

Penn's Cave & Wildlife Park
Centre Hall, PA
Wildlife Teacher's Guide

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Introduction

Thank you for your interest in the Penn's Cave Wildlife Park. This teacher's guide will help you prepare your students for their field trip. Please feel free to use as many of the activities as you like. Most activities can be adapted to different age groups and learning abilities.

The busses are "open-air" to allow for the best viewing opportunities, but we can insert windows if it rains. We will be spending some time outside, however, so please remind your students to dress for the weather. Each bus holds between 25-35 persons.

Acceptable items to bring include binoculars, cameras, and notebooks. We ask that students refrain from using cell phones while the tour is in progress. Also, please keep food and beverages packed away during the tour.

Our wildlife park is not a petting zoo; although our animals are familiar with their human caretakers, they are still wild animals and we must respect them as such. Students will not be permitted to feed or touch the animals during the tour.

Questions can be addressed to:

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Please let us know if we can be of further assistance as you plan your trip. We look forward to seeing you soon!

Pennsylvania's Habitat

Pennsylvania spans an area of 117,412 square kilometers (45,333 square miles) and contains a diverse array of **habitats**. Pennsylvania's geology, soils, and drainage affect the **climate** and ultimately determine which plants and animals can survive. Some animals can survive in a broad spectrum of habitats, whereas others require very specific conditions. Understanding an area's habitat leads to a better understanding of the animals that live there and the specific **adaptations** they need to survive.

During the Paleozoic Era (600 to 225 million years ago), shallow inland seas covered much of the United States. As the seas spread and receded, the land underwent several episodes of uplift. Sediments from the sea bottom were compressed together and eventually formed the limestone, sandstone, and shale that underlie Pennsylvania today. Rock layers folded to form mountains near the end of the Paleozoic Era. Softer rock (limestone) began to erode away while more resilient rock (sandstone) remained. This pattern of erosion gave way to the sandstone mountains and limestone valleys that characterize Central Pennsylvania today.

The Penn's Cave corporate property spans 1500 acres and is located in Pennsylvania's ridge and valley physiographic province. This area is characterized by farmed lowlands and long, narrow, parallel forest-covered mountain ridges created by the upheaval of rock near the end of the Paleozoic Era.

Pennsylvania has a humid climate characterized by hot summers and cold winters. Local weather patterns exhibit great variations because the state is located between polar and tropical air masses. Annual precipitation averages 40 inches.

Pennsylvania Forest Types

- **Appalachian Oak Forest** – characterized by different species of oaks such as red, white, black, scarlet, and chestnut mixed with hemlock and pines. It also contains other hardwoods such as maples, hickories, yellow poplar, and beech. This forest type occurs in lower elevations below 600 meters (2000 ft).
- **Northern Hardwoods Forest** – commonly occurring trees include sugar maples, yellow birch, beech, and hemlock, interspersed with pine, oaks, and maples. This forest type was common in PA prior to the extensive logging that took place in the late 19th century. Today, this forest type can be found in northern parts of the state and in the western part of the ridge and valley province.
- **Beech-Maple Forest** – This forest type is dominated principally by beech and sugar maples interspersed with hickory, ash, and other hardwoods. It was originally found in the northwestern part of the state, but because of lumbering and farming, this forest type has been replaced by hemlock and northern

hardwood communities in ravines and beech and sugar maple communities in plateau areas.

- **Mixed Mesophytic Forest** – most diverse of all forests in the eastern U.S. It reaches its northernmost point in southwestern Pennsylvania and consists mainly of sugar maple, buckeye, beech, yellow poplar, white oak, red oak, and basswood. It is found primarily on moist slopes or in river valleys.
- **Oak-Hickory-Pine Forest** – Reaches its northern limit in the Ridge and Valley province in the southern part of Pennsylvania. A mixture of oaks, white pine, pitch pine, and Virginia pine characterize this forest. It occurs mainly along dry, rocky ridges with shallow, acidic soils.
- **Northern Hardwoods-Spruce Forest**- Although it was once common, this forest type is now rare in PA. It is characterized by red spruce, sugar maple, yellow birch, beech, and hemlock.

Other Habitats in Pennsylvania

- **Farmlands and grasslands** – many grasslands are old fields undergoing succession. Farm fields also provide important habitat to animals.
- **Wetlands** – include swamps, marshes, bogs, and tidal flats. Wetlands provide habitat for aquatic and semi-aquatic animals. Many of the animals that live in wetlands have very specific habitat requirements and there is an intricate interplay between wetland species; they rely on each other for survival.

Tree Identification: Dichotomous Key Activity

Age/Grade Appropriateness

Grades 5-7

Key Concepts

Taxonomy

Observation

Working together

Background

Scientists use **dichotomous keys** to help identify items in the natural world. A dichotomous key will only identify items previously included in the key. In order to successfully use a dichotomous key for trees, students must first become familiar with some new terminology.

Coniferous – A tree that keeps its leaves all year

Deciduous – A tree that loses its leaves in the fall

Single needles – Needles on a coniferous tree that are not grouped together

Grouped needles – Needles on a coniferous tree that are grouped together

Flat needles – Some coniferous trees have needles that are flat; roll the needle between your fingers to determine whether it is flat

Angled needles – Not flat; can roll easily between your fingers

Simple leaf – Leaves come out of the branch singly

Compound leaf – Each leaf has multiple **leaflets** attached to it

Lobes – The edges of the leaf are not smooth

Teeth – Teeth are smaller indentations and differ from lobes

Activity 1 – Creating a Dichotomous Key

Purpose

Students will learn about dichotomous keys by creating a simple key using common objects. This activity works best in groups of 4-5.

Materials

Give one of each of the following objects to each group:

- Paperclip
- Pencil
- Pen
- Staples
- Glue
- Tape

Procedure

1. Ask students to divide the objects into two groups.
 - a. Examples: One group for writing instruments (pencil and pen) and one group for objects used to fasten or adhere (glue, tape, paperclip, staples)
2. Ask students to keep subdividing their groups until each object is in a group of its own
 - a. Examples: Divide pencil and pen into permanent writing instrument and erasable writing instrument, or made of wood and made of plastic.
 - b. Divide second group into sticky objects (tape and glue) and objects made of metal (staples and paperclip)
 - c. Further subdivide tape and glue into liquid sticky object and solid sticky object
 - d. Further subdivide staples and paperclip into metal object with rounded edges and metal object with sharp edges
3. Ask students to share their methods for dividing objects
4. Ask students to create a dichotomous key for their objects
 - a. Example:
 - 1a) Writing instruments.....Go to 2
 - 1b) Objects used to fasten or adhere.....Go to 3

 - 2a) Made of wood.....**pencil**
 - 2b) Made of plastic.....**pen**

 - 3a) Sticky object.....Go to 4
 - 3b) Metal object.....Go to 5

 - 4a) Liquid.....**glue**
 - 4b) Solid.....**tape**

 - 5a) Rounded edges.....**paperclip**
 - 5b) Sharp edges.....**staples**
5. Ask students to test their key by picking one object and trying to “discover” its identity.

