Endangered Species Project Resources

Project Based Learning- How do humans affect species in their habitat?

The following resources can be used to help guide the discovery of how endangered species are being affected by humans around the world.

Online Resources

- U. S. Fish and Wildlife Service- Endangered Species Database:
  - [https://www.fws.gov/endangered/](https://www.fws.gov/endangered/)

- WWF: Endangered Species List and Facts:
  - [https://www.worldwildlife.org/species/directory?sort=extinction_status&direction=desc](https://www.worldwildlife.org/species/directory?sort=extinction_status&direction=desc)

- Mystery Science Lesson: Why Would a Hawk Move to New York City? (5th):

- How endangered species are classified:

- Video: Endangered Species: Worthy Saving from Extinction?
  - [https://learn.kqed.org/discussions/4](https://learn.kqed.org/discussions/4)

- Calculate your Carbon Footprint here:

- Endangered Species Coalition
  - [https://www.endangered.org/endangered-species/](https://www.endangered.org/endangered-species/)

- Defenders of Wildlife
  - [https://defenders.org/](https://defenders.org/)

- Woodland Park Zoo
  - [https://www.zoo.org/esa](https://www.zoo.org/esa)

- Book Recommendation: *Hoot* by Carl Hiaasen
Endangered Species Project Resources

Project Based Learning- How do humans affect species in their habitat?

**Online Reading Resource Sites**

- Education.com: Educational site that includes reading, math, and writing activities (PK-5)
  - [https://www.education.com/](https://www.education.com/)
- History Classroom: Guides and classroom materials for History Channel's programming (4-12)
  - [https://www.history.com/classroom](https://www.history.com/classroom)
- ReadWorks: Select from a variety of topics for reading passages with questions (K-12)
  - [https://www.readworks.org/](https://www.readworks.org/)
- ReadWriteThink: Practice and resources in reading and language arts instruction (K-8)
  - [http://www.readwritethink.org/](http://www.readwritethink.org/)
- Scholastic: Day by day reading activities for kids (K-8)
  - [https://classroommagazines.scholastic.com/support/learnathome.html](https://classroommagazines.scholastic.com/support/learnathome.html)

**Printed Materials**

- Pygmy Rabbits in Washington State
- Scavenger Hunt
- Dinosaur Food Web
- Greater Horseshoe Bat Reading and Questions
- Loggerhead Turtle Reading and Questions
- White Tailed Fish Eagle Reading and Questions
- Lion-Tailed Macaque Reading and Questions
- Black Footed Ferret Reading and Questions
- Math Activities

**Articles For Parents and Caregivers**

- Edutopia: How Teachers Can Support PBL at Home:
  - [https://www.edutopia.org/article/how-teachers-can-support-pbl-home](https://www.edutopia.org/article/how-teachers-can-support-pbl-home)
- Edutopia: Strategies for Differentiated Instruction in Project Based Learning:
  - [https://www.edutopia.org/blog/differentiated-instruction-strategies-pbl-andrew-miller](https://www.edutopia.org/blog/differentiated-instruction-strategies-pbl-andrew-miller)
By Elizabeth Jackson, Foster Creek Conservation District & Oregon State University

Columbia Basin Pygmy Rabbit

An activity book about the biology and environment of the

Pygmy Rabbits in Washington State
How to define the word “rabbit”?

- Many believe that rabbits are rodents, however, this is not the case. Rabbits, hares, and pikas are considered Lagomorphs, meaning “hare-shaped”.

- Lagomorphs have two pairs of upper incisors, or teeth used for gnawing, while rodents only have one pair.

- Rabbits and hares are different too. Let’s take a look at some of the differences...
  
  - **Hares** are physically larger and more independent. They build their nests in the grass aboveground and are born **precocial**, or covered in fur with eyes open. Hares can begin hopping around soon after being born – incredible!

  - **Rabbits**, on the other hand, are smaller and more social. They build their nests underground and are born **altricial**, or hairless and blind, like a kitten. Rabbit kits require a lot of parental care.
What is a pygmy rabbit?

- The term “pygmy” can refer to species that are smaller than most of that same type of animal.

- These rabbits are unique herbivores because they eat sagebrush which is toxic to most wildlife, such as deer, elk, and mice.

- They are easily confused for cottontail rabbits which have a bright, white tail. Pygmy rabbits do not have a white tail or belly, theirs are brown.

- They are only one of two rabbits in North America that dig their own burrows. The other is the volcano rabbit that lives in Mexico.

- Baby rabbits are called kits. Young rabbits are called juveniles and “children” rabbits are called offspring.

- Each female produces an average of 3 litters per year and average 6 kits per litter.

- Their average lifespan is short averaging only 2 – 3 years in the wild and 3 – 5 years in captivity.
Where can I find a pygmy rabbit?

The expansion of human development and agriculture, such as orchards and cropland, have replaced the rabbit's habitat, leaving them without a safe place to live. Sagebrush Flat was the last population of rabbits before the Washington Department of Fish and Wildlife began recovery efforts to increase the number of pygmy rabbits in 2002.

The Columbia Basin pygmy rabbit is a distinct population. These rabbits are hundreds of miles away from other populations of pygmies.
Where can I find a pygmy rabbit?

Less than 100 years ago, Washington’s pygmy rabbits were found throughout six counties. Today, they are only found in Douglas and Grant Counties.

How to identify a pygmy rabbit...

