



BEARS, BISON & YELLOWSTONE GUIDE FOR EDUCATORS

INTRODUCTION

News about climate change is everywhere—in the newspaper, on TV and the radio, even at the movies. It's hard enough for grown-ups to sort out what's true and to determine what we should do about it. For kids, it can seem even more complicated and scary. That's why age appropriateness is a vitally important ingredient of climate change education.

The most age-appropriate measure you can take as a teacher is to help your students explore nature in their own neighborhoods and communities. This fosters a strong, positive connection with the natural world and builds a foundation for caring about global environmental problems later in life.

But how do you answer the questions your students inevitably raise about climate change? And how do you begin to examine the topic in a manner that doesn't frighten or overwhelm them? The best strategy is to provide children with brief, accurate information at a level you know they can understand and relate to—and in hopeful ways. This guide is one tool you can use to do just that.

About Howard Ruby, the photographer:

Wildlife images featured on Climateclassroomkids.org and throughout this guide were taken by Howard Ruby. Mr. Ruby is a nature photographer, Chairman of Oakwood Worldwide, and a supporter of the National Wildlife Federation. He has spent years traveling around the world to photograph the many amazing wild animals and wild places seen on this site. He is passionate about using his photos in creative ways to teach children and adults about the effects of climate change and he has been the driving force behind the creative development of this website and education program.

You can also visit his website, www.howardruby.com to see a preview of other photos that will soon be featured on our site.

ABOUT NATIONAL WILDLIFE FEDERATION

National Wildlife Federation inspires Americans to protect wildlife for our children's future. For more than 70 years, NWF has been connecting people of all ages with nature through award-winning education programs and resources, including the children's magazines Wild Animal Baby®, Your Big Backyard®, and Ranger Rick®.



NWF is proud to partner with Howard Ruby in the Climate Classroom Kids website and activity guides.

ABOUT THIS GUIDE:

This guide's activities are designed for grades 3-5, with extensions for younger and older children. These activities meet national standards for English/Language Arts, Science, Social Studies, and Visual Arts.

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INTRODUCTION

www.climateclassroom.org/kids

Yellowstone National Park and the surrounding area is one of the most treasured regions of North America. Old Faithful and the majority of the world's geysers are preserved here. They are the main reason the park was established in 1872 as America's first national park—an idea that spread worldwide. A mountain wildland, home to grizzly bears, wolves, and herds of bison and elk, the park is the core of one of the last, nearly intact, natural ecosystems in the Earth's temperate zone. Today, Scientists are finding that Yellowstone is warming at a faster rate than the rest of the globe, with the temperature over the last decade at 1.4 degrees Fahrenheit higher than the regional average for the 20th century. Change is evident in receding glaciers and reduced birthrates of migratory elk, that rely on meadow grasslands that are drying too early in summer.

The American Bison is a grazer that relies on the grasslands of the Great Plains. Research shows that warmer grasslands have grasses with less protein. As the average temperature of the bison's range increases, the grasses they consume contain less protein resulting in the bison gaining less weight. As the average size of bison shrinks, it is likely that the same will be observed in cattle, resulting in the industry facing huge losses as a result of degrading grass quality.

Why Focus on Yellowstone in Climate Change Instruction?

Yellowstone National Park and the surrounding area is one of the most treasured regions of North America. Scientists are finding that Yellowstone is warming at an alarming rate. Many unique and iconic animals that inhabit Yellowstone National Park are considered at risk species and are particularly vulnerable to the effects of climate change.

What do Bison and Bears Have to Do with Climate Change?

Climate change is altering key habitat elements that are critical to wildlife's survival, including the quality and quantity of major food sources. Both bison and grizzly bears may move to new areas to survive these changes, putting the two species at risk as they compete with each other and other wildlife for dwindling resources.