Activity 2 – Identifying Trees

Purpose

Students will use a basic dichotomous key to identify some common Pennsylvania trees using leaves and leaf characteristics.

Materials

Note: If you are doing this activity in the winter or early spring, you can cut “leaves” out of construction paper or paste pictures of leaves on paper for kids to use. You will need an assortment of leaves from the following trees (enough for one leaf per group):

- White pine
- Scotch pine
- Oak

- Maple
- Aspen
- Dogwood
- Black walnut
- Honey locust
- Cedar
- Eastern Hemlock

Procedure

1. Review the tree vocabulary words listed in the background section and use your collected leaves as examples.
2. Give one leaf to each group of students.
3. Give one dichotomous key to each student.
4. Instruct students to try to identify their leaves using the key; help any groups that have trouble. Groups can then swap leaves until they have had a chance to identify all specimens.

Basic Tree Dichotomous Key

- 1a) Tree is coniferous.....Go to 1
 1b) Tree is deciduous.....Go to 3
- 2a) Leaves are needle-shaped.....Go to 4
 2b) Leaves are not needle shaped.....Go to 5
- 3a) Leaf is **simple**.....Go to 6
 3b) Leaf is **compound**.....Go to 7
- 4a) Needles are grouped in singles.....Go to 8
 4b) Needles are grouped in multiples.....Go to 9
- 5).....**Cedar**
- 6a) Leaves are **lobed**..... Go to 10
 6b) Leaves are **not lobed**.....Go to 11
- 7a) Less than 15 **leaflets**.....**Black walnut**
 7b) More than 15 **leaflets**.....**Honey locust**
- 8).....**Eastern Hemlock**
- 9a) Needles are in groups of 5.....**White pine**
 9b) Needles are in groups of 2.....**Scotch pine**
- 10a) 7 or more lobes.....**Oak**
 10b) 5 or fewer lobes.....**Maple**

- 11a) Teeth.....**Aspen**
11b) No teeth.....**Dogwood**

Discussion

Why is classification important? It helps us learn about the world around us and can tell us how things are related to each other.

What are the limitations of a dichotomous key? If a new species is discovered, it can't be identified using this method; sometimes in nature it is difficult to tell where something fits because there is variation. Two leaves from the same tree could look very different.

Can a dichotomous key be too big? Why would this pose a problem? It could take too long to find a solution.

Why is it important to know what kinds of trees can be found in an area when we are studying the environment? Trees provide habitat and food to many different animals. Have students make a list of animals that use trees for shelter or food. Trees are also important to people; lumber, food in the form of fruit, etc.

Penn's Cave Wildlife: Bison and Texas Longhorn Cattle

The following sections will help you introduce your students to the animals at Penn's Cave & Wildlife Park. You may wish to ask students to choose an animal and work in groups or individually to prepare a research paper and report. Students can then share what they've learned with the rest of the class. The field trip is a more valuable experience if students are already familiar with the animals when they arrive.

Bison

The American Bison is the largest land mammal in North America since the last Ice Age. There is a difference between bison and buffalo. Bison can be found in North America, whereas true buffalo can be found in Africa and Asia. French explorers came to the Americas and started calling bison "les boeufs", which was eventually translated to "buffalo" by English settlers. Today, buffalo is an acceptable synonym for bison, although the scientifically correct name is bison.

Historically, bison were native to Pennsylvania, but they were truly predominant in the Midwest. Before Europeans began to settle in North America, there were millions of bison roaming the plains. During the westward expansion of the 1800's, many bison were killed in collisions with trains. In addition, the government was trying to force the Native Americans to move to reservations. Since bison were the primary food source for the Native Americans, the government began to kill off the bison in order to force the Native Americans to comply. By 1900, bison were in danger of becoming extinct and there were as few as 1000 animals left. A group of concerned citizens led by William T. Hornaday lobbied for legal protection of the bison and they began to make a comeback.

Today, there are about 200,000-300,000 bison in North America with a free-roaming herd still remaining in Yellowstone National Park. Most bison today are raised on farms and preserves. They have become increasingly popular in recent years because their meat is very lean and low in cholesterol. It also has a flavor comparable to beef.

The **gestation** period for a female bison is about 9 ½ months. One calf is born in the spring. Calves weigh about 35-60 lbs. at birth. Full-grown females can weigh up to 1000 lbs and full-grown males can top 2000 lbs. Because they are such large animals, people often mistakenly think they are slow, lumbering animals. Bison are actually quite agile, reaching speeds of up to 30 miles per hour. They are weather tolerant animals that originally ranged from Canada to Mexico.

Texas Longhorn Cattle

Texas Longhorn Cattle are not native to the United States. Texas Longhorn Cattle originated from the Longhorn Cattle of Spain, which were a crossbreed between black and white Spanish cattle and red Indian Cattle. Christopher Columbus brought Longhorn Cattle of Spain to the Americas on his second voyage in 1493. He dropped them off in Florida and they began to populate the United States. During the next 300 years, the Longhorn Cattle of Spain evolved into a separate species. Their hooves became hard, making it easy for them to walk long distances over rough terrain. Calves are small, weighing only 35 lbs and taking 5 years to reach maturity, compared with 2 years for European cattle. Texas Longhorns can eat and digest almost anything, and their meat is very lean (low in fat).

In the 1800's when people started to populate the Midwest, they found that the Texas Longhorn Cattle were easy to herd. They would herd the cattle to Kansas City and ship them via train to the East. People did eat the meat, but they truly sought after the fat. Meat was a byproduct; there was no refrigeration, so the meat had to be eaten when it was fresh. The fat was used for cooking and in oil lamps. However, Texas Longhorn Cattle are lean animals; they don't have much fat. Nobody wanted to wait five years for the calves to reach maturity if they couldn't get the fat they were after. As a result, almost nobody wanted to raise Texas Longhorn Cattle. Six individual families in Texas raised Texas Longhorns, and there was a government herd at the Wichita National Wildlife Refuge in Oklahoma. These seven groups preserved the species; without them, Texas Longhorn Cattle probably would have gone **extinct**. They are becoming more popular today because their meat is so low in fat. Longhorn meat has less fat than chicken, turkey, and venison.

The **horns** are made of **keratin**, which is the same substance that is in our fingernails. Both male and female animals have horns. The horns begin to grow when the animal is a few months old and they continue growing for its entire life. During the first year, the horns can grow up to 8 inches. This growth slows down considerably as the animal ages; ½ inch of growth per year is average for animals in their 20's and 30's. They can live to be 35 years old. Females can weigh up to 1600 lbs, males can weigh up to 2000 lbs. Color varies considerably among animals; black and white parents could yield an all red calf.