- You will not find pygmy rabbits running under houses, sheds, or other human-made structures. They are secretive and do not like human disturbances, such as roads and residential areas.

- These rabbits dig their burrows in deep, loamy soils. This deep soil allows for their tunnels to go two to three feet underground.

- Incredibly, these rabbits absorb water from the plants they eat. They can be found in areas without water and can go their entire life without ever taking a drink.

- Rabbits do not hibernate — in fact, they are active all year long, especially during dawn and dusk.

- Pygmy rabbit tracks are easiest to find in the winter because the snow shows their footprints. This makes surveying for them much easier for wildlife biologists!
Coyotes, badgers, long-tailed weasels, owls, harriers, and hawks are common predators of the Columbia Basin pygmy rabbit.
Other threats to rabbits

- Wildfire is major risk to pygmy rabbits. Fires can destroy the rabbit's sagebrush habitat, leaving them without food or shelter for years.
- Disease is another serious threat to the pygmy rabbit. Efforts to increase the number of wild rabbits will reduce the risk of disease.

Coccidiosis is a soil-borne parasitic disease that can be fatal to rabbits.
The Sagebrush Sea

- Home to important wildlife, such as rabbits, grouse, pronghorn, burrowing owls, and much more.

- Unique habitat full of shrubs, grasses, and forbs (flowers). All of which pygmy rabbits will eat.

- The **sagebrush** shrub-steppe is found throughout the Western United States from the Canada to Mexico borders in an area referred to as the Intermountain West.

- Arid (dry) land that receive little rainfall per year.
Pygmy rabbits are herbivores and a primary consumer. As such, they are lower in the food chain, acting as an important prey species for omnivores, such as badgers, and carnivores, such as coyotes and owls.
How you can help pygmy rabbits!

• Get outdoors and enjoy nature!
  • Visit Sun Lakes – Dry Falls State Park, Moses Coulee, Ancient Lakes, or another nature preserve to get up close and experience the sagebrush shrub-steppe.

• Realize that you are lucky to live in beautiful Washington State!
  • Central Washington, in particular, is home to a unique environment full of wonder and wildlife. Be proud!

• Learn science and volunteer!
  • Science is all around us, everyday. It has many topics and could be the path to your future career. Volunteering at an organization that interests you will increase your skills and knowledge for the future.
Break the Code

Use the key below to decipher the hidden message.

A B C D E F G H I J K L M N
1 2 3 4 5 6 7 8 9 10 11 12 13 14
O P Q R S T U V W X Y Z
15 16 17 18 19 20 21 22 23 24 25 26

Pygmy Rabbit Word Search

Search for the important words that describe pygmy rabbits and their habitat. Words can be found forwards, backwards, up, down, or diagonal.

J D Z
M J A B T O T H K
M R F U R B T I B B A R E
C I I X K Z S A V O A S D F H W O
E Q C A R L Y L W L V L R Z E A X A E
K X A D W E K X D L A U O P A K R K U M X
H A I T P I T I K D M C N Z S U A E S Z L
H W B G S C M E O E Q R A S F W G J G C X T
L I X A R R U Y Q Y X A I Q V L D T S G N G
F O L H E C I E R U Z O M D I C M Q R B T A D P
A B D I K T Y C C T R Z C I N Y Q C E D E H R D B
T L N P L P N A U O K E A G B M O P O U D P C F N
O E N H H Z K C Z L L V E V W I N Y R P A N J X O D E
P I H S R E N T R A P T E J J S G K N N B P L C L L S
J S A G E B R U S H W R Y U T F W U K M N L A D
U V J W M Y P Q S I L V I E G Q R H E C I R D E G
U E R M J S V T P Q A C K N H Q L R Z J G N U E
A R I L L P U P T V L I Q R J K B O U E F Z W
D N L U Q I W I Q J H T E E W Z V R R A J X
K B B V I O V H S S R A D H A B I T AT Y
O J I N N R S A Y X D E X N H T B M H B B
J N W Z R W O N R K G H U I K R A R A
U G L U G D H E B I S H I W E P E
Y B S Y Y Q U L Q G D M H
B U L B N R V N S
H E I

AGRICULTURE
CONSERVATION
ENDANGERED
HERBIVORE
PARTNERSHIP
RECOVERY
WASHINGTON
BADGER
COYOTE
HABITAT
KIT
PYGMY
SAGEBRUSH
WILD
BURROW
DIG
HAWK
MAMMAL
RABBIT
SOIL

p. 11
Help the pygmy rabbit find its way back to the burrow before the great-horned owl catches it!

Connect the Dots below to reveal a new picture

"You made it!"

p. 12
Did you know that up until the 18th century, rabbits were called "conyes?"

Crossword Puzzle

Test your knowledge about the Pygmy rabbit by filling in this crossword puzzle. All of the answers to the puzzle are underlined somewhere in this packet.