TALKING TO KIDS ABOUT CLIMATE CHANGE

- 1. Be age appropriate.** Climate change is the largest environmental problem humans have ever faced. Solving it is a vast responsibility to place on the next generation. Our responsibility is to prepare our children for it—and to hand it over only when they're ready. **Preschool/Early Elementary:** This is a time for children to explore the immediate environment (backyard, neighborhood, nearby parks) in a way that is hands-on and full of joy. It's not a time for them to worry about environmental tragedies. There's no need to bring up climate change at this age if children don't ask about it. If they have questions, by all means address them—but keep your answers brief and basic. Assure children that grown-ups are working hard on solutions. The very best thing you can do for the youngest children is to foster a strong, positive connection with the natural world. This builds a foundation for caring about global environmental problems later in life. (For ideas and resources to connect young children with nature, visit www.greenhour.org.) **Upper Elementary:** As their ability to think abstractly increases, older children will be able to discuss climate change in more depth. This is the time to talk about your students' questions and ideas, model your own interest in learning more about the issue, and seek out concrete actions you can take to be part of the solution. At the same time, continue exploring and enjoying the local environment. Outdoor exploration and learning are vitally important ways to foster care for the planet.
- 2. Let students guide the conversation.** Listen carefully to their questions and concerns. It may be hard to hold back, especially if you know a lot or are passionate about this subject, but it's important not to overload students with information they aren't ready for.
- 3. Answer questions.** To effectively answer students' questions, it's important to be informed yourself. Visit www.climateclassroom.org/kids for additional child-friendly information about climate change.
- 4. Diffuse fear.** There's no doubt that climate change and many of its projected impacts are scary. If students are anxious or upset by what they have heard, acknowledge these fears. Then try to diffuse them by steering the conversation toward solutions.
- 5. Don't burden them.** Children didn't create this problem, and it's not fair to tell them that they'll be solely responsible for solving it. Let them know that many, many grown-ups are working hard to resolve it.
- 6. Think positively.** Children are naturally optimistic. We'll need every drop of that optimism to tackle climate change successfully—so be sure they keep it! Emphasize that it's not too late. People have caused this problem, and people, working together around the world, should be able to solve it.
- 7. Invite participation.** Explain that solving the problem will require some big changes—in society and also in our own daily lives. We'll need to rethink many things, from the way we get energy to the way we build our houses and get around. Simply turning off the lights won't solve the problem. But everyone can play a part in turning the tide.
- 8. Empower action.** Provide opportunities for students to take action at home and in the classroom. Seek out positive steps you can take together. Whenever possible, keep it local and tangible, with visible results. For instance, you may not be able to directly help the bison and bears in Yellowstone, but you could participate in a habitat restoration project that will benefit wildlife in your own neighborhood.

ACTIVITY ONE

WHERE IN THE WORLD?

Subjects: Geography: Landforms, maps, globes

LEARNING OBJECTIVES:

- Identify the Yellowstone region and some of its key geographic features on a globe and a map.
- Compare ways information is presented on globes and maps.
- Record and discuss prior knowledge and perceptions of the Yellowstone region.

MATERIALS:

- Photos of the Yellowstone region
- Globe
- World Map
- Pencils
- Student Page “What I Know About the Yellowstone Region”

BACKGROUND:

Established in 1872, Yellowstone National Park is America’s first National Park. Located in Wyoming, Montana, and Idaho, it is home to a large variety of wildlife, including grizzly bears, wolves, bison, and elk.

Yellowstone is sitting on a large volcanic field that, millions of years ago, had some of the world’s largest known eruptions. That legacy makes it the site of the Earth’s largest concentration of geysers, including Old Faithful, and some of the world’s most extraordinary hot springs.



Longitude and latitude are imaginary lines on a map or globe that help us describe the location of any place on Earth. Latitude lines measure the distance north or south of the Equator. Longitude lines measure the distance east or west of the prime meridian. Both are measured in terms of the 360 degrees of a circle. Yellowstone National Park is 44 degrees North (latitude) and 110 degrees West (longitude).

Yellowstone is best known for its mammals, including bison, grizzly bears, gray wolf, elk, pronghorn, bighorn sheep, mountain goat and mountain lion. The park actually has the largest concentration of mammals in the lower 48 states, with 67 different mammal species.

Yellowstone encompasses many different kinds of wildlife habitat, including:

Alpine tundra: Dry, rocky, and treeless areas near the tops of mountains. Alpine tundra has low growing plants and a few mammals, such as mountain goats and pika.

