon, who was an experienced skinner, came along. He promised to teach me all he could about skinning. He gave me both a long bowed knife to hang on my hip and another short knife, something like a dagger, to strap on my boot. They were sharp enough to cut paper. Doug explained skinning to me while we searched for the herd. He told me we would prepare the hides for sale back in Dodge City and that my earnings would depend upon how many animals I could skin in a day. The more I did, the more money I would make.

As we traveled, I became excited about the hunt and the thought of making money. We came over the crest of a hill and saw the buffalo below us. It was a huge herd that covered the open plain as far as the eye could see. Some were young, some were calves, and some were heavy with young not born. It was an amazing sight. As my eyes lingered on the herd, a crack rang out in the air as a bullet shot into the herd and took out a yearling, which Doug whispered to me would be our dinner for the next few days. Sure Eye (now I realized how he got his name) took aim again and shot another. Crack after crack of the rifle rang out as Sure Eye killed buffalo after buffalo. It wasn't until he had killed 30 or so that he stopped.

Doug hollered at me to "Move it!" We raced down the hill and began our work. It took us all day and late into the night before we had skinned all the dead animals. Sure Eye came by and said, "Well done, boy! As far as I can figure, you just made yourself a whole heap of money. Well done." He slapped me on the back and moved on back to camp.

I continued to skin buffalo until there were no more to be found. I earned a great deal of money and was able to return to Dodge City to build a home; marry my wife, Sally; and work in town.

Some days I miss those grand herds of buffalo stretching across the horizon. It was quite an adventure, those early days on the prairie.

Memoir II: From the Stories of Gray Hawk

Back in the days when the Earth was new, my forefathers hunted buffalo on foot. The buffalo flesh provided my people with food, and the skin became clothing and the sheltering cover of tepees. My people's daily life revolved around the buffalo hunt, and our rituals and worship were dedicated to its success.

Then the Spaniards brought horses, and many of these animals wandered over the plains. My people learned to tame and ride these wild animals. We became great horsemen. The horse allowed us to become great hunters; it helped us follow the buffalo herds. We also crafted tools to help us hunt. Hunters carried a short bow, a quiver for barbed arrows, and a long shear. Because the hunters were able to ride with hands free, they could feed and release the bow, and the hunts became more and more successful.

With the horse, our tribe was able to follow the buffalo and have a steady supply of food. The tribe grew. Often, small hunting groups would leave the larger tribe, but each summer all our people would reunite for the sacred ritual dance. This ritual lasted four days in which we honored the buffalo with offerings and ceremonial dances. Our dance celebrated the natural cycle of the grass, the soil, and the buffalo. We honored the buffalo, for it provided us with our daily needs.

The buffalo herds began to grow smaller. We had become skillful hunters, and settlers came to live on our land, build railroads, and hunt buffalo. The buffalo could not survive; the natural cycle had been changed. Then the settlers' government told my people we had to change our ways. We were told where to live and that we could not continue to follow the buffalo herds. The fact was that the buffalo herds were gone and that the ways of our ancestors would continue only in our stories.

Memoir III: From the Diary of Catherine O'Riley

Early in the year of 1860, my husband and I left the forest lands of Missouri for the tall grass prairie of the area now known as Oklahoma. Our dream was to build a cattle ranch in this fertile grassland. We had been told that this was a wild area, but it was also rich in opportunity. However, in this land without trees, building a house, corrals, and barns became a problem. Providing water proved to be an even more difficult task. We soon knew that survival in this new land would require us to be strong and self-sufficient.

The first years on the ranch were tough. We were not prepared for what happened the first time a herd of buffalo moved into our cattle grazing area. The buffalo were large, aggressive animals, and the cattle scattered in fright. The buffalo depleted the grass and rolled in the dirt, creating great dust clouds. These large animals trampled anything that got in their path, and constructing barriers did nothing to change their course. Along with the buffalo came the native tribes. Many tribes had been relocated to the Oklahoma Territory, but they did not always stay on their reservation lands.

We thought the U.S. government with the soldiers from the area forts would make sure the tribes stayed on the land they were given. The government, however, was fighting a civil war. The only soldiers that we had to protect us and our property were untrained recruits, and they caused more problems than they solved. Many ranchers in the area met to discuss a way to handle the problem of the roaming herds of buffalo and the roaming tribes.

Someone had heard about the buffalo hunters hired by the railroad. Supporting these buffalo hunters seemed a good way to remove the threat of these animals. It was also suggested that if the tribes stayed on the reservations, the government could provide them with cattle. Then they would not need the buffalo, and we would have a new market for our animals. However, it was obvious that it was up to us to protect our property and livelihood.

By 1890, the buffalo and the native tribes were removed from the plains, and cattle freely grazed on the lush grass of the open public range. The best cows and bulls were kept and the breeds constantly improved. For the next few years, ranching was one of the most profitable industries in the country.

To Be Wild

by Dale and Linda Crider

By DALE and LINDA CRIDER

D CHORUS Em A 7 D

Oh, to be ___ to be wild ___ and free like an ea - gle o - ver the land; ___

Em A7 D FINE

Oh, to sing, ___ to be wild and sing ___ all o - ver A - mer - i - ca ___ a - gain. ___ ___

D VERSE Em A7

1. O - ver the moun - tains, for - est, o - ver the plains; ___ O-ver the riv - ers, marsh-es
2. Wild is the wild - est word, why can't it be more? More than the moun-tains, more

1. D 2. D D Em

(all) wild life do-main, Wild is the free-est word ___ we can ev - er sing; ___
than the o - cean shore; Wild - life of tun-dra, marsh-es, lakes and for - est floor;

A7 D 1. 2. D CODA

___ Oh, to be, to be wild. *D.C. al Coda* Yes, wild ___ is the wild-est life, ___ im-ag-
___ Wild is this and more.

Em A7 D

- ine, if ___ you can, ___ Un-tamed by zoos or cag - es; Wild is wild - er than ___ the

Em A7

wild-est thing im-ag - ined by ___ do - mes - ti - cat - ed man. ___ Wild all o - ver A-

D D Em

mer - i - ca ___ a - gain! ___ Oh, to sing ___ this song, ___ to be ___ wild is why. The

A7 D D D

song, ___ "To Be Wild" ___ lets my own ea - gle fly ___ O - ver the prair - ies, des - erts,

Em A7 *D.C. al Fine* D

o - ver the plains, ___ Wild ___ all o - ver A - mer - i - ca ___ a - gain.

(Repeat Chorus)

Factors That Influence Attitude/Viewpoint Toward the Environment

political	pertains to the role or position of a governmental agency
economic	pertains to uses for food, clothing, shelter, and other benefits
religious	pertains to faith
ecological	pertains to roles in maintaining a natural ecosystem
scientific	pertains to providing an understanding of biological functions
cultural	pertains to societal customs, beliefs, and laws
educational	pertains to providing an understanding of a species and of the role people play in the environment
aesthetic	pertains to sources of beauty and inspiration
social	pertains to shared human emotions and status
recreational	pertains to providing leisure activities
egocentric	pertains to a focus on human benefit of resource
health-related	pertains to positive human conditions
ethical/moral	pertains to responsibilities and standards
historical	pertains to connections to the past

Quotable Quotes

"I am against nature. I don't dig nature at all. I think nature is very unnatural. I think the truly natural things are dreams, which nature can't touch with decay."

Bob Dylan (1986)

"After you have exhausted what there is in business, politics, conviviality, and so on—have found that none of these finally satisfy, or permanently wear—what remains? Nature remains."

Walt Whitman (1882)

"There are those who look at Nature from the standpoint of conventional and artificial life—from parlor windows and through gilt-edged poems—the sentimentalists. At the other extreme are those who do not look at Nature at all, but are a grown part of her, and look away from her toward the other class—the backwoodsman and pioneers, and all rude and simple persons. Then there are those in whom the two are united and merged—the great poets and artists. In them, the sentimentalist is corrected and cured, and the hairy and taciturn frontiersman has had experience to some purpose. The true poet knows more about Nature than the naturalists because he carries her open secrets in his heart."

John Burroughs (1906)

"Man masters nature not by force but by understanding. This is why science has succeeded where magic failed: because it has looked for no spell to cast over nature."

Jacob Bronowski (1953)

"Of all the things that oppress me, this sense of the evil working of nature herself—my disgust at her barbarity, clumsiness, darkness, bitter mockery of herself—is the most desolating."

John Ruskin (1871)

"You may drive out nature with a pitchfork, yet she'll be constantly running back."

Horace (8 B.C.)

"To sit in the shade on a fine day and look upon verdure is the most perfect refreshment."

Jane Austin (1814)

"There is in every American, I think, something of the old Daniel Boone—who, when he could see the smoke from another chimney, felt himself too crowded and moved further out into the wilderness."

Hubert H. Humphrey (1966)

"In a few generations more, there will probably be no more room at all allowed for animals on the earth: no need of them, no toleration of them. An immense agony will have then ceased, but with it there will also have passed away the last smile of the world's youth."

Ouida (Marie Louise de la Ramee) (1900)

"Nature has no mercy at all. Nature says, 'I'm going to snow. If you have a bikini and no snowshoes, that's tough. I am going to snow anyway.'"

Maya Angelou (1974)

"The tree which moves some to tears of joy is in the eyes of others only a green thing that stands in the way. Some see nature all ridicule and deformity … and some scarce see nature at all. But to the eyes of the man of imagination, nature is imagination itself."

William Blake (1799)

"The Laws of Nature are just, but terrible. There is no weak mercy in them. Cause and consequence are inseparable and inevitable. The elements have no forbearance. The fire burns, the water drowns, the air consumes, the earth buries. And perhaps it would be well for our race if the punishment of crimes against the Laws of Man were as inevitable as the punishment of crimes against the Laws of Nature—were Man as unerring in his judgments as Nature."

Henry Wadsworth Longfellow (1857)

"One swallow does not make a summer, but one skein of geese, cleaving the murk of a March thaw, is the spring. A cardinal, whistling spring to thaw but later finding himself mistaken, can retrieve his error by resuming his winter silence. A chipmunk, emerging for a sun bath,but finding a blizzard, has only to go back to bed. But a migrating goose, staking 200 miles of black night on the chance of finding a hole in the lake, has no easy chance for retreat. His arrival carries the conviction of a prophet who has burned his bridges."

Aldo Leopold (1970)

Dilemma Card

A deer herd has grown so large during the past 10 years that many of the deer appear to be starving. The herd is severely damaging the habitat, eliminating much of the vegetation that the animals use for food or shelter. There is a disagreement within your community as to what course of action is best to take. You personally are opposed to hunting. A limited legal hunt has been proposed to reduce the size of the herd in this area. Would you:

- Investigate and consider the situation to see what, in your judgment, seems the most humane and reasonable solution, including the feasibility of options such as moving some deer to other areas, even though you understand that they still may not survive?
- Attempt to identify the causes of this population increase and propose action to return the system to a balance?
- Allow the habitat degradation to continue and the deer to starve?
- Leave it to the state wildlife agency to work with the landholder to arrive at a solution?
- Do something else?

Dilemma Card

You are a homeowner in an area directly above a city. Local government officials have proposed diverting a small stream from the property of several homeowners above the city, including yours, to power a hydro-electric system that will benefit the entire city. As a homeowner, you are concerned with losing the aesthetic values of this stream from your property. You also are concerned about the effect the removal of this stream will have on the fish and aquatic habitat. Another concern is that your property may lose some of its value for resale. You realize that your city needs to supply electric power to all its citizens as cost-effectively as possible. Would you:

- Hire a lawyer and prepare to sue the city for loss of property value?
- Form a coalition of homeowners to meet with city planners and explore possible alternatives?
- Sell your property before the project is begun?
- Decide the needs of the city are more important than either the consequences to you personally or the ecological costs?
- Do something else?

Dilemma Card

Your family owns a 500-acre farm. A tributary to a high-quality fishing stream runs along the boundary of your property. The nitrogen- and phosphorous-based fertilizer that your family uses to increase crop production is carried into the stream by rain run-off. This type of fertilizer is increasing algae growth and adversely affecting the fish population in both the tributary and the main stream. Your farm production is your sole source of income, but your family has always enjoyed fishing and doesn't want to lose the fish from the streams. Would you:

- Change fertilizers even though it may reduce crop yield?
- Allow a portion of your land along the stream to grow wild, thus establishing a buffer zone (riparian area)?
- Investigate the possibility of gaining a tax exemption for the land you allowed for a buffer zone?
- Do nothing?
- Do something else?

Dilemma Card

You are a farmer. You have been studying and hearing about farming practices such as leaving edge areas for wildlife, no-till farming, and organic pest control. Although these practices may improve your long-term benefits, they may reduce your short-term profits. You are already having trouble paying your taxes and keeping up with expenses. Would you:

- Sell the farm?
- Keep studying farming practices but make no changes for now?
- Try a few methods on some of your acreage, and compare the results with other similar areas on your land?
- Do something else?

Dilemma Card

You are fishing at a secluded lake and have caught 2 fish during your first day at the lake. Now, on the second day, the fishing has been great, and you have caught 5 fish in the first hour, all of which are bigger than yesterday's fish. The law allows you to possess 12 fish. Would you:

- Continue to fish and keep all the fish?
- Dispose of the smaller fish you caught yesterday, and keep the big ones to stay within your limit?
- Have fish for lunch?
- Quit fishing and go for a hike?
- Do something else?

Dilemma Card

You are finally able to build your family's dream house. Because of rising construction costs, you realize that you cannot include all the features you had planned for. You must decide which one of the following you will include:

- solar heating,
- recreation room with fireplace,
- hot tub and sauna,
- greenhouse, or
- something else.

Dilemma Card

You are a member of a country club that has recently voted to build a wildlife farm to raise animals for members to hunt. You are not a hunter, you think that hunting is okay only to do in the wild, and you are opposed to building the wildlife farm. Would you:

- Stay in the club and do nothing?
- Stay in the club, and speak out strongly against the subject?
- Resign from the club?
- Do something else?

Dilemma Card

You are an influential member of the community. On your way home from work, you are stopped by a police officer and cited for having excessive auto emissions. Would you:

- Use your influence to have the ticket invalidated?
- Sell the car to some unsuspecting person?
- Work to change the law?
- Get your car fixed and pay the ticket?
- Do something else?

Dilemma Card

Your class is on a field trip to the zoo. Although you know that feeding of animals by zoo visitors is prohibited, some of your friends are feeding marshmallows to the bears. Would you:

- Tell them that feeding marshmallows may harm the bears, and ask them to stop?
- Report their behavior to the nearest zoo keeper?
- Ask the teacher to ask them to stop?
- Do nothing?
- Do something else?

Dilemma Card

You are on a picnic with your family and you see members of another family leaving to go home without picking up their trash. It is clear the other family is going to leave litter all around. Would you:

- Move quickly, and ask them to pick up their trash before they leave?
- Wait for them to leave, and pick up the trash for them?
- Do nothing?
- Do something else?

Dilemma Card

You are walking in the woods and come upon a young fawn. There is no sign of the fawn's mother. Would you:

- Leave the fawn where it is?
- Move the fawn to a sheltered area?
- Take the fawn home?
- Do something else?

Dilemma Card

You love children and would like to have a large family. You are aware, however, of the world's population projections for the future. Would you:

- Plan to have a large family anyway?
- Decide not to have children?
- Limit yourself to one or two children?
- Do something else?

Dilemma Card

You have found a young screech owl and raised it to maturity. You have been told that you cannot keep the owl any longer because keeping it without the proper permit violates state and federal laws. Would you:

- Offer it to your local zoo?
- Keep it as a pet?
- Call members of the local fish and wildlife agency and ask their advice?
- Determine whether it could survive in the wild; if it appears the owl could, release it in a suitable area?
- Do something else?

Dilemma Card

You are out in the woods with a friend when you spot a hawk perched on a high limb. Before you realize what is happening, your friend shoots the hawk. An hour later, you are leaving the woods and are approached by a state wildlife officer who tells you a hawk has been illegally shot and asks if you know anything about it. Would you:

- Deny any knowledge of the incident?
- Admit your friend did it?
- Make up a story implicating someone else?
- Say nothing, but call the fish and wildlife officer later with an anonymous phone tip?
- Do something else?

Dilemma Card

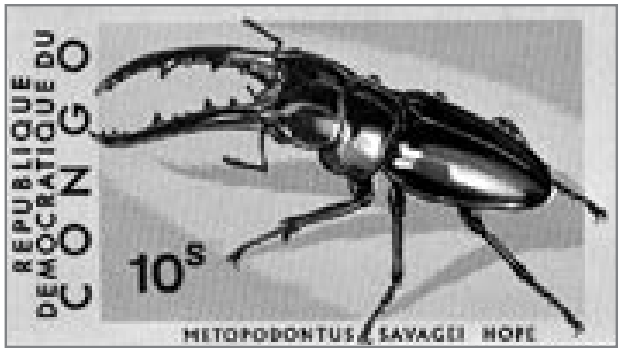
You are president of a large corporation. You are very interested in pollution control and have had a task force assigned to study the pollution your plant is creating. The task force reports that you are barely within the legal requirements. The plant is polluting the community. To add the necessary equipment to reduce pollution would cost so much that you would have to fire 50 employees. Would you:

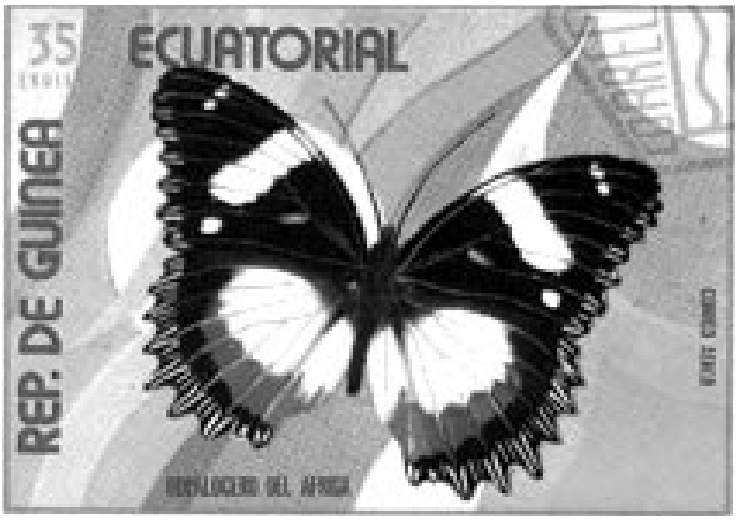
- Add the equipment, and fire the employees?
- Not add the equipment?
- Wait a few years to see if the cost of the equipment will drop?
- Hire an engineering firm to provide further recommendations?
- Do something else?

Dilemma Card

You have purchased a beautiful 10-acre property in the mountains to build a summer home. One hillside of the property has a beautiful view of the valley and lake below and is your choice for your home site. However, you discover an active bald eagle has a nest site on that hillside. The bald eagle is sensitive to disturbance around its nest tree and is a protected species. Bald eagles are highly selective in choosing nest sites and usually return to the same nest year after year. Would you:

- Select a different site on the property to build your home?
- Sell the property?
- Chop down the tree and build your home?
- Do something else?





Number of Participants for Three Wildlife-Associated Activities

1970 versus 1996

Activity	1970	1996
Fishing	33,000,000	35,200,000
Hunting	14,000,000	14,000,000
Wildlife Watching	38,200,000	62,900,000
Total	**85,000,000**	**112,100,000**

Source: "1970 National Survey of Fishing and Hunting" and the "1996 National Survey of Fishing and Hunting and Wildlife-Associated Recreation," published jointly by the U.S. Department of the Interior, U.S. Fish and Wildlife Service, and U.S. Department of Commerce, Bureau of the Census.

Activity Cards

CONSUMPTIVE **WILDLIFE MANAGEMENT FACTOR**	• Good fortune! You have won first prize in a fishing contest. Collect $50 from the Public Bank if you have a fishing license. Most states maintain a number of fish hatcheries to stock public fishing areas. Transfer $25 from the Wildlife Management Fund to the Public Bank. (Keep this card if you have a fishing license.)

CONSUMPTIVE **WILDLIFE MANAGEMENT FACTOR**	• Dry weather and poor forage have reduced the deer population in your hunting area. You must buy your meat this year. Pay $150 to the Public Bank. Deer management involves aerial surveys, habitat protection and improvement, and law enforcement. Transfer $50 from the Wildlife Management Fund to the Public Bank. (Keep this card.)

CONSUMPTIVE **WILDLIFE MANAGEMENT FACTOR**	• You just caught your favorite lure on a submerged stump. Pay $5 to the Public Bank for a replacement. There is a federal tax on fishing gear that helps pay for sportfish restoration. Transfer $50 from the Public Bank to the Wildlife Management Fund. (Keep this card if you have a fishing license.)