Compare and Contrast: Bison and Texas Longhorn Cattle

Bison and Texas Longhorn Cattle are closely related, although there are some differences between them. They are in the same scientific family, the **Bovid**, or cow family. Bison have heavy heads that cannot be raised to shoulder level. Bison have 14 ribs; cattle only have 13.

Both bison and Texas Longhorns almost went extinct during the 1800's and early 1900's. Bison were purposely killed off, whereas Texas Longhorns were considered "unpopular" by ranchers due to their low fat content. Both animals rebounded from the brink of extinction due to government regulations and individuals who preserved them.

Penn's Cave Wildlife: Deer and Elk

White-Tailed Deer

The whitetail deer is the state **mammal** of Pennsylvania. Males are called **bucks** and can weigh up to 300 pounds, whereas females (**does**) can weigh up to 150 pounds. The maximum lifespan of a whitetail deer is determined by the animal's teeth. Around age 11, the teeth begin to wear out and the ultimate cause of death is starvation.

The best way to determine the age of a deer is to examine its teeth. The **dentine** is the dark material in the tooth and it is visible as the hard **enamel** is worn away. Therefore, a deer with more dentine showing is older. This method is called the **tooth wear and replacement** method and it is not 100% accurate due to differences in habitat and diet. A more accurate method is to remove a tooth, cut a cross section, and look at it under a microscope. A layer of cementum forms on the tooth each winter, so counting the layers gives an accurate estimate of age.

Whitetail deer are **browsers**, which means they like to eat woody plants and shrubs. They will also eat mushrooms, mast crops, clover, and alfalfa. Sometimes they will eat grass, but only as a last resort.

Antler growth is influenced by **hormones**, and usually only bucks develop **antlers**. However, there have been documented cases of females growing antlers due to a hormone imbalance, although this is rare. The size of a buck's antlers is determined by age, genetics, and nutrition. Therefore, it is not always true that a buck with large antlers is old. Antlers begin to grow in the spring. Growing antlers are made of **cartilage** and surrounded by an outside layer of skin and blood vessels, which provide nutrients to the growing antlers. The antlers are covered by tiny hairs called velvet. During peak growth, antlers can grow up to an inch every day. At the end of the summer, the antlers turn to bone during a process called **ossification**. This coincides with hormonal changes due to the coming onset of the breeding season and blood supply to the antlers shuts off. The outside layer of skin, blood vessels, and velvet will come off. Bucks will use their hardened antlers to determine breeding rights. At the end of the winter, bucks shed their antlers and new ones will begin to grow again in the spring.

Females give birth in late May and early June. Usually, whitetail deer will have twins or sometimes triplets. Babies weigh about 5-6 lbs. They have white spots on their backs to help them blend in with their surroundings and they emit virtually no odor for the first few weeks of their lives. Mother deer instinctively know that in order to keep their babies safe, they must not stay with them for too long. The mother's scent could attract predators to the babies. Babies will lie very still in the tall grass and the mother comes back periodically throughout the day to feed them. If you find a baby deer lying by itself, leave it alone. The mother will be back to care for it soon.

Elk

Elk are members of the deer family. Males (**bulls**) can weigh up to 1000 pounds and females (**cows**) can weigh up to 600 pounds. The maximum lifespan is about 17 years and is determined by the condition of the animal's teeth. Calves are born in late May or early June and the average number of offspring is one. Elk are **grazers**, meaning their diet consists mainly of grass. They will also eat mushrooms, mast crops, clover, alfalfa, and sometimes browse.

Bulls develop antlers each year. When they are one year old, they will get one single spike on each side. Every year afterward, they will develop multiple tined antlers. During the breeding rut, bulls will defend groups of cows called **harems**.

The subspecies of elk native to PA was the **Eastern elk**. When early settlers arrived, the Eastern elk was harvested to the point of extinction. Between the years of 1913 and 1926, 177 elk from the **Rocky Mountain** subspecies were introduced to PA. Today, there are between 500 and 600 Rocky Mountain elk living wild in PA. They are concentrated in the north central part of the state and they are managed by hunting. It is important to harvest some of the elk each year because they have no natural predators in Pennsylvania. Without some form of population control, there would soon be too many elk for the habitat to support.

Compare and Contrast: Deer and Elk

Deer and elk are both members of the same biological family (the **cervid**, or deer family). They have their offspring at the same time of year. They have multi-chambered stomachs to aid in digestion of plant material which is rich in cellulose. This allows them to "chew their cud" and extract important nutrients from their food. Only the males of both species develop antlers. Deer and elk both live in the wild in Pennsylvania today. Their lifespan is determined by the condition of their teeth.

Deer often have twins or triplets, whereas elk only have one calf each year. Deer are **browsers**, but elk are **grazers**, which is why deer and elk can live together in the same habitat; they prefer to eat different things. Elk are the only members of the cervid family that have upper incisors; deer lack upper incisors. Deer are smaller than elk, and elk can live longer than deer.

Genetics: The Punnet Square Activity

Age/Grade Appropriateness

Grades 9-12

Key Concepts

Genetics

Probability

Background

Several deer at Penn's Cave Wildlife Park are white. At first glance, they may appear to be **albinos**, but if you look closely, you will notice that they do not have pink eyes. Our white deer are **piebald** deer. Piebaldism is a **recessive** trait; both the mother and father must pass a copy of the gene along to the offspring in order for it to occur. In the wild, piebald deer are often brown with patches of white. In captivity, breeding piebald deer together eventually produces all white deer.

Individual traits are determined by **genes**, which are inherited from parents. Genes come in pairs. A **dominant** gene will overshadow a recessive gene. For example, the gene for brown eyes is dominant over the gene for blue eyes. If you inherit one brown-eyed gene from your father and one blue-eyed gene from your mother, you will have brown eyes. If you have blue eyes, it means you must have inherited a blue-eyed gene from each parent, because the recessive trait is only shown when you inherit a copy of the recessive gene from each parent.

A **Punnet Square** is a tool that makes it easy to see the possible outcomes from a combination of genes.

Activity – Punnet Squares

Purpose

Students will learn to use a basic Punnet Square to study genetics.

Procedure

Have students reconstruct the following table. Instruct them to label the top row with the father's genes and the left column with the mother's genes. In this example, the mother has two blue-eyed genes (designated by **b**) and the father has two brown-eyed genes (designated by **B**). The four **RED** cells represent the possible outcomes for their children. Remember, brown (**B**) is dominant.

Eye Color	B	B
b	bB	bB
b	bB	bB

Ask: What is the probability that a child will be born with brown eyes?

Answer: 100% (brown is dominant and it overshadows blue).