ACROSS

1. The average lifespan of a Pygmy rabbit is 2-3 years. (15)
2. The Pygmy rabbit is listed as a Threatened Species by the United States. (15)
3. The Pygmy rabbit is the only rabbit native to the United States. (15)
4. The Pygmy rabbit is a ground-dwelling animal. (15)
5. The Pygmy rabbit is a herbivore. (15)
6. The Pygmy rabbit is known to eat a variety of plants. (15)
7. The Pygmy rabbit is known to eat a variety of seeds. (15)
8. The Pygmy rabbit is known to eat a variety of insects. (15)
9. The Pygmy rabbit is known to eat a variety of snails. (15)
10. The Pygmy rabbit is known to eat a variety of small rodents. (15)

DOWN

1. The Pygmy rabbit is known to eat a variety of plants. (15)
2. The Pygmy rabbit is known to eat a variety of seeds. (15)
3. The Pygmy rabbit is known to eat a variety of insects. (15)
4. The Pygmy rabbit is known to eat a variety of snails. (15)
5. The Pygmy rabbit is known to eat a variety of small rodents. (15)
6. The Pygmy rabbit is known to eat a variety of plants. (15)
7. The Pygmy rabbit is known to eat a variety of seeds. (15)
8. The Pygmy rabbit is known to eat a variety of insects. (15)
9. The Pygmy rabbit is known to eat a variety of snails. (15)
10. The Pygmy rabbit is known to eat a variety of small rodents. (15)

Name:
If you think you have seen a Columbia Basin pygmy rabbit or if you would like to learn more about them, please visit the following websites or contact your local wildlife office:

1) Washington Department of Fish, (509) 754 – 5257
   https://wdfw.wa.gov/species-habitats/species/brachylagus-idahoensis#conservation

2) U.S. Fish and Wildlife Service, (509) 665 – 3508
   https://www.fws.gov/sagebrush/wildlife/pygmy-rabbit/

3) Foster Creek Conservation District, (509) 888 – 6372
Scavenger Hunt

Can you list all the abiotic and biotic factors in your environment?

<table>
<thead>
<tr>
<th>Abiotic Factors:</th>
<th>Biotic Factors:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>DINO DIE-OFF</td>
<td>Tyrannosaurus rex</td>
</tr>
<tr>
<td>--------------</td>
<td>-------------------</td>
</tr>
<tr>
<td>a food web model</td>
<td>Size: 40 ft long (12 m)</td>
</tr>
</tbody>
</table>

**Earthworm**

- Size: up to 8 in (20 cm)
- I get my energy from rotting wood, dead leaves, and rotting animals. I burrow underground.

**Dracorex hogwartsia**

- Size: 13 ft long (4 m)
- I get my energy from leaves, seeds, and fruits of living plants. My name means “dragon king of Hogwarts.” I got my name when the scientists who found my skull in 2016 donated me to a museum.

**Prehistoric turtle (Compsognathus)**

- Size: 12 in (30 cm)
- I get my energy by eating worms and crickets. Like modern turtles, I can hibernate underwater when the weather is cold.

**Dryptosaurus**

- Size: 21 ft long (6.4 m)
- I get my energy from eating other dinosaurs. I hunt plant eaters that are my size or a little bit bigger.
Triceratops

Size: 30 ft long (9 m)

I get my energy by munching on living plants. And I'm big, so I need a lot of food to keep going. That means a lot of plants. Good thing that palm trees grow so well around here.

Sinornithoides

Size: 3 ft long (1 m)

I've got feathers. If you saw me, you'd probably say I was a bird. I get my energy by eating worms and crickets and other small animals.

Prehistoric cricket

Size: up to 4 in (10 cm)

I get my energy by eating seeds, berries, and leaves—either fresh off the living plant or dead on the ground. And I'm always hungry! Every day, I eat my own body weight in food.

Sunlight

I'm the sun. My light and heat are both forms of energy. Every living thing—from palm trees to Tyrannosaurus—and energy to move, to grow, to stay warm, and to heal when they are injured.

Living green plants

We're the plants of the Cretaceous period: leafy palm trees, evergreen trees, ferns, flowering plants, plants that grow berries, and more! All of us plants provide abundant food and energy for herbivores.

Dead plants & dead animals

Earthworms and crickets chow down on us dead plants—our fallen leaves and rotting wood make great food. Didelphodon and other animals that scavenge for food munch on us dead animals. Our rotting meat and bones make great snacks. All dead plants and animals store food energy that some animals can use later.
Dinosaur Food Web

1. What animals do you think *Tyrannosaurus rex* would eat? Why do you think that?

__________________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________

2. List the animals you think can survive when the sunlight is blocked.

__________________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________

3. Why did some animals go extinct while other animals survived? Construct an explanation using evidence from your food web.

__________________________________________________________________________
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__________________________________________________________________________
Dinosaur Food Web

1. What animals do you think *Tyrannosaurus rex* would eat? Why do you think that?

*Triceratops*, duckbill dinosaur, *Dracorex hogwartsia*, and *Dryptosaurus*. All these dinosaurs are large enough that catching them is worth the effort (or energy) it takes.

Note: Students may also say that *T. rex* would eat *Didelphodon*. That mammal would likely be too small for *T. rex* to bother with, but this could be a good subject for discussion.

2. List the animals you think can survive when the sunlight is blocked.

*Didelphodon*, Earthworm, Prehistoric turtle (*Compsemys*), *Sinornithoides*, *Prehistoric cricket*

3. Why did some animals go extinct while other animals survived? Construct an explanation using evidence from your food web.

When the sunlight was blocked by the asteroid dust, there was less energy for plants to grow, so plants would have died. Then, the herbivores that ate ONLY living plants (*Triceratops*, duckbill dinosaur, and *Dracorex hogwartsia*) starved. Without those herbivores to eat, *T. rex* and *Dryptosaurus* also starved. The animals that survived got their energy from dead plants and animals—or from animals that ate dead plants and animals. Most of the survivors were small omnivores, so they didn’t need as much energy and they had many food sources.
Greater Horseshoe Bat

The Greater Horseshoe Bat is one of the larger bat species, and is the rarest of the fourteen species found in the southern part of England and southwest Wales. Studies have shown that are only 4,000-6,000 Greater Horseshoe Bats left in existence. The species has been declared as endangered in Europe.