Mountain meadows: Lush, spongy oases of sedges, wildflowers and shrubs at elevations from about 6,000 to above 11,000 feet. They range from small glades to grasslands of thousands of acres. Because of heavy winter snows, mountain meadows often remain moist throughout the year. Elk, pronghorns and mule deer frequent these habitats.

Sage-steppe Grasslands: Treeless areas of grasses, shrubs and herbaceous plants such as wildflowers, with low moisture and seasonal extremes in temperature, in which bison can be found.

WHAT YOU DO:

1. Divide students into small groups and give each group a set of photos of the Yellowstone region. Tell students that today they are going to learn about a special place. Have each group look through its photos and jot down answers to these questions:
 - What does this place look like?
 - How would you describe its climate?
 - What is this place called?

Invite groups to share their answers with the class. Then tell students that they are going on a mapping adventure to find the place pictured—the Yellowstone region.

2. Using a globe, show students the Yellowstone region. Ask the class:
 - What are the differences between globes and maps?
 - Which tool would you use to see the best model of the entire Earth?
3. Distribute copies of the student page called “What I Know about Yellowstone.” Give students ample time to record what they know about the Yellowstone region in the chart on this page.
4. Collect the completed pages. At the end of this teaching unit, return the pages to your students and have them compare their initial Yellowstone knowledge with their current knowledge.

USEFUL LINKS:

Photos of the Yellowstone region can be found at www.climateclassroomkids.org/photo-galleries
Much more information can be found at www.nps.gov/yell
www.nwf.org/Wildlife/Wild-Places/Yellowstone

STUDENT PAGE

WHAT I KNOW ABOUT THE YELLOWSTONE REGION

Directions: Record things you know about the Yellowstone region in the spaces below.

Climate _____

Animals _____

Plants _____

People _____

Other _____



ACTIVITY TWO

HOW MANY BISON?

Subjects: Math, science, critical thinking

LEARNING OBJECTIVES:

- Understand a scientific method of sampling wildlife populations.
- Understand the benefits and limitations of this method.

MATERIALS:

- one brown paper bag
- 100+ tokens (polystyrene pieces, craft sticks, macaroni)
- felt-tipped markers in 2-3 colors (be sure to use permanent markers so colors won't transfer to other tokens)
- paper and pencil
- calculator
- copies of the Data Sheet, one per team

BACKGROUND:

Population sampling is a tool scientists use to help understand the effects of climate change on bison and other wildlife. How many bison are in a herd? In Yellowstone National Park, wildlife biologists go up in airplanes to count the individual bison. This is a good way to count big animals in open places, but biologists also have other ways to figure out populations. By using percentages and proportions, they can sample a population and estimate its size without counting every animal. This activity simulates this common method.

To sample a population, biologists capture and tag animals in a given location. (A tag is a marking placed on an individual animal.) Later, they recapture animals in the same location and count the number of tagged animals. They might repeat this procedure several times and average the results; this number is the estimate of the population. Its accuracy will depend on factors such as the size of the sample and the number of recounts. (Larger samples and more recounts increase accuracy.) By comparing the results over time, biologists can see how much a wildlife population fluctuates.

WHAT YOU DO:

1. Study the sample data sheet (below) that shows the concept of estimating populations by using proportions.
2. HINT: Test Step 2 of the procedure. The “sample” size will vary with the size of the tokens and the size of your students’ hands. You may have to instruct them to scoop two handfuls. The goal: To tag more than 10% of the total in the sample.
3. Decide how many teams you will establish, and prepare a “population” for each team:
 - Choose at least 100 tokens to represent the bison population.
 - Place the tokens in each brown bag.
 - Write down the number of tokens in each bag.
4. Divide all the students into teams. Explain that each team will be estimating the size of a bison population and that the tokens represent bison.
5. Hand out the bags and instruct each team to do the following:
 - Scoop out a handful of tokens, then use a crayon or magic marker to mark each piece with the same color. These are now the first group of tagged “bison.”
 - Count these pieces and record the number on the data sheet as “A,” which represents the number of “tagged” bison.
 - Replace the “bison” back in the bag, and shake the bag. Scoop out another batch of tokens. Count the tokens and write that number on the data sheet as “B,” the total number of “bison” that you “captured” this time. Count the number of pieces that are already tagged, and write that number on the data sheet as “C.”
 - Solve the equation for “y,” which is your first estimate of population.



