4-H 905

4-H Wildlife Manual

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National Collection

Name _____

County _____

Cooperative Extension Service
Purdue University

Indiana 4-H Wildlife Project Manual

Level C
Grades 7-9

4-H Wildlife Manual (Level C)

Studying and learning about wildlife is fun for people of all ages. Wildlife exists all around you, wherever you live. Some people enjoy studying insects, while others like to observe and study birds. If you take time you can find mammals around you, although they are generally more difficult to see than birds or insects.

In the first two manuals you learned about species identification and basic categorization. It is difficult to categorize animals because species have many adaptations, animal interactions are very complex, and there are always exceptions to the rules. With this level we want you to begin to understand these complexities and how different species may benefit one another and compete against each other as well.

The Indiana 4-H Wildlife manual was written for young people who enjoy wildlife and for those who want to learn more about Indiana wildlife. The key to learning, as with any 4-H project, is for you to enjoy your studies and to learn at your own pace. The authors hope this study is just the start of a lifetime enjoyment of wildlife.

Goal: Advanced wildlife concepts and topics are introduced and discussed. Youth are encouraged to understand these concepts by completing inquiry-based activities.

Note: Although fish are briefly mentioned, this wildlife manual is not a definitive source for aquatic education. If you are interested in learning more about fish, the 4-H Sport Fishing Project would be of interest to you.

Leader's Guide: The experiential learning model, answers to questions, record sheets*, and other information for adults are available online at www.four-h.purdue.edu/leader/

* Record sheets are also available on the Internet at: http://www.four-h.purdue.edu/. Choose Search and enter "record" in the Description line and scroll down to the green arrow to go to the next page.

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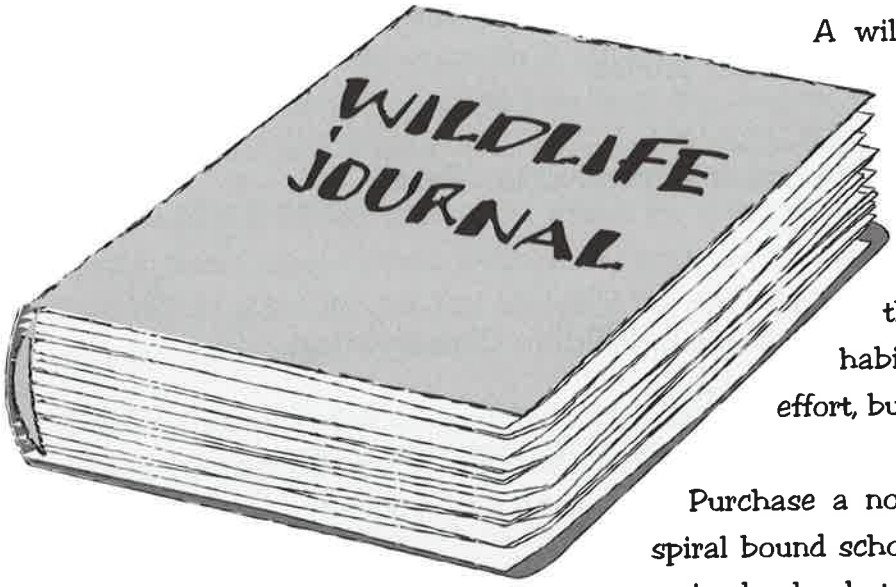
LEARNING OBJECTIVES:

Learn about interactions between species, including benefits and competition.

SECTION 1

YOUR WILDLIFE JOUR



A wildlife journal is a great place to record wildlife information. Most wildlife biologists and naturalists like to keep records of their observations and thoughts. Notes that are carefully recorded let you recall years later the things you saw and heard. Developing the habit of writing down your observations takes effort, but it is worth the work.

Purchase a notebook or bound-journal. An inexpensive spiral bound school notebook will not last as long as more expensive books, but this might be the best choice as you begin, particularly if you are not sure that wildlife study is something you are really interested in. Size and durability are important if you plan to keep your journal over the years. You may prefer a smaller notebook (about 3" x 9" square inches) since they are small enough to be easily carried but still have plenty of space for writing. A three-ring binder or bound notebook may be used. You may be able to find a field notebook with waterproof pages. Polyethylene pages are available with some notebooks and are washable, resist chemicals, and accept virtually all writing devices.

Notes should be recorded in waterproof ink (drafting or embossing ink) using a drafting pen. (Drafting pens are available at most stationery stores.) Pencils will smudge, and you may be tempted to change your notes. Resist any temptation to change them. Your notes are a record of what you noticed the day that you were in the field. Report as accurately as you can. Include the date and location of your observations. Be as specific as you can with the location, including the distance and direction to the nearest crossroads. If you are not using a bound book, put your name on each page.

NAL

Your notes can be recorded in any style as long as they are clear to you. Many biologists use running phrases to record their thoughts quickly and briefly. Observations should include the things you see, hear, and smell. Also include ideas you develop, questions you have, impressions you form, your feelings, motivation, etc. Practice making what you observe come alive in your notes.

Some suggestions for entries in your field notebook are:

- Daily observations of wildlife
- Notes from 4-H activities in this manual
- Wildlife sketches
- Locations of special wildlife sites: dens, nests, etc.
- Wildlife photographs
- Wildlife news articles of interest to you

Note: Many of the activities in your 4-H wildlife manual can be done in your personal journal. Activities that are especially appropriate for journal entries are noted with the following symbol.

SECTION 2 SIGNS OF WILDLIFE ACT

You may not always see live animals, but you can find signs that animals are around you. You might see tracks, scats, pellets, rubs, skeletons, fur, feathers, snake skins, browse lines, nests, or dens.

Activity 1: Make an area to collect animal tracks by removing any turf and clearing out an area to collect new tracks (3' x 3', 4' x 4', or use a yardstick held in the center and swiveled around in a circle). The soil should be raked smooth so animals walking across it will leave an impression. Check to see if you can make an impression with your thumb (you may need to add sand to some soils). Return to this site every day and record (draw and describe) the tracks you see. Smooth the soil each day to know which tracks are new. You can encourage animals to walk on your prepared soil by adding a scent or visual attractant for animals in the center of the track area. Keep a record of the date and the tracks you see.

Activity 2: Look for signs of animals in your yard, a park, or on a walk in the country. You might find all of the following if you look carefully:

- *Bones*
- *Feathers*
- *Antlers*
- *Tracks*
- *Trails*
- *Scats*
- *Deer browse lines*
- *Nests (don't disturb)*
- *Dens*
- *Owl pellets*
- *Deer rubs*
- *Girdled plants from rabbits*

Record the signs you see by listing or sketching them. Use any resources necessary (encyclopedia, parents, friends, etc.) to identify the animal signs.

Scent Attractants: Scent attractants (lures) can be purchased from trapping supply houses or sporting goods stores. Wrap a small amount of cotton to a small stick or wooden skewer. Place four to five drops of lure on the cotton and stick the end without cotton into the ground in the center of the plot. In place of a purchased lure, oil of anise or vanilla will attract many animals.

Visual Attractants: For a visual attractant, bind two small breast feathers (from domestic chicken or duck) back to back with very fine wire. Make a small loop at the end of the wire and loop it to another wire (similar to two links in a chain so the feathers can swivel) attached to a stick two to three feet tall.

Human Odors: It is nearly impossible to eliminate all human scents at the site. However, you can minimize human odor by avoiding use of strong perfumes and soaps before you set up and check your plot.

Activity 3: Making plaster casts

You can make a plaster cast of wildlife tracks, for a permanent record of animals you may rarely see. You can often find tracks in damp soil near water, or you can make a specific place to collect tracks as described in Activity 1.

Materials needed

- Animal track
- Plaster of Paris
- Form—made from cutting a cross section from a half-gallon milk carton or a plastic cup.
- Mixing cup and stick or spoon for mixing the plaster of Paris (Plastic containers are desirable because hardened plaster can be easily removed from them by flexing the plastic and the container may then be used again.)

Steps to making your cast:

1. Select the track you'll use as the mold for your cast, choosing the one that is sharpest in detail. Carefully clear away any twigs or rocks that may have fallen in the track or around it.

2. Place your form around the track. Gently press the form into the soil to create a dam for the plaster.

3. Pour enough plaster of Paris into a mixing cup to fill your form to a depth of about one inch. Add water to the plaster, a small amount at a time, and stir with a stick or spoon until the plaster is smooth, thickened and will pour slowly—about the consistency of pancake batter.

4. Pour approximately one inch of plaster into the form. If you are making a cast of a track in sand or loose soil, pour the mixture down the stirring stick to avoid damaging the specimen. Fill the form nearly to the top to make a stronger cast.

5. Leave the plaster until it dries. Drying time will depend on temperature and humidity. Once the plaster has set, carefully lift the cast off the specimen. Brush the excess soil or debris away after the cast is thoroughly dry.

6. Dry the plaster mold completely. During summer months it can be baked in the sun for a day. In the winter the plaster may take several days to dry.

SECTION 2

HABITAT

Introduction

Wildlife habitat management requires an understanding of the species you will be managing and how that species interacts with other species and its environment. The presence of a particular species and the number of animals of that species in a landscape are determined by many factors and the interaction of those factors. The major concepts presented in this Habitat Section are habitat requirements, plant succession, layering, edges and contrast, corridors, and shelter.