Greater Horseshoe Bats prefer to roost in the attics of old buildings, tunnels, mines, caves or hollow trees. Destruction of these habitats, especially those populated by breeding females, has lead to a decline in the number of these bats. Another risk to the bat population is insecticides used on crops. The poisons leave the bats without their main food source, insects.

People are just beginning to realize how fascinating Greater Horseshoe Bats are. A great deal of research has been done to educate the public about the roosts, flight patterns, diets, and habitats of these bats. As people learn more, they are realizing that bats are not sinister, but interesting and worth saving.

Efforts to support the population of the Greater Horseshoe Bats include limiting insecticide use, maintaining land in a way that is beneficial to bats (keeping pastures, woodlands, and hedgerows), and continuing to inform the public as to the needs of the bats in agricultural settings.

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Greater Horseshoe Bat

Short Answer Questions

1. Below are two drawings of the Greater Horseshoe Bat. How are the artist’s renderings similar? How are they different?

2. Which of the two drawings do you think is a more accurate representation? Why?

3. The name of this bat comes from something in its appearance. What do you think it is?

4. Bats find their way by echolocation. What is echolocation?

5. Name some similarities of and differences between bats and birds.

6. Create a Venn diagram using your answers from #5.

7. Some people consider bats sinister. After reading the selection, what do you think of the Greater Horseshoe bat?

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Loggerhead Turtle

Loggerhead Turtles live in temperate and subtropical oceans around the world. They live exclusively in the water, but females lay eggs on beaches. It is estimated that there are approximately 60,000 living today.

The main threat to the Loggerhead Turtle is becoming trapped in the nets of tuna of shrimp fishing boats. The turtles live in water, but need to surface to breathe. When they become trapped in the nets, they are unable to reach the surface. Other threats include coastal development of nesting habitats and predators targeting nests.

Loggerhead Turtles have a variety of habitats. They may live close to shore or hundreds of miles out to sea. Females return to the beach where they were born to lay their own eggs.

The turtle’s diet consists of snails, sponges, squid, clams, and fish. Some newly hatched turtles will eat algae. The turtles are important in maintaining the ecosystem by ingesting these invertebrates. In addition, their shells can host many species of plants and animals that would die without the turtles.

To protect the Loggerhead Turtle, nesting grounds are being guarded from predators and litter is being removed from beaches so it is not accidentally ingested by the turtles. The threat from fishing boats continues to be a real danger to the species.
Loggerhead Turtle - Short Answer Questions

1. Below is a picture of a Loggerhead Turtle. Use your best descriptive language to write a paragraph about him. Read your paragraph to a friend and then show them the picture. Did your words accurately describe the turtle?

   ![Loggerhead Turtle Image]

2. Brainstorm ways that fishermen can avoid catching the turtles in their nets.

3. Research the reasoning behind the name of the Loggerhead Turtle.

4. Research ways that conservationists are protecting turtle nests.

5. The average weight of an adult Loggerhead turtle is 350 pounds (159 kilograms) with a length of 2.5-3.5 feet (73-107 centimeters). Draw a picture representing how a turtle compares in size to a human.

6. How many eggs does the average nest contain?

7. Loggerhead turtles may be hunted for their meat and eggs. Why do you think people continue to hunt them even though they are endangered?
White Tailed Fish Eagle

The White Tailed Fish Eagle (also known as the White Tailed Sea Eagle) is a large bird of prey found predominantly in northern parts of both Europe and Asia. The population of these eagles in the wild is only 18,000-22,000. Their name comes from their preference for fish and water birds that dwell near the surface in shallow water.

These eagles prefer to nest in mature forests near rocky seacoasts. They may also inhabit inland areas near rivers or lakes.

The main threats to the White Tailed Fish Eagle are power line electrocution, wind farms, and loss of habitat and nesting sites due to deforestation and development. The birds of prey are also persecuted and shot or poisoned because they are unjustly accused of killing livestock. To protect this species, forests should be maintained to preserve nests and habitats, and insulation should be improved on power lines. Wind turbines should not be located near known nesting areas. Public education about the eagles may decrease the threats related to persecution.

White Tailed Fish Eagles act as a bioindicator for scientists to monitor the health of the environment in which they live. The Sea Eagle Project Team in Scotland has been successful in breeding the eagles and releasing them into the wild to preserve the inspiring and beautiful birds.
White Tailed Fish Eagle - Short Answer Questions

1. Below is an artist’s representation of a White Tailed Fish Eagle. Without using physical descriptors, what adjectives could you use to describe the painting?

![White Tailed Fish Eagle Image]

2. Why do you think wind turbines are a threat to the White Tailed Fish Eagle?

3. What is a “bird of prey”?

4. Often, when we think of eagles, we think of the bald eagle. What differences can you find between the bald eagle and the White Tailed Fish Eagle?

5. What are some similarities between the bald eagle and the White Tailed Fish Eagle?

6. The passage describes these birds as a useful bioindicator. What is a bioindicator and why is it useful?

7. White Tailed Fish Eagles have been the victims of persecution and have been unfairly accused of attacking livestock. How do you feel about this persecution? What ideas do you have for changing this idea about the birds?