This time, suppose the father has brown eyes, but he is carrying a recessive blue-eyed gene.

Eye Color	B	b
b	bB	bb
b	bB	bb

Ask: What is the **probability** that a child will be born with brown eyes?

Answer: 50%, or 1:2

Now, try to use a Punnet Square to study the genetics of piebald deer. In this example, the mother is white and the father is brown but carries a recessive piebald gene. Piebald is designated by **p** and normal colored is designated by **N**. Normal is dominant.

Fur Color	N	p
p	pN	pp
p	pN	pp

Ask: What is the probability that a baby will have the piebald gene?

Answer: 100%

Ask: What is the probability that a baby will have a white coat?

Answer: 50% (2 out of 4, or ½)

Ask: Is it possible for two “normal” parents to have a piebald baby?

Answer: Yes, if they are both carriers of the gene. Try this situation in a new example.

Fur Color	N	p
N	NN	Np
p	pN	pp

Ask: What is the probability that two “normal” parents will have a piebald baby?

Answer: 25%, or one in 4

Penn's Cave Wildlife: Wolves

Wolves

In the wild, wolves live in social groups called **packs**. A wolf pack usually consists of five to nine individuals. The pack leader is the **Alpha male**; his mate is the **Alpha female**. The Alpha male and female are the only ones that breed. Other members of the pack assist in raising the pups.

All domestic dogs are descendants of the wolf, but there are some key differences between wolves and dogs. First, a wolf walks in a straight line, placing its rear foot where its front foot just was, whereas a dog walks a staggered line. In addition, wolves fold their ears against their heads when they walk, but domestic dogs will keep their ears forward and upright. Curved canine teeth help a wolf to catch its prey and tear meat, whereas a domestic dog has straight canine teeth. Finally, as in most wild animals, a wolf will shed its entire coat twice each year. Domestic dogs shed constantly.

The average lifespan of a wolf is 12-14 years and they weigh between 50-100 lbs. Wolves howl for various reasons. Sometimes, howling allows wolves to warn other wolf packs that might be approaching their territory. Often wolves howl because they enjoy it; howling helps to strengthen the pack bond. A wolf pack can roam a territory several square miles in size and they can run up to 35 miles per hour.

The **Timber wolf** is the wolf subspecies that was historically native to Pennsylvania. The newly formed United States government wanted to make the New World a safe place for people to live with their families. People were afraid of large predators like wolves and mountain lions; they didn't understand the important role that predators play in an ecosystem. In order to eliminate the large predators, the government issued a **bounty** payment. As a result, timber wolves no longer live in Pennsylvania. They can be found in the wild today in southern Canada, northern Michigan, and northern Minnesota.

Public attitudes about predators began to change after the passage of the Endangered Species Act in 1973. In 1995 and 1996, 66 wolves from Canada were trapped and reintroduced in Yellowstone National Park and central Idaho. The reintroduction was successful and wolves are once again reproducing and thriving after many years of absence.

The wolves at Penn's Cave & Wildlife Park are gray wolves that were born and raised in captivity and have been spayed or neutered. Our goal is not to breed animals, but to inspire respect for nature by educating people about these magnificent animals and their habitats.

Animal Communication Activity

Age/Grade Appropriateness

Grades 3-6

Key Concepts

Observation

Group Discussion

Background

Being able to communicate is very important to us as human beings. We use communication to ask for things we need, such as food or water. We use communication to express how we are feeling and to learn about the world around us.

Animals communicate with each other in many different ways. Some animals use sound, scent, special colors, and body language.

Pre-Activity Discussion

Ask students to brainstorm ways in which they communicate to their friends, teachers, and pets. They should be able to provide at least three specific ways in which they communicate, such as writing an e-mail, waving goodbye, or through poetry or music.

Next, ask students to brainstorm how animals communicate to humans and to each other. Animals communicate through scent, vocalizations, movement, and contact with other animals.

After students have completed both lists, ask them to compare and contrast their personal communication methods with those of animals.

Vocabulary Words

Scent – A distinctive odor

Territory – An area where an animal lives and defends against intruders

Pheromone – A chemical given off by an animal that affects the behavior of other animals of the same species

Scent glands – A special skin gland that gives off a strong odor used to signal other animals or for self defense

Jacobson's Organ – Special scent receptors in an animal's mouth

Activity 1 – Common Scents

Purpose

To gain insight into olfactory (scent) communication in animals and humans

Materials

Plastic film canisters with holes punched in the lids

Various scented items to put inside the film canisters, such as coffee beans, orange peel, rubbing alcohol, cinnamon, etc.

Procedure

Divide students into groups of four. Each group member will smell the four canisters without opening the lid and try to guess what is inside. Gather the groups together and reveal the scents in each container.

Discussion

1. How do humans use their sense of smell? **To alert us if something is wrong (i.e. fire), to know when dinner is ready, etc.**
2. How might our sense of smell help us determine what is safe to eat? **If it smells bad, it might be spoiled and not safe to eat.**
3. What are ways animals might communicate using scents and smells? **Skunks – warn predators to go away. Turkey vultures – one of the few birds with a keen sense of smell – uses smell to locate food (carrion). Bobcats – mark territory with urine and scat.**
4. What is a territory? **A place where an animal lives and defends against intruders.**
5. How do your pets use their sense of smell when interacting with you? **Pet cats and rabbits have scent glands under their chins. They will rub their chins on furniture and people to mark their territory. Your dog will sniff you when you come home to determine where you've been.**

Activity 2 – Body Language

Purpose

This activity will give students the opportunity to experience body language communication first hand while relating this experience to animal communication.

Procedure

Before the lesson, gather reference material about body language as a means of communication in humans or animals. Pictures of people or animals using body language to communicate would be very helpful. Jumpstart the discussion by asking students to figure out what message the person or animal is trying to communicate based on the body language in the picture.

Have students take turns using body language to communicate the emotions of sadness, fear, surprise, happiness, disgust, love, hunger, and anger in front of the class. These emotions can be expressed using gestures and body language. Other students should be

able to guess what message is being relayed. Ask students to give examples of how and why animals might communicate these emotions.

Discussion

1. How do humans use body language to communicate?
2. Is waving good-bye a form of body language?
3. How effective is body language as a means of communication?
4. How is sign language effective in communicating needs and desires?

Field Trip Activity

Students should complete the table below (table is shown here already completed). For each animal, give a specific example of how that animal communicates, corresponding to each category (scent, vocal, body language). If the animal does not use one of these methods, leave that box blank. This activity can be completed at Penn’s Cave Wildlife Park or after you return to school.