CONSUMPTIVE **WILDLIFE MANAGEMENT FACTOR**	• You spend most of the day collecting firewood that was used to cook the delicious fish you caught. Your energy level is so high that you get to take another turn if you have a fishing license. The trees for your firewood are a renewable resource that benefits both wildlife and people. For forest management, transfer $25 from the Wildlife Management Fund to the Public Bank. (Keep this card if you have a fishing license.)

CONSUMPTIVE **WILDLIFE MANAGEMENT FACTOR**	• This site is being used for the annual cut-your-own Christmas tree sale. Pay $20 to the Wildlife Management Fund for a tree of your choice. This area is managed by the State Forest Service in an effort to benefit both wildlife and people. Transfer $30 from the Wildlife Management Fund to the Public Bank. (Keep this card.)

CONSUMPTIVE **WILDLIFE MANAGEMENT FACTOR**	• Your request to hunt on private property has been denied. Lose your next turn. Private land is critical to wildlife management. Cooperation from landowners is an important part of a wildlife agency's mission. (Keep this card.)

CONSUMPTIVE **WILDLIFE MANAGEMENT FACTOR**	• A bountiful mussel harvest enables you to have a "mussel bake" for your friends if you have a fishing license. If you do not have a fishing license, pay a $100 fine to the Wildlife Management Fund for poaching mussels. Aquatic wildlife populations are maintained through harvest limits. Law enforcement helps to make sure the limits are respected. Transfer $50 from the Wildlife Management Fund to the Public Bank. (Keep this card if you have a fishing license.)

CONSUMPTIVE **WILDLIFE MANAGEMENT FACTOR**	• The morel mushrooms you find today are a delicious addition to your dinner. A restaurant owner likes your dinner dish. He was so impressed that he bought your recipe for the La Petite Chateau for $100 (from the Public Bank). Wildlife eat a variety of plants. A healthy habitat needs to have many different plant species. Transfer $20 from the Wildlife Management Fund to the Public Bank. (Keep this card.)

CONSUMPTIVE	• Pay $20 to the Wildlife Management Fund for a firewood permit. Receive $100 from the Public Bank for a cord of wood that you were able to cut today on public land.
WILDLIFE MANAGEMENT FACTOR	Timber harvests affect wildlife in both positive and negative ways. Firewood collection helps reduce the fuel load of future forest fires. Harvesting also provides funding for public land management agencies. Transfer $100 from the Public Bank to the Wildlife Management Fund for timber sale. (Keep this card.)

CONSUMPTIVE	• A game warden observes you fishing. If you do not have a fishing license, pay $100 fine to the Wildlife Management Fund.
WILDLIFE MANAGEMENT FACTOR	Fishing license fees pay for producing and stocking game fish and other management activities. If you are fishing without a license, you are literally stealing fish from licensed anglers who have helped pay for them. (Keep this card if you have a fishing license.)

CONSUMPTIVE	• Increased development has resulted in cancellation of hunting at this site. Return to your previous location. DO NOT draw an additional card for going to that site.
WILDLIFE MANAGEMENT FACTOR	Thousands of acres of wildlife habitat are lost daily because of development. Sustainable development must include the protection of wildlife habitat and wildlife corridors within communities. (Keep this card.)

CONSUMPTIVE	• Improved road construction saves you time. Take another turn.
WILDLIFE MANAGEMENT FACTOR	The new highway affects critical winter range for deer. A deer fence must be constructed to keep deer off the highway. Transfer $30 from the Wildlife Management Fund to the Public Bank. (Keep this card.)

CONSUMPTIVE **WILDLIFE MANAGEMENT FACTOR**	• Archery practice pays off. The resulting venison saves you $100 in meat costs. Collect this amount from the Public Bank if you have a hunting license. Hunters and anglers participate in a variety of hunting and fishing opportunities. Examples are archery, fly fishing, muzzle-loading, and spear fishing. License fees help pay for this management. (Keep this card if you have a hunting license.)

CONSUMPTIVE **WILDLIFE MANAGEMENT FACTOR**	• You want to go duck hunting, but first you must purchase a federal duck stamp. Pay $15 to the Wildlife Management Fund for the stamp. Money received from the sale of duck stamps is used to purchase and protect wetlands in Canada, the United States, and Mexico. As of 1995, federal duck stamp sales have generated more than $500 million that has been used to preserve more than 4 million acres of waterfowl habitat. (Keep this card.)

CONSUMPTIVE **WILDLIFE MANAGEMENT FACTOR**	• You choose to keep a bass that is below the legal size limit, and you get caught. Pay a $50 fine to the Wildlife Management Fund. In heavily used areas, wildlife managers impose regulations, such as size limits, to ensure quality fishing opportunities. Size limits usually allow fish to reproduce at least once before being taken. (Do not keep this card.)

CONSUMPTIVE **WILDLIFE MANAGEMENT FACTOR**	• In spite of spending $75 on camouflage clothing to hunt turkey, you went home empty-handed and ended up buying a frozen turkey for $25. Pay a total of $100 to the Public Bank. Thanks to an aggressive reintroduction program, turkey populations have increased dramatically across the United States. Transfer $30 from the Wildlife Management Fund to the Public Bank. (Keep this card.)

CONSUMPTIVE **WILDLIFE MANAGEMENT FACTOR**	• Because of a lack of funding resulting from decreased license sales, this area is closed. Move to the next square of the same type (move to the next public or private square), and choose another card. Seventy to eighty percent of the budget for most state wildlife agencies comes from sales of hunting and fishing licenses. Transfer $50 from the Wildlife Management Fund to the Public Bank. (Do not keep this card.)

CONSUMPTIVE **WILDLIFE MANAGEMENT FACTOR**	• An increase in the number of deer in this area results in your bagging a deer on the first day of hunting, saving you $100 because you do not stay to hunt the next day. Receive this savings from the Public Bank if you have a hunting license. Managing deer populations is beneficial to wildlife and visitors. Healthy habitat can support only a limited number of deer. To manage deer, transfer $40 from the Wildlife Management Fund to the Public Bank. (Keep this card.)

CONSUMPTIVE **WILDLIFE MANAGEMENT FACTOR**	• You left plastic bait containers and excess fishing line at the lake. You receive a citation for littering. Pay $50 fine to the Public Bank. Litter and other pollutants can harm wildlife. Educating the public is an important part of wildlife management. Take $40 out of the Wildlife Management Fund for the education budget. (Do not keep this card.)

CONSUMPTIVE **WILDLIFE MANAGEMENT FACTOR**	• Farmer Jones plants a hedgerow for wildlife. Your pheasant hunt on his land is successful. Your romantic pheasant dinner for two saves you $50. Collect from the Public Bank if you have a hunting license. Farmers can do many things to benefit wildlife including planting hedgerows, protecting wetlands, and delaying mowing until after nesting seasons. To date, Pheasants Forever has spent almost $10 million helping farmers protect more than 65,000 acres of farmland for wildlife habitat. (Keep this card if you have a hunting license.)

CONSUMPTIVE **WILDLIFE MANAGEMENT FACTOR**	• You travel to River Glen resort to fish in their private trout ponds. You land a 4-pound brown trout! Pay $15 to the Public Bank for the privilege of fishing here. Your fishing license is not needed at this private lake. Although it cost $15 to fish here, private fishing lakes are not managed by state wildlife agencies. Therefore, the cost of your fishing license did not cover the fee. (Do not keep this card.)

NONCONSUMPTIVE **WILDLIFE MANAGEMENT FACTOR**	• You walk onto private property hoping for a glance at a rare bird but you forgot to ask permission. Pay $100 to the Public Bank for trespassing. Whether you are a consumptive or nonconsumptive user, you must ask permission to enter private land. (Do not keep this card.)

NONCONSUMPTIVE **WILDLIFE MANAGEMENT FACTOR**	• Fees paid by hunters and anglers historically have been the prime source of funding in outdoor recreation areas. These funds are declining. Pay a $25 access fee to the Wildlife Management Fund to view wildlife in your favorite state wildlife area. Managing current wildlife areas is a lot like farming and involves planting and thinning, fencing, and even constructing roads. Transfer $50 from the Wildlife Management Fund to the Public Bank. (Keep this card.)

NONCONSUMPTIVE **WILDLIFE MANAGEMENT FACTOR**	• Your tax bill has gone up to pay for free access to public land (i.e., U.S. Forest Service). Pay $100 to the Wildlife Management Fund. Public lands are managed in a multiple-use manner. A portion of the cost for managing these lands helps wildlife. Transfer $30 from the Wildlife Management Fund to the Public Bank. (Keep this card.)

NONCONSUMPTIVE	• Today is Memorial Day. Your favorite public campground is full. Move to the nearest private area, and pay a $20 camping fee to the Public Bank. DO NOT draw an additional card for moving to this site.
WILDLIFE MANAGEMENT FACTOR	To reduce bear problems in campgrounds, special garbage containers have been designed and installed. Transfer $10 from the Wildlife Management Fund to the Public Bank.
	(Keep this card.)

NONCONSUMPTIVE	• This area was featured in a recent newspaper article, resulting in increased use. You choose not to hike and camp as planned because of overcrowding. You have lost $50 in travel costs. Pay this $50 to the Public Bank.
WILDLIFE MANAGEMENT FACTOR	Public land managers must balance the needs of wildlife and visitors. Transfer $20 from the Wildlife Management Fund to the Public Bank to pay for research to identify and protect critical wildlife habitat such as fawning and nesting areas.
	(Keep this card.)

NONCONSUMPTIVE	• Today is the first day of hunting season. This area is closed except to licensed hunters. Return to your previous location if you do not have a hunting license. DO NOT take another card for going to your previous site.
WILDLIFE MANAGEMENT FACTOR	Different areas are often managed for different wildlife recreation opportunities. Not all wildlife areas provide recreation. Some are managed to protect critical habitat.
	(Keep this card if you have a hunting license.)

NONCONSUMPTIVE	• OOPS!! While trying to get a closer look at a bald eagle, you did not see the NO TRESPASSING sign. Pay the $50 fine to the Public Bank.
WILDLIFE MANAGEMENT FACTOR	The Endangered Species Act (1972) provides federal funds and protection for endangered species. These funds protect habitat and provide money for research. To protect endangered species, transfer $50 from the Wildlife Management Fund to the Public Bank.
	(Do not keep this card.)

NONCONSUMPTIVE **WILDLIFE MANAGEMENT FACTOR**	• The poem you wrote while resting in this natural area earns you $100. Take your prize money from the Public Bank. The challenge of wildlife management is to provide opportunities to enjoy wildlife in different ways. Nature provides inspiration to writers, artists, musicians, and religions. (Keep this card.)

NONCONSUMPTIVE **WILDLIFE MANAGEMENT FACTOR**	• A new hiking trail opens near your home. You save $25 in transportation costs. Collect $25 from the Public Bank. Public land managers hire trail maintenance crews to build and maintain hiking trails. Transfer $25 from Wildlife Management Fund to the Public Bank. (Keep this card.)

NONCONSUMPTIVE **WILDLIFE MANAGEMENT FACTOR**	• You have won $50 in a wildlife photography contest. Collect your winnings from the Public Bank. Wildlife is managed for all types of uses. Game management money also supports wildlife viewing. Transfer $20 from the Wildlife Management Fund to the Public Bank. (Keep this card.)

NONCONSUMPTIVE **WILDLIFE MANAGEMENT FACTOR**	• You did not realize how much a recent temperature inversion had reduced the visibility on a wildlife photography trip. You lose the $20 it cost you for the wasted film and its development. Pay this $20 to the Public Bank. For many, wildlife serves as an inspiration for art and other means of creative expression. Without effective wildlife management, one may not be able to enjoy such activities. Money collected for license fees helps pay for those benefits. Transfer $20 from the Wildlife Management Fund to the Public Bank. (Keep this card.)

NONCONSUMPTIVE **WILDLIFE MANAGEMENT FACTOR**	• A birding club just put up a new observational blind, saving you time in spotting your favorite waterfowl. Join the National Audubon Society. Pay $25 to the Wildlife Management Fund, and take another turn. For more than a century, the National Audubon Society has been actively involved in bird research and education. Organizations like the National Audubon Society may choose to give grants to wildlife agencies. (Keep this card.)

NONCONSUMPTIVE **WILDLIFE MANAGEMENT FACTOR**	• You win $100 for obtaining a conservation easement* on old growth forest land. Keep it or donate a portion to The Nature Conservancy. (If you choose to donate some of your winnings, put them into the Wildlife Management Fund.) The Nature Conservancy, Ducks Unlimited, the Rocky Mountain Elk Foundation, and other nonprofit organizations contribute millions of dollars annually toward land acquisition and protection for wildlife. Transfer $100 from the Public Bank to the Wildlife Management Fund. * See Glossary. (Keep this card.)

NONCONSUMPTIVE **WILDLIFE MANAGEMENT FACTOR**	• You take your family of five to picnic in a state park. If you do not have a current parks pass, pay the $5 entrance fee times five individuals for a total of $25 to the Wildlife Management Fund. An entrance fee is one of the few ways for nonconsumptive users to contribute to wildlife management. (Keep this card.)

NONCONSUMPTIVE **WILDLIFE MANAGEMENT FACTOR**	• Because of extreme weather conditions, your guided snowmobile tour of this area has been cancelled. You lose the $50 down payment (no refunds). Pay this amount to the Public Bank. Especially in winter when food is limited, recreation can have an adverse effect on wildlife. Wildlife managers may limit public access to certain areas and may have to supplement wildlife food supplies during harsh weather. Transfer $25 from the Wildlife Management Fund to the Public Bank. (Keep this card.)

NONCONSUMPTIVE	• Today's canoe trip was fantastic! Show your appreciation by "adopting" a portion of the river. Pay $25 to the Wildlife Management Fund in an effort to support this clean-up program.
WILDLIFE MANAGEMENT FACTOR	Rivers and streams are important to all wildlife species and must be managed for the benefit of both wildlife and people. Transfer $25 from Wildlife Management Fund to the Public Bank. (Keep this card.)

NONCONSUMPTIVE	• You have received a citation for littering. Pay a $50 fine to the Public Bank.
WILDLIFE MANAGEMENT FACTOR	Litter and other pollutants can harm animals. Educating the public is an important part of wildlife management. Take $40 out of the Wildlife Management Fund for the education budget. (Do not keep this card.)

NONCONSUMPTIVE	• A game warden observes your dog chasing a fawn. Pay a $100 fine to the Wildlife Management Fund.
WILDLIFE MANAGEMENT FACTOR	Pet dogs and cats can have serious impacts on wildlife. Dogs occasionally kill deer and other wildlife. A recent study estimated that house cats kill as many as one million birds every day in North America. (Do not keep this card.)

NONCONSUMPTIVE	• You donate $100 to The Nature Conservancy to purchase important land used as a prairie chicken breeding ground. Pay $100 to the Wildlife Management Fund.
WILDLIFE MANAGEMENT FACTOR	Wildlife management is a partnership between state wildlife agencies and nonprofit organizations such as The Nature Conservancy. The Nature Conservancy has helped protect more than 70 million acres of habitat worldwide. (Keep this card.)

NONCONSUMPTIVE **WILDLIFE MANAGEMENT FACTOR**	• The weather is so gorgeous that you decide to extend your bird-watching trip. Take another turn at this time. The Watchable Wildlife Program is a component of most state wildlife agencies. Transfer $50 from the Wildlife Management Fund to the Public Bank. (Keep this card.)

NONCONSUMPTIVE **WILDLIFE MANAGEMENT FACTOR**	• You contribute $25 of your tax return to the nongame check-off on your tax form for wildlife. Donate $25 to the Wildlife Management Fund. Many states have a tax "check-off" on the state tax form that allows taxpayers to contribute a portion of their tax return to wildlife. In Colorado, this option generates more than $2 million each year for endangered species. Transfer $50 from the Public Bank to the Wildlife Management Fund. (Keep this card.)

NONCONSUMPTIVE **WILDLIFE MANAGEMENT FACTOR**	• You don't hunt or fish, but you would like to contribute to wildlife management in your state. Purchase a special "conservation" license plate for your vehicle. Pay $25 to the Wildlife Management Fund. Many states generate wildlife funds by issuing conservation license plates for an extra fee. In Florida, these special "designer-type" plates generate more than $5 million per year for endangered species and habitat protection. (Keep this card.)

FISHING LICENSE
VALID FOR ONE YEAR
(ONE LAP OF THE BOARD)
FEE: $30

FISHING LICENSE
VALID FOR ONE YEAR
(ONE LAP OF THE BOARD)
FEE: $30

FISHING LICENSE
VALID FOR ONE YEAR
(ONE LAP OF THE BOARD)
FEE: $30

FISHING LICENSE
VALID FOR ONE YEAR
(ONE LAP OF THE BOARD)
FEE: $30

HUNTING LICENSE
VALID FOR ONE YEAR
(ONE LAP OF THE BOARD)
FEE: $100

HUNTING LICENSE
VALID FOR ONE YEAR
(ONE LAP OF THE BOARD)
FEE: $100

HUNTING LICENSE
VALID FOR ONE YEAR
(ONE LAP OF THE BOARD)
FEE: $100

HUNTING LICENSE
VALID FOR ONE YEAR
(ONE LAP OF THE BOARD)
FEE: $100

ANNUAL PARKS PASS
VALID FOR ONE YEAR
(ONE LAP OF THE BOARD)
FEE: $40

ANNUAL PARKS PASS
VALID FOR ONE YEAR
(ONE LAP OF THE BOARD)
FEE: $40

ANNUAL PARKS PASS
VALID FOR ONE YEAR
(ONE LAP OF THE BOARD)
FEE: $40

ANNUAL PARKS PASS
VALID FOR ONE YEAR
(ONE LAP OF THE BOARD)
FEE: $40

START
OPTIONS:
Fish Lic. $30
Hunt Lic. $100
Park Pass $40
County Park (public)
State Wildlife Area (public)
Happy Valley Ranch (private)
Tikki Mountain Lake (private)
State Park (public)
Payday! Collect $100
National Park (public)
State Park. Purchase a Park Pass if you don't have one.
Private land, closed to public. Pay $100 fine for trespass.
National Wildlife Refuge (public)
National Seashore (public)
National Park (public)
Bear gets into your car. Pay $50 to replace damaged cooler.
YEAR END
Licenses and passes expire. Re-purchase, if desired.
Apple Valley Meadow (private)
State Marsh (public)
State Trail (public)
National Forest (public)
Wildlife Viewing Area. Stop to watch elk. Lose turn.
Payday! Collect $100
Sam's Orchard (private)
Riverfront Park (public)
Greenway Open Space (public)
Mall Buffer Zone (public)
Giles Golf Course (private)
You hit a deer. Pay $75 to bank for vehicle repairs.
Young's Quarry (private)
Claymont Second Growth Forest (private)
State Wildlife Management Area (public)
Schultz's Farm Field (private)
Jim's Dairy Farm (private)
State Wildlife Management Area (public)
Payday! Collect $100
National Forest (public)
CONSUMPTIVE
NONCONSUMPTIVE

Group Scenario Description Cards

Group A is lost near a murky pond surrounded by many small willow shrubs that are suitable for kindling. They have a lot of small animals to hunt, but with the number of mammals in the area, the water could be full of micro-organisms and must be carefully filtered to keep everyone healthy. Oil can be found seeping from the ground in small puddles.

Group B is lost in an open area protected from prevailing winds by a large, rocky knoll. It has a clear river flowing through it and patches of snow from the previous winter. Larger animals can be found migrating through this area.

Group C is lost in a spruce forest. There are large animals in the area. A small stream flows through it.