Habitat Requirements

Wildlife species have four needs known as "habitat requirements" that must be met in their habitat to ensure their survival. The four basic habitat requirements are food, water, shelter, and space. Each species has its own set of specific requirements. For example, the gray squirrel uses acorns for food, while the woodpecker eats insects. Mallards use thick grass and forb cover for nesting, while brown thrashers nest in shrubs. Habitat requirements change for wildlife as seasons change. The food and cover wildlife use in the winter may be much different than what they use in the summer. Each animal must be able to satisfy its needs within its range. For example, if an animal has a five square-mile range, it needs to satisfy all its habitat requirements within five square miles.

Wildlife biologists use aerial photographs to more clearly see different habitats and how various habitat features relate to each other.

Activity 1: Habitat mapping– Look at the aerial photograph shown and identify the key features such as ponds, lakes, rivers, roads, homes, farm lots, forests, woodlots and ag-ricultural cropland. (You may also use the aerial photograph on page 39.)

Activity 2: Map a square mile section around your home (one mile in each direction—north, south, east, and west). Label all key features: your home, other homes or apartments, businesses, parks, water, cropland, farms, woodlots, etc. You might find a county soil map, county road map, or aerial photograph helpful.

If you have Internet access you can view aerial photographs of parts of Indiana (not all places had been entered at the time this manual was published) at: http://terraserver.microsoft.com/default.asp

MY HOME

Plant Succession

Providing vegetation (for food and cover) and water are the basis of habitat management. Understanding plant succession is also important for wildlife habitat management. Succession is the orderly progression through time of changes in community composition, usually described in terms of plant life. While this process is complex, we can divide it into six specific successional stages. We can usually predict the type of vegetation that will occur in an area at each stage until a final or "climax" stage is reached. When not disturbed, the climax vegetation is stable and will remain the same for a long time. If an area is disturbed (by humans or natural forces) succession may be set back and the cycle will continue forward from the new starting point. In general, the stages of plant succession that occur on land are as follows:

Successional Stages

1. Bare ground
2. Annual forbs and/or grasses
3. Perennial forbs and grasses
4. Shrubs
5. Young woodland or trees
6. Mature woodland or trees

Sometimes natural factors such as the soil type, topography, or climate will prevent succession from proceeding past a certain stage. For example, in the Great Plains Grassland Region a lack of precipitation often prevents succession from proceeding past stage three. In this case, stage three would be considered the climax stage. Natural factors also help to determine the type of vegetation at each succession level. For example, in northern Indiana the climax stage is beech/maple hardwood trees, and in southern Indiana it is oak/hickory hardwoods.

A single successional step may take weeks, months, years, or even centuries, depending on a variety of natural and human-caused factors. Your garden may change from bare ground to being full of weeds in only a few weeks, but it would take centuries (without human interference) for an abandoned parking lot to become a mature oak-hickory forest. If vegetation is disturbed, succession will revert to an earlier stage. Disturbance may be caused by natural factors such as insect or disease outbreaks, tornadoes, hurricanes, avalanches, or naturally occurring fires.

Although natural causes can, and do, create setbacks to natural succession, human intervention is a more common cause of disturbance. Human disturbance is caused by construction, development, urban sprawl, agricultural practices, burning, cutting forests and woodlots, and clearing land. Often these procedures mimic natural disturbances.

Succession is a continual process. Even abandoned concrete parking lots are eventually taken over by plants. Plants first grow in the cracks and around the edges, slowly creating gaps in the concrete for other plants to intrude. Then the concrete parking lot will become "home" for some wildlife species.

Acitivity 3: Use the space below or your journal to describe plant succession stages at a site near your home. Write an essay (two hundred fifty words maximum) about the changes. You may write about set-back succession (higher successional stages moving to a lower stage) or advancing succession (lower successional stages moving to a higher stage). You can learn about advancing succession by talking to long-time residents or looking at old pictures, since these changes generally happen slowly. A common set-back succession occurs when a garden is planted or an abandoned field is plowed and planted. In your essay explain why and how the changes took place and include the plants that were growing during each successional stage.

Location: Time Span Discussed:

Initial Successional Stage: Current Successional Stage:

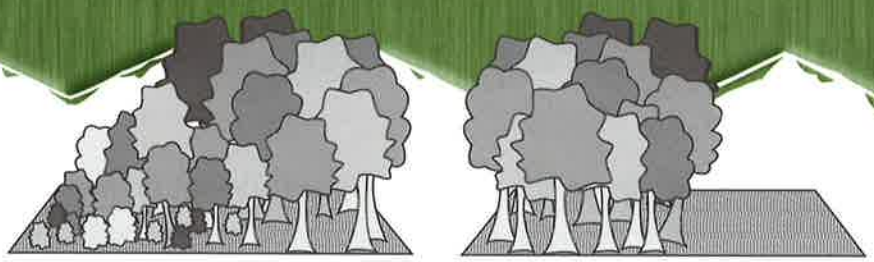
Layering

Forest and aquatic habitats with different vegetation layers can be important to many species. Horizontal layers are those with a variety of plant types. Some species prefer a variety of layers, while others prefer a single layer. For example, some species may require a herbaceous layer for food but also need a tree canopy for cover. Not all areas in a single stage of succession are alike. One woodland in stage 6 of succession may have a variety of layers comprised of grasses, forbs, shrubs, and trees, while another stage 6 woodland may have only one distinct layer of tall trees.

Fish and birds use different horizontal layers to reduce competition for the same resources. Some birds stay near to the ground to satisfy food and cover needs, while others spend their time in the upper canopy of the forest. Similarly, you will find different species of fish at different water depths.

Activity 4: Show two different horizontal layering scenes in a wildlife setting (bird or fish ecosystem). You may sketch the pictures, take a photograph, or find a picture from a magazine.

Edges and Contrast



The boundary where two or more different types of vegetation or successional stages meet is called edge. Sometimes there is an abrupt change where one type of vegetation stops and another begins. Some edges are less distinct, with a gradual transition from one stage to another. In places with a gradual change, an edge looks a little like both successional stages. Where abrupt changes occur, the edge is sharp. Edges attract many different wildlife species because a variety of food, cover, and other habitat requirements are close together.

Edges produced when successional stages have very different types of vegetation are defined as having high contrast. There is high contrast where an area in stage 2 (grass and forbs) meets an area in stage 6 (tall trees) of plant succession. In other words, the wider the difference in stages, the higher the contrast. An agricultural field next to a woodlot would have high contrast. A boundary between stages 2 and 3 has low contrast.

Activity 5: Show an area with low succession stage contrast and an area with high contrast. You may take a picture, draw a sketch, or use a picture from a newspaper or magazine. Try to find an example in your county or nearby. Note the succession stage number and explain why you think this contrast is present. (Examples to look for: a cornfield next to a woodlot or a lawn next to a woodlot.).

Area of low contrast:
Succession stage:
Explanation and/or picture:

Area of high contrast:
Succession stage:
Explanation and/or picture:

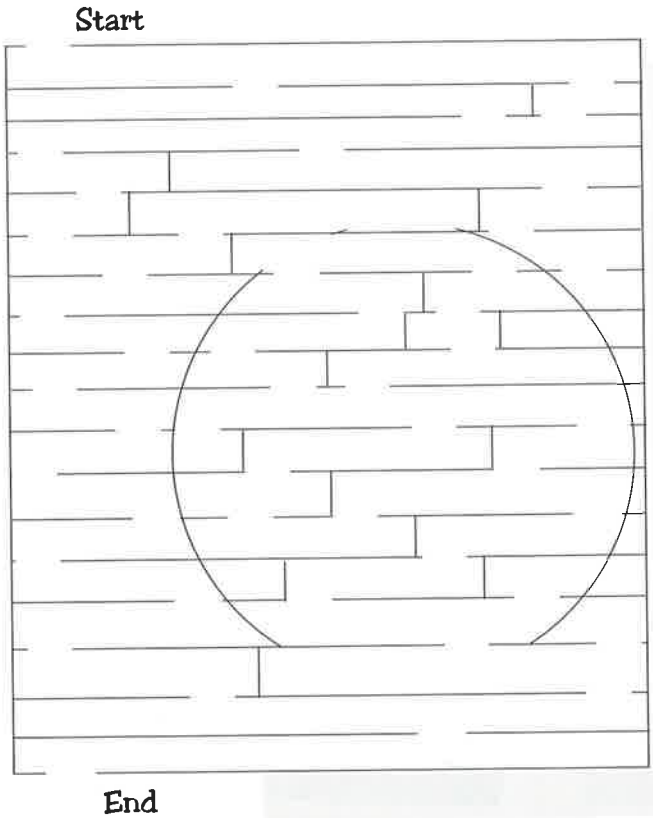
Corridors

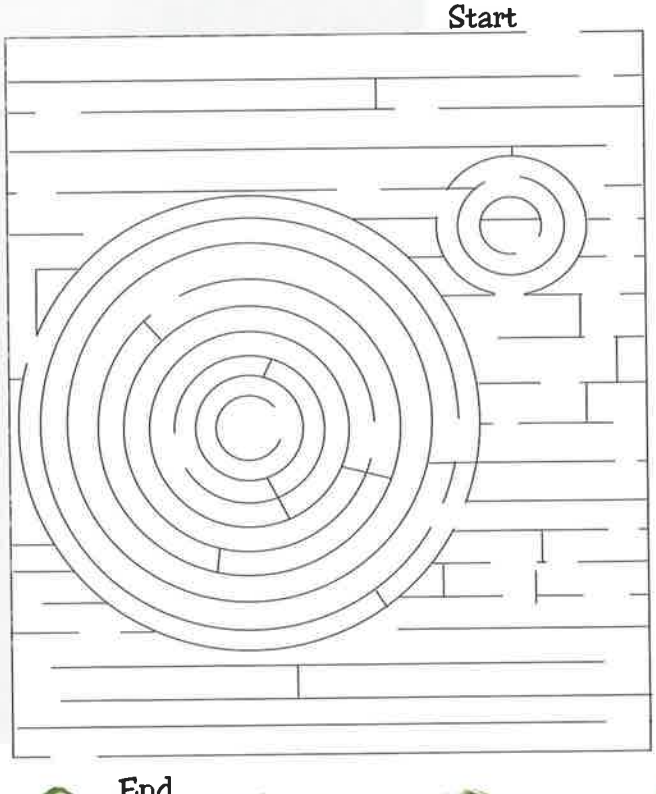
Corridors are areas of continuous habitat that provide habitat shelter for animals as they travel from one area to another. When habitats become more fragmented (broken up) from construction of roads, parking lots, urban development, harvest of timber, clearing for agriculture, etc., only small islands of vegetation remain.

Corridors allow animals to find and use islands of suitable habitat. For example, in an urban area, relatively unbroken corridors along riparian areas and ravines allow wildlife to move into parks and other suitable habitats. Preservation, maintenance, and creation of unbroken corridors are very important in wildlife habitat management.

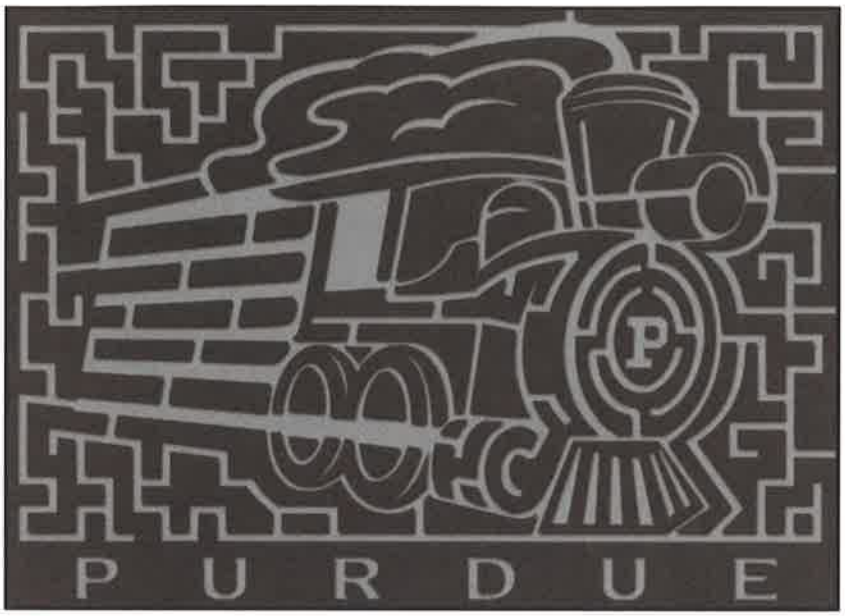
The size of a corridor affects the safety of animals using it. Narrow corridors do not provide as much safety as broad corridors. Long corridors between woods may be riskier for animals than short corridors because there is not as much cover as they travel through the corridor. Predation rates tend to be higher in narrow and long corridors since animals, nests, and dens are more easily found by predators.

Corridors are rather like a maze. Wildlife habitats with adequate corridors are like the simple maze shown on the left. Habitats with poor corridors or broken corridors make it difficult, and sometimes impossible for wildlife to reach food sources and water, more like the maze on the right.





Activity 6: Make a maze at home or a 4-H club meeting for others to go through. First make a maze showing good corridors—the maze is easy to complete. Then show how barriers and dead ends make the maze difficult or impossible to complete. If there are younger kids at your 4-H club meeting, explain what corridors are and how wildlife use them to get to food and water.



You can also make your own maze on paper showing corridors (trees, tall grass, etc.) and problems for wildlife (open spaces, housing developments, drainage of a wetland, etc.).

Note: What makes a good corridor for one species may not be good for another. For example, a road is useful for humans but dangerous for wildlife.

Shelter

Animals need shelter for protection from the weather and predators. Different species use different types of shelter.

Activity 7: Make a brush shelter for birds, mice, chipmunks, rabbits, or other small mammals. Pile tree or bush branches on logs or rocks to provide tunnels. Use smaller branches on top. Two or three small brush piles are generally preferable to one large pile. Observe your brush piles regularly and record any activity in your journal.

Examples of shelter include:

- Conifer trees
- Snags
- Bird houses
- Brambles (berry bushes) and thorn bushes
- Brush piles
- Tall grass or weeds
- Buildings
- Shrubs

SECTION 4

WILDLIFE BY NUMBERS

Carrying Capacity

Carrying capacity is the term used to define the population of a given species that an area will support without deterioration of the area. The quantity and quality of food, water, cover, and space interact to affect carrying capacity. If one of the basic requirements is in short supply, the carrying capacity is lowered because of competition for that limiting resource. A wildlife manager can increase the habitat's carrying capacity by managing for the missing ingredient. Determining the limiting resource is often a difficult and complex task.

Carrying capacity varies from year to year and from season to season. It is usually greatest from late spring through fall; this is when most young are born and grow. With the coming of winter, food and cover gradually diminish and the carrying capacity is likely to be reduced.

More animals are produced each year than will survive to the next year. Young wildlife and animals in poor health experience the highest death rates. The obvious way to increase a population is to increase the number of animals born and to reduce the number that die. However, if the habitat cannot support any more animals, these efforts will fail. A long-term increase in population can only be accomplished by increasing a habitat's carrying capacity.

You can begin to understand carrying capacity better by trying the following activity.

Activity 1a: Carrying Capacity Game

• Find one hundred pennies and a die. One penny will represent the food that each animal needs for a month. For simplicity assume that there is adequate water, shelter, and space throughout this activity, but remember that they all impact carrying capacity in real life.

• Assume you start with two animals in January (one female and one male). You will be removing one penny from your food supply for each animal, each month (start with January through March. Put the pennies representing food aside—this food has been consumed and is no longer available. Draw a chart like the example on the next page. Write the results in your chart.

• For March roll the die to determine how many offspring the pair of animals have. Assume that 1/2 of the offspring are male and 1/2 are female. If you roll an odd number the higher number are females (for example, a roll of five represents two males and three females). Remove pennies symbolizing the food for the newborns beginning April.

• For the following months, remove pennies, one per month, for each animal.

• In March of the second year roll the die again for each female animal to determine how many offspring each has (and the sex of each).

• In the second year, add fifty pennies in April. The additional pennies represent new food sources. Continue to remove pennies (food) for each animal, each month, until they are gone.

• See how long your animal family lives, with females giving birth each March and adding fifty cents for food in April. Assume that no animals are lost during the year.

• You can easily see how soon a limited food supply can run out.

Number of pennies to start: 100

Start	Number of Pennies	Notes	Start	Number of Pennies	Notes
Jan	98	2 animals (1 male & 1 female)	Jan	34	6 animals (3 female; 3 male)
Feb	96	subtract 2¢	Feb	28	subtract 6¢
Mar	94	4 babies (2 male & 2 female)	Mar	22	3 females—total of 12 babies
Apr	88	subtract 6¢ each month	Apr	54	add 50¢ (new food)
May	82		May	36	subtract 18¢ each month
Jun	76		Jun	18	
Jul	70		Jul	0	
Aug	64		Aug	0	
Sep	58		Sep	0	
Oct	52		Oct	0	
Nov	46		Nov	0	
Dec	40		Dec	0	

Population Dynamics

It would be rare for all the offspring described in the previous activity to survive until the following year. Animals are lost to a population for many reasons (disease, predation, physical weakness, or just bad luck). The changes in a population are referred to as population dynamics. You can study population dynamics by repeating the previous exercise (1a) with the addition of a factor that removes animals from the population. Note that these activities (1a&b, 2) use food as a convenient way to discuss a limiting factor for a population but that there are many other possible limiting factors (lack of nesting sites, hibernation caves or dens, etc.). Many of these factors are often linked. For example, a limited food supply could result in weakened animals leading to an increased susceptibility to predation or disease.

Activity 1b: Roll a die each month for each animal and remove any animal for which a "1" is rolled. Use a table similar to the one on page 15 to keep track of the number of animals that you have after two years. Note if the addition of a mortality factor (e.g., disease) changes the results (longevity of the animal family). You can try this activity again using a different mortality method (roll the die every other month, use the numbers "1" and "6" to remove individuals, etc.)

Activity 2: You can use the scientific method with the previous activities (1a & 1b) (see description on page 38). You can use the following example or create your own study. *(Example hypothesis: A raccoon population will live at least two years longer, without running out of food, when a population control is used.)*

1. Write your hypothesis: _____

_____

2. Make a data sheet similar to the one below.

Start	Number of Pennies	Notes	Start	Number of Pennies	Notes

Complete your own data sheet.