ANIMAL	SCENT	VOCAL	BODY LANGUAGE
Whitetail deer	Smell food before eating	Grunt	White tail flicking in the air, signaling alarm
Elk	Smell the air	Grind teeth together	Males lock antlers in dominance displays (mating season only)
Bison	Mothers recognize calves	Huff	Charge each other
Texas Longhorn Cattle	Smell the bus; looking for food	Moo	Follow each other
Wolves	Marking territory	Growl, whine, howl	Lick each other’s lips (submissive behavior), roll over (submissive behavior), kick dirt
Bears	Stand on hind legs to smell	Growl	Put paws in water, sit by fence, play
Bobcats	Open mouth to engage Jacobson’s organ (special organ in mouth that enhances smell), mark territory	Purr, growl, hiss	Pounce, hold ears back, pace, scratch
Cougars	Mark territory, sniff air	Chirp, purr	Prowl, pace, scratch
Nyala (African museum)			Female’s posture shows she’s interested in the male
Springbok (African museum)			Jumping in the air to alert others that a lion is approaching

Penn's Cave Wildlife: Black Bears

Three species of bear can be found in North America: The grizzly or brown bear (*Ursus arctos*), the polar bear (*Ursus maritimus*), and the black bear (*Ursus americanus*). Of the three, only the black bear is native to Pennsylvania. Because of their shy nature and large size, black bears are often misunderstood and feared.

Black bears are **omnivorous**, which means they eat a variety of different things; opportunistically feeding on whatever is most convenient or seasonally available. They will eat meat if the opportunity presents itself – a recent study by the Pennsylvania Game Commission and Penn State University showed that black bears prey upon more fawns than previously thought. They prefer to eat nuts, berries, vegetables, acorns, seeds, and roots, which make up as much as 75% of their diet. They will also occasionally eat carrion, eggs, frogs, fish, and insects. They especially love bees and their honey. They have a sweet tooth and an excellent sense of smell and are attracted to bird feeders, garbage cans, and campsites where human food is present.

Black bears mate in the spring and early summer. The fertilized eggs do not implant until after the female enters her state of dormancy in autumn. This is called **delayed implantation** and it insures that the female has enough fat stores built up to nourish the developing embryos through the winter. The cubs are born in January or February and the average number of offspring is 3. The babies will stay with their mother for about a year and a half. Male bears have been known to kill cubs so the female will come back into heat and be receptive to mating again.

In Pennsylvania, the population is expanding into more rural areas and people are reporting more conflicts with black bears. Most bears in the wild are more afraid of us than we are of them; black bear attacks on humans are extremely rare. If you encounter a black bear in the wild, stay calm and slowly move away from the animal. Do not make direct eye contact. If the bear charges at you, wave your arms and scream in an effort to drive it away. If it attacks, fight back. Bears have been driven off with rocks and sticks.

Fur color can range from black to light brown. At Penn's Cave & Wildlife Park, our three bears show three different color variations; Colonel is all black, Oscar is black with a white spot on his chest, and Thrasher is a **cinnamon phase** black bear. The cinnamon phase is not very common here in the east; it is seen in less than 2-3% of wild black bears. In the west, cinnamon bears are more common and make up 20-30% of the population. There are two theories as to why this might be. The first is that brown fur might not absorb as much heat as black fur in the hot western climate, and thus a cinnamon bear would have a survival advantage. The second theory is that a cinnamon bear gains a survival advantage because it more closely resembles the formidable grizzly bear.

Penn's Cave Wildlife: Bobcats and Cougars

Bobcats

The bobcat (*Lynx rufus*) is Pennsylvania's only wild cat. They can be found in almost every habitat throughout North America because they are so adaptable. Bobcats are about twice the size of an average housecat, weighing about 15-20 lbs on average. Larger individuals can weigh up to 40 pounds, and males usually weigh more than females. Many people mistake the bobcat for the Canada Lynx, which is not found in Pennsylvania. Although at first glance the two may look similar, there are some key differences between the two. First of all, bobcats have black only on the top of the tip of their tail, whereas the tip of a lynx's tail is completely encircled in black. Secondly, the lynx has longer ear tufts and a larger ruff of fur around its neck, making it appear larger than the bobcat. Finally, although bobcats and lynx are both **carnivores**, the lynx is a picky eater – most of its diet consists of snowshoe hares. The bobcat, in contrast, can eat many different animals such as squirrels, rabbits, frogs, mice, fish, and sometimes an occasional sick or injured white-tail deer.

Bobcats are **nocturnal**, which means they are most active at night. They have more rods than cones in their eyes and slit-shaped pupils that can open wide to emit light. **Rods** are the cells that see black and white and **cones** are the cells that see color; thus, bobcats are colorblind but they can see in the dark. They have sharp retractable claws like a housecat and they are very well **camouflaged** to blend in with their surroundings. Bobcats spend most of their time during the day in treetops or rocky outcrops. It would be easy to pass right by a bobcat in the woods without knowing it.

Bobcats can live up to 13 years in the wild and even longer in captivity. Bobcats are **solitary** animals by nature and will mark and defend their territories against other bobcats. Males and females will spend brief amounts of time together during the breeding season. Kittens are born in the spring and will stay with their mother until autumn.

Optimal habitat for bobcats consists of remote areas with brushy vegetation. In the early 1900's, much of Pennsylvania was brushy second growth forest with an abundant supply of prey for bobcats. As the forests matured and people continued building towns and roads, bobcats became more and more scarce. In 1970, bobcats were granted protection under a new law and their population began to rise. Studies in the 1980's helped wildlife biologists better understand the habitat needs of bobcats.

At Penn's Cave & Wildlife Park, you will meet Tom Kat and Kit Kat. This brother and sister pair was born in captivity in 2004 and they are both spayed/neutered.

Cougars

Did you know that cougar, puma, mountain lion, and catamount all mean the same thing? Early settlers in the New World were curious about the mysterious big cat in the forest – they thought all the skins came from female lions because none of them had a mane like the male African lion. Some settlers called the cats panthers because they resembled the panthers of the Old World. The latin name for the cougar is *Puma concolor*, which means cat of one color.

Cougars originally ranged from Yukon to Chile, the largest range of any western terrestrial land mammal. Conflicts with cougars arose when Spanish explorers brought livestock to the New World. During European colonization of the new world, cougars were hunted and forced into three strongholds: the Rocky Mountains, Olympic Peninsula, and Florida Everglades. When Theodore Roosevelt took office in 1901, he established a policy on eliminating predators. Thousands of cougars were bounty hunted over the next 50 years. At this point in time, the discipline of Wildlife Science emerged. People started to realize that without cougars, there were too many deer that were stripping the range bare and destroying habitat for other animals.

The Nittany Lion has been Penn State's mascot since 1907. According to the Legend of Penn's Cave, the name Nittany came from the Indian Princess Nittanee.