Token Tally
Data Sheet

Name: _____ Round: _____

Animal Tokens ■

Animal	Color Squares	Value	Number Found	Points
Ptarmigan	Orange	1		
Rabbit	Blue	2		
Fish	Red	4		
Beaver	Yellow	50		
Duck	Green	1		
Bear	White	50		
Caribou	Black	100		
Moose	Brown	200		

Total Animal Points = _____
300 needed for survival

Water Tokens ●

Water Source	Color Circles	Value	Number Found	Points
River	Blue	25		
Stream	Green	25		
Pond	Brown	10		

Total Water Points = _____
300 needed for survival

Shelter Tokens ▲

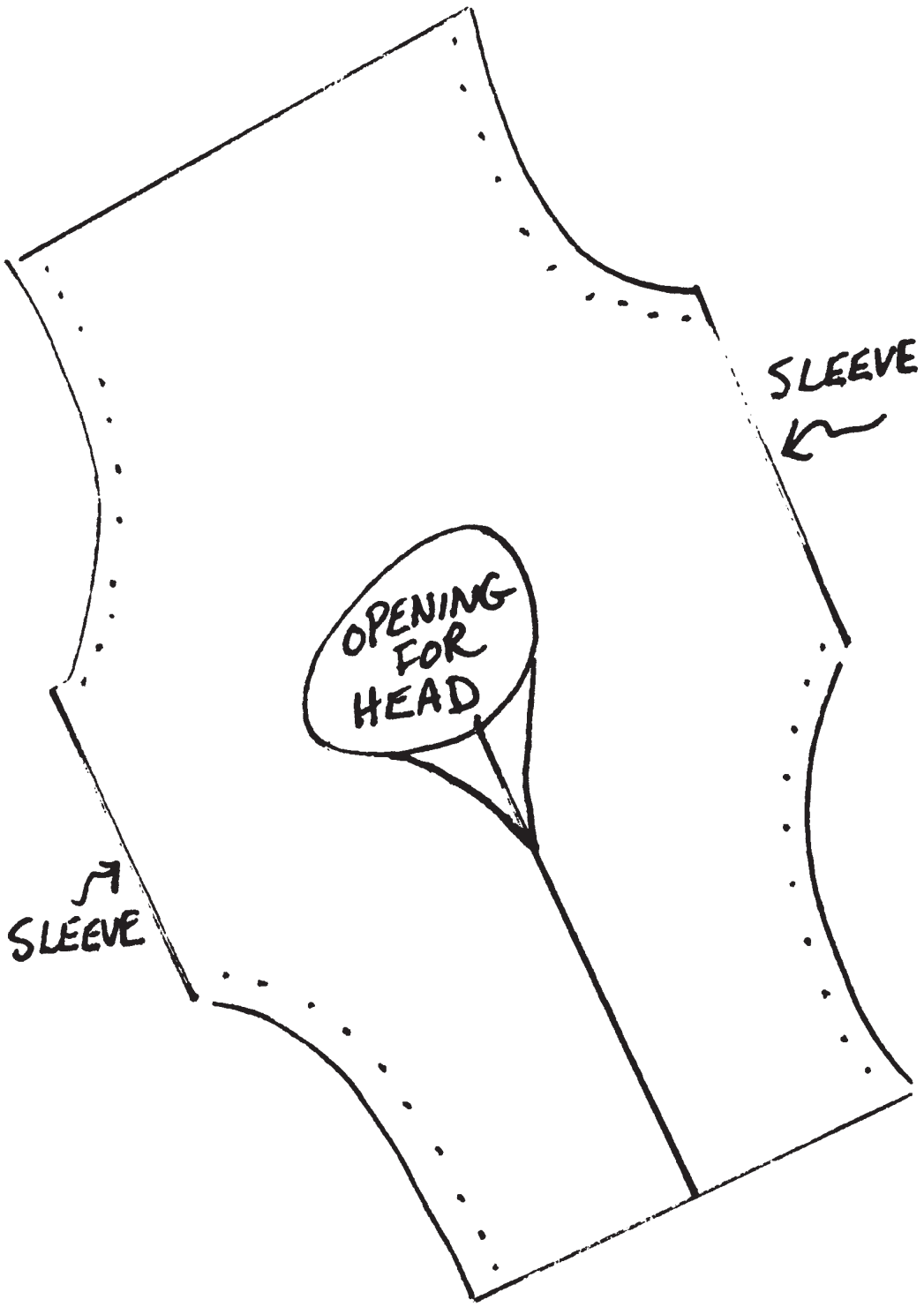
Shelter Resource	Color Triangles	Value	Number Found	Points
Wood	Brown	25		
Stone	Gray	10		
Earth	Black	5		

Total Shelter Points = _____
300 needed for survival

Heat Tokens ▬

Heat Source	Color Rectangles	Value	Number Found	Points
Oil	Black	20		
Wood	Brown	10		

Total Heat Points = _____
300 needed for survival


SLEEVE
OPENING FOR HEAD
SLEEVE

MEAL COSTS FOR FOUR PEOPLE

	PRODUCT	COST	
MEAL 1	EGGS	.80	.20 each
	TOAST	.24	.06 each
	BUTTER	.12	.03 each
	MILK	.60	.15 each
	JUICE	.60	.15 each
		2.36	.59 each

Wild Turkey Cards

Card 1

Scientists estimate that wild turkeys have been around for at least 10 million years. Wild turkeys are native only to the North and South American continents. Once there may have been as many as five different species, but if so, most of these became extinct in prehistoric times. Before European settlement, scientists estimate that 7 to 10 million turkeys were in North America.

Turkeys have been used as a source of food for thousands of years. At the Indian Knoll site in Kentucky, archeologists found large quantities of turkey bones, second only to the number of deer bones. Radiocarbon dating procedures indicated that these turkey bones existed before 3,000 BC.

The use of turkey as food varied among Native Americans. The Navajos, Tonkawas, and Lipans ate turkey, as did the Native Americans living in Connecticut. However, many Apache would not eat turkey, and the Cheyenne believed that eating turkey would make them cowardly.

Turkey feathers were used widely by Native Americans to make blankets, quilts, dresses, coats, and robes. The Cheyenne, as well as other native groups, used turkey feathers on their arrows. In 1612, Captain John Smith noted turkey spurs (from old gobblers) being used as arrow tips in Virginia. Feathers were also used to fashion ceremonial masks and headdresses and turkey bones were used to make spoons, beads, and other ornaments.

Many Native American groups—like the Cherokee, Chickasaw, and Mohawk—left turkey hunting to the children. Today's turkeys are very wary of people and are difficult to hunt. However, it appears that in the past turkeys were not shy of people and were considered too easy to hunt to waste the time of the experienced hunters.

Card 2

During the 1600s when Europeans began settling in North America, wild turkeys still were very plentiful. In fact, in 1709 there were reports of turkeys numbering 500 to 1,000 birds in one flock. The settlers began to rely on turkeys as an important source of food because turkeys were so plentiful and the meat was tasty. The turkey's primary feathers also were used for writing quills.

As the continent's population grew (more than 4 million by 1790), more forested land was cleared for farms, towns, cities, industries, roads, and railroads. Wildlife continued to provide food, clothing, and goods for trading and marketing. During this time, there were no effective laws regulating the use of land and wildlife. As expansion continued, wildlife became scarce near towns and cities; consequently, settlers were not able to go out easily to hunt for their own food.

From the late 1700s through the 1800s, market hunters helped supply food for settlers, selling deer, elk, turkey, bison, and other wildlife to markets and restaurants. Initially, wild turkeys sold for as little as 25 cents each. By 1900, turkeys were $5.00 each in Chicago. Continued habitat loss, combined with market hunting, which allowed hunters to sell their game to markets for profit, was taking a toll on many wildlife species.

By 1813, wild turkeys were gone from Connecticut. They were last seen in Vermont in 1842, in New York in 1844, in Michigan in 1897, and in Iowa in 1907. By 1920, the wild turkey was lost from 18 of the original 39 states of its ancestral range and from the Canadian province of Ontario.

Card 3

All turkeys in the world, including the domesticated turkey, are classified into two species. The wild turkey (*Meleagris gallopavo*) is the most common turkey and is found throughout North America. The ocellated turkey (*Meleagris ocellata*) is the other species and is found on the Yucatan Peninsula of Mexico, northern Belize, and the El Peten region of northern Guatemala. The wild turkey (*Meleagris gallopavo*) is divided into six distinct subspecies. Of these, the eastern wild turkey (*Meleagris gallopavo silvestris*) is the largest and most common subspecies. It originally ranged in the eastern half of the United States. Another subspecies, the Mexican turkey (*Meleagris pallopavo gallopavo*), is the forerunner of all domesticated turkeys we have in the world today. The Mexican turkey is the smallest of the six subspecies of the wild turkey, *Meleagris gallopavo*. Originally, it was found in southern Mexico, but it is now considered extinct.

Domesticating a species involves raising the animals in captivity and selectively breeding them for generations. Usually they are bred to benefit people (e.g., more meat, etc.). Eventually, they become very different from their ancestors in behavior and appearance.

When Hernando Cortes arrived in Mexico in 1519, the Aztecs already had large flocks of domesticated turkeys. The Aztecs had domesticated those turkeys from the Mexican wild turkey. How long the Aztecs kept domesticated turkeys is uncertain, but some scientists think those turkeys were introduced to Native Americans in the southwestern United States before 1350 A.D. The Aztecs used these birds mostly for their feathers and for sacrificial ceremonies. There are also reports that Montezuma, Aztec Emperor in 1519, fed about 500 domesticated turkeys daily to his menagerie of hawks, owls, and eagles.

By 1520, Spanish explorers took domesticated turkeys from Mexico to Spain. From there, the turkey quickly spread to Italy and France and then throughout Europe. By 1541, the domesticated turkey had reached England. By 1573, the turkey was so plentiful that it became part of the typical Christmas dinner. With selective breeding, new varieties of domesticated turkey were developed. By 1802, there were at least four standard varieties known in England.

Card 4

When the Spanish arrived in Mexico in the early 1500s, they were greatly impressed with the turkeys that had been domesticated by the Aztecs. Consequently, they took the domesticated turkey back to Spain, where farmers raised it throughout Europe.

Domesticated turkeys soon became part of the standard supplies sent with English colonists to America. In 1607, domesticated turkeys were brought back to North America with the settlers at Jamestown. Domesticated turkeys were also sent to help feed English colonists in Massachusetts in 1629. Soon small flocks of turkeys were being kept by many of the early colonists.

During the 1700s and 1800s, the propagation of domesticated turkeys stayed on a small, local scale. But even at this scale, changes were occurring to the domesticated turkey. The initial domesticated turkeys were smaller than the turkeys of today. They also were smaller than the eastern wild turkey (*Meleagris gallopavo silvestris*) found commonly throughout the eastern United States. During this time there were reports that local farmers captured wild turkey gobblers (males) and bred them with domesticated turkey hens (females) to obtain a larger bird.

In the 1920s, large commercial turkey farms were established in the United States. By World War II, turkey farming was a major industry. Over the years, selective breeding of domesticated turkeys led to today's domesticated turkey. Domesticated turkeys are now larger and plumper than wild turkeys. Domesticated turkeys come in a variety of colors, and they cannot fly. (Some of the early breeding of domesticated turkeys was done for feather quality and not necessarily meat.) Some of the most popular domesticated turkeys are the Beltsville, Small White, Black, White Holland, and Bronze.

Turkey farming continues to be a major industry. The United States raised about 275 million turkeys in 1999, with North Carolina producing more turkeys than any other state.

Card 5

Before European settlement, scientists estimate that there were 7 to 10 million wild turkeys in North America. By the 1930s, there were about 30,000 turkeys in the wild. The habitat destruction, unregulated hunting, and market hunting of the 1700s and 1800s decimated the wild turkey population throughout North America.

Land and wildlife were affected as the number of settlers grew. A few laws were passed to try to protect land and wildlife but with the lack of consistent enforcement of the law throughout the country, most settlers did not realize that turkey populations were limited. By the end of the 1800s, the reduction in wildlife populations could not be ignored. By 1900, wild turkeys—along with deer, elk, bison, pronghorns, passenger pigeons, and other species—were reduced to small populations found only in a fraction of their original ranges. By 1914, the passenger pigeon became extinct. Many people feared that the wild turkey would suffer the same fate.

Scientists, hunters, foresters, bird watchers, and others interested in turkey conservation formed organizations to urge conservation. In 1875, the American Forestry Association was founded, emphasizing the conservation of trees and forests. Theodore Roosevelt and George Bird Grinnel established the Boone and Crocket Club, an association of hunters interested in conservation.

Naturalists and writers published books and articles promoting conservation. In 1876, John Muir wrote of the need for the government to protect the forests. Henry David Thoreau published "Walden" in 1854. In 1870, essays and stories were published in Harper's new *Monthly Magazine* deploring the destruction of American wildlife and attracting the attention of people throughout the country. In 1849, the Depart-ment of the Interior was formed and by the end of the 19th century, some states had formed wildlife agencies. These organizations, as well as popular writings, slowly began to influence the opinions of the general public and lawmakers. The stage was set for the recovery of the wild turkey.

Card 6

In 1891, the President of the United States was given the power to create forest reserves through the Forest Reserve Act. State laws and the Lacey Act of 1905—a federal law that limited interstate shipment of illegally taken wildlife—curtailed market hunting. The Pittman-Robertson Act of 1937 helped provide funds to states for use in wildlife recovery programs by placing an excise tax on hunting and sporting equipment. Many states established hunting regulations and seasons and, although still small, now had wildlife agencies and personnel to enforce those laws. Some states also established wild turkey refuges, setting aside land for turkeys until the population could rebound.

With the United States' entry into World War I in 1917 and the Great Depression of the 1930s, the conservation movement slowed. At the same time, abandoned farms and timbered forests reverted to the shrubs and forested land preferred by the wild turkey. After World War II, many state wildlife agencies started to make plans to restore wildlife populations, including the wild turkey.

Obtaining wild turkeys for use in restoration projects was difficult. One widely used method was to raise wild turkeys in pens and release them into the wild. This method was used for almost 20 years but ultimately was not successful. Pen-raised turkeys did not have the skills needed to survive in the wild.

In 1951, biologists began using the cannon-net method to trap wild turkeys for later transfer. A large net was concealed on the ground near bait and quickly propelled over feeding turkeys by an electronically detonated small cannon. Using this method, along with improving habitat for wild turkey, state wildlife agencies were able to increase the wild turkey population in the United States to 1.3 million birds by the 1970s.

Throughout the conservation and restoration movement, volunteer conservation organizations greatly contributed to conserving habitat and wildlife populations. Since 1973, the National Wild Turkey Federation has partnered with state and federal wildlife agencies to provide support in the restoration of wild turkey populations. Today nearly 5 million turkeys can be found in North America, including all states in the United States except Alaska. These birds provide opportunities for bird watchers, hunters, and other people who appreciate wildlife.

Diagram A: Room Setup

(Front Desk) Envelopes for A B C

Group A Selected members stand here Resource Cards for Section A distributed here	Group B Selected members stand here Resource Cards for Section B distributed here	Group C Selected members stand here Resource Cards for Section C distributed here

Resource Cards: Section A

Resource Card 1 BISON	Resource Card 1 BISON	Resource Card 1 BISON	Resource Card 1 BISON
Resource Card 1 BISON	Resource Card 1 BISON	Resource Card 1 BISON	Resource Card 1 BISON
Resource Card 1 BISON	Resource Card 1 BISON	Resource Card 1 BISON	Resource Card 1 BISON
Resource Card 1 BISON	Resource Card 1 BISON	Resource Card 1 BISON	Resource Card 1 BISON

Resource Cards: Section B

Resource Card 5 FISH	Resource Card 5 FISH	Resource Card 5 FISH	Resource Card 5 FISH
Resource Card 5 FISH	Resource Card 5 FISH	Resource Card 5 FISH	Resource Card 5 FISH
Resource Card 5 FISH	Resource Card 5 FISH	Resource Card 5 FISH	Resource Card 5 FISH
Resource Card 5 FISH	Resource Card 5 FISH	Resource Card 5 FISH	Resource Card 5 FISH

Resource Cards: Section C

Resource Card 25 bushels CORN	Resource Card 25 bushels CORN	Resource Card 25 bushels CORN	Resource Card 25 bushels CORN
Resource Card 25 bushels CORN	Resource Card 25 bushels CORN	Resource Card 25 bushels CORN	Resource Card 25 bushels CORN
Resource Card 25 bushels CORN	Resource Card 25 bushels CORN	Resource Card 25 bushels CORN	Resource Card 25 bushels CORN
Resource Card 25 bushels CORN	Resource Card 25 bushels CORN	Resource Card 25 bushels CORN	Resource Card 25 bushels CORN

Needs Chart

Each Resource Card collected represents 250 points.

Each person in the group must have per round: 50 FOOD points
50 SHELTER points
50 CLOTHING points

Points	Round One					Round Two					Round Three				
4,000															
3,750															
3,500															
3,000															
2,750															
2,500															
2,225															
2,000															
1,750															
1,500															
1,250															
1,000															
750															
500															
250															
	Food	Shelter	Clothing	Ceremony	Tools	Food	Shelter	Clothing	Ceremony	Tools	Food	Shelter	Clothing	Ceremony	Tools

Draw a red line across the food, shelter, and clothing columns at the necessary level for the size of your group. Anything above that line represents an excess in that area, and anything below equals deficiencies. Include this information in your history.

Background Information Scenarios

Group Scenario for Section A

Your small group lives on the North American plains. Your group hunts game such as bison, deer, elk, and antelope, and roots and plants supplement your diet. It is a tedious process to herd and isolate the big animals. Dogs help, though, to transport the meat back to your band by dragging carcasses on wooden frames, or travois. Because you must move constantly to get game, your band is nomadic and lives in tepees that can be set up easily. For meat to be preserved, it is "jerked" or dried over a fire, or pounded with berries into pemmican. Not much meat is preserved in this way because of your need to travel lightly.

You have heard that some other groups have discovered horses moving into their area and that these groups are learning to use these strange animals for hunting. You do not see other bands from your group often because the area is sparsely populated. You trade little except for medicines and occasionally shells used to decorate clothing. Those from other groups whose language you do not speak communicate with you through sign language.

Although your group is not large, the boys work at war games and the girls learn to cook and sew. All adults instruct the children in tribal ceremonies; aggressiveness and individualism are encouraged. The group values "counting coup," or touching your enemy.

Clothing such as robes, leggings, shirts, dresses, and moccasins is made from hides. Decoration has been minimal in the past. Typically, decorations are made from porcupine quills that have been dyed with plants. You have used elk teeth and animal claws and have traded for shells from the sea. There is no headgear except for use in ceremonies. These items and tools usually are made from animals such as birds and bison.

Medicines and "visions" are important in your culture. Illness is caused by foreign substances in the body that can be exorcised by the medicine man, who has great powers. He may even walk on fire as proof of this power. Four and seven are sacred numbers.

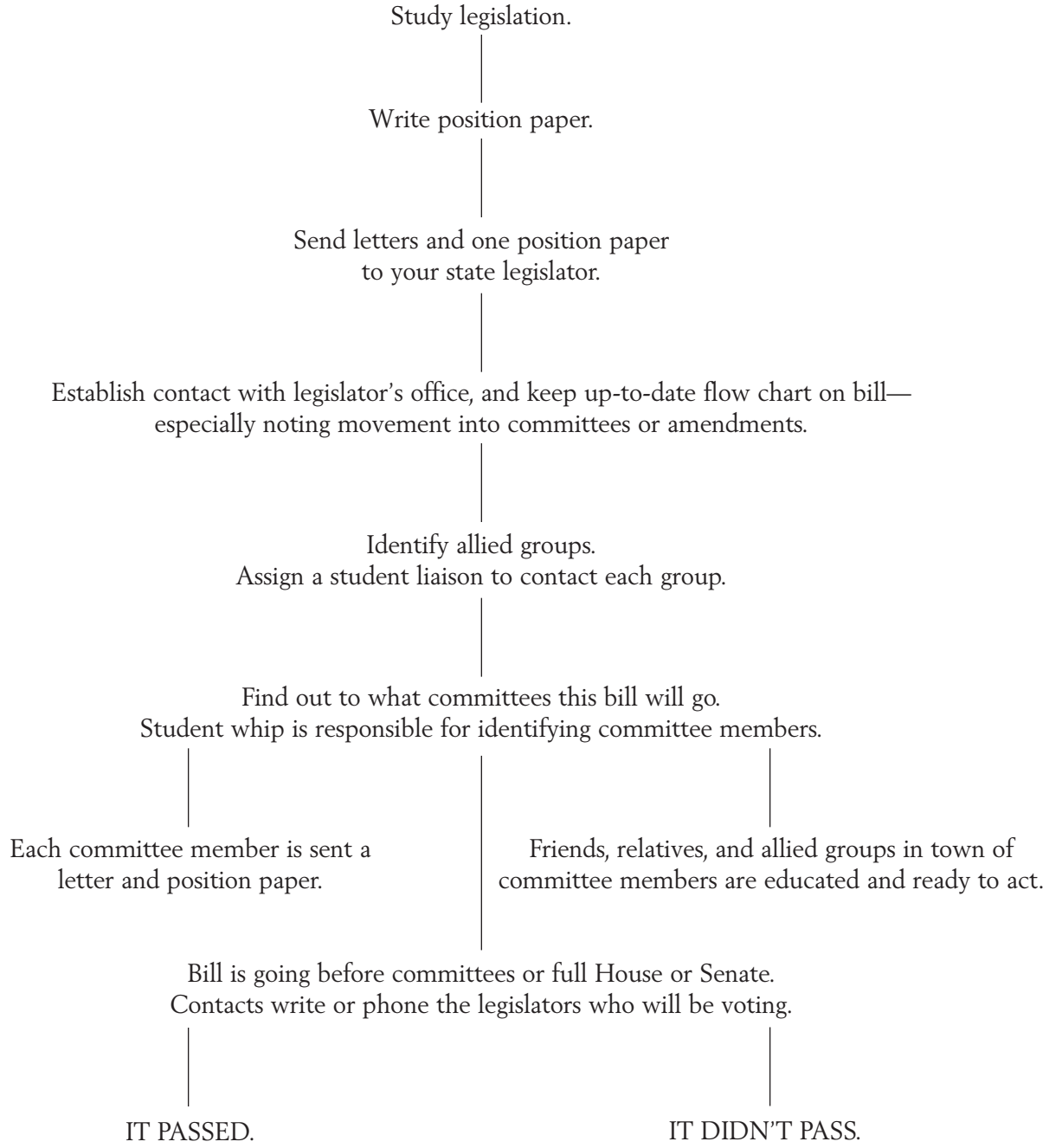
Group Scenario for Section B

Your large group lives in the Northwest where the river watersheds are covered by great stands of trees. Your primary food is the salmon that migrate by your riverside village in the late summer. Other fish and game are also plentiful. Transportation by canoes allows you to trade and communicate with other groups. During the summer, the entire village concentrates on smoking and preserving as much fish as possible for the long, cold, snowy winter.