To test your hypothesis (that food lasts longer when population control is included) you need to make a similar data sheet for the second tria–with the additional component of removing individuals. Roll a die each month for each animal. When you roll a "1," remove that animal from the population. Keep track of which animals are removed because you need to know how many females remain in the population to determine the number of offspring.

Note: This activity depends on chance (the roll of a die). Therefore, if you want to be able to see patterns and make inferences a number of trials are needed. This becomes a statistical exercise – statistics can tell us what to expect and to show trends, but statistics do not tell us exactly what will happen in a given situation because there are so many variables that affect the outcomes.

3. Compare the trials (Activities 1a, 1b, and 2). Was your hypothesis (#1) proved, or disproved in each trial?

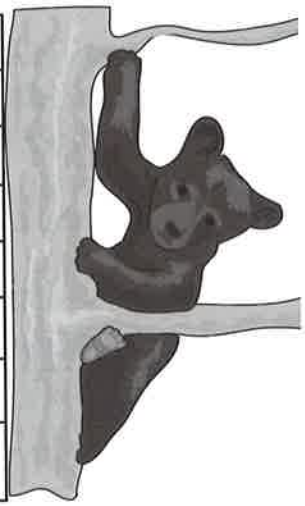
4. Did you learn anything that you did not expect? Would you be able to write a better hypothesis the next time you did this activity?

Notes:

Reproduction Rates

Animals have adopted different reproductive approaches. Animals, particularly those that are lower in the food chain generally have high reproductive rates and high mortality rates. This type of adaptation is said to be "r-selected." Animals that are higher in the food chain often have low birth rates and lower mortality rates. These animals are said to be "K-selected." Animals that are primarily K-selected may have offspring on a yearly (or longer) basis and tend to take care of their young for longer periods of time than "' animals." The terms, r- and K-selected are generalizations used to represent the ends of a continuum. Most species fall somewhere in between.

r-selected animals	K-selected animals
• high reproductive rates	• low reproductive rates
• high death rates	• low death rates
• short life span	• long life spans
• shorter gestation	• longer gestation periods
• shorter maternal care	• lower turnover rates
• high turnover rate	• longer maternal care
examples: rabbits, voles	*examples: bobcat, black bear, bald eagle*



Activity 3: Identify three species for each category (r- and K-selected). You can find this information by looking in an encyclopedia, species resource books, or by asking for help from a knowledgeable adult or older 4-H'er. You probably will not find the term "r-selected," unless you are using a college textbook. Use Table A to determine if the life span for a species is short or long. List the gestation length, life span, and reproduction rate, then decide how to rate the life span. The animals that you list as short life span will generally be categorized as r-selected, and those listed as long life span will be categorized as K-selected. List these in table B.

Table A

Animal	Gestation Length	Life span	Reproduction Rate	Life Span (short or long)

Table B Life Span Categorization

r-selected	K-selected

Critical Life Stages

Success, or failure, of a species may depend more on its survival during a particular phase of life than on the general habitat in which the species lives. Animals have critical stages of their lives during which special requirements must be met in order for the species to survive. These requirements may be for food, breeding conditions, den or nesting sites, or other similar necessities. Some species are more susceptible to extinction than others because of their specific requirements during critical stages of their lives.

Activity 4: Identify five species that have a critical stage in their life. Then list actions (natural or caused by humans) that could negatively impact the species. You may ask for help from your parents, friends teachers, etc.

Species	**Actions that threaten species**
Monarch butterfly	*Destruction of sites for overwintering in Mexico*
Bluebird	*Loss of nesting cavities*

SECTION 5 ANIMAL INTERACTI

Many wildlife species affect their habitat, and that has an impact on other species. Sometimes species make changes on the environment in which they live that improve living conditions for some other species. This effect is known as the "keystone effect," and the species that make these changes are known as "keystone species." In Indiana, the beaver is a keystone species. By damming streams, beavers create ponds or marshy areas that benefit a wide range of other species. Muskrats, mink, and waterfowl are examples of the species that may thrive in ponds that beavers have created.

Sometimes a wildlife species will have a negative impact on other species of plants and animals around it. White-tailed deer are a good example of a species that can destroy the habitat of many other species. Historically deer populations in Indiana were kept in balance naturally by large carnivores (wolves, bobcats, bears, etc.). These animals have been eliminated by hunting and habitat destruction. Consequently deer populations have risen dramatically, especially in state parks or suburban areas where hunting is not allowed. Large populations of deer cause severe damage to much of the vegetation, reducing the diversity and density of plant species. This affects other species that depend on the plants for food and cover. Carnivores that depend on these species are also affected.

No species has had as much impact on wildlife as humans. This impact may be positive or negative.

In the early days of Indiana settlement, large tracts of forestland were cut and/or burned to make way for livestock, crops, and families. The destruction of forestland caused a great loss of wildlife habitat. Furthermore, the unregulated harvest (hunting) of many wildlife species caused or contributed to the decline of many species. Some of these species are no longer found in Indiana, although they still exist in other states (for example, gray wolves and cougars).

Most of Indiana's original wetlands were drained for agriculture and other development. The changes occurring in Indiana at the time were not much

different than what had already occurred in the eastern U.S., or what would happen further west in the years to come. Starting in the early 1900s many laws were enacted, both on the state and national levels, to help control development by humans and to regulate harvest of wildlife by hunters. The modern science of wildlife management also got its start in the early part of the twentieth century. Today, Indiana has rebounded well from the destruction of a century or more ago. The Clean Water Act of 1974 has greatly improved water quality for fish and other aquatic animals. More careful use of chemical pesticides has led to the return of the bald eagle. Wild turkeys are once again a common sight in much of the Indiana landscape. It is sometimes difficult to imagine that white-tailed deer, which are so common today, were all but eliminated from the state several decades ago.

The following historical summaries will give you an idea of the impact humans have had on Indiana wildlife. Although much of this information seems negative, remember that people did not intend to destroy habitat and species. The historical view of progress has been from a human point of view, and we have only recently begun to consider other species in development plans.

HISTORICAL INFORMATION

Native Americans...European Settlers

From the 1400s to the 1700s Native Americans farmed much of Indiana's open lands. They burned prairie lands yearly to keep forests from encroaching on the grasslands. The Native Americans probably used slash, burn, and abandon farming techniques. After the land was abandoned the forests would regrow. Native American populations were fairly small, with a maximum for Indiana estimated to be around 200,000 people. After Europeans came to Indiana in the 1700s and early 1800s, the Native American population was reduced to about 20,000 due to diseases and their forced removal from the state.

When Europeans first moved to Indiana they settled in prairie remnant areas where they could graze their livestock. Then settlers cleared the forests to plant crops. People did not have the tools necessary to break the sod, and they did not think that the prairie soils were productive. They were very wrong—these soils have been shown to be very productive.

Europeans initially practiced the same methods as Native Americans, but they were not nomadic. They used the smaller trees for building (boards, fences, etc.). Larger logs were rolled into piles and burned. In the first half of the ninteeth century, there were accounts of people walking in smoke for one hundred miles, due to the year-round burning of these large logs.

Wetlands

Wetlands are an important Indiana resource, especially for wildlife. Many species use wetlands for feeding, nesting, and various other habitat needs. Wetlands act as a natural filter—in fact, a great deal of study is underway to determine the value of using constructed wetlands to clean human and agricultural wastes. Wetland plants filter and remove many potentially harmful substances from water. The purity of the end product at the outlet of a wetland depends on the size of the wetland, the level of contamination, and how much water flows through it.

Indiana has lost 85 percent of its natural wetlands. This is generally true for all of the United States. Most wetlands have been drained for agriculture and development (urban expansion).