Cougars have round pupils for daytime and nighttime hunting. Their eyes are set close together and they have excellent depth perception. They can weigh between 85-225 pounds. Cubs can be born at any time of the year and the average number in a litter is 2-3. The cubs are spotted when they are first born so they can stay hidden in the den while their mother hunts. They will stay with their mother for 1 ½ to 2 years and accompany her on hunts when they are about 6 months old.

Our cougars, Apache and Seneca, were born in June 2006 at Game Park Safari in Oregon and came to us when they were about 8 weeks old. They are brother and sister and are both spayed/neutered. Cougars are solitary animals in the wild, but when raised together in captivity they become very attached to one another.

Compare and Contrast: Cougars and Bobcats

Although both cougars and bobcats were both originally native to PA, only the bobcat remains in the state today. Bobcats are primarily nocturnal and they have slit pupils whereas cougars are active at any time and have round pupils. Bobcats are small cats with short tails and cougars are much larger with long tails. Both are members of the "small cat" subdivision of the feline family. Large cats, like the African lion and jaguar, have a flexible cartilage in their throat that permits them to roar. Small cats, like the cougar and bobcat, lack this cartilage so they purr instead. Cougars and bobcats are both spotted when they are born, but only bobcats retain their spots into adulthood. Both cats have been affected by humans – bobcats indirectly through habitat destruction and cougars directly through bounty hunting.

Predators and Prey Activity

Age/Grade Appropriateness

Grades 3-5

Key Concepts

Relationships between predators and prey

Background

The University of Georgia Savannah River Ecology Laboratory (SREL) has some excellent programs for kids on predator-prey relationships. This activity has been adapted from their Kids Do Science program. Visit their website and follow the link for a PowerPoint slide show that will give a good background for this activity.

<http://www.uga.edu/srel/kidsdoscience/kidsdoscience-predator-prey.htm>

Vocabulary

Camouflage – Blending in with surroundings to hide from predators

Carnivore – An animal that eats other animals

Carrion – An animal that is already dead

Consumer – An animal that eats plants or sometimes other animals

Decomposer – A tiny living organism at the bottom of the food chain that breaks down dead plants and animals

Detritivore – An animal that eats detritus

Detritus – Non-living organic matter such as decaying leaves

Ecosystem – All the plants and animals that live together in a specific area that is characterized by things like climate, landforms, and rainfall

Food chain – The transfer of food, or energy, among animals and plants

Herbivore – An animal that eats only plants

Insectivore – An animal that eats insects

Mimicry – When one animal is better able to survive when it looks like another animal

Niche – the role an animal plays in its environment, or its “job”

Omnivore – An animal that eats plants and animals

Predator – An animal that gets food by killing and eating other animals

Prey – An animal that is hunted or eaten for food

Producer – Plants at the bottom of the food web that provide food to herbivores and omnivores

Activity 1 – Predator-Prey Interactions

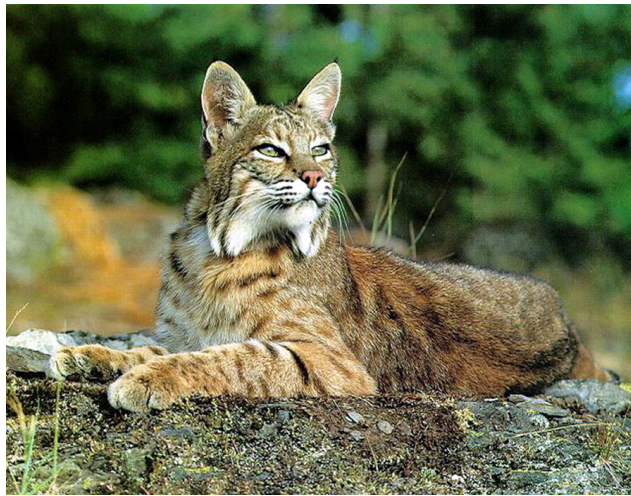
Purpose

Students will become familiar with predator/prey relationships through a game in which they will “stalk”, “kill”, and “eat” as many prey as they can in five minutes. This activity will reinforce concepts of food quality and prey adaptations.

Materials

- Print out the predator species cards and laminate or place them in plastic page protectors for durability. “Predators” wear the cards around their necks to remind them which prey species they must locate during the game.
- Make templates of prey animals and cut 1/3 of the prey from brightly colored paper that can be distinguished from the backgrounds of the room. The remainder of the prey is cut from digital photographs of objects and surfaces in the actual room. This ensures that many of the prey are camouflaged in the room, making it more difficult for predators to “find” their food sources.
- Print and make copies of the Predator-Prey Activity Data Sheet and give one copy to each student. Students will need to carry these with them during the activity, as well as a pencil or pen.
- Sticky notes