Because winter can be severe, you retreat indoors for social and cultural activities. It is the time for much celebration as your group honors the earth, ravens, seals, fish, and trees with song and dance. This is also the time that you carve totem poles to depict your history and traditions. Members of your group are artists who paint and carve on the wooden huts and who spend time decorating the furs and woven bark clothings that you wear.

The members of an immediate family live together in a large, square, wooden hut with plank walls and a roof. The social structure of your group is well organized, and rank is determined by hereditary closeness to the ancestral founder. Potlatch, a formal ceremony involving gift giving, confirms the social status of group members. Education is also organized formally through apprenticeships in which the children learn various skills, and all adults contribute to the transmission of etiquette, moral standards, and cultural traditions such as the Spirit Dance.

Action Flow Chart for "Know Your Legislation" Activity



The Twins

By Dr. Clifford Knapp and Suzanne Iudicello

The twin fawns were born on a May day when the sun dabbled the edge of the forest through the newly budding leaves and apple blossom petals fell in the abandoned orchard like fragrant snow. They were not the only twins that year; food had been plentiful in the valley and white-tailed deer were sleek and round-bellied.

Even as the doe licked her offspring clean, strength flowed into the young bodies. It hadn't hurt that she had been able, through the fall and winter, to slip into a nearby farm at night for corn, alfalfa and clover to add to the leaves, twigs, juicy weeds, acorns, and mushrooms the forests and fields offered to the white-tails.

The valley was a generous place for the herd of 60 animals. Where the hillsides dipped down to meet the farm fields, the shady forest ended. This edge meant that food was varied and abundant. It hadn't always been that way.

In the early 1700s, when the valley was first settled, the forests were widespread. Since white-tailed deer require a mixture of forest, openings and edge, they were present but not plentiful then. By 1900, however, the deer population had been almost eliminated by a human appetite for venison. Too much hunting had reduced the size of the herds. Much of the once abundant forest had been cleared for wood products and used as agricultural lands. This limited suitable habitat for the deer. Later, laws controlled hunting, and changes in land use practices led to a return of some of the forest. The mixture of agriculture and young forests provided an excellent environment for the deer herds and with the regulated hunting, they thrived. The young plants that grew in the open areas of the cut-over forest yielded an abundance of food, and by the 1930s, there were more deer in the valley than when the settlers first came.

That soft, May afternoon saw another birthday celebrated in the valley. The boy ran out to greet his father who was climbing down off the tractor after a day of making furrows for the spring planting. He looked up into the lined face of his father and barely contained his impatience while the farmer removed his hat and wiped the sweat from his forehead with a big, blue kerchief.

"Is it time?" the boy asked breathlessly.

The man smiled down at his son—a strong, wiry boy, made tough by summers of throwing hay bales and winters of chopping wood.

"Yes, Jamie," he grinned. "It's time." He put his arm across the boy's shoulders, and they walked up onto the wide porch where a table stood decked with early daisies and tiger lilies in a Mason jar, bright orange and yellow paper napkins, and a three-layer chocolate cake with 12 yellow candles. The boy's mother was already sitting at the table, pouring tall glasses of foamy, fresh milk.

"Do you want us to sing first?" She laughed as Jamie scraped the chair legs across the porch floor in his haste to get to the table.

"Nope. Where's my present?"

"Now, Jamie," his father scolded good-naturedly, "birthdays aren't just for presents. This is a special year for you and it brings with it not just a gift but some responsibility. You're no longer a little boy. You're a young man. This is not a birthday for toys."

Jamie looked down at his hands on his lap. "I know, Dad; I'm sorry."

But when he looked up again at his father, the excitement and expectation shining in his eyes were not those of a serious young man, but of a boy about to burst with anticipation.

As his mother cut the cake, Jamie's father took from behind the door a long, narrow box tied with a gold ribbon. "Okay, son, this is what you've been waiting for, and we won't keep you from it."

Jamie tore the ribbon from the box and lifted the cover. There, gleaming in the soft yellow cloth, lay the rifle. It wasn't new, but the gloss on the stock showed a new coat of oil and betrayed hours of careful rubbing, and the barrel shone with new bluing. The scratches he remembered on the dull gray were gone, but the initials his grandfather had carved on the stock were still there.

He drew the rifle from the box, taking care to point it away from anyone as his grandfather and father had taught him. It was much heavier than the .22 he'd lugged through the woods to stalk squirrels.

"It's yours now, Jamie, just as we promised," his father said. "You're 12 now and old enough to go deer hunting this fall."

Although Jamie thought the fall would never arrive, the summer passed quickly, filled with days of helping his father in the fields, fishing and swimming, and lots of practice with the rifle.

In the hills above the farm valley, the twin fawns gained strength quickly. By June, they followed the doe along the well-worn trails. As summer ripened, they roamed with the herd over the length of the valley and high on the hillsides. They were just two of 50 fawns that had been born that spring, swelling the herd from 60 to more than 100.

They fed on leaves, twigs, fruits, and nuts of the trees and shrubs in the forest and on the grasses and weeds along its edges. The summer habitat provided abundant food. The doe and her fawns grew strong and healthy on the bounty. This was fortunate, for the stark winter ahead would not offer such abundance.

November blew in rainy and cold, and Jamie was restless after the crisp, bright days of October. The harvest was complete, the fields lay in a stubble under the gray sky, and the few brown apples remaining on the trees were torn down by the wind. He sat in the warm kitchen and looked out at the glistening black branches scratching at the sky.

"Can I go out, Mom?" he asked. She looked up from the lunch dishes at her son, his dungaree cuffs well above the tops of the worn boots and the elbows frayed out of his plaid flannel shirt. The restlessness was about to burst his skin as his growing body had burst the seams of most of his clothes that summer.

"All right, but wear your father's poncho," she called as he was already halfway out the door, the rifle over his shoulder.

Jamie knew, from his summer forays and from past autumns when he'd been too young to hunt, that the deer often came down to the abandoned orchard to nip at the withered apples that grew on the overhanging trees. That part of the farm wasn't used now, and the orchard had long since overgrown, producing only tiny, bitter fruits, but the deer seemed to like them. He had watched, enthralled many an evening, as the slender, tawny forms moved delicately and then froze like shadows in the dusk.

As he trotted away from the yellow light in the kitchen window, dusk gathered and the rain turned to sleet. The gray afternoon was threatening to turn bleaker yet. He scrambled over the crumbling remains of a stone wall and entered the orchard in a blast of wind that nearly took his breath away. "At least it's blowing toward me," he thought, settling in under a tree to wait. Just before nightfall, his patience was wearing thin, his foot was tingling where he had been sitting on it, the rain was trickling under his collar, and the sleet was stinging his face. He was about to stomp his foot to bring it back to life so he could walk home, when the doe entered the orchard; Jamie caught his breath.

The words of the wildlife license agent echoed in his ears as he raised the rifle to his shoulder. "We're going to open the season this year—bucks, does, fawns." The man had punched Jamie's slip of yellow paper for fishing and hunting—the first time he'd been the age to have a license for deer. "This is your first hunting season, son?" he'd asked. "Good luck."

Jamie watched the doe down the barrel of the rifle. She was stretching up, her front feet off the ground, trying to reach a last, wrinkled apple clinging stubbornly to a high branch. The slender neck glistened from drops of rain caught in the soft hair. His heart was pounding, and he wasn't sure if he was still breathing. He reached around with his thumb and gently pushed the safety off the rifle.

Just then the twin fawns stepped delicately into the orchard, melting from the darkened tree trunks like slightly smaller shadows of the doe. Jamie lifted his eyes from the barrel to the fawns. They, too, were stretching to try to reach the last brown leaves and few apples high in the branches but they were too short. They moved close to the doe, where her efforts at pulling on the branches had jostled a few apples to the ground.

Jamie refocused on the doe, sighted down the barrel and let out a deep breath to steady his hand. Just then, a blast of wind ripped through the orchard, carrying sleet and snow before it, ripping a tree branch in its fury. The branch tumbled down and the three deer bolted back into the thicket.

The boy reset the safety on the rifle and gingerly got to his feet. He looked into the darkening sky and the tossing branches and thought, "I'm glad. Maybe those three will make it through the winter."

Winter hit that night, lashing the valley with wind and snow that piled into high snowdrifts, and that froze into hard crusts and remained. The herd, trapped on the hillside, didn't move more than a quarter of a mile the whole winter. They competed for the dwindling food supply that remained poking above the snow and many fawns and does died.

Jamie thought often about the trio, as he looked out over the white landscape.

The grip of the season finally loosened one moist, February day. Rain pelted the snow, turning it to slush and pitted mounds where the mud showed through. Spring and summer returned to the valley and with them the activity that kept life for a farm boy busy and full.

For the herd, the winter had taken its toll. Most of the fawns had died of starvation and cold, as did many older bucks and does, weakened by age. The herd was reduced from the summer high of more than 100 to fewer than 50. Those remaining ventured down out of the hills to the greening valley where their favored plants sprouted anew. Throughout the spring and summer, they found plenty of food to go around among their reduced numbers, particularly since few fawns had been born after the harsh winter.

Summer's hazy, golden days burned into fall and as harvest time ended, Jamie's thoughts drifted again to the abandoned orchard and his rifle. One evening he took it out of its wrappings and cleaned and polished it, wondering if the twin fawns were among this autumn's yearlings.

The frosty straw stubble crunched under his feet as he made his way across the fields to the orchard. The passing of a year had seen more stones fall from the top of the wall and Jamie noted that the tree that had been his resting place last season was uprooted and lying broken. He concealed himself among the twisted branches and settled to wait.

The evening was still, the sky a pale salmon color where the sun had just slipped below the hills. Jamie hoped the slight varying breeze would not carry his scent. He slid a round into the chamber of the rifle, wondering how many times his grandfather had sat like this, in this very orchard, with this very rifle. He checked to make sure the safety was on.

Dusk fell with the twittering of a few last thrushes, and Jamie started at the sound of a snapping twig. A yearling doe stepped into the orchard, the brush rustling back to fill the space where she had emerged from the forest. Jamie exhaled quietly, trying to relax again, because this year was bucks only, the season restricted because the herd had so dwindled over the harsh winter. He watched the doe nosing among the brown weeds for fallen apples, wondering if she was the fawn of last autumn. He watched, still, admiring the sleek brown sides and graceful curve of the neck. The doe raised her head and listened, so close he could see her nostrils flickering to catch a scent. The deer glanced at the forest edge, tensed, and then bent her head to browse again as a yearling buck emerged from the same trail, disguised by the thick brush.

Jamie lifted the rifle to his shoulder, nestling it close against the rough wool of his jacket. He looked down the barrel at the young white-tail, wondering if these were the twins of that blustery evening a year ago. He questioned whether this time he would pull the trigger. "He made it through the winter; who am I to kill him now?" he asked himself.

The buck stepped away from the doe and began pulling apples from the drooping branches. It would be a clean shot, Jamie knew, well away from the doe, certain to be a quick kill. He exhaled, steadied his arm and concentrated on a patch of rusty brown hair on the animal's shoulder. "I can't look at his head," he thought. "I just have to keep thinking of him as meat for my family." As he thumbed off the safety, he allowed himself one last, stolen glance at the sculptured head, arching up to grasp an apple. Jamie swallowed and …

"The Twins" is adapted, with permission, from a story that originally appeared in Open Lands and Wildlife (Union, New Jersey: Pollution Control Education Center).

Land-Use Dilemma

Pleasant Valley is a ranching and logging community on the western slope of the Snow Mountains. Silverton—a town of 20,000—is the trade center of the area. Cramer Lumber Company is expanding its operations. This expansion will provide 250 new jobs but housing is very limited. A 200-home subdivision has been proposed for an 80-acre plot of undeveloped land on the south edge of town. This forested area is bordered by Rattlesnake Creek on the west. Rattlesnake Creek provides excellent fishing for rainbow trout. Fifty-three species of birds have been sighted in this area, including some rare species. In the spring and fall, the area is used by migrating waterfowl, and deer feed in the area. Many small watchable species—such as ground squirrels and pocket gophers—inhabit the area. This 80-acre plot is currently zoned for agriculture and forestry and would have to be rezoned for residential by a vote of the county commissioners. The subdivision would be on a central water system but each home would have its own septic system.

Personal Data Cards

Jack or Janet Thompson, Rancher (County Commissioner)

You are the third generation to run the "Rolling T" Cattle Company. You are proud to tell people that your grandfather was one of the first people to settle in this valley. Your spread covers 800 acres, and you have grazing rights to surrounding U.S. Forest Service land. You resent the increase in population of the area, and although you are involved in community affairs, you resent individuals moving into the area who do not share your values. Last winter, snowmobiles cut your fences three times, and in one case your cattle wandered onto the highway and caused a traffic accident.

Jelmer or Bertha Willas, Resident

You are a 68-year-old "old-timer" living on the land proposed for the subdivision. You have lived on Cornwall's land for 45 years, have built a home there with Cornwall's permission, and have raised seven children. You raise bees and chickens out back, and your garden covers one-half acre. You are settled in the middle of the area proposed for the housing development, and there is no question that you will have to be evicted and your house torn down. You have no legal claim to any of the land but have nowhere else to go.

Bob or Betsy Henderson, Farmer (County Commissioner)

You own and operate a large farm near the south edge of town and adjacent to the 80-acre plot in question. You have been interested in the possibility of buying the land to add to your family's agricultural operations. You've a keen interest in the environment, making efforts to use agricultural practices that benefit wildlife and minimize damage to other natural resources. Because you are an adjacent landholder, you may need to disqualify yourself from participation as a Commissioner in this meeting.

Tom or Mary Bennett, President of Chamber of Commerce

This is your 10th year as president of the Chamber of Commerce. You own a grocery store in the middle of town. Your greatest concern is the weak business climate in your community. The Chamber recently hired Smith & Wittigen, a business consulting firm, to evaluate the business potential of Pleasant Valley. Their findings indicate that the business community has overbuilt. Your profits and those of your fellow merchants have been declining steadily. You see this new lumber mill as the salvation of your business. You also have wondered about possible ways to improve the economy through increased tourism.

Oscar or Jan Sparrow, Local Audubon President

You represent more than 300 active Audubon members and are director of the annual bird-count competition. You have a list of 15 rare bird species found in the Rattlesnake Creek area. You are 37 years old and work at the lumber mill.

Len or Linda Olsen, Realtor (County Commissioner)

You started your business in Silverton 5 years ago. Your business is doing well, but you have difficulty relating to the "old-timers" like Thompson. Your real estate company is not developing this property. You have some questions regarding the credibility of the developer but you generally vote in favor of development.

George or Alice Long Wings, Native American Leader

You have an interest in the sanctity of the area in question because it is an ancient ceremonial site for your people.

Personal Data Cards

Harlie or Charlotte Jackson, Hunter

You are a 68-year-old "old-timer" and an avid hunter and angler. You have four children, and hunting always has been an important family activity. You are an influential member of Ducks Unlimited and the 80 acres proposed for development contain one of the prime duck hunting areas close to town.

Wallace or Wilma Cramer, Lumber Mill Owner

You own the nearby lumber mill. Operations have expanded, and you need inexpensive housing for new employees coming to the area. The wood milled is used locally and transported throughout the state. It provides an important source of income to the town.

Martin or Ethel Higgins, Developer

You own the largest development company in the area and can afford to buy the land outright. You will make a substantial profit if the housing that is needed for the lumber mill employees is built. You are successful and fairly competent but you have been criticized more than once for a lack of attention to landscape detail and design.

James Erma "Frosty" White, Snowmobiler

You are 30 years old and have just been elected president of the "Rattlers," the local snowmobile club. You feel that you should defend their interests in the area. The cost of gas is high, and your club doesn't want to have to drive long distances to ride snowmobiles. You would like to open a snowmobile repair shop but you might get a job at the new lumber mill.

Harold or Cornelia Cornwall, Landowner

You are a 63-year-old retired businessperson. You want to sell your land, move to Palm Springs, and live happily ever after under sunny skies. You want cash but your asking price is very reasonable. You own the 80 acres of prime wild land south of town.

Frank or Frances Study, College Professor

You teach at a nearby community college. You are an active member of several animal welfare organizations and are vocal in your opposition to hunting.

Harvey or Gladys Crow, Banker (County Commissioner)

You are a 50-year-old banker, and you are willing to finance new home loans. You are an art collector and former president of the local Chamber of Commerce. You also love bird watching and fishing. You think the whole area south of town has economically valuable recreational potential but are concerned about protecting environmental quality.

David or Wanda Dresser, Merchant (County Commissioner)

You are 46 years old and own a furniture store. You would like to sell furniture to all the new homeowners. You can also see the value of the 80 acres left in a natural and undeveloped condition. You are wondering if there might be another site for the development of this housing area.

Dominant Species Chart

TEAM _____

PLOT _____

Species	Number Found	Characteristics	Remarks	Native/ Non-Native

Total Number of Non-Natives _____ / Total Number of Species Found = % Non-Natives _____

Total Number of Natives _____ / Total Number of Species Found = % Natives _____

Adapted with permission from "Charting Exotics," by Jen Richards, Kelly Kearns, and Al Stenstrup. Wisconsin Department of Natural Resources.

At Issue: Land-Use Planning

Approximately 100 miles of what is called riparian zone—in this case riverbank property—is vegetated in mature trees and associated plants. The property includes both publicly and privately owned land. Many of the riparian zone's tree species are not native to the area. These plants are non-native species. For the past 90 years, non-natives have been introduced into this ecosystem. The non-native trees were both intentionally and accidentally introduced. Native trees still survive in the area but their numbers are declining. The non-native trees have crowded out some of the native trees, creating a different type of habitat. Many native wildlife species are not as well adapted to the new non-native tree-filled habitat.

Some ecologists have recommended that the non-native trees be eliminated from the riparian zone. These ecologists recommend that all of the riparian zone's properties be treated to eliminate the non-native trees. Any non-native trees left in the riparian zone would be potential seed sources for re-establishing non-native trees in areas where they have been removed. The ecologists propose that the cut logs could be sold as firewood or left on the ground.

Because the land has many owners, there are several different philosophies about how the land should be managed. The riparian zone public lands include both a wildlife refuge that has a policy against cutting trees for any reason and a state forest that permits tree removal but lacks the funding to complete such a project. The tree removal could occur on private lands only if the property owners choose to let that happen.

County ordinances would be necessary to prohibit any new introductions of non-native species. The ordinances could allow for exceptions for things like fruit trees, or could prohibit all non-native trees. These ordinances would particularly affect homeowners along the river who want to landscape or plant windbreaks. Many of the existing non-native trees are in established windbreaks and visual screens surrounding homes in this area.

The public agency responsible for management of wildlife in the area and a group dedicated to wildlife preservation strongly oppose the proposed plan to harvest trees. They argue that the impact on wildlife in the area will be extreme. Local wildlife will lose food and shelter that is provided by many of the non-native trees. They further argue that the project would cause many fish and other aquatic organisms to die. Logging would remove shade that keeps the water cool. Because the roots of the non-native trees hold the soil in the bank, their removal would lead to increased siltation in the river.

Other groups, including a local native plant association and a public agency responsible for endangered plants and animals, adamantly support the proposed plan to remove the non-native trees. They argue that native plants and animals are losing their position in the environment in favor of non-native plants and animals. Although they admit that short-term effects of siltation and habitat loss may present some problems, they argue that the long-term effects of re-establishing the native ecosystem will outweigh any short-term side effects.

All of the involved land is found in one county. The county Board of Commissioners will hold a hearing on the topic of removing the non-native trees. The proposal is called "The Vegetation Manipulation Plan for the Riparian Zone."

Student Reference Sheet A

Neotropical Migratory Birds

Almost 70 percent of the world's bird species are declining in population. Many birds are on the endangered, threatened, or watch lists in different states and countries. The rapid decline in the species of birds worldwide signals that the ecology of the planet is changing. What are the major threats to birds worldwide? What are people doing to try to protect them?

You will complete a simulation that focuses on certain types of neotropical migratory birds. These birds breed and spend summers in the United States or Canada and then travel great distances to their wintering grounds in Central or South America. The majority of the approximately 200 species of neotropical migratory birds are songbirds.