6. Repeat Step 2 at least two more times; be sure to use a different color tag each time.
7. Average the three population estimates to arrive at a final estimate of the population.
8. Compare the estimates of each group with the actual number of tokens placed in the bags..
9. Discuss the following questions:
 - How did the predictions compare with the actual number of “buffalo”?
 - Why might your results be different from the actual number of tokens?
 - Why do biologists need to estimate the size of wildlife populations?
 - What challenges might they face as they try to count animals?
 - What are the pros and cons of this method for estimating population?

ADAPTATIONS:

For older students. Suggest that some students research other methods of estimating wildlife populations, and compare them to the sampling method they tested.

USEFUL LINKS:

Photos of bison and the Yellowstone region can be found at www.climateclassroomkids.org/photo-galleries and www.nps.gov/yell

Learn more about bison at www.nwf.org/wildlife/wildlife-library/mammals/bison



How Many Bison?



Sample Data Sheet

Sample	1st Set	2nd Set	3rd Set	Average Population
Color of Tag	Red	Green	Purple	
A = total number in first sample	39	40	51	
B = total number in second sample	40	60	40	
C = number in second sample that were tagged	4	5	5	
Population estimate	390	480	408	426

Example - 1st Set

1. Plug in your data for each set into the following equation:

$$\frac{\# \text{ in 1st sample (A)}}{\text{total population (y)}} = \frac{\# \text{ in 2nd sample that were tagged (C)}}{\# \text{ in second sample (B)}}$$

$$\frac{39}{y} = \frac{4}{40}$$

2. Solve for y by cross-multiplying.

$$AB = Cy$$

$$AB/C = Y$$

$$39 \times 40 = 4y$$

$$1560 = 4y$$

$$390 = y$$

Your Data	1st Set	2nd Set	3rd Set	Average Population
Color of Tag				
A = total number in first sample				
B = total number in second sample				
C = number in second sample that were tagged				
Population estimate				

1. Plug in your data for each set into the following equation:

$$\frac{\# \text{ in 1st sample (A)}}{\text{total population (y)}} = \frac{\# \text{ in 2nd sample that were tagged (C)}}{\# \text{ in second sample (B)}}$$

2. Solve for y by cross-multiplying.

$$AB = Cy$$

$$AB/C = Y$$

3. Obtain a final population estimate by averaging the results of all three sets.

ACTIVITY THREE

BEARS AND ME!

Subjects: Science, art, math

LEARNING OBJECTIVES:

- Identify several characteristics of grizzly bear cubs
- Compare and contrast students' own growth and development to that of bears

MATERIALS:

- Bears and Me worksheet
- Bear Paws worksheet
- Crayons or markers

BACKGROUND:

Grizzly bears are large and range in color from very light tan (almost white) to dark brown. They have a dished face, short, rounded ears and a large shoulder hump. The hump is where a mass of muscles attach to the bear's backbone and give the bear additional strength for digging. They have very long claws on their front feet that also give them extra ability to dig after food and to dig their dens. Grizzly bears received their name because their brown fur can be tipped with white. This gives them a "grizzled" look, especially when backlit by the sun.

Grizzly bears weigh upwards of 700 pounds. The males are heavier than the females and can weigh up to 1,700 pounds. A large female will weigh up to 800 pounds. The most commonly eaten plants are the fleshy roots of some plants, fruits, berries, grasses, and forbs. If grizzly bears are on the hunt, their prey can include fish (especially salmon), rodents like ground squirrels, carrion and hoofed animals like moose, elk, caribou, and deer.

Grizzly bears hibernate in warm dens during the winter to minimize energy expenditure at a time when natural foods are not available and to permit their tiny young to be born in a warm and secure environment. Throughout the summer and autumn, grizzlies build up fat reserves by consuming as much food as they can find. In late fall or winter, grizzly bears find a hillside and dig a hole to serve as their winter den. When inside the den, grizzly bears slow down their heart rate, reduce their temperature and metabolic activity and live off stored fat reserves. Pregnant females give birth in the dens and nurse their cubs until they are large enough to venture outside in the spring as snow melts and new food become available. Depending on the length of the winter season grizzly bears can stay in their dens for up to 7 months. The mother cares for her young for at least 2 more years, feeding and protecting them.