Forests

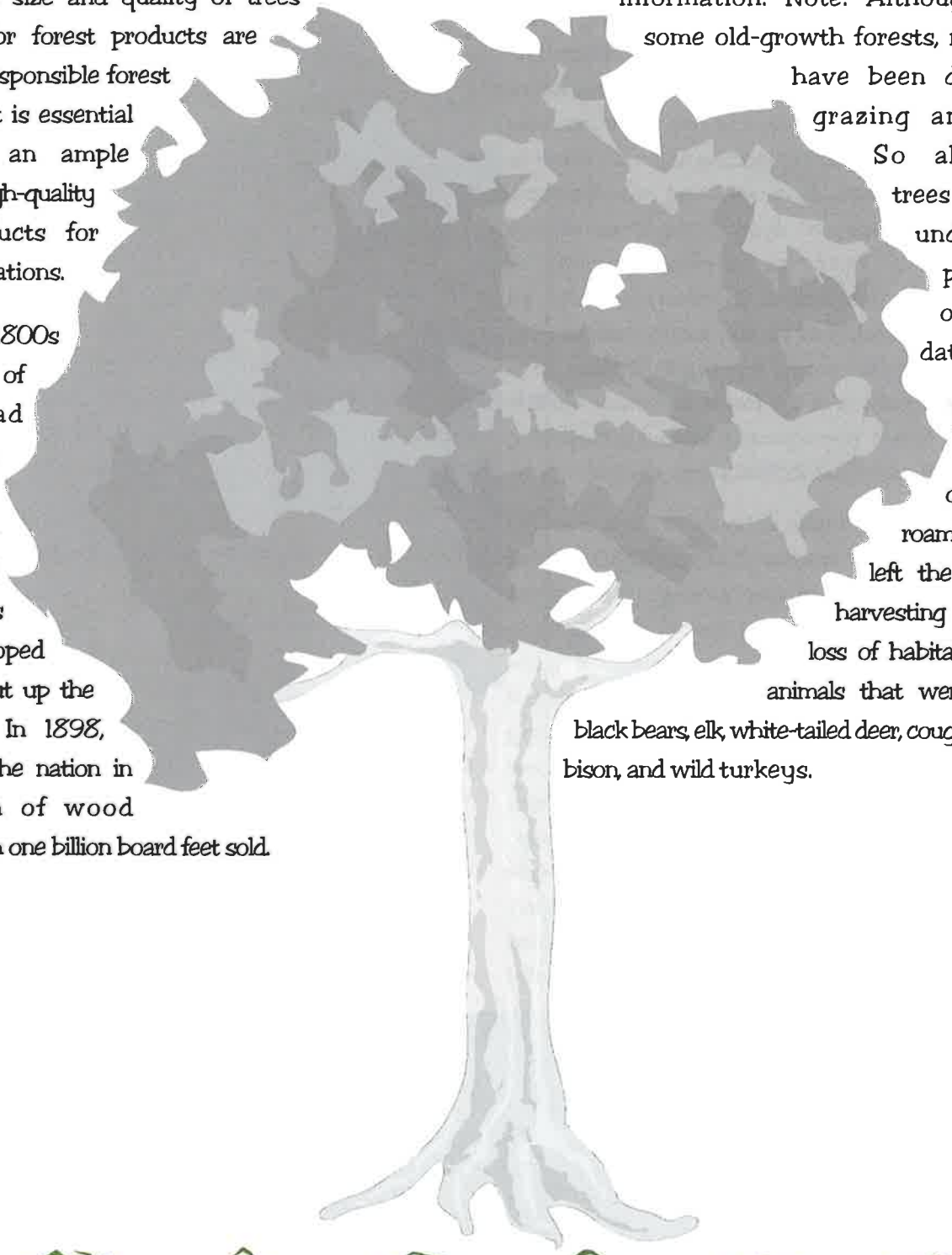
Central Hardwood region (parts of eastern and midwestern United States). Indians and early settlers cleared the unbroken native central hardwood forest to create farmland. By the 1890s, land clearing in the northern, flatter half of the region was nearly complete. The remaining forested land, located primarily in the non-agricultural southern hilly areas, was cleared for logging and charcoal production in the early 1900s. The remaining forest land was subjected to widespread burning and grazing until the 1930s. During this period, land use patterns began to change as many small, nonproductive farms located on poor soil or highly erodible areas were abandoned and reforested, mostly through natural plant regrowth.

Today, there are about 100 million acres of forestland in the Central Hardwood region. Despite continued development and urban sprawl, future net looses of forestland will be minimal. Portions of retired and highly erodible crop land are now being reforested. Since 1985, approximately one hundred thousand acres acres of cropland in this region, enrolled in the Conservation Reserve Program (CRP), have been planted with trees. Timber now covers 12 to 77 percent of the landscape in the central hardwood

states, and most of these second-growth stands are approaching middle age (fourty to seventy years old). About three-fourths of all forested land is controlled by small, private, nonindustrial forest owners with varying objectives for their land. However, current harvest patterns are such that the average size and quality of trees harvested for forest products are declining. Responsible forest management is essential to ensure an ample supply of high-quality wood products for future generations.

By the mid 1800s about half of Indiana had been cleared. In the 1840s steam-powered sawmills were developed that could cut up the large trees. In 1898, Indiana led the nation in production of wood products with one billion board feet sold.

Currently, there are about fifteen thousand acres of high-quality, old-growth forests (predating European settlers) left in Indiana. Contact the Division of Nature Preserves in Indianapolis to find the closest old-growth forest near you. The Nature Conservancy is also a good source for local information. Note: Although we have some old-growth forests, most of them have been disturbed by grazing and/or fires. So although the trees are old, the understory will probably be of more recent date.



Wildlife

By 1860 most of the large, roaming wildlife had left the state due to harvesting (hunting) and loss of habitat. Some native animals that were lost include black bears, elk, white-tailed deer, cougar, gray wolves, bison, and wild turkeys.

Wildlife and the Forests

Wildlife and the forests in which they live are closely linked. The abundance of most wildlife populations and the amount of forested lands have paralleled each other throughout history. This link between plant and animal communities illustrates the balance of nature. Understanding this balance helps us realize why forest management is important. Any action that affects the abundance of one population may alter the balance of another. For example, an increase in den trees provides more homes for cavity-nesting species and may result in an increase in squirrels, raccoons, and woodpeckers. However, an increase in deer, rodent, or insect populations might have an adverse impact on surrounding plant communities. Overcrowded deer, an exploding rodent population, or too many insects may eat all available fruits, twigs, leaves, or shrubs, thus affecting the composition of the forest and other wildlife species. Good forest management means considering the needs of both plant and animal communities.

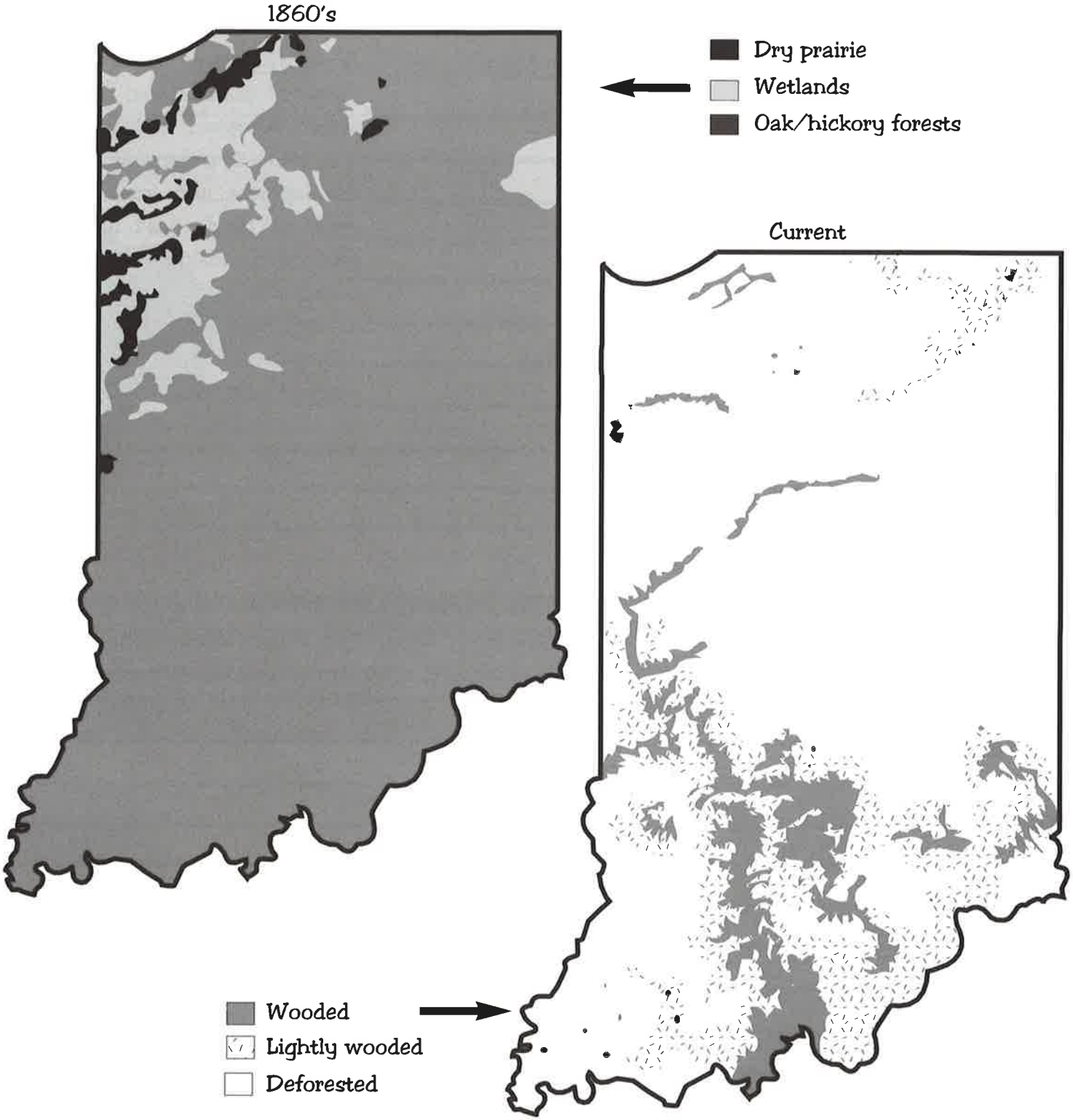
The Central Hardwood Region is home to more than 60 species of mammals, 40 species of reptiles, 130 species of birds, and 30 species of amphibians. Throughout history, human influence and the resulting changes in the forest composition have changed wildlife populations. Before European settlement, substantial openings in the predominantly unbroken forest canopy were made only by strong winds or fire. These natural events strongly benefited certain species requiring these open areas: woodcock, deer, turkey, grouse, and many species of songbirds. As people began to open up forests through land clearing, wildlife populations responded. However, excessive land clearing and uncontrolled hunting for food and market led to the disappearance of many wildlife species from much of their historic range. Among the affected species were deer, ruffed grouse, wild turkeys, wolves, mountain lions, black bears, passenger pigeons, Carolina parakeets, ivory-billed woodpeckers, common ravens, and bald eagles. In the early 1900s, regulations were enforced to control wildlife exploitation. At the same time, abandoned farm ground was returning to young forest vegetation.