The life cycles of these migratory birds are very complex. To understand the population changes of these birds, you must consider the breeding grounds in the north, the wintering areas in the south, and the migration path. Below are some of the major threats facing neotropical migratory birds:

- habitat fragmentation
- nest predation
- cowbird parasitism
- urbanization
- linear development (i.e., roads, pipelines, and high tower lines)
- loss of habitat—summer, winter, and stopover habitat

You will investigate how forest fragmentation might affect populations of interior forest migratory birds. Forest fragmentation is the reduction of extensive, contiguous forest into smaller, isolated parcels separated by roads, fields, houses, and other development.

Studies by the United States Fish and Wildlife Service have shown that many forest bird species are rare or absent from many small, isolated habitat blocks of forest. It is difficult to determine an exact size of territory needed in acres because minimum area estimates vary by species, regions, and habitat types. Despite these difficulties, general patterns of species of birds are emerging. Some bird species are not sensitive to habitat fragmentation and occur in habitat patches of all sizes, whereas others are moderately or highly sensitive and rarely occur in small forested areas. Listed below are samples of each:

Moderate or High Sensitivity

Ovenbird
Acadian flycatcher
Scarlet tanager
Wood thrush

Low Sensitivity

Red-headed woodpecker
Northern cardinal
Indigo bunting
Black-capped chickadee
Bluejay

Wildlife research now shows that many species of forest birds require large blocks of habitat. Moderate to high sensitivity species avoid habitat on the edge of built communities and do not nest successfully near edges. Populations of these species generally do poorly in areas where habitat is broken, or fragmented, into small, isolated blocks.

You will now look at two different scenarios for changes to a forested area and the effects of fragmentation on a wood thrush population.

Student Reference Sheet B

Introduction to the Wood Thrush

(*Hylocichla mustelina*)

The wood thrush can be found in the moist and shady deciduous forests throughout the eastern United States. Because the population has been declining at a rate of 1 to 2 percent each year for nearly 30 years (1966–1994), it has been the subject of many ecological research projects. Research conducted on the breeding grounds has centered on the effects of forest fragmentation on nesting success.

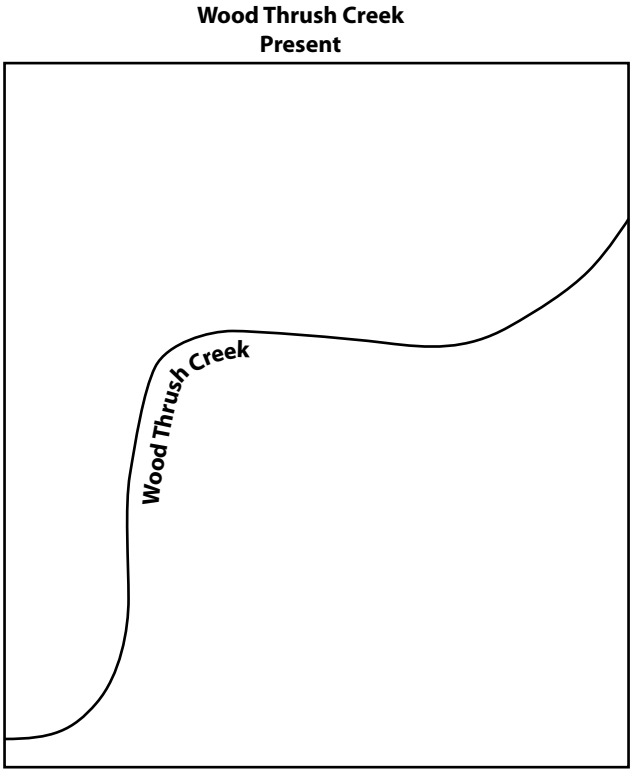
Forest fragmentation is the name given to the reduction of extensive, contiguous forest into smaller, isolated parcels separated by roads, houses, agricultural fields, utility lines, logging, and other development. Carving up a forested area into smaller parcels creates more forest edge relative to forest interior. This process makes the wood thrush nests more susceptible to predators such as chipmunks, raccoons, blue jays, crows, and cowbirds. (The cowbird is a "brood parasite" that tends to select forest edges for reproduction and lays its eggs in other birds' nests. The "foster parents" usually raise the cowbird young at the expense of their own eggs and young.)

The Smithsonian Migratory Bird Center reports find that wood thrush nesting success is greatest in large forested areas. Success rates decline with smaller forest size as a result of increased predation on eggs and young.

Wood Thrush Creek Scenario: Present

The area around Wood Thrush Creek has been forested for many years. The area is privately owned, and Wood Thrush Creek is an excellent trout stream.

How many Wood Thrush nesting territories can be established in this wooded area?

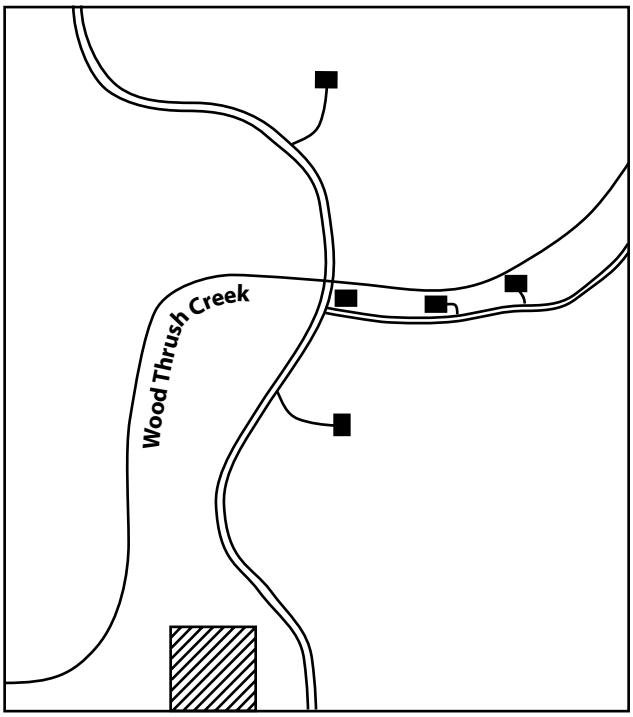


Wood Thrush Creek Scenario: A

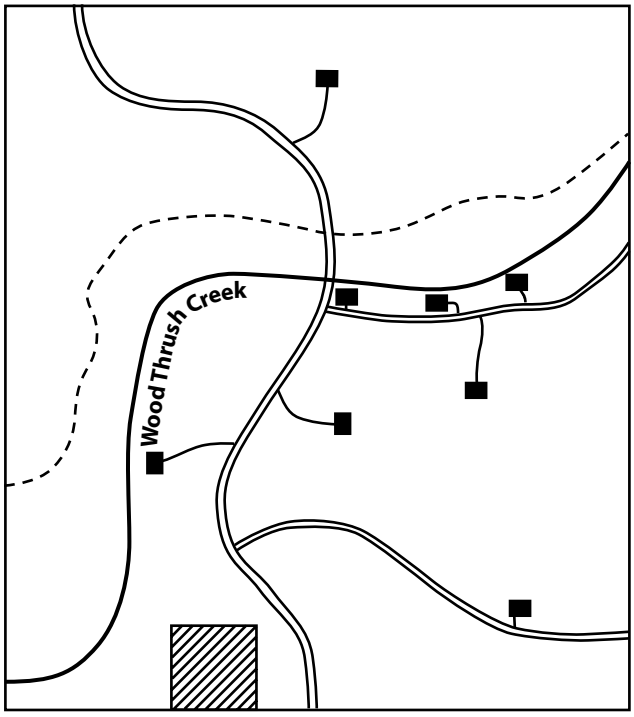
The owner has decided to sell some of the land. The owner also established a timber sale to provide some income and forest products, which are in demand. People are moving into the area and building homes.

- What are the changes in Scenario A during the first 10 years?
- What are the possible reasons those changes are occurring?
- How do the changes affect the wood thrush? How many circles will still fit in the forested areas if the circles cannot cover human structures represented on the map?
- What are the changes in Scenario A after 20 years? How many circles will still fit in the forested areas?

Wood Thrush Creek
Future: 10 Years



Wood Thrush Creek
Future: 20 Years

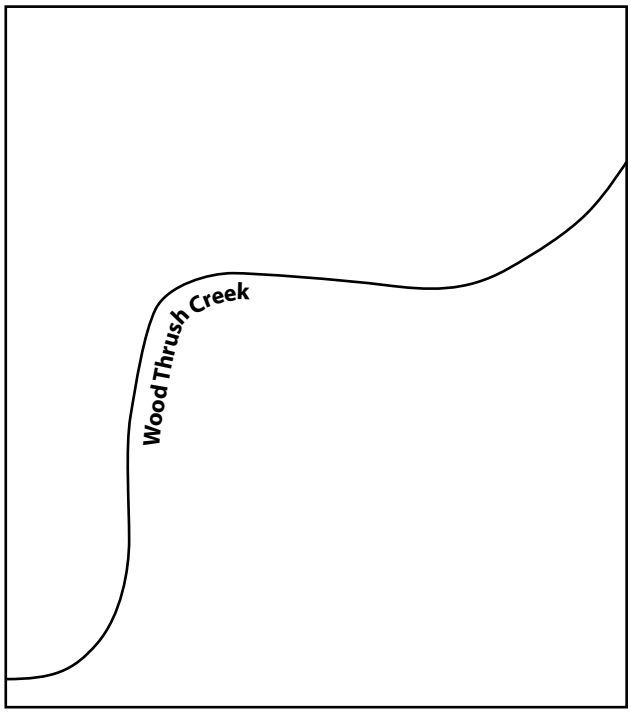


Wood Thrush Creek Scenario: B

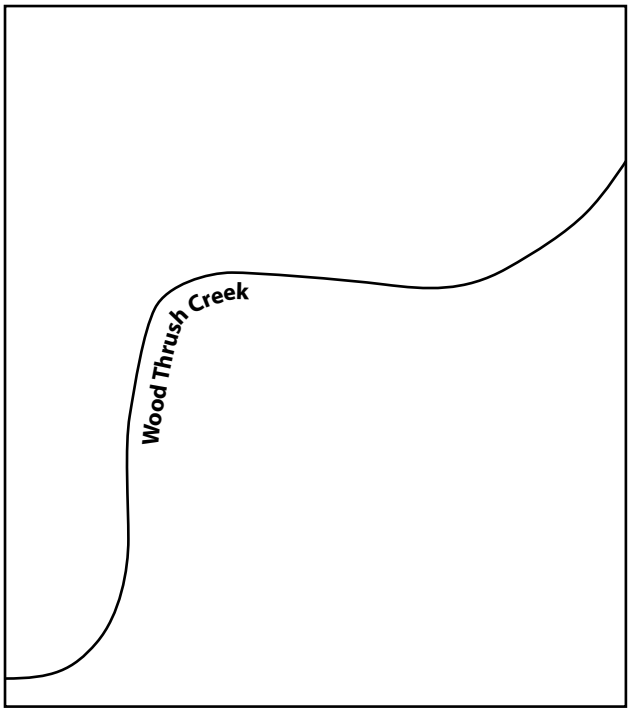
Scenario B presents a different kind of change to the area. Your group will decide where to put the houses, roads, and other developments. Use the same number of homes and a logged area as in Scenario A. Fill in the areas with your plans. Try to provide for the maximum of forested areas large enough to support nesting areas for the wood thrush. Add a 4-inch long snowmobile/ATV trail on the Future: 20 Years map.

- What decisions did your team make when mapping the development?
- How would those changes affect the wood thrush? How many nest sites did you have in the first 10 years? Second 10 years?
- How do these changes compare to those in Scenario A?

Wood Thrush Creek
Future: 10 years



Wood Thrush Creek
Future: 20 years



Cabin Conflict

The following imaginary conflict is based on one family's real experience and similar cases.

A dispute has arisen between owners of three cabins situated on deeded land that has been designated as a state wildlife primitive, management, or refuge area by a legislative act and by the state wildlife agency. Under the act, all property owners would be required to sell their property to the state or their property would be condemned and taken by the state.

Two property owners use the property for weekend and summer homes while the other property owner uses the property as an environmental learning base for her elementary school students, as well as for a summer cabin. This property owner would like to keep the property to enhance the educational program and for its historical value.

Seventy-five years ago, the area was the site of a small mining community of about 500 people. Zinc and lead were mined. Part of the old smelter remains near the educational cabin. A black mountain of charcoal used in the smelting process and several old mine shafts still exist. The existing three cabins are located on originally deeded mining claims of about 3 acres each.

North American Alligator *(Alligator mississippiensis)*

The North American alligator, a member of the crocodile family, can be found in marshes, swamps, shallow lakes, ponds, and waterways in the southeastern United States—from Texas to Florida and as far north as the Carolinas and southern Arkansas. As adults, these large reptiles can weigh more than 500 pounds and measure 8 to 13 feet or more in length.

North American alligators are predators and eat a wide variety of foods including fish, turtles, snakes, birds, and small mammals. The North American alligator has existed for more than 180 million years. It is well adapted to life in the wet areas of the south. Alligators are exothermic. They have no internal method to control body temperature and rely on water to keep their body temperatures lowered in the hot summers. The North American alligator helps retain water in its habitat by creating holes that retain water in times of drought. These "gator holes" help supply water for wetland plants and wildlife.

During the early colonization of the southeastern United States, alligator populations remained fairly stable throughout most of their range. However, at the end of the 19th century, it became fashionable to use alligator hide in boots, wallets, purses, belts, and other fashion items. Market hunters began to take alligators in large numbers to use their skins in the fashion industry. In the 1920s, 200,000 alligators were killed each year in Florida alone.

During the 1920s, thousands of acres of wetlands also were being drained to provide more land for agriculture and development, and to limit mosquito populations. With the combined pressures of habitat loss and market hunting, alligator populations began to plummet. By the 1950s, the American alligator was on the verge of extinction.

Between the 1940s and the 1960s, the southeastern states began protecting their remaining alligator populations. In 1967, the North American alligator was placed on the federal endangered species list, which provided it complete protection. It remained on the list under the Endangered Species Act of 1973. This act emphasizes protection and recovery of endangered species and helps provide funding for research and recovery projects. An amendment to the Lacey Act and CITES II (Convention on International Trade in Endangered Species of Wild Fauna and Flora) also protects the alligator by regulating interstate and international commerce in alligator products. (A South American alligator, not found in the wild in North America, is not endangered and never has been. Those alligators are sometimes sold in pet stores.) As a result of such efforts, the North American alligator has made a complete recovery. Effective management, habitat protection and restoration, law enforcement, and, in some states, reintroduction and restocking have enabled alligator populations to grow dramatically in recent years. In 1987, the American alligator was reclassified from "endangered" to "threatened."

While North American alligator populations continue to grow in the southeastern United States, the human population and associated development is also increasing. Because many people want to live along water, waterfront property has become a prime area for housing developments. People share these waterways with alligators while fishing, boating, swimming, and so forth. Greater contact has led to increased conflict between people and alligators, and most conflicts are due to alligators being in places where people do not want them. Although these reptiles typically stay away from people, people and alligator incidents can result when alligators lose their fear of people because someone has been feeding them. Alligators are large predators and have also been known to prey on household pets.

To help manage alligator populations, some states now allow closely monitored hunting and trapping. Alligator hide and meat are valued commodities. To help meet this need, alligator farming has become a thriving business. Some states have allowed the limited collection of eggs and hatchlings by licensed alligator farms and have allowed limited hunting by private individuals.

North American alligators remain protected on state, federal, and international levels to help ensure their continued survival.

Black-Footed Ferret *(Mustela nigripes)*

The black-footed ferret is the only ferret native to North America. These long, slender mammals were once found throughout the Great Plains, ranging from southwestern Canada to northern Mexico. Scientists do not think they were ever very abundant. The black-footed ferret is considered the rarest wild mammal in North America.

Black-footed ferrets are members of the mustelid family, along with weasels, otters, minks, badgers, and wolverines. Although they occasionally eat rabbits, mice, and other small mammals, black-footed ferrets feed almost exclusively on prairie dogs—in fact, prairie dogs make up more than 90 percent of a ferret's diet.

Prairie dogs are burrowing rodents that live in large groups often referred to as "towns." At one time, there may have been as many as 5 billion prairie dogs sharing the prairie with ferrets and other wildlife. It is no coincidence that the ranges of these two animal species overlap. Not only do black-footed ferrets rely on prairie dogs as their main food, but they also live and raise their young in the burrows of prairie dogs.

Prairie dog towns provide food and shelter for many other animals as well. Prairie dogs are the prey of other predators such as coyotes and red-tailed hawks. Burrowing owls use prairie dog holes for nest sites, and many species of snakes, lizards, and amphibians use the burrows for shelter and hibernation.

Prairie dog towns provide recreational opportunities for wildlife watchers, photographers, and hunters. Although valued or tolerated by many people, others consider prairie dogs as nuisances. Besides eating agricultural crops, they eat the prairie grasses that are also eaten by livestock. Most of the land that could be developed in some areas is inhabited by prairie dogs. In addition, prairie dogs can contact sylvatic plague, which, when transmitted to humans, is called bubonic plague.

Since the late 1880s, many methods have been used to control and eradicate prairie dog communities. At the same time, the majority of their habitat (more than 98 percent) has been lost to development. Poisoning, trapping, shooting, and other control measures; habitat loss; and disease have led to a decline in prairie dog populations. This loss of habitat and their major food supply, in conjunction with disease, caused black-footed ferret populations to plummet as well.

In 1967, the black-footed ferret was placed on the federal endangered species list. By 1980, black-footed ferrets were thought to be extinct. Then in 1981, a population of black-footed ferrets was discovered in a prairie dog colony in Wyoming. Biologists began to study these animals to determine what could be done to protect this colony. By 1985, the colony had expanded to 129 animals. Unfortunately, an outbreak of canine distemper almost wiped out the colony. By 1987, the 18 remaining black-footed ferrets were taken into captivity as a last ditch effort to save the species.

In 1988, the U.S. Fish and Wildlife Service adopted the Black-Footed Ferret Recovery Plan. State and federal wildlife agencies in cooperation with several zoos began a captive-breeding program to try to increase the number of black-footed ferrets. The goal of the program is to reintroduce these ferrets into the wild. Overall, the captive-breeding program has been a success. The first project to reintroduce black-footed ferrets into the wild took place in 1991 in a prairie dog colony in southern Wyoming. Since then, small numbers of ferrets have been reintroduced into Montana, Arizona, Utah, and South Dakota. On-site breeding programs have also begun in Arizona, Colorado, and Utah. In 1998, more than 100 black-footed ferrets were born in the wild, and more than 400 were born as part of the captive-breeding program.

Many challenges remain in this reintroduction effort. Little was known about black-footed ferrets, especially about how to raise them in captivity while maintaining their abilities to survive in the wild. Land-use conflicts among farmers, ranchers, and prairie dogs continue to exist, on public as well as private lands. Today, where some prairie dog species continue to be legally classified as "pests," poisoning and other measures are being used to control nuisance colonies. Urban development continues to affect the land used by both prairie dogs and black-footed ferrets. To help address some of the issues associated with the recovery project, the reintroduced black-ferret populations have been designated as "experimental nonessential" populations under the Endangered Species Act.

As land-use practices change and more prairie dog communities are eradicated, the final challenge may be to maintain enough suitable habitat and prairie dog communities for black-footed ferrets to survive in the wild.

Gray Wolf *(Canis lupus)*

The gray wolf is a highly social animal, and lives in packs of two to more than a dozen animals. Within the pack there is a definite hierarchy of dominant and subordinate individuals. Typically, only the alpha (lead or highest ranking) male and female mate, which helps limit the size of the pack and the number of newborn pups. The alpha pair, along with its offspring, forms the pack. Wolves hunt in packs and will share their food with pups and other adults in their pack. This arrangement is rare in the animal world.

Gray wolves can survive in many habitats where food is plentiful. They usually live in isolated forested habitats interspersed with grassy areas where their prey—deer, elk, moose, and other ungulates—graze. Wolves are large animals and can weigh up to 175 pounds and measure up to 6 1/2 feet in length, but most wolves are about half this size. Although named the "gray" wolf, the color of these mammals varies in shade from black to white to gray.

The gray wolf once was found throughout North America from Canada to central Mexico. When European colonists began to settle in North America, they relied on many species such as deer and elk for food and clothing and for trade. They had very little knowledge about predators. Wolves, like other predators, were viewed with fear or as competitors for important food sources. Settlers were also concerned that wolves would attack their livestock or themselves. Consequently, as early as 1630, large bounties were paid to people to kill wolves. The Massachusetts Bay Colony paid an average month's salary for the head of a wolf.