Predator Species Cards



David Westphalen ©

I am a **bobcat...**
I eat **rabbits and mice**



© Wolf Haven International

I am a **gray wolf**...
I eat **deer and rabbits**



Washington Department of Fish and Wildlife ©

I am a **cougar**...
I eat **deer**



I am a **screech owl**...
I eat **mice, snakes, and frogs**



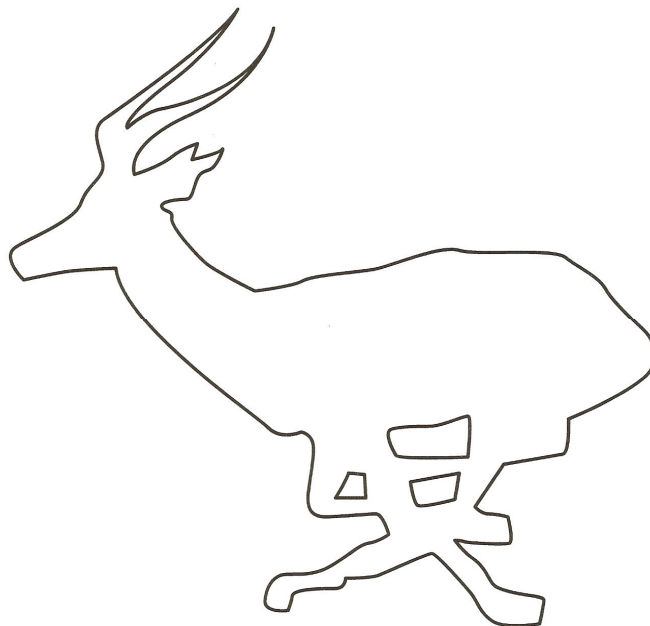
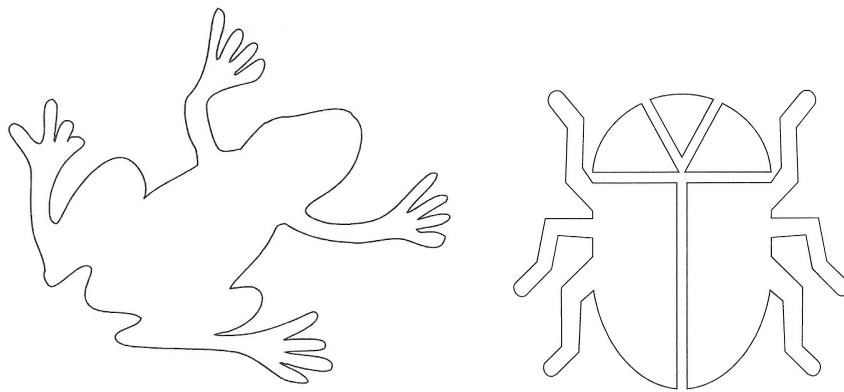
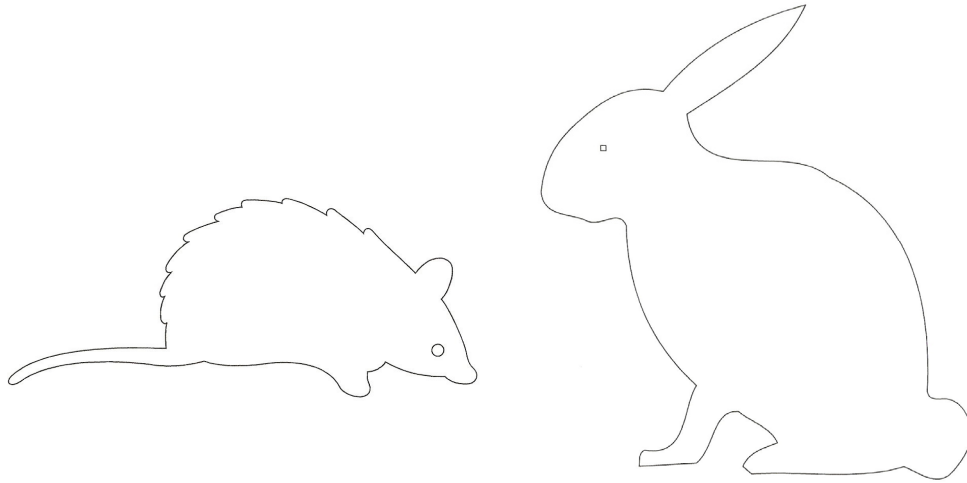
Mark Byart ©

I am a **black bear**...
I eat **insects and fawns**



I am a **bat**...
I eat **insects**

Prey Species Templates



Predator-Prey Activity Data Sheet

I am a **PREDATOR** (circle one)

Bobcat Gray Wolf Screech Owl Cougar Black Bear Bat

The **PREY** I eat are:

Rabbit Mouse Deer Insects Frog

My DATA

I found prey at:

	Type of Prey	Location in Room
1 st Prey		
2 nd Prey		
3 rd Prey		
4 th Prey		
5 th Prey		
6 th Prey		
7 th Prey		
8 th Prey		

What I ate (my data summary):

Possible Prey Species	Total of each prey I “ate”
Rabbit	
Mouse	
Deer	
Insects	
Frogs	

Examine the Predator’s Survival Guide under *Game Rules*. Did you find enough to survive?

Did other predators the same as you find **more** or **fewer** prey items than you did?

GAME RULES

1. **Predators** can only eat certain **Prey** items.

Predator eats:	Prey
Bobcat	rabbits and mice
Gray wolf	deer and rabbits
Screech owl	mice and frogs
Cougar	deer
Black bear	insects and deer
Bat	insects

2. **Predators** cannot talk to other **predators**; they must be *stealthy*, although they can make predator noises.
3. Predators have **5 minutes** to stalk and locate their prey.
4. When a predator finds an item that it can eat, it must **kill it** (by placing a sticky note on it) and **take time to eat it** (by recording the location of the prey in the Data Sheet). Other predators cannot kill a prey item that is already dead!
5. After 5 minutes, predators must return to their “refuges”.

Predator Survival Guide (Prey needed to stay alive)

<i>Predator</i>	<i>To survive it needs to eat:</i>						
Bobcat	2 rabbits	Or	5 mice	Or	1 rabbit & 3 mice		
Gray wolf	2 deer	Or	5 rabbits	Or	1 deer & 3 rabbits		
Screech owl	3 mice	Or	3 frogs	Or	2 mice & 1 frog	Or	1 mouse & 2 frogs
Cougar	3 deer						
Black Bear	10 insects			Or	1 deer		
Bat	15 insects						

Animal Tracks and Sign Activity

Age/Grade Appropriateness

This activity can be used for any age group. It can be modified to make it less time consuming by bringing finished plaster casts made by the teacher to class or by encouraging older students to make plaster casts on their own as homework or for extra credit.

Key Concepts

Observation
Research

Background

Studying mammals is often quite difficult. Unlike birds which are conspicuous, brightly colored, and **diurnal**, most mammals are inconspicuous, well camouflaged, and active at night. For these reasons, mammalogists, or scientists who study mammals, often look for signs that an animal is living in an area. Tracks are perhaps the most obvious indicators that an animal is close by, but other signs include **scat** and **browse**. In order to use tracks and signs to learn about animals, it is important to learn what to look for and how to interpret your findings.

The features of the tracks can give us information about the animal itself. For example, if the front tracks are bigger than the back, what does this tell us about the distribution of weight of the animal? Which animals would have this pattern? Does the animal place its whole pad down or does it walk on its “toes”? What might this mean?

A series of tracks can tell us a story. For example, perhaps two animals were traveling together to find food, or one animal was chasing another animal, or baby animals were following their mother to the den.

The best tracks are found in mud or soft soil or sand. Look near a pond or riverbank in the early morning, since most mammals are active at night and would visit the water to drink. Tracks are easy to see in the snow, but remember snow can melt and make the tracks appear larger than they are naturally.

Vocabulary and Supplemental Information

Plantigrade – An animal that walks on its entire foot. Examples: bears, humans

Digitigrade – An animal that walks on its toes, or “digits”. Examples: bobcat, wolf

Unguligrade – An animal that walks on its hooves, or toenails. Examples: deer, elk

Diagonal walkers – Move opposite limbs together, right foreleg with left back leg.

Examples: cats, dogs, and hoofed animals

Bounders – Hop in steady series of jumps, forelegs first and back legs pulling right behind them. Examples: most weasels except skunks, badgers and wolverines

Gallopers – These animals hunch down and bring hind legs in front of back legs. Examples: most rodents and rabbits.

Pacers – They shuffle along but move from pacing to bounding as they go faster. Examples: Wide-bodied animals such as raccoons, opossums, black bears, beavers, porcupines, wolverines, badgers, and skunks.

Families: (adapted from Tom Brown's Field Guide to Wilderness Survival 1983 NY: Berkley Press)

Cat family: Rounded tracks with four toes on both front feet and back feet. Claws are retracted and don't show. They place back paws where the front paw just was. Try following a house cat around and see what you can learn about their range and activities. Wild cats, of course, have a wide range from their home den.