Of the estimated 250 terrestrial vertebrate wildlife species occurring in the central hardwood forest, none are currently known to require old-growth (one hundred plus years) forest stands. Forest stands over 40 years old benefit about 30 percent of these species. Nearly 70 percent require successional stages of a forest less than fourty years old to meet at least part of their habitat requirement.

Today's smaller land holdings and social and economic needs no longer permit us to allow habitat diversity and natural forest regeneration. Proper forest management practices can create the disturbances needed to provide a home for numerous species of wildlife and allow us to use timber and firewood that would have been lost through natural events.

Managing the forest for wildlife also benefits the trees. Birds consume large numbers of insects harmful to trees. Earthworms and rodents turn over the soil and recycle nutrients as they burrow and dig for food. The resulting loosened soil permits air and moisture to penetrate to the tree's feeder roots, allowing tree growth. Small mammals (shrews, mice, and voles) consume insects harmful to trees and assist in seed distribution. Tree seeds are dispersed by most small forest mammals (squirrels, mice, and chipmunks) as they store seeds in caches or bury (plant) individual seeds in the soil, thus assisting in the natural regeneration process. Birds are also excellent seed distributors because consumed seed, deposited in the bird's droppings, may be carried miles from the original seed source. Wildlife is a necessary part of the forest environment. Encouraging healthy, diverse wildlife populations benefits the entire forest and can benefit recreation, timber production, and forest aesthetics.

Activity 1: Look at the two maps of Indiana. The historical map on the left shows Indiana in the 1860s. The map on the right is from 1999. Write about the differences you see in the two maps of Indiana and how the features you discuss impact humans and wildlife. Do you see any of these changes where you live?



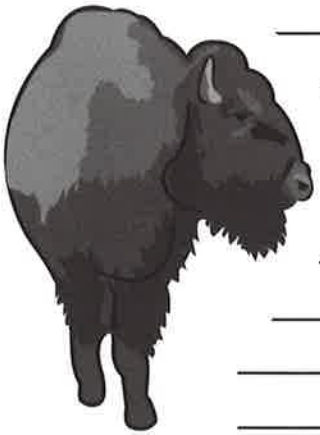
MAP COMPARISON

Differences in forested land—on the map and where I live:

About 87 percent (about 21 million acres) of Indiana was forestland before European settlement. Land was cleared to provide room for development and areas for agriculture. Lands used for timber production remain forested through sustainable forestry practices that manage this renewable resource. Today there are about 4.1 million acres of forestland in Indiana.

Activity 2: Discuss signs around you of human impacts on wildlife. You might note short-term changes (gardening, plowing, mowing) or long-term changes (new road development, new housing, clear cutting).

Activity 3: Look for local historical information at your county historical society or county library. See what information you can find about your county one hundred or one hundred fifty years ago. Describe the county then and now. List any population numbers you can find (human and animal). (You may find bounty records, which give an indication of animal populations.) Quote any interesting news articles that discuss wildlife.



Activity 4: Visit a park, roadside rest area, playground, outdoor lab, or similar area and describe any positive or negative impacts that humans have had on the wildlife in the area. (Some positive examples you may find are nesting boxes and feed for birds. Negative impacts would include trash and habitat destruction.)

Activity 5: Human activity has a major impact on wildlife. Research one of the human activities/strategies listed below and discuss its positive or negative impact on Indiana wildlife. Include sketches, pictures, and examples to explain your topic.

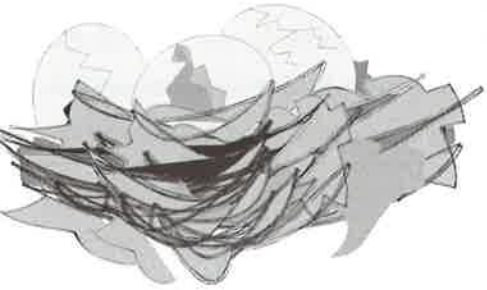
- Pollution(urban, industrial, agricultural DDT and other chemical pesticides)-short and long-term effects
- Subdivisions
- Constructing and maintaining agricultural fence rows and/or windbreaks
- Highways
- Constructed wetland
- Introduced and reintroduced species– how introduced, their impact and control
- A pattern of small vs. large agricultural fields
- Loss or addition of riparian zones
- Urban sprawl

Topic:

Pioneers in Wildlife Conservation

Theodore Roosevelt (1858-1919)—Twenty-sixth president of the United States (1901-1909). T. Roosevelt was a firm believer in conservation of national resources, and he sought to halt exhaustion of timber and mineral supplies by private interests and added many millions of acres of land to public ownership. Roosevelt's endorsement and enthusiastic implementation of the Reclamation Act of 1902 has had a far reaching impact on wildlife, through the creation of protected public lands.

Gifford Pinchot (1865-1946)—one of America's leading advocates of environmental conservation at the turn of the twentieth century. Pinchot and a friend, Overton Price, coined the word "conservation" as it applies to natural resources.



Note: Roosevelt and Pinchot were instrumental in building and launching the conservation movement. They gathered fragmented parts into a solid structure and launched it with enough momentum to carry it forward for centuries. America's wildlife was a major beneficiary.

Rachel Carson (1907-1964)—Author of Silent Spring, which she wrote from 1958 to 1962. Carson's book examined the way chemical pesticides had been used without sufficient research or regard for their potential to harm wildlife, water, soil, and humans. This book offered the first generally acknowledged look at widespread ecological degradation and touched off an environmental awareness that still exists. The book is a "must read" for those who care about wildlife.

John Muir (1838-1914)—a naturalist and advocate of forest conservation. Muir was largely responsible for the establishment of Sequoia and Yosemite national parks in California.

Gene Stratton-Porter (1863-1927)—A famous Indiana author. One of her most famous nature books is A Girl of the Limberlost. Mrs. Stratton-Porter used her own photographs to illustrate her books.

Aldo Leopold (1887-1948)—Best known as the author of A Sand County Almanac (1949) and his efforts to preserve wildlands and wildlife. He was a scientist and conservationist and has greatly impacted forestry and wildlife ecology. Leopold worked for the U.S. Forest Service from 1909-1928 and taught at the University of Wisconsin from 1933-48.

Important Wildlife Legislation

Pitman-Robertson Federal Aid in Wildlife Restoration Act (1937)—earmarked the excise tax on sporting arms and ammunition to the state and territorial fish and wildlife agencies for use in wildlife land acquisition, development, and research. Federal allocations were to be matched by state funds (75 percent federal & 25 percent state).

Wallop-Breaux Amendments to the Sport Fishing Restoration Act (1984) created the Aquatic Resources Trust Fund, also known as the Wallop-Breaux Trust Fund, with two separate accounts -one for boating safety funds and another for sport fishing.

Activity 6: Study someone you admire who has worked to conserve wildlife and wildlife habitat. You can choose one of the people mentioned on the previous page or anyone else whose life interests you. It can be a person who worked and lived years ago or it can be someone that lives and works with wildlife now. You may do your research by interviewing someone or by doing research in a library.

Name of the person: _____

Job title/life work: _____

Why you admire this person: _____

_____

_____

_____

_____

The impact this person had/has: _____

_____

_____

_____

_____

Other interesting information: _____

_____

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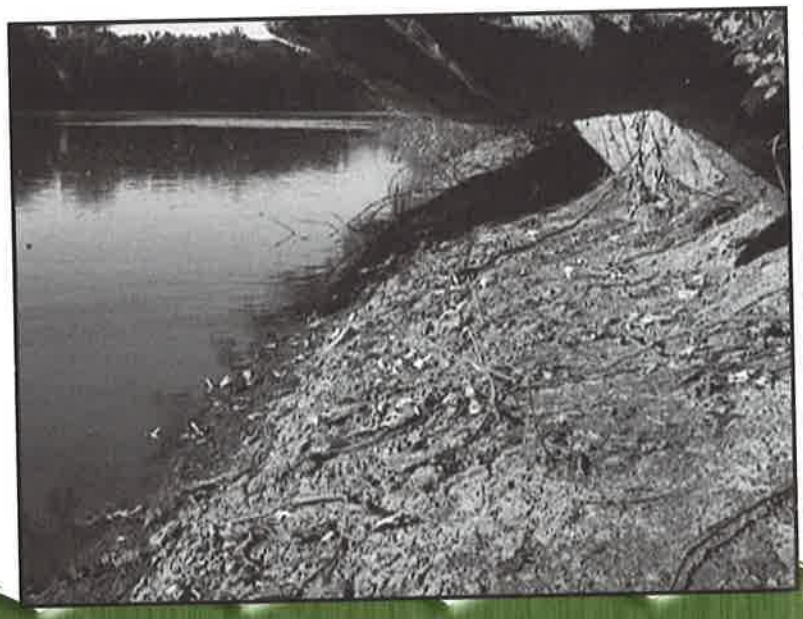


What Are We Doing Today?