As more people settled the land, the pressure on wildlife drastically increased. Between hunting and loss of habitat, many wildlife species, including elk, bison, and deer, were almost eliminated from parts of the country. The wolf was being pushed into an ever-decreasing range with a greatly reduced food supply. Conflicts between wolves and people grew. Programs, including those subsidized by the government, were established to eradicate the wolf. By 1897, the eastern timber wolf (*Canis lupus lycaon*), a subspecies of the gray wolf, was eradicated from the northeastern United States.

Wolves remained fairly common in the wild lands of the northwest through the early 1900s. However, continued habitat loss and eradication programs persisted. By 1950, wolves had been eliminated throughout the contiguous United States except for some remote wild areas in northern Minnesota. In 1967, the eastern timber wolf was included on the federal endangered species list. In 1973, the northern Rocky Mountain subspecies (*Canis lupis irremotus*) was listed as endangered. With a relatively large eastern timber wolf population surviving in parts of Minnesota, there was some confusion as to the legal status of the wolf in the United States. To clarify the situation, the U.S. Fish and Wildlife Service (USFWS) reclassified the Minnesota wolf as "threatened," and all other gray wolves south of Canada were listed as "endangered."

The Endangered Species Act of 1973 provides protection for endangered species and requires that plans be prepared for the recovery of these species. Over many years, federal and state agencies, as well as interested organizations, conducted studies, held public hearings, and conducted opinion polls to help assess which recovery strategies would have the best chance of success. In 1987, the USFWS approved the Rocky Mountain Wolf Recovery Plan that designated three official recovery areas in the northern Rocky Mountains. These areas were in northwestern Montana (including Glacier National Park and the Bob Marshall Wilderness); central Idaho (the Selway-Bitterroot and Frank Church River of No Return Wilderness Area); and the Yellowstone ecosystem (including Yellowstone National Park and surrounding areas in Montana, Idaho, and Wyoming).

During the early 1980s, wolves naturally began to recolonize in northwestern Montana, dispersing south from Canada. By 1994, approximately 64 wolves were in Montana, forming five packs. As a result, plans for wolf reintroduction centered on central Idaho and Yellowstone National Park. In 1994, final plans were made for the reintroduction. And between 1995 and 1996, 66 wolves were brought to the United States from Canada. Thirty-one were reintroduced into Yellowstone National Park, and 35 were reintroduced into central Idaho.

The reintroduction of wolves into the northwest has been very controversial. Wildlife biologists, environmental organizations, and many individuals applaud the return of wolves as a step in restoring the natural balance in the ecosystem. Chambers of Commerce, shopkeepers, and entrepreneurs view the wolves as a way to attract tourists to the areas and increase profits.

In contrast, agriculture and some hunting and outfitting interests feel the introduction of wolves will affect their ability to make a living. Some are concerned that there will be timber harvest restrictions where wolves have been reintroduced. Some hunters are worried that wolves will reduce opportunities for big game hunting. Sheep and cattle ranchers fear wolves will prey on livestock, thereby affecting their livelihoods. Wolves can and sometimes do prey on livestock. However, not all wolves do, even those near livestock. Wolves that do prey on livestock tend to continue to do so and may teach their pups to do so as well. Some people have expressed safety concerns as they enjoy outdoor recreation in areas where there are wolves even though there are no documented attacks on humans in North America.

Before reintroducing wolves, the USFWS examined several options or alternatives: (1) reintroduce wolves with the wolves classified as "experimental populations", (2) take no action—allow wolves to naturally expand into Idaho and Yellowstone, (3) change laws and prevent wolf recovery, (4) establish legislation for states to implement wolf recovery with no federal oversight, and (5) reintroduce with wolves classified as endangered.

In an effort to address the concerns of local citizens, the reintroduced wolves in Yellowstone and central Idaho were designated "nonessential experimental" populations under the Endangered Species Act. This classification allows more involvement on the state level, broader flexibility in managing individual wolves and the pack, and the use of management options that would not be permitted if the populations were classified as endangered. Should the wolves pose a threat to livestock, pets, or property, problem or nuisance wolves can be relocated or, if necessary, killed by designated personnel. In addition, when the wolf is classified as an "experimental" population, private landowners can injure or kill a wolf if it is caught in the act of wounding or killing livestock on private land.

Amid all of the publicity, issues, and controversies, wolves are returning to North America. The gray wolf populations in Montana, Yellowstone National Park, and central Idaho continue to grow and the eastern timber wolf populations in Minnesota continue to thrive. In the early 1990s, red wolves,* a smaller wolf species, were reintroduced into selected wild areas in North Carolina, Florida, and Tennessee. And in 1998, several family groups of the Mexican wolf, a subspecies of the gray wolf, were released in the wilds along the Arizona–New Mexico border. Now, there are some environmental groups examining the possibilities of restoring wolves to areas in the northeastern United States and southwestern Colorado.

* Most scientists classify the red wolf as a distinct species of wolf. Others describe it as another subspecies of the gray wolf.

Issue Analysis Sheet

Species_____ Date_____

Team Members:_____

A. Natural History Information

Preferred habitat:

Food:

Historic range:

Current range:

Current status:

B. Decline and Recovery

Major reason(s) for the decline of this species:

Events, changes, or laws that occurred to enable recovery:

C. Issues/Conflicts

Identify and record existing or potential issues or conflicts associated with the recovery of this species. Then identify all potential interested groups, individuals, or organizations. Identify their views or opinions about the recovery of the species. Consider their reasons or motivations for these views.

Issue:

Interest Groups	View or Opinion	Reasons/Motivation

Issue:

Interest Groups	View or Opinion	Reasons/Motivation

Issue:

Interest Groups	View or Opinion	Reasons/Motivation

D. Issue or Conflict Resolution

1. What measures or strategies have been taken to resolve these issues? Do you agree with them? Why or why not?

Strategy	*Issue It Addresses*	*Agree Yes/No*	*Explain*

2. What are your recommendations to help resolve the issue or conflicts?

Recommended Strategy	*Issue It Addresses*

Chart A (Student Copy) (Step 1) **EXPONENTIAL GROWTH DATA TABLE**

	YEAR	1	2	3	4	5	6
1.	Beginning population	46	276	506			
2.	– five year olds	0	0	0	0	46	230
3.	– last year's hatch (not yet breeding)	0	230	230			
4.	= Breeding population	46	46	276			
5.	Breeding pairs (#4 ÷ 2)	23	23				
6.	Offspring (#5 x 10 eggs/clutch)	230	230				
	+ breeding population (#4)	46	46				
	+ last year's hatch (#3)	0	230				
7.	= Total population	276	506				

Chart B (Student Copy) (Step 3) **LINEAR GROWTH DATA TABLE**

YEAR	1	2	3	4	5	6
Population	46	276				
+ increase	230	230				
= total population	276	506	736			

Ecosystem Cards

#1 Prairie Ecosystem

A prairie ecosystem is near a new housing development on the edge of town. Prairie dogs live in the grassy field. With all the new houses, lots of the prairie dogs' natural enemies—coyotes and eagles—have disappeared. Now the prairie dog population is growing. The prairie dogs are digging burrows and mounds in the lawns of the new homes. They are also eating vegetable gardens and underground telephone wires. Some people are worried that the prairie dogs might carry diseases, and they want to begin poisoning the prairie dogs. As a manager, how could you help solve this problem? What animal(s) or plant(s) in the cards provided could help with this problem?

#2 Farm Ecosystem A

You are a farmer. You store large amounts of grain and hay in your barn and storage bins. The problem is that field mice have discovered the grain, and now you are overrun with them. You could set numerous mouse traps, but this is time consuming. If you set out poison, you may poison birds and other animals by mistake. What animal(s) or plant(s) in the cards provided could help with this problem?

#3 Golf Course Ecosystem

You are the manager of a golf course. You are very proud of your golf course—especially the nearby stream, ponds, and water holes on the course. One problem: there are so many mosquitoes that the golfers are starting to complain. You could spray insecticide around the course to kill the mosquitoes, but it's expensive and probably would harm other animals. What animal(s) or plant(s) in the cards provided could help with this problem?

#4 Urban Stream Ecosystem

A stream ecosystem runs through town. Most of the time there is only a little water in your stream, but when a thunderstorm hits, lots of rain falls on paved streets and parking lots. The rain can't soak into the asphalt, so it runs downhill into the stream. The stream suddenly fills with fast-moving water. This water often carries the oil and gasoline that has dripped on the asphalt from cars. The stream banks erode so trees and shrubs along the edge of the stream sometimes fall, and soil washes away. When the storm is over, the stream gets low again. It is full of dirt, sand, and other pollutants. As a manager, your job is to stop the erosion of the stream bank and to keep the stream from having big changes in the level of water. What animal(s) or plant(s) in the cards provided could help with this problem?

#5 Farm Ecosystem B

You are a farmer. Your crops are turning into a field of dreams for insect pests like grasshoppers. They are eating up your crops. You could spray with insecticides to kill the grasshoppers, but they are expensive. Your field is also close to homes. The homeowners do not want the spray to drift over into their yards. What animal(s) or plant(s) in the cards provided could help with this problem?

#6 Stream Ecosystem

A stream ecosystem runs near a farm. Along the edge of the stream is a nice, green area with lots of willows and tall trees. In the spring and summer, the farmer takes water out of the stream. The water goes from the stream down an irrigation ditch to water a field of crops. As a result, the water level in the stream may drop. Small fish can live in shallow water, but bigger fish need deep, cool pools of water. What animal(s) or plant(s) in the cards provided could help with this problem?

#7 Pine Forest Ecosystem

In your pine forest ecosystem, many of the trees are being damaged by bark beetles. Bark beetles bore through bark and eat the layers of wood inside. Your forest is infested with too many beetles, and a large number of trees have been infected. As a manager, your job is to maintain a healthy forest so that a variety of animals live there. You need to reduce the number of beetles. What animal(s) or plant(s) in the cards provided could help with this problem?

#8 Garden Ecosystem

Your town has a community garden where townspeople plant vegetables. However, this year small insects called aphids are eating the vegetables. People want vegetables to eat. You could spray insecticides to kill the aphids, but some people don't want to use insecticides. They are concerned about possible health effects. The community garden has another problem: the soil is too hard and packed so roots have a hard time growing. What animal(s) or plant(s) in the cards provided could help with this problem?

#9 Town Park Ecosystem

In the town park, some of the old oak trees are dying. They need to be replaced by young oak trees. Of course, that project would need funding. What animal(s) or plant(s) in the cards provided could help with this problem?

#10 Downtown Ecosystem A

Downtown becomes very hot in the summer. The sun shines on the sidewalks and asphalt streets and directly into the windows of buildings. People turn on air conditioning, which uses electricity and indirectly creates air pollution. The pollution makes being outside even more miserable. What animal(s) or plant(s) in the cards provided could help with this problem?

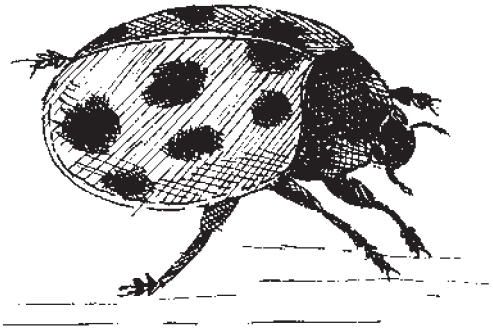
#11 Foothills Ecosystem

On the hills at the edge of town, many houses were going to be built. The bulldozers scraped the ground and plowed the dirt roads to get ready for the new construction. But the construction project was suddenly called off. The soil is now being blown away by the wind and washed downhill into the stream by rainstorms. What animal(s) or plant(s) in the cards provided could help with this problem?

#12 Downtown Ecosystem B

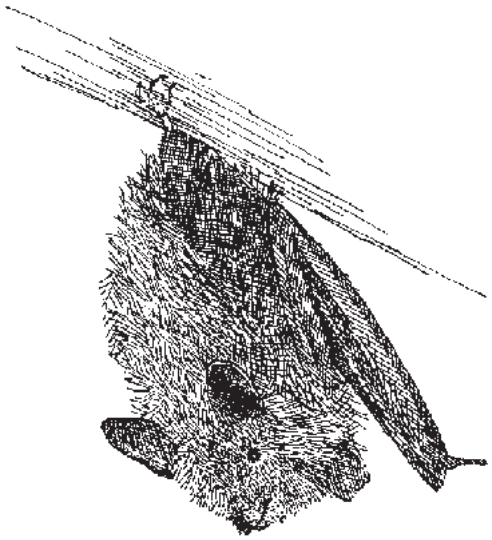
There are many pigeons downtown. They nest on the ledges of buildings. Some people like the pigeons, but others say there are just too many. Their droppings make certain areas really dirty, and the birds may carry diseases. What animal(s) or plant(s) in the cards provided could help with this problem?

Critter Cards

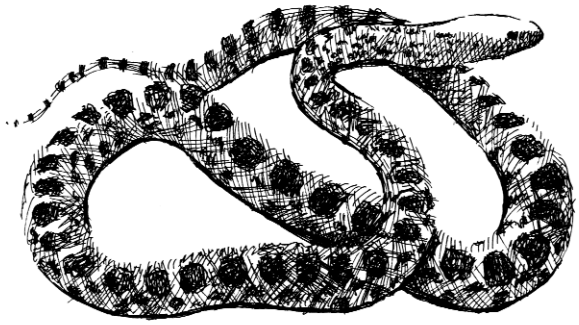


LADYBUGS

WILLOWS



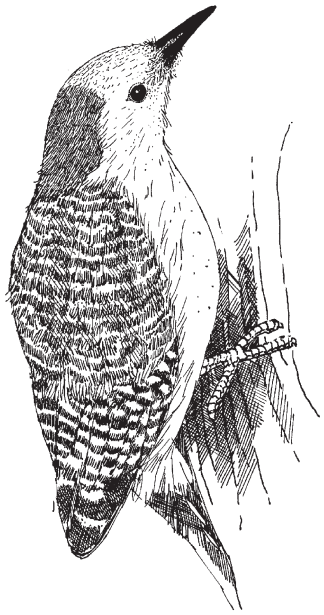
BATS



BULLSNAKES

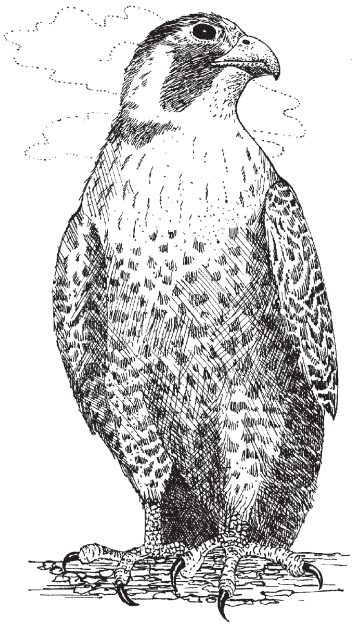
Critter Cards

BEAVERS



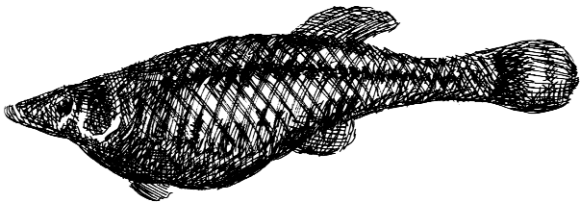
WOODPECKERS

GRASSES



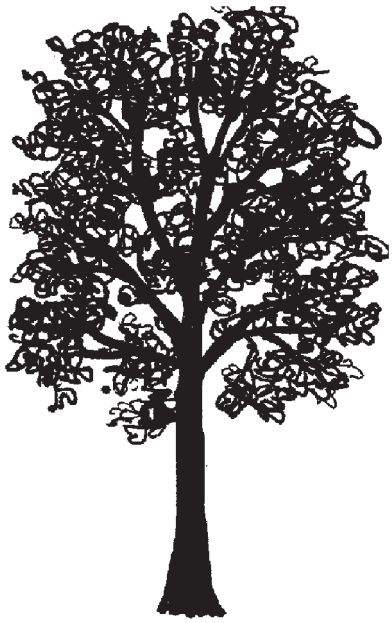
PEREGRINE FALCONS

Critter Cards



GAMBUSIA FISH

SQUIRRELS



TREES

MEADOWLARKS

Critter Cards

BADGERS

Information for the Back of the Critter Cards

Willows

We are shrubs that grow along the edges of streams and beaver ponds. Our roots spread out and grow deep. They help hold the soil and keep it from getting washed away by floods.

Ladybugs

We are very small, and we eat other small tasty bugs such as aphids and scale insects.

Bullsnakes

We live in dry fields and around farms. We like to eat small mammals like prairie dogs and other rodents. Although we can grow to be very big (eight feet long and as thick as your leg), we are not venomous.

Bats

We are experts at eating flying insects. We swoop around and can eat thousands of flying insects in one night! Some people are scared of us, but we aren't really bad. Besides, we are active at night when most people are asleep.

Information for the Back of the Critter Cards

Woodpeckers

We live in forests. We peck out the insects that live under the bark of sick or dead trees. We also use our beaks to chip deep holes into trees where we build our nests. Sometimes these holes are used by other birds, such as bluebirds and nuthatches, for their nests. Our holes help to bring new varieties of birds into the forest.

Beavers

Using our big front teeth, we cut down trees and shrubs, chew them into smaller sticks, and build small dams. These dams help to slow down the water in streams and make deep pools. Our dams help to slow small floods.

Peregrine Falcons

We are hawk-like birds that are built for speed. We live and nest near high cliffs, canyon walls, and even skyscrapers. We catch smaller birds to eat. Ecosystems with steep walls and plenty of birds can be good places for us.

Grasses

We grow fast, and our roots help keep soil from blowing away in the wind and washing away in the rain. We are often the first plants to grow where the soil has been disturbed, and we can tolerate long periods with little water.

Information for the Back of the Critter Cards

Squirrels

In the autumn, we collect acorns from oak trees and store them to eat in winter. Sometimes we hide our acorns underground. The only problem is we collect so many acorns that sometimes we forget where we've buried them! Some of these acorns sprout and grow into tall trees.

Gambusia Fish

We enjoy the nice warm waters of ponds and lakes. One reason is that mosquitoes do, too! A female adult mosquito lays her eggs in the water. The eggs hatch into wiggly worm-like animals that stay underwater. Eventually, they turn into flying mosquitoes. It's those underwater mosquito wigglers that we love to eat!

Meadowlarks

We are robin-sized birds that live in fields and on farms. We are known for our beautiful song and the black "V" on our chests. Many people don't know we like to eat many insects.

Trees

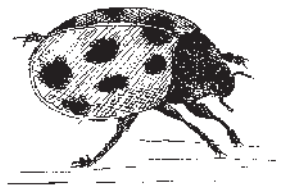
Trees do many good things for the environment. Our roots help to hold soil in place. We provide shade and keep areas cool. Our leaves help clear the air of some kinds of pollution.

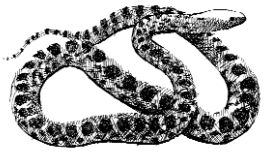
Information for the Back of the Critter Cards

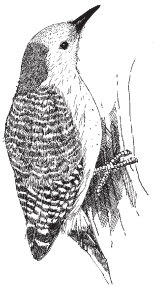
Badgers

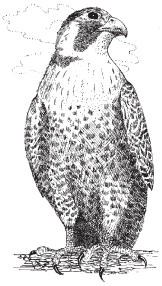
We live in underground burrows in dry fields. We are reclusive and avoid people. Although we are not much bigger than a small dog, we are tough and ready to defend ourselves. We dig underground to eat small, furry creatures like prairie dogs and other rodents.