One of grizzly bears' most important food sources just before hibernation is whitebark pine seeds. In addition to an introduced disease called pine blister rust killing the trees, the whitebark pine is also being attacked by the mountain pine beetle. The mountain pine beetle was not able to withstand the cool year round temperatures and freezing temperatures of higher elevations, but due to global warming the beetles are now able to live in the ecosystem where the whitebark pines live. Decline of this important food source for grizzly bears is leading to fewer cubs being born.

WHAT YOU DO:

1. Pass out copies of the Bears and Me comparison page.
 2. Have students draw human shapes on their own paper and find a human fact that corresponds with each bear fact. For students who are not reading, read each bear fact aloud. Point out the bear fact in italics. Students will write a corresponding fact for each by writing the correct number, word, or phrase in a human shape they drew. They may need to take this home as homework. For example, one bear shape says "At birth I weighed 15 oz. and was 10 inches long. My eyes were closed." Students will need to find out their approximate weight and length at birth and whether human babies are born with their eyes open or closed, and write this information in a human shape. Provide analogies (i.e., a 5 lb bag of sugar) as needed for your students.
 3. Have students trace their hands inside the outline of the bear cub and adult bear paws. What do they discover? They may want to take this sheet home to trace one of their parents' hands inside the adult bear paw outline as well.
 4. Have students share their comparison findings for the paws and the other factors. What have they discovered?
- Illustrate themselves next to a bear cub or adult, showing several of the similarities and differences
 - Make a growth chart comparing themselves with a grizzly bear

ADAPTATIONS:

For older students: Have students trace the bear paws and their own hands onto graph paper and calculate the area of each. They can then create a bar graph showing the areas of each hand and paw they measured. What do they notice?

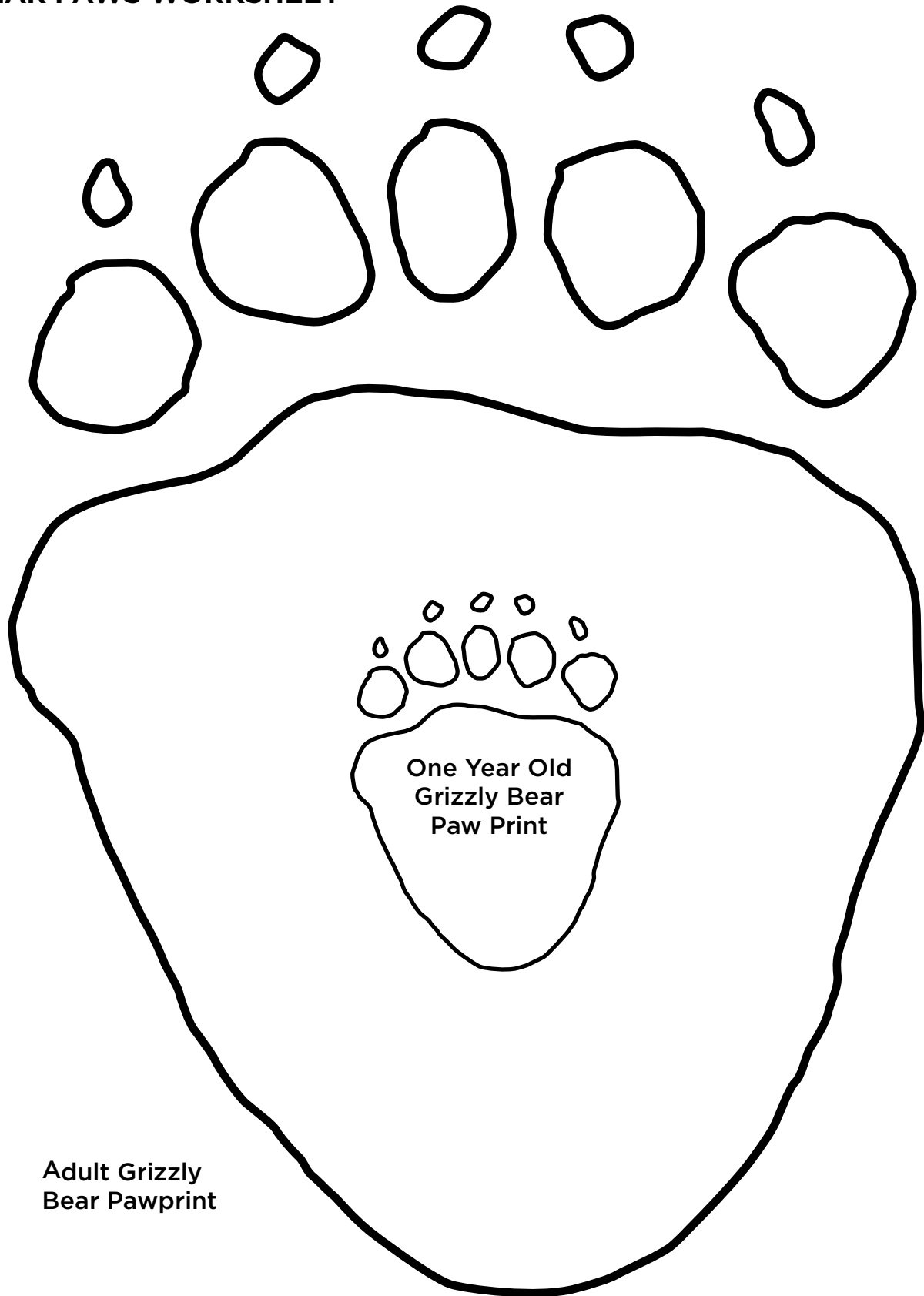
USEFUL LINKS:

Learn more about grizzly bears at: www.nwf.org/Wildlife/Wildlife-Library/Mammals/Grizzly-Bear



STUDENT PAGE

BEAR PAWS WORKSHEET



Adult Grizzly
Bear Pawprint

One Year Old
Grizzly Bear
Paw Print

STUDENT PAGE

BEARS AND ME WORKSHEET



ACTIVITY FOUR

WOLVES AND CHANGE

Subjects: Science, geography

LEARNING OBJECTIVES:

- Track the relationship between people and wolves over time and observe the changes that have occurred.

MATERIALS:

- The article “Return of the Gray Wolf” by Douglas H. Chadwick, National Geographic, May 1998 (Available in most school and local libraries or online)
- Internet Access
- Tracing paper
- Markers
- Map of North America

BACKGROUND:

The story of the wolf in the U.S. Illustrates well the way in which many predators have suffered and declined. The conflict between people and wolves is well described in “Return of the Gray Wolf” by Douglas H. Chadwick, in the May 1998 issue of National Geographic. On page 81 of the article is a map, showing how the expansion of human settlement in the United States greatly reduced the wolf’s territory. Share the article and map with students, then lead them in a mapping activity that will help them see how people have affected wolf distribution over time.

WHAT YOU DO:

1. Enlarge the outline of North America shown here and give students (individually or in groups) a copy. Each student or group also gets a list of events that follow and a layer of tracing paper for each event (eight sheets).
2. Instruct students to draw a rough outline of the area inhabited by wolves for each period and shade it. Use a separate piece of paper for each period. Once all the periods are shaded in, overlay the pages chronologically on the map with the oldest period on top. Lift each page to see how the wolf’s territory has shrunk since the arrival of European settlers, and how it is now recovering.
3. Ask students to describe what changes they think the wolf’s habitat underwent over the years as people moved farther west. What relationships do the maps show between human settlement and the territory of wolves? Compare the wolf population maps with human population distribution maps. What correlation can students draw? Why might the gray wolf have survived in Mexico’s Sierra Madre and northernmost Minnesota? Have students re-search the history of wolves on Isle Royale, Michigan.
4. Ask students why wolves are enjoying renewed popularity. How have the efforts of conservation groups, educators, and the media influenced their popularity? Ask students to speculate about how people may feel about wolves in the future. Parks are enjoying increased revenues because people are interested in seeing wolves. Economics has played a negative part in the wolf’s past, and ranchers today want to protect their livelihood. How might economics now favor wolves? Despite wolves’ renewed popularity, public opinion about them is varied and debate continues. Ask students to explain the role of public opinion in protecting wolves.