Many people are concerned about the habitat changes that occur because of increasing human population and the related development. Parks (local, state, and national) offer habitat for wildlife and green space for humans. The Conservation Reserve Program (CRP) takes sensitive lands out of agricultural production and converts them to conservation uses. This program often benefits wildlife. Landowners may also enter the Wetland Reserve Program. Landowners receive incentives to restore appropriate farmlands to wetlands.

State and federal laws require developers who drain or fill wetlands for building purposes to create a wetland of equal value elsewhere (wetland banking). Some wetlands have been restored by simply breaking drainage tiles and allowing the low area to fill with water. Generally, wildlife and plants will naturally find and colonize new wetlands quite quickly (within one to three years).

SECTION 6 WHO MANAGES INDIANA WILDLIFE?

The mission of the Indiana Department of Natural Resources (IDNR) is to protect, enhance, preserve, and wisely use natural, cultural, and recreational resources for the benefit of Indiana's citizens through professional leadership, management, and education. In order to carry out this mission the IDNR regulates both hunting and fishing.

Because of our increasing knowledge, general wildlife management is very different now than in past years. Single-species management, (managing for one species only,) was the focus in past years. The food, water, and cover needs of the species of interest were the primary considerations. Single-species management generally tries to maximize population size of one species. With single species management any benefits, or detriments, to other species were by accident.

Internet Connection

The IDNR Home Page is:

http://www.state.in.us/dnr/

Look for the Division of Fish & Wildlife Home page or for more information go directly to:
http://www.state.in.us/dnr/fishwild/index.htm

Today, wildlife biologists more commonly practice ecosystem management. They are trying to incorporate multiple species in management plans. Ecosystem management tries to manage for species diversity and sustainability and benefit a natural, sustainable system.

Some state initiatives help to fund specific projects like the reintroduction of eagles, otters, and turkeys to the state of Indiana. In other cases, volunteer citizen groups encourage and assist a species. For example, many local groups have assisted with the return of bluebirds. Conservations groups such as Ducks Unlimited, Quail Unlimited, Pheasant Forever, and National Wild Turkey Federation raise money for research and management for their species off interest.

Funds for wildlife management also come from hunting licenses, special stamps that hunters must purchase, state license plates, and taxes on sporting goods.

License and Stamp Purchases

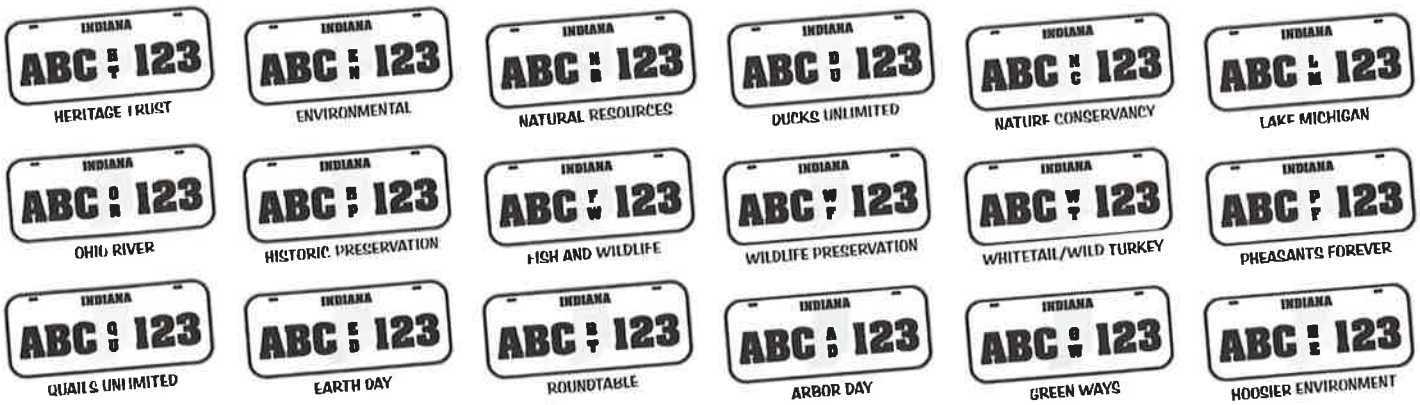
Purchased by people who hunt, fish, and trap wildlife must purchase licenses. The funds help to pay for wildlife management, wildlife biologists, and land purchase. People who hunt specific species (migratory birds and upland game) must also purchase a special stamp from a U.S. Postal Office. In some cases, such as hunters of waterfowl, a state stamp must also be purchased. The necessary licenses and stamps must be carried by the hunter and shown upon request. Many art collectors also purchase these beautiful stamps. Artists compete yearly for the honor of providing the migratory bird and upland game stamps.

Special Recognition License Plates

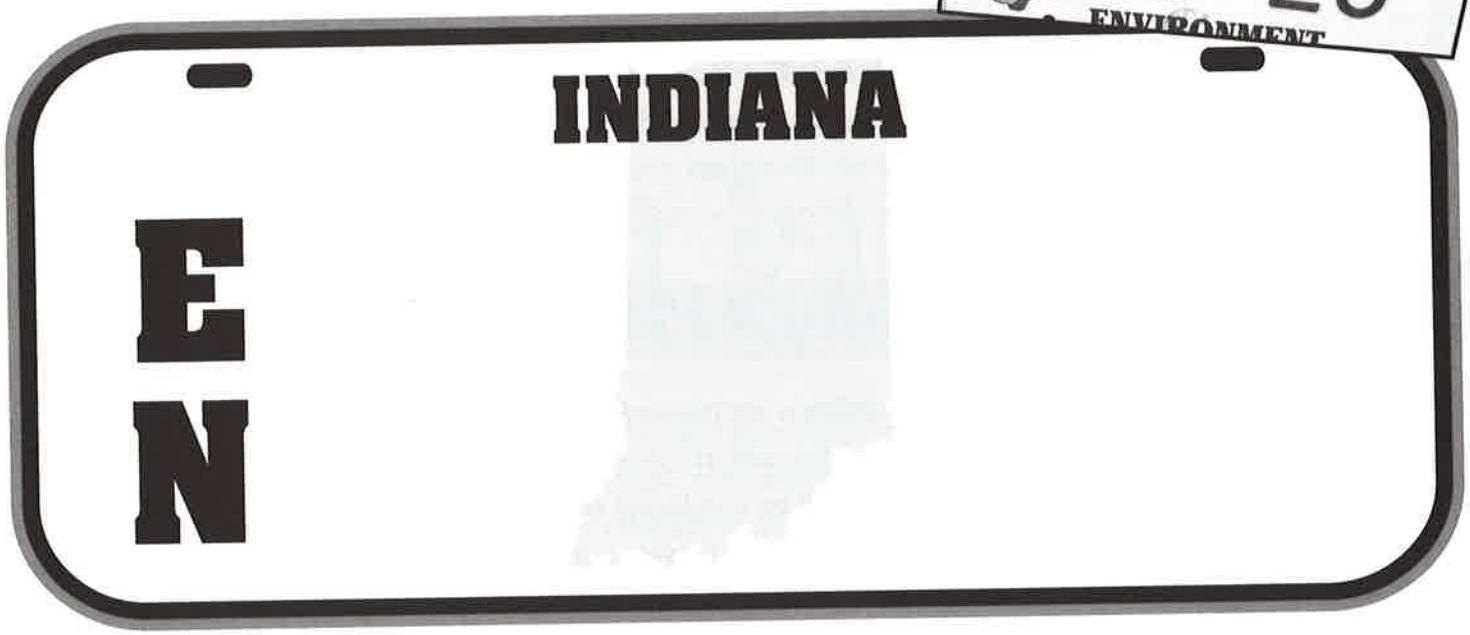
The Indiana environmental license plate provides a permanent source of funding for the Indiana Heritage Trust. The environmental plate was first offered for sale in 1993. The license plate features an eagle-and-sun design on a light blue field. The current design will be displayed through the year 2001. All donations go to the Hoosier Trust Fund, a group that protects and purchases sensitive natural areas for parks, wetlands, forests, recreation, wildlife habitat, and nature preserves.

Through 1998, $10,395,700 had been raised from the sale and renewal of 415,828 environmental plates. By the end of May 1998, the Heritage Trust had purchased and protected 20,572 acres though real estate purchases from willing sellers. License plate sales have helped set aside important land all across Indiana, including: the Grand Kankakee Marsh restoration project in Lake County, a buffer zone in Fort Harrison State Park to protect a great blue heron rookery in Marion County, and land along the Blue River Corridor in Harrison County. (for current information see: www.state.in.us/dnr/heritage)

Indiana environmental License Plate Stacked Alpha Series (types of license plates)
www.in.gove/dnr/heritage/



Ativity 1: Design a new Indiana environmental license plate.