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Lion-Tailed Macaque

The Lion-Tailed Macaque is a type of monkey that lives only in the southern part of India. This species is one of the most threatened primates. There are only about 3,000 in the wild today.

The population of Lion-Tailed Macaques has decreased due to the spread of agriculture as well as habitat destruction for human settlement. These monkeys prefer to avoid proximity to humans, so as their tropical forests are destroyed, they have dwindling places in which to live. This species is also victim to poachers intent on selling them for Chinese medicine, zoos, pet trade and research.

Their diet consists of fruits, leaves, and insects that are native to the habitat. They may eat small birds and mammals as well.

The Lion-Tailed Macaque gets its name from the look of their tail, but the fluffy gray manes around their heads may also remind people of lions. Adults weigh 15-33 lb. (7-15 kg.)

This species is important for their role in the ecosystem. They are able to carry fruit in large cheek pouches. Because of this, they play a role in distributing seeds for various fruits throughout their environment.

Since the main threat to the Lion-Tailed Macaque is the loss of their habitat, limiting deforestation for agriculture and settlement will help reduce the danger of extinction.
Lion-Tailed Macaque - Short Answer Questions

1. The Lion-Tailed Macaque is diurnal. What does this mean?

2. Why do you think the animal is diurnal?

3. This is a picture of the Lion-Tailed Macaque. Write a detailed description of his appearance. Read it to a friend before showing the picture. Did your words give your friend an accurate mental picture of the animal? If not, what could you have added to make it more descriptive?

4. The Lion-Tailed Macaque is omnivorous. What does this mean?

5. These animals travel in groups of 4-34. Why do you think they stay in groups?

6. Watch this video: (http://www.arkive.org/lion-tailed-macaque/macaca-silenus/video-12.html) that shows the social behaviors of the Lion-Tailed Macaque. Describe the interactions that you observe.

7. Now watch this video: (http://www.arkive.org/lion-tailed-macaque/macaca-silenus/video-06b.html) of Lion-Tailed Macaques jumping between trees. How would you describe their actions?
**Black Footed Ferret**

The Black Footed Ferret is a small prairie mammal found in North America. This ferret’s body resembles that of a weasel, but the black mask-like coloring around its eyes brings a raccoon to mind. It lives in burrows made by prairie dogs in short and mid-length grass. There only about 750 Black Footed Ferrets in the wild.

These secretive, nocturnal mammals subsist on a diet primarily of prairie dogs. In the 1920s-1960s farmers held prairie dogs responsible for damage to agriculture and a risk to cattle. In response, the United States government sponsored programs to get rid of prairie dogs by plowing through their tunnels and poisoning. With their food source decreasing, Black Footed Ferrets began to die out. Habitat loss due to the conversion of grasslands to farmland has also harmed this population.

From the late 1960s to the 1980s, the Black Footed Ferret was considered extinct. The National Zoo, U.S. Fish and Wildlife Service and the Conservation and Research Center have worked together to rebuild the population. Efforts to reestablish the Black Footed Ferret in the wild include breeding in captivity. Before these captive-bred ferrets can be released, they must be taught survival skills by living in an outdoor pen. There, they are protected as they learn to kill prairie dogs and live in burrows.
Black Footed Ferret - Short Answer Questions

1. This is a picture of a Black Footed Ferret. Use your thesaurus to find 8 adjectives to describe this mammal.

2. Why do you think that these animals must be taught survival skills when bred in captivity?

3. How did prairie dogs damage agriculture?

4. What animals are predators of Black Footed Ferrets?

5. Why do you think these animals are nocturnal?

6. View this video
of Black Footed Ferrets. Do they remind you of other animals at play? What animals and why?

7. Write a story about a Black Footed Ferret from a prairie dog’s point of view.

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**Pollution Spotting**

Terra Town is keeping tabs on pollution! Follow the directions below to help spot the town’s problems.

**Directions:** Read each problem and ordered pair listed below. Use the coordinates to locate the site on the map. Write the site’s name. Then tell what type of pollution the problem can cause. Write A for air, L for land, or W for water in the space to the right. Some problems may cause more than one type of pollution.

<table>
<thead>
<tr>
<th>Problem</th>
<th>Site</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. heated water dumped (F, 1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. fertilizer overused (G, 9)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. 55 gallons of oil spilled (C, 3)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. trees cut down (G, 5)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. gases from smokestack (B, 3)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. too much garbage (C, 3)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. garbage being burned (G, 5)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. throwing away excess packaging (G, 4)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. too many cars (H, 2)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. burning coal for energy (F, 1)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Bonus Box:** Circle the site where you think pollution may harm people, animals, or plants the most. Then, on the back of this sheet, make a plan to help clean up that site.
Answer Key

Answers may vary for the type of pollution.

1. power plant, W
2. farm; L, W
3. dump; L, W
4. neighborhood, A
5. factory; A, L, W
6. dump; L, W
7. neighborhood, A
8. shopping center, L
9. parking lot, A
10. power plant, A
Learning Activity:

The Future of Species

<table>
<thead>
<tr>
<th>Activity Type</th>
<th>Statistics and probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Focus Areas</td>
<td>Mathematics, science</td>
</tr>
<tr>
<td>Time Required</td>
<td>30–60 minutes</td>
</tr>
</tbody>
</table>

● Overview

The recent biodiversity assessments conducted by WWF and other contributing organizations revealed a 60% decline in populations of fish, birds, mammals, amphibians, and reptile species in the past 40 years. More than 1 million species are now threatened with extinction, and that number will only increase if we don’t change course now. In this activity, students will plot species population data and use observed trends to determine the probability of those species’ survival.