Dog family: Four toes in front and back with claws showing. They walk with the back feet falling just behind the front feet. Follow a pet dog and see what you can notice about its range and activity. Wild dogs tend to have scent piles to which they return, and more than one den.

Weasel family: Five toes in front and five in back, with claws usually showing. Skunk-like smell.

Raccoons, opossums, and bears: Five toes in front and five in back, with claws usually showing. Opossums and raccoons will have a distinct thumb print from the front foot. Raccoons travel around water, opossums live in logs or stumps, and bears travel widely and spend the winter in their dens.

Rodent family – four toes in the front and five in the back, with some five and five. These are gnawing vegetarians.

Rabbit family – Fur on the bottom of the feet, thus it will be difficult to distinguish the toes. The entire back foot touches the ground and is much larger than the front foot.

Hoofed mammals – Tracks are heart shaped.

Activity 1 – Making a Plaster Cast

Purpose

Students will look for wild animal tracks and create a plaster cast of the track. Then, they will identify the animal that made the track. As an alternate project, students can be asked to draw the track.

Materials

Plaster of Paris
Mixing container
Stick or spoon for mixing
Water
Thin cardboard strips (optional)

Procedure

Find a good track that shows a lot of detail. If needed, gently remove any leaves or sticks that have fallen into the track. You can very gently blow away some of the excess dirt, but be careful not to destroy the track. If you want, you can use the cardboard strip to form a wall around the track to contain the plaster. This is useful if the track is on a slope and the plaster will run out. Pour dry plaster into your mixing container. Then, pour in some water and mix with a stick or spoon until you have plaster that is about the consistency of pancake batter. Slowly pour the plaster into the track, being careful to get plaster into all the toes and claw marks. You can let the plaster overflow the edges of the track. Let it dry for about half an hour. To check for dryness, knock gently on the plaster. If it has a ceramic sounding ring, it is dry enough to pick up. If the plaster is still mushy, leave it to dry longer. Some plaster, especially art casting plaster, can take an hour to dry. The plaster used by carpenters is best because it dries quickly. When you pick up the track, try not to grab the edges as these sometimes break off. It's best to lift the track from underneath. You can use a stick or knife to get under the track and lift. Be careful if you do this with a big track as this can cause the casting to crack. After you've picked up the cast, let it dry overnight before trying to get the dirt off. Some dirt will not wash off. You can paint the casting if you want. Casting in snow can be difficult because the plaster generates heat as it dries. Try misting the snow with water from a spray bottle. Let the water freeze for a while. This may firm up the track enough to make a casting. Castings may be taken home or back to class for further study. Identify the animal that made it and look up information about the animal's life history.

Tip: To make the plaster dry quicker, add a little salt to the mixture. Be careful; it dries really fast. To slow down the drying process, add a little vinegar.

Discussion

Students should be able to answer some basic questions about their track.

What shape is the track? How many toes did the animal have? Where did you find the track? What do you think the animal might have been doing when it made the track? Try to come up with at least two possible answers.

Find a partner with a different track and compare the two. How are they the same? How are they different?

Visit http://www.concord.org/~btinker/guide/tracks/tracks_activities.html for more information on animal tracking as well as a list of books and resources for further study.

Glossary

This glossary includes all vocabulary words not already listed in the Activities sections. Vocabulary words can be identified in throughout the packet by **bold face** type. Not all vocabulary words are suitable for all age levels, so feel free to pick and choose the ones that will best suit your students.

Adaptation – Any adjustment to environmental conditions that enables an animal to survive

Albino – Lack of pigmentation – an albino usually has white fur, pink or blue eyes with a red pupil, and very light skin

Alpha wolf – The animal at the top of the social hierarchy of a wolf pack

Antler – Bony structure that grows from the head of a member of the deer family

Bovid – Cow family – characterized by unbranched, permanently attached horns

Bounty – A payment to encourage the destruction of “bad” or unwanted animals

Browser – An animal that eats mostly woody plants and shrubs, but also some fruits, mushrooms, crops, and grasses

Buck – A male deer

Bull – A male elk

Cartilage – A soft tissue in antlers that eventually hardens into bone

Cementum aging – A way to determine the age of an animal by counting the layers of cementum deposited on a tooth

Cervid – Deer family – characterized by antlers that are not permanent – they fall off and grow back year after year

Cinnamon phase – A color variation in black bears that is seen in 2-3% of wild bears in Pennsylvania

Climate – Environmental conditions that characterize an area, such as precipitation, wind, and temperature

Cone – A cell in the eye that “sees” color

Cow – A female elk

Delayed implantation – Seen in black bears; the fertilized eggs do not implant until after the female enters her state of dormancy in autumn sometime after breeding actually occurs

Dentine – A dark material harder and denser than bone that composes the inside of a tooth

Diurnal – Active during the day

Doe – A female deer

Dominant – Overshadowing or the trait that comes through in a gene pair

Eastern elk – The subspecies of elk living in Pennsylvania when early settlers arrived

Enamel – The substance that covers the outside of a tooth

Extinct – All members of a species die off; the process by which a species becomes gone forever

Gene – A unit of inheritance found in DNA

Gestation – The amount of time it takes for a baby to develop inside the mother

Grazer – An animal that eats mostly grass, but will sometimes eat woody plants and shrubs, fruit, crops, or mushrooms

Habitat – The place or environment where an animal normally lives

Harem – A group of female elk defended by one male during the breeding season

Hormone – Cells that circulate in the body to stimulate other cells or processes

Horn – A permanent projection growing from the head of an animal- in members of the bovid family, the horn is made up of keratin

Keratin – Substance that makes up the horns of animals in the cow, or bovid family- also found in our hair and fingernails

Mammal – An animal that is warm blooded, has hair, and produces milk to feed its young

Nocturnal – An animal that is most active at night

Ossification – the process of turning to bone

Pack – A family group of wolves

Piebald – A recessive trait that is characterized by spotted or blotchy colored fur – in deer, they can be bred to be all white

Punnet square – A tool that helps someone to figure out probabilities of gene transfer to offspring

Recessive – A gene that can be carried without showing – will be overshadowed by a dominant gene

Rocky mountain elk – The subspecies of elk native to the rocky mountain area – introduced to Pennsylvania and now found wild in the state

Rod – The cells in the eye that allow us to see black and white

Scat - Droppings

Solitary – Animals that prefer to live and hunt by themselves

Timber wolf – The species of wolf that was originally found in Pennsylvania but can be found today in Michigan, Canada, and Minnesota

Tooth wear and replacement method – A way to determine the age of an animal using the condition of the teeth and the number of teeth present

Resources and Additional Information

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