Critter Tokens



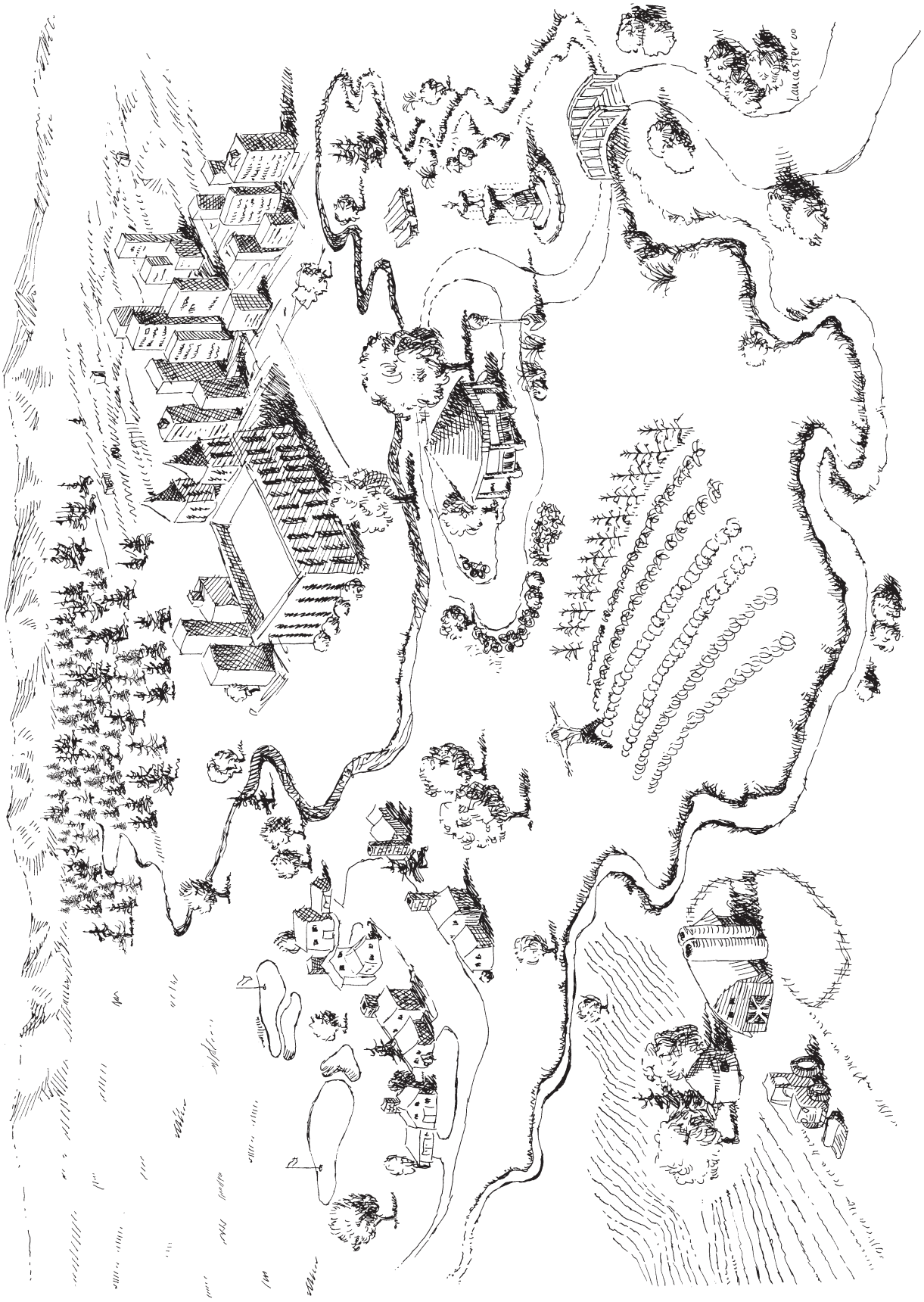










Ecosystem Map



Reproduction	**Reproduction Card—Average Year (6)** This has been an average reproduction year. Increase your herd by (100/your current population size) three times your roll, if your current population is over 50 individuals. If your population is between 50 and 10, increase your population by three times your roll. If your population is under 10, don't reproduce.
Condition	**Weather Card (2)** _____ (Students need to specify what) has had a serious negative impact on the survival of the herd. Decrease your herd by the percentage equal to five times your roll.
Condition	**Weather Card (2)** _____ (Students need to specify what) has had a dramatic positive impact on the survival of the herd. Increase your herd by the percentage equal to five times your roll.
Condition	**Habitat Destruction Card (2)** _____ (Students need to specify what) has occurred, destroying critical habitat. Decrease the herd size by the number equal to five times your roll.
Condition	**Predator Card (1)** Predation has occurred, affecting the herd size. Decrease the herd size by the percentage equal to your roll.
Condition	**Habitat Degradation Card (4)** _____ (Students need to specify what) has occurred, damaging critical habitat. Decrease the herd by the number equal to three times your roll.
Condition	**Disease Card (1)** Disease has struck the herd. Decrease the herd by the percentage equal to your roll.
Condition	**Habitat Loss Card (5)** _____ (Students need to specify what) has resulted in a loss of critical habitat for the herd. Decrease the herd by the number equal to five times your roll.
Condition	**Poaching Card (1)** Poaching—illegal killing of animals—has reduced the size of the herd. Decrease the herd by the number equal to two times your roll.
Management	**Habitat Restoration Card (1)** _____ (Students need to specify what) has occurred, restoring critical habitat. Increase the herd by the percentage equal to five times your roll.

Reproduction	**Reproduction Card—Excellent Year (3)** This has been an excellent reproduction year. Increase your herd by (100/your current population size) five times your roll, if your current population is over 50 individuals. If your population is between 50 and 10, increase your population by the number equal to five times your roll. If your population is under 10, you may not reproduce.
Management	**Habitat Alteration Card (2)** _____ (Students need to specify what) has occurred, altering critical habitat. Increase or decrease (students choose which before rolling the die) the herd by the percentage equal to three times your roll.
Management	**Habitat Improvement Card (1)** _____ (Students need to specify what) has occurred, improving critical habitat. Increase herd by the number equal to five times your roll.
Management	**Research Card (1)** _____ (Students need to specify what) research has been successfully accomplished. Increase or decrease (students choose which before rolling the die) the herd by two times your roll.
Management	**Law Enforcement Card (1)** _____ (Students need to specify what) law enforcement activities have protected the herd against illegal actions like poaching. Increase the herd by the percentage equal to two times your roll.
Management	**Education Card (1)** _____ (Students need to specify what) education activities have led to increased understanding of wildlife and habitat. Increase or decrease (students choose which before rolling the die) the herd by the percentage equal to two times your roll, or by two times your roll.
Management	**Habitat Acquisition Card (1)** Habitat acquisition has increased the area of available and suitable habitat. Increase the herd by five times your roll.
Management	**Hunting Card (1)** A request for a hunting season has been made. Do you wish to allow hunting in your area? If yes, decrease your herd by the percentage equal to five times your roll. If no, record no change in the size of your herd.

Student Calculation Table

		Condition				Reproduction				Condition				Management			
Year	Starting Population	Die Roll X	Card Factor =	Population Change	New Population	Die Roll X	Card Factor =	Population Change	New Population	Die Roll X	Card Factor =	Population Change	New Population	Die Roll X	Card Factor =	Population Change	New Population
1																	
2																	
3																	
4																	
5																	
6																	
7																	
8																	
9																	

Prairie Questionnaire

Name: _____

Here are 10 statements about how prairies might be used. Read each one, and then circle the number on the scale that best describes your feelings.

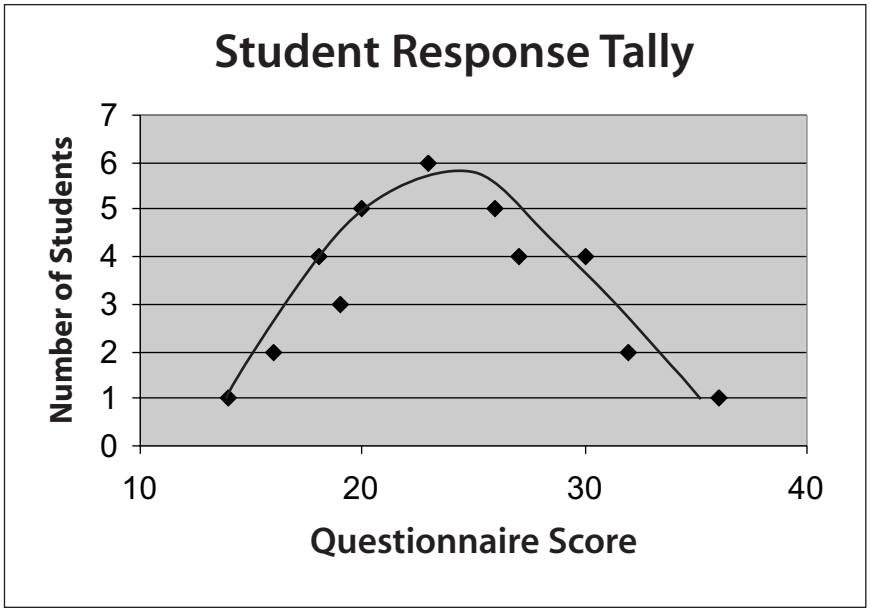
1. We need more cropland to feed the world's growing population.	1 strongly agree	2 agree	3 disagree	4 strongly disagree
2. The importance of prairies in U.S. history is a poor reason to preserve them.	1 strongly agree	2 agree	3 disagree	4 strongly disagree
3. Farmers should be allowed to drain and farm prairie potholes if they need the money instead of farming around them.	1 strongly agree	2 agree	3 disagree	4 strongly disagree
4. Wildlife species that depend on prairies are no longer important.	1 strongly agree	2 agree	3 disagree	4 strongly disagree
5. If a landowner can make more money by building houses on a prairie than by preserving it, then it is all right to build houses.	1 strongly agree	2 agree	3 disagree	4 strongly disagree
6. Prairies are not needed to prevent soil erosion and protect water quality.	1 strongly agree	2 agree	3 disagree	4 strongly disagree
7. Because Native Americans no longer depend on the prairie ecosystem and its wildlife, prairies do not need to be preserved.	1 strongly agree	2 agree	3 disagree	4 strongly disagree
8. The scenic beauty of the prairie should not be considered when deciding to develop or preserve a prairie.	1 strongly agree	2 agree	3 disagree	4 strongly disagree
9. Prairies make excellent sites for farming and development because they are generally flat and thus should be used for those purposes.	1 strongly agree	2 agree	3 disagree	4 strongly disagree
10. Prairies should be farmed even if they are rocky or steep.	1 strongly agree	2 agree	3 disagree	4 strongly disagree

Prairie Species Data Sheet

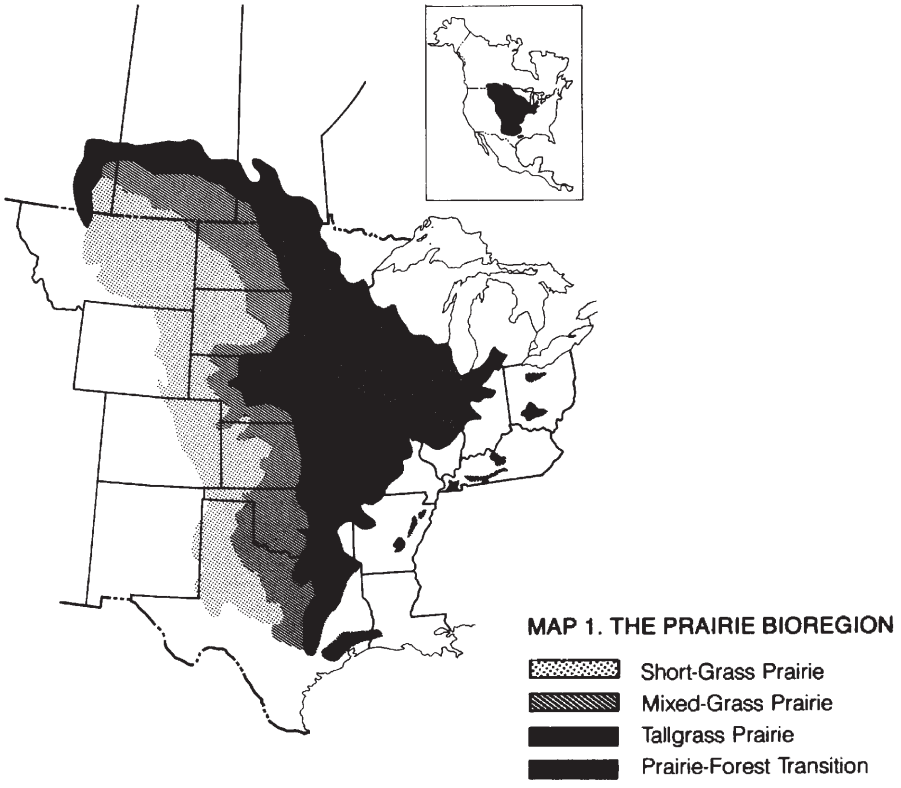
Add the name of the species you researched, and fill in the blanks using your findings.

Wildlife	Plant
Range:	Range:
Food:	Food:
Predators:	Predators:
Shelter:	Shelter:
Special adaptatons:	Special adaptatons:
Management practices:	Management practices:

Sample Graph
Class Talley of Responses to the Prairie Questionnaire



The Prairie Bioregion



Readings from Lonesome Prairie

Dear Diary:

The sun rose to a cloudless sky and what seemed to be an endless sea of waving grass. It has been 3 days since we left the secure and bustling city of Independence. The prairie goes on forever, as far as the eye can see.

Our journey would be simple if we could sail across the tops of the hills, but for every hilltop there is a valley. We travel the ridgetops as long as we can, but then we must travel down into the valley, only to have the oxen pull the wagon to the top of another hill.

I've found that it is much easier to walk than ride in the jolting wagon. Walking away from the wagon train, I can enjoy the songs of the birds—the sharp whistle of a partridge, the chirp of a lark, or the croaking of a raven in the distant woods. The birds' songs are mixed with the whirl of insect wings as they sail from one clump of grass to another.

I now recognize five different types of grasses, but the wildflowers will take much longer. The wildflowers make the prairie look like a floral tapestry, woven with threads of yellow, white, blue, lavender, and pink.

Along our path today, we encountered many streams, or perhaps it was the same one that kept crossing our path. Most have been shallow, not more than a foot deep. It is the 3 and 4 feet deep crossings that cause us to stop, unload the wagon, cross, and reload.

We did not stop today until after 2 o'clock. The prairie provided us with entertainment. Three very large black birds with red heads soared tirelessly for more than an hour. Not one flapped a wing the entire time.

The only shelter from the sun is under my bonnet, which has been hard to keep on because of the constant wind. The only other shade is from the occasional trees found along the streams. Cottonwood, elm, and sometimes a bur oak offer some relief.

We found little firewood for tonight's cook fire and will have to resort to a cold dinner. I hope we find firewood on tomorrow's journey. We made 12 miles today. I hope we can continue to make good progress.

—Nellie Morgan, June 6, 1855

Dear Diary:

I can't believe that when I agreed to marry Fred, I would have to leave my home at the corner of 6th and James and move to the farm. From my front steps, I could see the front doors of six of my best girlfriends, and the corner drug store was only two blocks away.

But not here—I am in the middle of the prairie. Our closest neighbors are the Humphreys, a half mile to the east, and the Floyds are just over a mile to the south. From my front steps, the only thing I can see is wave after wave of waist-high wheat. Out the back door is the barn and the corral full of Holsteins waiting for their 4 o'clock milking.

In the afternoons between chores, I've been reading Fred's family history. This farm has been in his family for more than 100 years. His great-grandmother, Nellie Morgan, was traveling west with her family when their wagon broke down. Having no materials to fix it or money to buy a new one, they decided to stake a claim here in Harvey County.

They first tried ranching but soon turned to growing wheat. Mennonite immigrants from Russia arrived in the area in the 1870s, bringing with them the drought resistant "Turkey Red" wheat. This plant forever changed the face of the prairie. Acres and acres of native prairie were plowed under to plant wheat, turning the "Great American Desert" into the nation's breadbasket.

Even though I've seen it many times before, I'm still impressed by the wheat harvest. Every year in June and early July, the harvest moves north across the state. Wheat fields, which were planted the previous fall, have reached a golden ripeness. Huge combines move through the fields, making short work of what previously was a labor-consuming job.

I need to get cleaned up and change clothes now. It's the Fourth of July, and there's a big celebration in town tonight. There'll be watermelon and hamburgers to eat, games, and a fireworks show. Maybe I'll see some of my high school friends.

—Linda Yoder, July 4, 1969

Background Text for Photos

Photo 1: Market Hunters

Market hunters exploited bison, antelope, deer and elk to meet the demands brought to the west by the mining boom. By the mid-1870s, market hunting had nearly wiped out the bison herds. By 1900, elk and deer populations were moving toward a similar fate.

Photo 2: Denver Market

This photograph was taken at the O. J. Munger and Company Wholesale Food Market at the corner of 16th and Market in downtown Denver, Colorado, in the late 1800s. Early Denver needed wild game to feed its expanding population. How have meat markets changed?

Photo 3: Moose Hunter

Moose populations were limited in the west between 1860 and 1978. However, conservation efforts between 1978 and 1986 proved more successful. This photo shows a scene from a moose hunt in 1985 when 500 people applied for licenses to take part in this opportunity. Compare this photo to Photo 1. What changes in policy and technology have occurred?

Photo 4: Modern Hunter

According to the Congressional Sportsman's Foundation, more people hunt and fish in the United States than attend National League Football, Major League Baseball, and National Hockey League games combined. Spending by hunters and anglers exceeds all U.S. exports of coal, corn, cigarettes, soybeans, meat, lumber, and metal ore combined. *Fortune* magazine estimates the economic impact of hunting is $10 billion annually. The funding for wildlife programs and services to support state parks and forests often does not come from state taxes. In Colorado, for example, more than 80 percent of the budget for wildlife programs and services is derived from selling hunting and fishing licenses, with the remainder coming from federal funding.

Photo 5: Confiscated Elk, 1930

By the early 1900s, state legislatures started to pass laws—including those establishing hunting and fishing license programs—to protect game animals. In this photo, the items on the wagon are hides of 441 illegally hunted elk. Regulations are a tool wildlife biologists use to conserve wildlife populations.

Photo 6: Confiscated Wildlife, 1989

Poaching continues to be a problem faced by state fish and wildlife agencies. This photo shows animals seized in 1989. This undercover operation was established to catch poachers and involved 275 wildlife officers from five states. Nearly 50 individuals were implicated by this operation.

Photo 7: First Fish Hatchery

In 1881, natural resource agencies were operating hatcheries like this one that stocked fish in streams. Compare this photograph with Photo 8.

Photo 8: Modern Fish Hatchery

The Rifle Falls Hatchery in Colorado became the largest state-owned hatchery in the world in 1955. Fish and wildlife management practices involve inventorying and monitoring populations and the propagation of species for stocking and reintroduction.

Photo 9: Fish Stocking

Horses carrying buckets and cream cans filled with fish were used to stock high mountain lakes at the turn of the 20th century. Compare this photo with Photos 10, 11, and 12.

Photo 10: Helicopter

Since the 1950s, airplanes, and more recently helicopters, have been used to stock fish into high mountain lakes. In this photo, a biologist stocks trout fry in a high mountain lake.

Photo 11: Early Fish-Stocking Truck

This photo shows one of the earliest models of fish-stocking trucks.

Photo 12: Modern Fish Stocking Truck

This photo shows a modern-day fish stocking truck used by wildlife agencies for transporting and stocking fish. To keep the fish alive, each tank must have a constant flow of oxygen pumped into the water. Water temperature is regulated to reduce stress on fish.

Photo 13 and 14: Live Trapping Elk

Many techniques have been used to track migration patterns of elk and other big game. One of the most effective ways to study wildlife movement is to tag the animals. Handling wild animals is always a difficult, and sometimes dangerous, task. These photos demonstrate capture techniques from two very different eras. In the late 1800s, the capture was done rodeo style. In the more recent photo, a biologist jumps on a cow elk from a helicopter. The deep snow cushions both the person and the animal. Other techniques include the use of tranquilizer guns and large corral-type traps. Each technique has its positive and negative aspects. The safety of the animal and the safety of the biologist are always the most important issues when choosing a technique to study wild animals.

Photo 15: Early Fish Biologists

In the 1920s, fish eggs were collected from productive lakes and transported back to the hatchery. These men are preparing the eggs for transport.

Photo 16: Modern Fish Biologist

A researcher examines fish in the stress tunnel at a research lab. Technology changes influence environmental management decisions by allowing more sophisticated science-based analysis. Compare this photo to Photo 15.

Photo 17: Watching Wildlife

The Watchable Wildlife Program began during the 1980s. Wildlife agencies are making efforts to fund programs that focus more on viewing wildlife (nonconsumptive uses such as canoeing, hiking, bird watching, etc.) than harvesting (consumptive uses such as hunting, fishing, trapping).

Photo 18: Development

The biggest challenge facing most wildlife biologists today is the loss of wildlife habitat because of human population growth. Wildlife habitat is disappearing as habitat is converted into developments and agricultural production. Although regulations are a necessary tool, protection and restoration of habitat are considered to be the most successful and cost-effective long-term techniques for managing wildlife species.

Photo 19: Wildlife Education

Education became an important wildlife management tool in the 1990s. The more people know about the needs of wildlife, the more likely they will be willing to share their communities with wildlife.

Photo Analysis Guide

Step 1. First Impression

What is your first reaction to the photograph? What images or feelings does this photo bring to mind?

Step 2. Collecting Data

Make a list of things and people in the photograph. Classify and categorize the list. Look for details. Does the photo include written information? What clues exist concerning the date of the photograph?

Step 3. Inferences

What theories or educated guesses do you have about this photograph? What is happening outside of the photo? What are the people thinking or feeling? Is the picture staged or just a random moment in life?

Step 4. Perspectives

Why was the photo taken? Whose history is being told? What or who has been left out? Would anyone object to this photo?