● Objective

At the completion of the activity, students should be able to:

- Graph population data of endangered species over time.
- Analyze and interpret population trends to predict extinction probability.
- Explain why monitoring these population trends is important in shaping our actions for the future.
Subject and Standards

Common Core Standards: Math

- 6.SP.B.4: Display numerical data in plots on a number line, including dot plots, histograms, and box plots.
- 6.SP.B.5: Summarize numerical data sets in relation to their context.
- 7.SP.A.1: Understand that statistics can be used to gain information about a population by examining a sample of the population; generalizations about a population from a sample are valid only if the sample is representative of that population. Understand that random sampling tends to produce representative samples and support valid inferences.
- 7.SP.A.2: Use data from a random sample to draw inferences about a population with an unknown characteristic of interest. Generate multiple samples (or simulated samples) of the same size to gauge the variation in estimates or predictions.
- 8.SP.A.1: Construct and interpret scatter plots for bivariate measurement data to investigate patterns of association between two quantities.
- 8.SP.A.2: Know that straight lines are widely used to model relationships between two quantitative variables. For scatter plots that suggest a linear association, informally fit a straight line, and informally assess the model fit by judging the closeness of the data points to the line.
- 8.SP.A.3: Use the equation of a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and intercept.

Next Generation Science Standards

- MS-LS2-1 Ecosystems: Interactions, Energy, and Dynamics
  - Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.
- MS-ESS3-4 Earth and Human Activity
  - Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth’s systems.
Materials Needed

- Biodiversity Educator's Resource Guide
- Data table of species population numbers (included in this activity)
- Graph paper
- Pencil
- Internet access (optional)
- International Union for Conservation of Nature's (IUCN) Red List

Vocabulary

- Biodiversity: all the different kinds of life you will find in one area, including animals, plants, fungi, bacteria, and genetic material
- Ecosystem: the living (plants, animals, other organisms) and nonliving (air, water, soil) components of an area that interact with each other in an interconnected way
- Line of best fit: a straight “trend” line that attempts to best represent the data on a scatter plot

Activity Procedure

Part 1: Introduction and Preparation

- Using information from the Biodiversity Educator’s Resource Guide, familiarize students with the meaning of biodiversity and why it is important.

  - A key point that students should understand is that the decline of species and habitats is a direct result of the decline of nature, on which we all depend. The more species and ecosystems that exist in an area, the more contributors there are working together, making the system stronger and helping nature thrive. If biodiversity is low, the stability of the system weakens, and all that depend on it will be affected.

- Discuss with your students how scientists study biodiversity. For example, every two years, scientists from WWF and other conservation organizations compile data from meticulous assessments of the world’s species and habitats to evaluate the state of our planet in the Living Planet Report. When studying
an area’s biodiversity, scientists evaluate its current status, as well as how it has changed or improved in that area, using different criteria, such as:
- The number of different types of species found in that area (composition)
- The actual count of individuals of each species (abundance)
- How spread out the individuals are (distribution)
- How many of these species have been identified as being threatened or endangered (extinction risk)

• Take a few moments to review species extinction classifications with students using the International Union for Conservation of Nature’s (IUCN) Red List. This comprehensive database provides information on species, such as their geographic range, habitat, threats, population counts, and current extinction status. It can be difficult to keep an accurate count of many species, given their fragmented populations and/or elusive nature. But it’s important for scientists to monitor numbers and draw inferences in trends to shape conservation actions necessary for species to thrive.

Part 2: Activity
In this activity, students will plot species population data on a graph and use the observed trends to predict the likelihood of the species’ survival in the future.

• Have students select a species for which to research population data. They should select a species that is currently classified by the IUCN as vulnerable, endangered, or critically endangered. If time allows, have students select a species to research online and find population counts from at least three or four different years. You can also have students choose a species from the data table included in this activity. This table consists of several species that have been identified as being at risk, as well as their surveyed population numbers from different years.

<table>
<thead>
<tr>
<th>Species</th>
<th>Extinction status</th>
<th>Population count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vaquita</td>
<td>Critically endangered</td>
<td>567 in 1997</td>
</tr>
<tr>
<td></td>
<td></td>
<td>245 in 2008</td>
</tr>
<tr>
<td></td>
<td></td>
<td>59 in 2015</td>
</tr>
<tr>
<td></td>
<td></td>
<td>18 in 2017</td>
</tr>
<tr>
<td>Black rhino</td>
<td>Critically endangered</td>
<td>100,000 in 1960</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2,410 in 1995</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4,880 in 2010</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5,042 in 2016</td>
</tr>
<tr>
<td>Tiger</td>
<td>Endangered</td>
<td>6,000 in 1998</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3,200 in 2010</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3,890 in 2016</td>
</tr>
<tr>
<td>Galápagos penguin</td>
<td>Endangered</td>
<td>2,020 in 1970</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1,009 in 2007</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1,200 in 2018</td>
</tr>
<tr>
<td>Baiji river dolphin</td>
<td>Critically endangered</td>
<td>400 in 1981</td>
</tr>
<tr>
<td></td>
<td></td>
<td>300 in 1985</td>
</tr>
<tr>
<td></td>
<td></td>
<td>100 in 1990</td>
</tr>
<tr>
<td></td>
<td></td>
<td>13 in 1999</td>
</tr>
<tr>
<td>Snow leopard</td>
<td>Vulnerable</td>
<td>4,080 in 2003</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3,920 in 2013</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2,710 in 2016</td>
</tr>
<tr>
<td>Black-footed ferret</td>
<td>Endangered</td>
<td>500 in 2008</td>
</tr>
<tr>
<td></td>
<td></td>
<td>274 in 2012</td>
</tr>
<tr>
<td></td>
<td></td>
<td>206 in 2015</td>
</tr>
</tbody>
</table>
Once students have selected a species and gathered the required information, they should use graph paper to diagram the population counts over time. Once the points are plotted, students should establish a line of best fit (if possible) to predict the population trend. See example:

![Population of Tigers Graph]

Based on their graph, have students draw inferences from the data and make predictions for the future of their selected species. Do they feel this species is on the rise? Or are the population numbers going to continue to decline? What do they think is the likelihood of the species going extinct? If this species were to decline, what effects would that have on the rest of the species' ecosystem?

**Part 3: Discussion and Assessment**

- As a class, recap the purpose of this activity and how it relates to the work conservation scientists conduct in the field. In order to ensure a future for biodiversity and nature, it's important to be aware of trends in species populations. Ask students why they think it's important for scientists to perform these biodiversity assessments. What can we learn by evaluating the numbers and distribution of different species?
- Use the information from the [Biodiversity Educator's Resource Guide](https://www.wwf.org) to share with students what WWF and other organizations are doing to restore biodiversity and bring species back from the brink of extinction. Then, using the "What kids can do" section of the guide, provide students with ways they can contribute to conservation efforts.
can take action in their own community—such as conserving resources and planting trees—to help species around the world. Explain that it will take all of us working together to make real change and reverse our planet's biodiversity loss.

**Extended Learning Options**

- If enough data points are collected and a line of best fit is determined, have students calculate the slope and intercept of their graph.

- Have students select two species and plot their data together on one graph. Are there patterns in the population trends of the two species? Students should use what they've learned about the threats currently facing species and biodiversity to draw inferences about how these species are associated.

- Add another research component to the activity by having students identify the specific threats affecting the species they chose to include in their graph. If the population trend of the species appears to be increasing, what can the increase be attributed to? If it is decreasing, what is being done/needs to be done to stop this trend?

- Use a tablet or smartphone (if available) to download the WWF Together app. Encourage students to explore the Planet Earth segment to learn more about how to protect life on our planet.

- Start a class fundraiser to protect biodiversity using WWF's online fundraising tool, Panda Nation. Learn more at pandanation.org.

*Deforestation to make room for cornfields in Brazil.*
Additional Background Info

You can use the information found at the links below to enhance your discussion with the class. You may want to share some links directly with students if you determine they are grade-level appropriate.

- **Report:** *Living Planet Report 2018*—published every two years, the *Living Planet Report* assesses the state of our planet's biodiversity and ecosystem health

- **Report:** *Living Planet Report for Youth 2018*—a condensed, young reader-friendly summary of the *Living Planet Report 2018*

- **Video:** *Our Planet*—Netflix documentary made in collaboration with WWF that brings you up close and personal with some of nature's most threatened species and habitats

- **Web feature:** *IUCN Red List of Threatened Species*—the International Union for Conservation of Nature's up-to-date data on species and the threats impacting them and their habitats

- **Web story:** *What is biodiversity?*—explains why biodiversity is important and what is at risk if we don't change our behaviors

For more fun classroom activities with a focus on wild species and conservation, visit [wildclassroom.org](http://wildclassroom.org)
Learning Activity:

**Biomimicry Design Challenge**

<table>
<thead>
<tr>
<th>Activity Type</th>
<th>Engineering and technology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Focus Areas</td>
<td>STEM</td>
</tr>
<tr>
<td>Time Required</td>
<td>45–60 minutes</td>
</tr>
</tbody>
</table>

**Overview**

Humans have put immense pressure on our planet by using products and practicing behaviors detrimental to the environment. In order to protect our natural world, we need to find new ways to provide for our growing population while not degrading our ecosystems. Nature has survived for millennia, with animals, plants, and bacteria demonstrating how they are natural problem solvers and survivors. Scientists and engineers are using processes found in nature as a basis for innovative solutions to human challenges. In this activity, students will take inspiration from the adaptations of some of their favorite species to develop an idea to solve a current problem facing our environment.

**Objective**

At the completion of the activity, students should be able to:

- Define biomimicry and give examples.
- Develop a design strategy based on traits found in nature.
- Explain how nature can teach us how to build a more sustainable future.

*In Indonesia, an octopus uses camouflage to protect itself against predators and hide from its prey.*
Subject and Standards

Next Generation Science Standards

- MS-LS1-4 From Molecules to Organisms: Structures and Processes
  - Use argument based on empirical evidence and scientific reasoning to support an explanation for how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants, respectively.

- MS-LS2-5 Ecosystems: Interactions, Energy, and Dynamics
  - Evaluate competing design solutions for maintaining biodiversity and ecosystem services.

- MS-ESS3-3 Earth and Human Activity
  - Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.

- MS-ESS3-4 Earth and Human Activity
  - Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems.

- MS-ETS1-1 Engineering Design
  - Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.