The Federal Aid in Wildlife Restoration Program (Pitman-Robertson program)

The Federal Aid in Wildlife Restoration Program (commonly called the Pitman-Robertson Program in honor of its legislative sponsors) is the most productive wildlife undertaking on record. The program is funded by an 11 percent manufacturers' excise tax on sporting rifles, shotguns, ammunition, and archery equipment used in hunting, and by a 10 percent manufacturers' excise tax on handguns. The U.S. Treasury Department collects the taxes and transfers them to the U.S. Fish and Wildlife Service. The U.S. Fish and Wildlife Service transfers most of this tax (up to 8 percent may be used for administrative expenses) to State wildlife agencies. States add at least $1.00 of state money for each $3.00 of tax money. Since the program began in 1937, the Pitman-Robertson program has contributed over $2 billion to the nation's wildlife and recreation programs. States have purchased nearly $4 million acres of critical habitat, and annually manage more than fifty million additional acres for wildlife. See http://fa.r9.fws.gov/wr/fawr.html for more information.

Activity 2: This activity is recommended for use with a group of younger 4-H members to teach them why hunting and fishing are regulated.

Fill a bowl with pennies (or marbles, dried beans or other item that can be easily handled). You should have at least five pennies for each child. The pennies represent all the fish (and the value of the fish) in the five Great Lakes. Pass the bowl around and have each person take as many "fish" as they wish. Once the pennies are gone you can talk to the youth about what happened. Did everyone take an equal amount of fish? Were there any left when the bowl got to the last person? Refill the bowl, but this time "regulate" (control) the take by allowing each youth to take only five fish. (Make sure there will be fish left over, if necessary only allow two or three fish per person.)

Explain that regulations are required to make sure a few people do not take more than their fair share of the fish. Regulations assure there are fish for everyone interested in fishing and enough left to continue the species. States regulate both the number of fish that may be taken and the method of fishing allowed. Once you limit the number of pennies each person can take, everyone will get a share of the catch and there will even be some left over. (If all the pennies were gone, the fish would become extinct as there would be no breeding stock left.)

You can demonstrate how regulations work by allowing each child to take as many pennies as they can using only two fingers. After passing the bowl of pennies around (some should be left over) explain that this regulation assures that enough fish will be left to keep the population at acceptable levels. This is similar to sport fishing regulations that do not allow some nets, or that limit the size of hooks or the number of fishing poles a person can use.

States can regulate the length of season, fishing hours, method of catch (including the type of nets used, size of hooks, or number of poles used), and number of fish that may be taken.

Note: *If your group is very well behaved, or too shy, they may self-regulate the first time the bowl is passed around. If this happens you can sit at the end of the circle and take all the remaining fish. Then proceed with the regulated example and only take five.*

Activity 3: Build a diorama (three-dimensional, scale model) showing a grassland, wetland, or woodland habitat. Include at least five common Indiana species. You may make your diorama with natural, artificial, or recycled materials.

Activity 4: Pick one of the twelve animals listed below. List what your animal needs to survive.

1. Beaver	2. Bobwhite Quail	3. Cottontail Rabbit
4. Coyote	5. Eastern Garter Snake	6. Wild Turkey
7. Opossum	8. Raccoon	9. Red Fox
10. Red-tailed Hawk	11. Striped Skunk	12. White-Tailed Deer

Animal _____

What type of food is needed _____

How would you maximize the food supplies _____

How would you provide the water needed _____

Cover needed _____

Space needed _____

How might managing for this one species affect the other species that live in the same ecosystem? _____

_____

_____

Activity 5: Interview a wildlife biologist, conservation officer, or other wildlife professional to get information about one of the following questions. Take complete notes while interviewing this professional.

- Why is the IDNR introducing river otters in Indiana?
- What were the decisions leading to deer hunting in some Indiana state parks?
- Why does the DNR change regulations from time to time?
- Why is there a length limit on some species of fish (DNR regulations)?
- Why has the reintroduction of the wild turkey been successful in Indiana?
- How many nesting pairs of bald eagles have been found in Indiana and how successful have they been at producing offspring?

Topic: _____

_____

_____

_____

_____

SECTION 7

CAREERS

Since you are interested in wildlife, you may want to pursue a career that would allow you to work with and for wildlife. You are at a perfect age to begin to explore your career options. One way to start your search is to find jobs that are currently available and see if they appeal to you. You may be able to find jobs that interest you in your local paper. Look for titles like: "wildlife," "natural resources," and "environment." The Internet makes job searching easy. You can go to the Purdue Department of Forestry and Natural Resources site (http://www.fnr.purdue.edu/) and then to the "jobs" icon. The Job Seeker also lists natural resource jobs.

Activity 1: Find a job listing on the Internet or in your local paper for someone with an interest and education in wildlife and fill in the following items:

Title:_____ Pay:_____

Qualifications required*:_____

_____

_____

Duties:_____

_____

_____

Contact:_____

_____

_____

THE JOB SEEKER
28672 Cty EW
Warrens, WI 54666
Phone/Fax (608) 378-4290
(back issues may be available fro little or no cost)

*Qualifications–keep in mind that there are choices you will make now, particularly in regards to what courses you take in high school, which will impact your ability to meet job qualifications. Math and science courses are generally required in science and wildlife college programs. Doing well in your classes, and learning all you can, keeps all you options open.

The Scientific Method

Scientific Method–an organized way to think about problems and solve them.

Assume you have put up a bird feeder and are interested in studying the birds that visit it.

1. Stating the problem
Think about what you want to learn. (ideas: number of birds sighted, number of different species sighted, time of day with the most feeding activity, comparisons of different feeding locations, dominant species, weather conditions, etc.)

2. Forming the hypothesis
Choose a hypothesis from one of the possible answers to your problem in #1. You might estimate how many birds or the type of birds that you expect to see. This step is important because it gives a basis for comparison of what you learned. Without this basis you are less likely to recognize increased knowledge. Furthermore, when you draw your own conclusions about your hypothesis you are making logical decisions that will be beneficial in helping you write a hypothesis in the future.

3. Observing and experimenting
Observe or set up an experiment to test your hypothesis. Tally your data. You can make your own charts by hand or on the computer.

4. Interpreting the data
Once you have collected your data you need to understand what it tells you. The data can be interpreted by comparing numbers visually or in graphic form. For example, list the species from the most common to the least common; compare results from different feeders; list the times of day with the most feeder activity in order; look for other patterns, etc.

5. Drawing conclusions
Consider how your observations and/or experiments affect your hypothesis. Is the hypothesis supported or rejected due to your observations and experiments? How do the results give you ideas for future studies and new hypothesis? Should you run your experiment again? Should you change one of your variables?

1. State the problem:

2. Write a hypothesis: _____

   _____

   _____

3. Observing and experimenting

   Create a data sheet to collect data. (see examples on pg. 19-21)

4. Interpret your data

   Tally and study your data

5. Drawing conclusions

   Was your hypothesis supported or not? (circle one) Accepted Rejected

What else did you learn? _____

GLOSSARY

Term	Definition
Board feet:	A board foot is a is a measurement equal to a board measuring 1 foot wide, 1 foot long, and 1 inch thick.
Browse line:	The height below which deer, in densely overpopulated areas, have removed all the vegetation they can reach from trees and bushes.
Carrying capacity:	The maximum population size that can be supported indefinitely by a given environment.
Corridor:	A passageway of trees and bushes through open lands. Corridors provide cover for animals traveling to water and food sources.
Critical stage:	An important period of development when a species may be at higher risk if their needs are not met; generally due to specific requirements of a species.
Constructed wetlands:	Human-made wetlands, generally used to filter agricultural wastes from contaminated water.
DDT:	A colorless, odorless, water-insoluble insecticide. DDT, which is banned in the United States, tends to accumulate in ecosystems and has toxic effects on many vertebrates.
Edge:	The contact zone between two or more different types of habitat or successional stages.
Emigration:	Moving away from a given place by an animal or species.
Forb:	A herbacous plant, other than grass.
Gestation:	Time of pregnancy, generally in days or months.
Girdled:	To cut away bark and cambium in a continuous circle around a plant stem. Girdling often kills the plant because it disrupts the flow of water and nutrients.
Immigration:	Moving into a given place by an animal or species.
Keystone species:	Species upon which other animals depend.
Limiting factor:	The resource most responsible for restricting population growth at a given time.
Mortality:	The number of deaths in a given time and place.
Natality:	The number of births in a given time and place.
Natural selection:	The natural process that results in the survival of individuals or groups best adjusted to their living conditions. The process is important for the perpetuation of desirable genetic qualities and for the elimination of undesirable genetic qualities.
Owl pellets:	Regurgitated pellets of nondigestible materials studied to determine what the animal has eaten
Population control:	Methods that maintain a sustainable species population.
Predation:	Obtaining food by killing and consuming animals.
Reproduction rate:	The number of pregnancies a species may have in a given time period (generally a year).
Riparian:	Living or located on the bank of a watercourse, lake, or tidewater.
Rubs:	Signs on trees and fenceposts that animals (especially deer) have rubbed against them.
Scats:	Animal fecal droppings.
Topography:	The configuration of a surface, including its relief elevation and the position of its natural and human-made features.
Tracks:	Detectable evidence from feet, hooves, or other modes of travel, that an animal has passed an area.
Turnover rates:	The rate at which population replaces individuals. Species with high turnover rates are short-lived, and species with low turnover rates are long-lived.
Urban sprawl:	The tendency of new housing to be built successively farther from urban areas. This propensity tends to take farmland out of production and leave centers of cities abandoned.
Woodlot:	An isolated forest fragment, normally square or rectangular.

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