Step 5. Conclusions

What insights about the past have you gained from analyzing and discussing this photograph? How did the background information change your understanding of the photograph? What changes in wildlife management techniques did you note through the history represented in the photos? What changes in the role of government in wildlife management did you discover?

NOTE: Project WILD recommends that students write their responses to the Guide. However, it may be redundant to do all steps with each photograph. Educators may want to cover some photos as a large group. With other photos, have students record their responses to every aspect of the Guide. Or have students verbally share each response with a partner or small group.

Photo 1

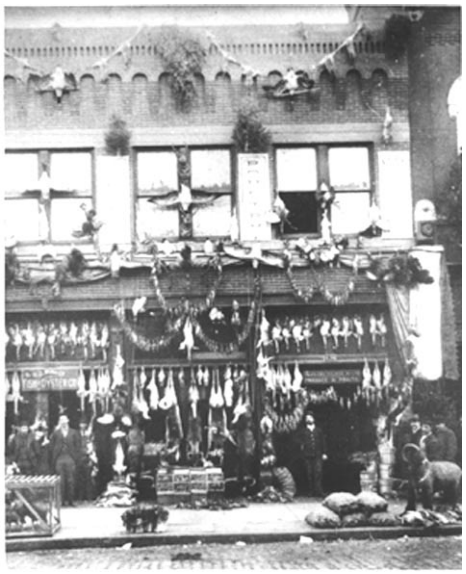


Photo 2

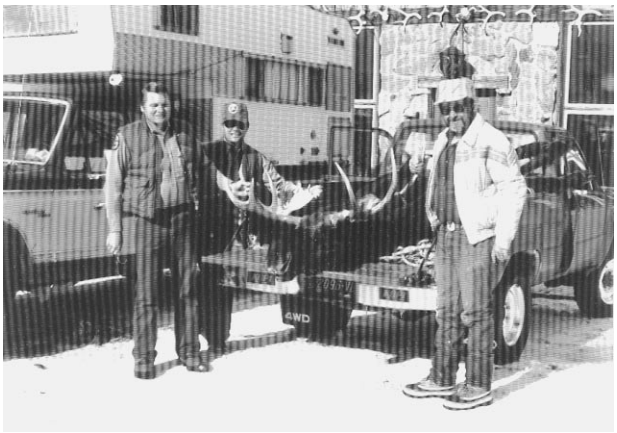


Photo 3

Photo 4

Photo 5

Photo 6

Photo 7

Photo 8

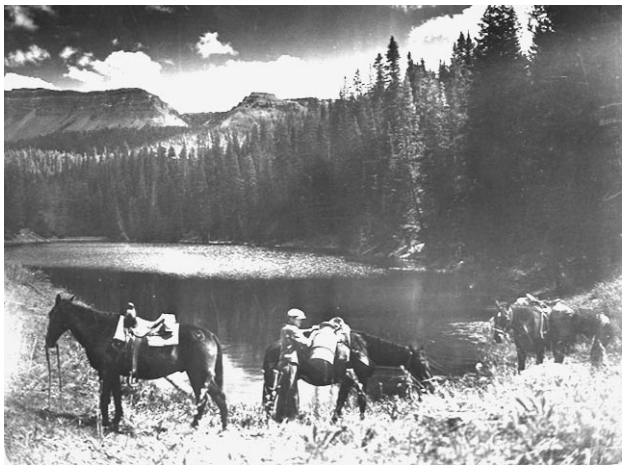


Photo 9

Photo 10

Photo 11

Photo 12

Photo 13

Photo 14

Photo 15

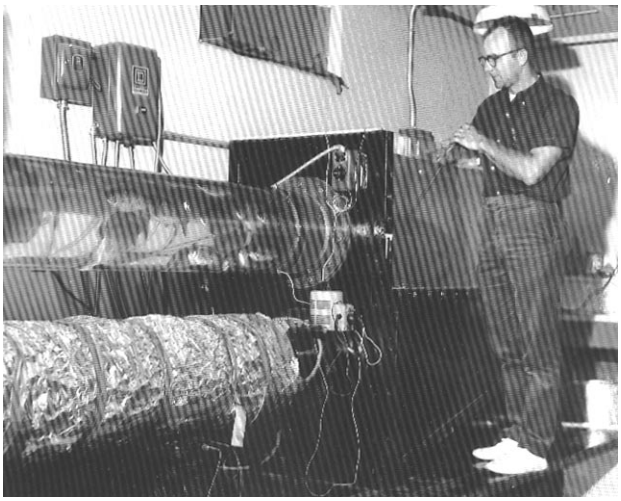


Photo 16

Photo 17

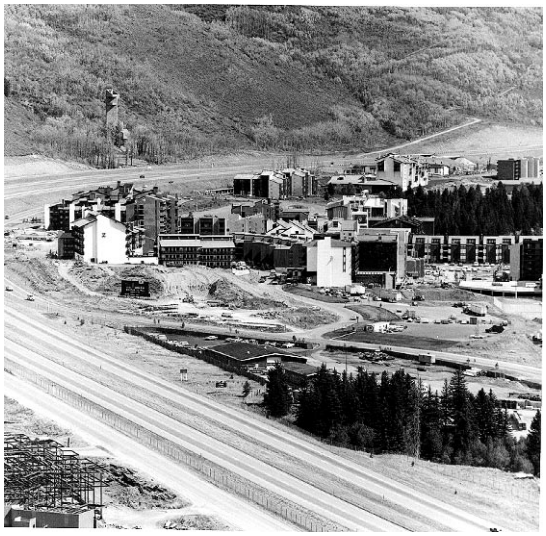


Photo 18

Photo 19

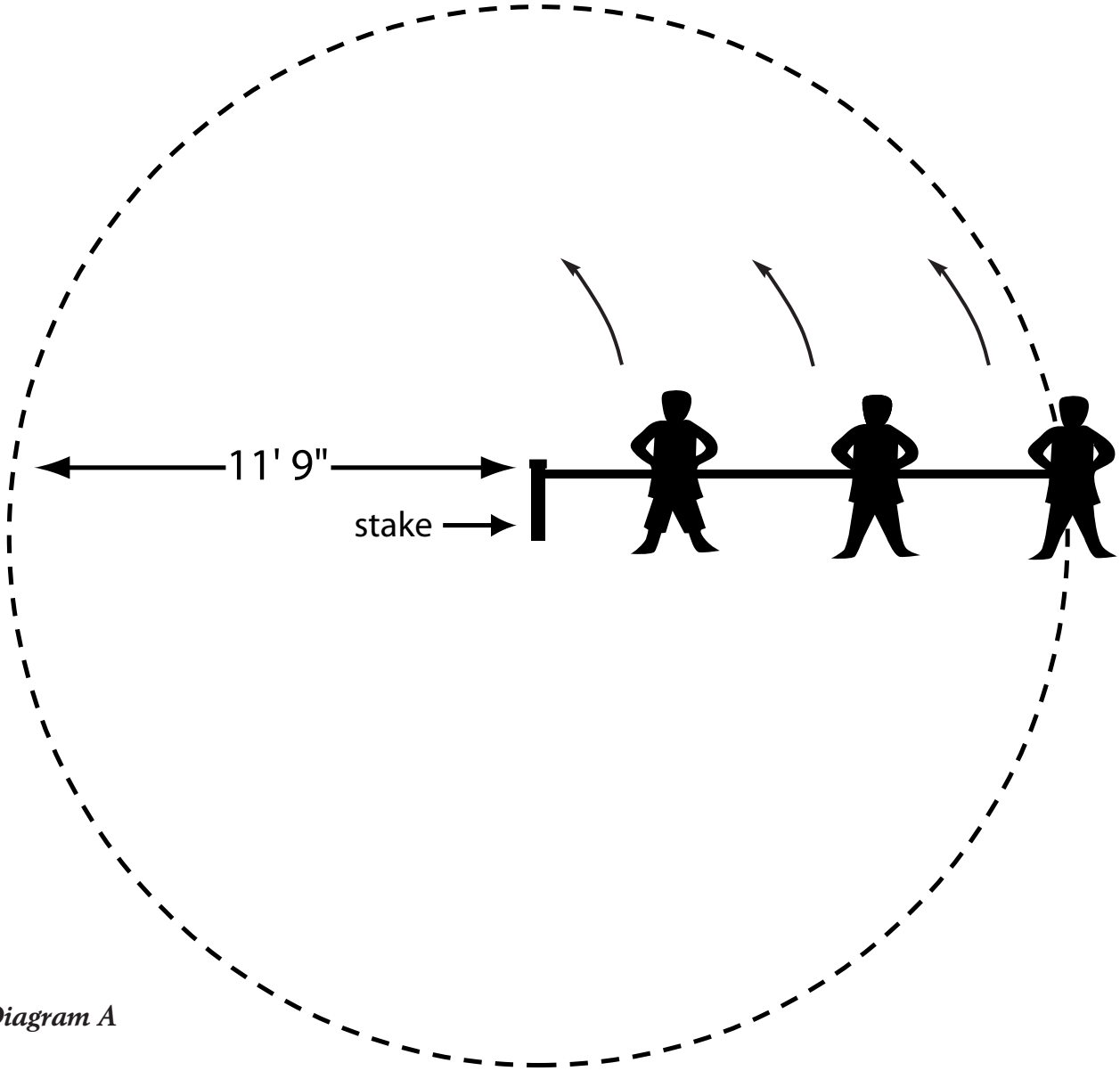


Diagram A

Pellet Group Counter Worksheet

Directions: On each of your circle plots, look carefully at the ground for groups of deer pellets. Each time you notice one, inspect it and estimate its age. Record the number of recent pellet groups in each plot below. Then use the equations to estimate the population. Record other observations in the right-hand column, including old pellet groups and evidence of other animals.

Pellet Group Plot Number	**Number of Recent Pellets Groups per Plot**	**Other Observations** (other animal signs)
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
Total		

Calculations:

A. $\frac{\text{total \# pellet groups}}{\text{\# total plots}} \times \frac{\text{100 plots}}{\text{acre}} =$ # pellet groups per acre

B. $\frac{\text{\# pellet groups per acre}}{\text{12 pellet groups per deer per day}} =$ # deer days/acre

C. # deer days/acre × # acres in study area = # of deer days in study area

D. # deer days ÷ 180 days = **number of deer living in the study area.**

NOTE: Because only recent (within 6 months) pellet groups are counted, 180 days or 6 months is used (in calculation D). Please be aware that pellets decompose much faster in areas of high humidity. In order to determine a decomposition rate specific to your area for use in calculations, please contact your state wildlife agency. If you find pellets last three months (approximately 90 days), replace "180" with "90" in calculation D.

Student Pages

Crystal Lake Park 's Deer Dilemma

Crystal Lake Park is an 850-acre multiple use park in Suburbanville, USA. The park has several soccer fields, a baseball complex, and a 6-acre lake used for fishing and canoeing. There is a nice picnic area adjacent to the lake. Nature trails exist around the lake, and the upper end of the lake is composed of a small wetland renowned for its excellent bird watching. Several nature trails exist in the forested portion of the park, but approximately 600 acres of the park land is seldom, if ever, entered by park visitors. The park is bordered on the southern and eastern sides by subdivisions. To the west lies the last remaining farm in this portion of the county. The Wolfpack River bounds the northern portion of the area.

Residents of the subdivisions, along with Charlie Fields, the neighboring farmer, have petitioned the local Board of Commissioners to do something about the ever-increasing deer population in the park. Mr. Fields currently allows hunting on his property but complains that the deer simply move to the park when the hunting starts and that very few are taken by the hunters on his property during the hunting season. Incidentally, he has resorted to using out-of-season nuisance animal permits to shoot the deer at night while they are eating his crops.
Mr. Fields does not like this option but feels he must shoot the deer in order to keep his farm profitable. The residents of the local communities have tried everything from fencing and repellants to feeding the deer in hopes of keeping the deer away from their flowers and out of the roads. Many residents are ready to use lethal control in this area. However, the issue has divided the community, and arguments about what to do with the deer are common. Some residents don't mind the deer and are willing to tolerate their presence. Many park visitors do not want the deer harmed in any way because they enjoy seeing the herds of deer grazing on the soccer fields in the evenings as they drive through the park.

The Board of Commissioners has called a public meeting to listen to the concerns of their constituents and ultimately to make a decision concerning this issue. State laws do not prohibit hunting in this park, so the decision will need to be made at the local level. The board has made no decision as to what option or options (more than one might be appropriate) to approve and has convened this meeting to hear ideas from their constituents.

Role Cards

Charlie Fields

Mr. Fields is a local farmer. His family has farmed this land for three generations, and he plans to pass the farm along to his children. He grows mostly grain crops on his farm. For the past 5 years, he has experienced considerable loss from deer eating his crops. Mr. Fields leases the hunting rights on his farm to a local group of hunters. The hunters have told Mr. Fields that they see very few deer during the hunting season because they all appear to move into the park. Mr. Fields is frustrated and would like the county to open the park to hunting in order to reduce the density of deer.

Dorothy Right

Mrs. Right is a local attorney who lives in one of the adjacent subdivisions. Mrs. Right enjoys hiking in the park during the evening hours with her two children. She is very concerned about the idea of hunting occur-ring adjacent to their subdivision and doesn't want any harm to come to her children. Mrs. Right does not oppose the lethal removal of deer from the park; she just wants to be sure things are done safely and in the least conspicuous way possible.

Michael Green

Mr. Green is a resident of the local subdivision and is an avid gardener. His roses were once award-winning and the envy of his friends and neighbors. Now his roses are food for the local deer herd. He is very upset and has tried several forms of repellants and fences to no avail. Mr. Green hates the deer and sees no value in their presence. He is supportive of removing all deer from the park.

Bob Stats

Dr. Stats teaches environmental biology at the local university, where he also does research on wildlife populations and factors that affect population changes. He prefers monitoring the deer herd size annually and using a combination of management techniques tailored to the population size each year.

Betty Bumper

Ms. Bumper lives at the end of county road in an area that is quickly becoming developed with new housing. Her work schedule demands that she be on the road at sunrise and at dusk when the deer appear to be most active. Therefore, she has hit several deer, and her auto insurance has increased. She is supportive of whatever means can be taken to diminish the number of deer in the area.

Don Dearlove

Mr. Dearlove is a member of an animal rights organization that believes that hunting of animals for any reason is cruel and unnecessary. He enjoys seeing deer in the area but is concerned about the potential for accidents and about the health of the deer herd. He feels local residents should use other methods of control.

Lynn Ranger

Ms. Ranger is a park naturalist who can testify about the reduction in the understory plant diversity of the park and how the population of deer has affected it. She has documented evidence that some rare plants are declining in number and some animal species are being affected by the declining plant diversity.

John Dodds

Mr. Dodds's son contracted Lyme disease last year, and he blames the deer. He is in favor of any means of removing the deer to diminish the threat of contracting this disease.

Brad Arms

Mr. Arms is one of the people who hunt on Charlie Fields's land. He believes that the best way to manage the deer herd is to allow regulated hunting in the park. He also sees this as an opportunity to provide hunter education to the community and to dispel some of the misconceptions about hunting and deer management. He is willing to pay for the opportunity to hunt in the park and to donate a portion of the harvested meat to food shelters in the community.

Sustainability Article #1

How do we bring about changes in human behavior that result in actively protecting and preserving our natural world? How can we repair damage to habitats and reduce damage in the future? Whatever methods are used, most likely everyone will pay the costs. The questions that society must decide involve balancing the value of material wealth and the value of environmental health. Until recently, that balance has favored production and consumption at the expense of natural resources because society has not understood nor put a price on the value of a healthy environment. Placing a value on actions necessary to achieve and maintain a healthy environment is important, because achieving it will cost money. Producing goods in a way that does not damage the environment may initially result in higher prices and fewer material goods, but we may be willing to pay that price for a healthy world. Others argue that new technologies will be developed that will help increase production without damaging habitats. But such developments take time and money, too, and may be short-sighted.

If we are willing to pay for a healthy environment, it is the individual who will probably lead the fight. Although business and government are crucial decision-making components driving the economy, politicians tend to act only when they're convinced that the voters want them to, and businesses produce goods and services that the public demands and will pay for. Sustainable change must be supported at the ultimate grassroots level because it is our cumulative individual material needs and wants that generate the production and economic activity that leads to the use of our resources.

For us to use limited resources most effectively and wisely, it will be important to distinguish "needs" from "wants." Needs are necessities, or things we must have. Wants are luxuries, or non-essential things that we would like to have for enjoyment or convenience. The distinction between the two may vary between individuals and even countries. What satisfies as a basic need for shelter in one country, for example, may be totally unacceptable in another. Perhaps because our economy does so well in meeting our basic needs, we are now able to focus on the environmental implications of our economic activity. We have tended to measure progress in terms of the quantity of goods and services, but now we are challenged to consider the quality of life as well, and to value things that have not historically had a price tag: a wilderness, a sparkling stream, clean air, and so on. Do we need more goods and services? How much do we need?

Adapted with permission from Jackson, Judith (Ed.), Environomics, Canadian Foundation for Economic Education: Toronto, Ontario, 1996.

Sustainability Article #2

Over the past century, we have managed ecosystems in at least five different ways. Until the middle of this century, the industrialized world tended to see the environment as an infinite supply of resources and a bottomless sink for wastes. This first approach, often referred to as "frontier economics," prevails even today in some developing nations and some sectors of industrialized countries. The economy was seen to exist in almost complete isolation, separate from the environment. Resources were seen as being abundant. So, for example, an increased demand for forest products could be met simply by building a new mill. The more pressing problem with frontier economics was the scarcity of workers, not of resources. Consequently, the destruction of the environment made little difference, because fresh territory and fresh resources always were within reach. It also can be argued that a further consequence of the frontier economics approach was the development of separate sciences. Forests or crops, for example, never were considered in relation to the soil that held them in place, to the rivers that ran through them, or to the animals that lived within them. Government programs, university faculties, and economic theories all perpetuated this rather unconnected and restrictive outlook on the world.

By the late 1960s and 1970s, many people in industrialized nations began to recognize the interdependence of man and the environment, and they became increasingly concerned about pollution. Although the environment continued to be less important than economics, the need to conserve and maintain resource stocks became a consideration for the first time. During this period policies were introduced to make polluters more accountable for the damage they caused and the relationship among land, soil, water, air, and animal life was made a factor within the traditional sciences. Under this second approach, known as "resource management," the environmental implications of resource removal was evaluated. These assessments, however, often were made as an afterthought, following the planning stages of a given development project. Consequently, business decision-making processes continued largely as before, with environmental consequences considered after the basic decisions were made.

Resource management remains, to a large extent, the dominant mode of thinking about the environment and economic development. Nevertheless, environmental awareness is growing at an increasingly rapid pace. "Selective environmentalism," a third approach, reflects a contrasting style of thinking. It can best be described as a "doing my part" approach, where consumers and agencies express their concerns about environmental degradation by making selected efforts to stop it. This desire to do something for the environment has led to many "environmentally friendly" products and initiatives, such as municipal recycling programs. However, selective environmentalism places little, if any, emphasis on cost-effectiveness. Moreover, it makes the assumption that the economy will simply take care of itself.

"Deep environmentalism," the fourth approach, disavows economics to the furthest degree. Here, the human race is seen as no more than one of many species that share this planet. Clearly, deep environmentalism is the antithesis of frontier economics. Where frontier economics gave little attention to the environment, deep ecology gives little attention to the economy.

The most balanced approach considers "sustainable communities." This fifth outlook supports the view that a healthy environment is essential for a sound and prosperous economy. Society, economics, and the environment are, therefore, seen as elements of a mutually supporting ecosystem and are automatically taken into account before decisions are made. A sustainable community approach holds that resources must be treated on the basis of their future, as well as their present, value. With today's unprecedented threats of global change and worldwide degradation of environmental resources, the need to integrate environmental, social, and economic goals in the broader ecological context has never been greater.

Adapted from "Ecosphere," Environment Canada: The State of Canada's Environment-1991. Ottawa: Supply and Services Canada, 1991, pp. 1–5, 1–7, 1–8. Adapted with the permission of the Minister of Public Works and Government Services Canada, 2000.

Inventions and Innovations

Plastics
Electric car
Snowblower
Steam engine
Aircraft de-icer
Gasoline-powered engine
Submarine telegraph cable
Newsprint
Braille
Panoramic camera
Helium substituted for hydrogen in airships
Telephone
Radio
Snowmobile
Football
Zipper
Self-cleaning ovens
Velcro
Polyester
Light bulb
Cardiac pacemaker
Jet engine
X-ray machine
Pizza
E-mail delivery services
Ear piercer
CDs
Remote control unit for television
Microwave ovens
Cellular telephones
Antibiotics
High-yield corn
Pesticides
Rubber tires
Hair coloring
Flush toilets
Air conditioning
Washing machine
Hair dryer
Contact lenses
Refrigerator
Double-paned windows
Insulation foam
Automobile
Personal computers
Computer modems
Toothpaste
Table hockey