Materials Needed

- Internet access (if available)
- Paper or poster board
- Writing and coloring utensils
- Copies of the Biodiversity Educator's Resource Guide
**Vocabulary**

- **Adaptation**: changes to a plant or animal that make it better equipped to survive under the conditions of its environment.

- **Biodiversity**: all the different kinds of life you will find in one area, including animals, plants, fungi, bacteria, and genetic material.

- **Biomimicry**: the imitation of natural biological designs or processes in engineering or invention.

- **Renewable resource**: resource that can be replaced by nature (examples are solar, wind, and water).

- **Sustainable**: of, relating to, or being a method of harvesting or using a natural resource so that the resource is not depleted or permanently damaged; an effective and innovative way to efficiently use natural resources and ensure their continued supply.

In Madagascar, a mossy leaf-tailed gecko, uses camouflage to blend into its surroundings.
Activity Procedure

Part 1: Introduction and Preparation

- Familiarize students with biomimicry by defining and providing examples.
  
  - Definition: Encourage students to define biomimicry by breaking down the word; "bio" refers to life, and "mimicry" means to imitate. Biomimicry is the act of imitating something found in nature.
  
  - Example: Scientists have invented numerous products stemming from ideas found in nature. When walking through the forest, Georges de Mestral noticed how burs stuck to his dog's coat as a means of seed dispersal. It inspired him to create Velcro, a product now widely used on clothing and accessories.

- After introducing biomimicry to your students, discuss and provide examples of how it can be used to innovatively solve problems. Plants and animals have been solving problems naturally for years; they have learned what works and have adapted solutions over generations that enable them to survive. In turn, by observing these characteristics and behaviors of the natural world, scientists have developed solutions to improve the design of products, processes, and systems to make them more sustainable.
  
  - Examples: Scientists have looked closely at how leaves retain and distribute water, using that design to rethink how we distribute electricity, water, and air-conditioning for more efficient energy use. Similarly, a new design for wind turbines is being modeled after humpback whale flippers. Scientists discovered that the ridges in the whales' flippers help them steer and gain speed underwater. This led to the creation of an improved and more efficient turbine blade design, resulting in a huge step forward for renewable energy. Scientists have also modeled high-speed trains after kingfisher birds that quickly and quietly dive in and out of water, less painful needles after the stealthy ability of mosquitoes to bite without you knowing, and long-distance communication through water after dolphins using echolocation.

- If time allows, have students research other examples of biomimicry so that they can become more familiar with the topic.
Part 2: Activity

- Introduce students to biodiversity, and have them identify its biggest threats using the Biodiversity Educator's Resource Guide. Be sure to include in the discussion people's everyday actions—such as polluting air and waterways, misusing plastics, and wasting food—that contribute to challenges facing our environment. Brainstorm with students various threats that could be impacting your local biodiversity.

- Take a few moments to review adaptations with students. As the definition states, an adaptation is a characteristic trait of a species that better equips it to survive within its environment. Migration, camouflage, flight, hibernation, and conservation of resources (such as food and water) are all examples of adaptations found in nature. Allow students time to brainstorm and research the physical and/or behavioral adaptations of some of their favorite species of plants or animals. Take students outside, and have them observe unique relationships and patterns found in nature right in their local ecosystem. We can learn a lot by simply sitting quietly and observing what's around us. Discuss the following questions as a class—What appearances or behaviors do species use to help them survive? What could we learn from these species?

- Using the examples of adaptations, students will select one species as inspiration for an invention to tackle a threat facing our environment. You can choose one threat for the whole class to consider or allow students to choose their own. If possible, keep the activity connected to your local environment by using the examples you discussed of nearby species and threats facing your local ecosystem's biodiversity.

- The biomimicry invention can be presented in a format of your choosing—a report or outline that describes the students' idea, a model, or a blueprint—but it should clearly define the problem they want to tackle and how their design reflects something found in nature.

Part 3: Discussion and Assessment

- Encourage students to share their designs with their peers.

- As a class, reflect on why nature is important (considering its intrinsic value—nature as it is—and all that it provides for the planet and for us) and what it can teach us. Students should understand that biodiversity supports nature, which supports life. It's essential for us to continue developing innovative solutions to help minimize our impact on the environment and maintain biodiversity. What better place to look for inspirational ideas than nature itself?

- Refer to the "What kids can do" section of the Biodiversity Educator's Resource Guide to provide students with additional ways they can do their part to restore biodiversity and create a more sustainable future.
Extended Learning Options

- You can take this design challenge a step further by asking students to map out how they would test the effectiveness of their invention. Students should include the steps of the scientific method when designing their experiment.

- Use a tablet or smartphone (if available) to download the WWF Together app. Encourage students to explore the Planet Earth segment to learn more about how to protect life on our planet.

- Start a class fundraiser to protect biodiversity using WWF's online fundraising tool, Panda Nation. Learn more at pandanation.org.

Additional Background Info

- You can use the information found at the links below to enhance your discussion with the class. You may want to share some links directly with students if you determine they are grade-level appropriate.

  - Report: Living Planet Report 2018—published every two years, the Living Planet Report assesses the state of our planet's biodiversity and ecosystem health
  
  
  - Video: World’s Largest Lesson—a colorful animation that shares stories of young people around the world who have come up with smart ideas to help the planet
  
  - Web story: What is biodiversity?—explains why biodiversity is important and what is at risk if we don’t change our behaviors
  
  - Web feature: The Biomimicry Institute—an organization dedicated to helping people investigate design lessons from nature when paving the way for our future

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