WOLF DATA

1607 - (prior to mass European settlement of North America) wolves range all across the continent and number in the hundreds of thousands. Note: In 1630 the Massachusetts Bay Colony institutes the first wolf bounty.

1900 - Most gray wolves gone from the eastern U.S.

1930s - Gray wolves eliminated from the lower 48 states

1960s - The only surviving gray wolves of south of Canada consist of a few in Mexico's Sierra Madre, around 20 on Isle Royale in Lake Superior, and between 300 and 700 in northernmost Minnesota. Note: In 1965, government agencies stop paying cash bounties for the killing of wolves. In 1967 experts state that wolves may become extinct south of Canada. In 1974 the gray wolf wins protection under the Endangered Species Act.

1980s - A few Canadian wolves move down the Continental Divide to Glacier National Park in Montana.

1987 - Captive-bred red wolves are reintroduced in North Carolina's Alligator River National Wildlife Refuge.

1995-1996 - The U.S. Fish and Wildlife Service relocate Canadian wolves into former U.S. habitats in Yellowstone National Park in Wyoming, Idaho, and Montana, and into the Frank Church-River of No Return Wilderness in Idaho.

1998 - Captive-bred Mexican wolves are reintroduced in Arizona's Apache and Gila national forests. Note: in 1998 there are some 150 wolves in Yellowstone, 70 in Idaho, and 85 in Montana. The U.S. Fish and Wildlife Service is considering delisting or reclassifying some populations. The numbers of Mexican and red wolves are still too small to be considered.

2003 - 2011 - A series of attempts by the U.S. Fish and Wildlife Service to delist the gray wolf from the endangered species list due to population recovery. The gray wolf is now delisted. Populations are now estimated at 1700 in the Northern Rocky Mountain population segment. It is also estimated that approximately 120 red wolves and 75 Mexican wolves living in the wild.

Adapted with permission from "Return of the Gray Wolf," a Geoguide Lesson Plan published in 1998 by National Geographic Society.

USEFUL LINKS:

Learn more about wolves at: www.nwf.org/wildlife/wildlife-library/mammals/gray-wolf and www.nps.gov/yell/naturescience/wolves



ACTIVITY FIVE

SPECIES AT RISK

Subjects: Science, math, art, history

LEARNING OBJECTIVES:

- Differentiate between species that are threatened, endangered, or extinct.
- Identify biological and human-influenced factors that make species susceptible to endangered.
- Use species risk factors to rank species' susceptibility to becoming endangered.
- Evaluate North American species' vulnerability based on what students have learned.

MATERIALS:

- Chalkboard/Whiteboard
- Internet Access
- Student Page: "Species at Risk"

BACKGROUND:

While any species can become endangered, there are certain characteristics of a plant or animal itself that make it more vulnerable to, or “at-risk” of becoming endangered than others. These include:

- 1. Specialized (diet and/or habitat):** Some animals are specialists because they eat only one type of food. These animals are especially vulnerable if their food source is destroyed. Also, some species are specialists because they can only live or make a nest in a very specific location, such as high altitude forests or vernal pools (temporary small wetlands). These types of specialists are also vulnerable to disturbance.
- 2. Large Size:** Large animals, such as bears, bison and large cats, tend to require a large amount of habitat in which to live and find all their basic survival needs. If habitat loss limits the areas in which they can live, these animals may not be able to find enough food or territory to survive.
- 3. Slow Reproductive Rate:** Some species only produce one offspring at a time, and have long gestation periods. If the number of individuals of these slow breeding species, like condors, elephants, or bears, decreases, it takes a long time for the population to recover.
- 4. Migratory Lifestyle:** Animals that migrate need healthy habitats at both ends of their journeys and safe places to nest, feed, and rest along the way. They are therefore more susceptible than non-migratory animals to habitat destruction because they depend on multiple areas, each with its own conservation challenges.
- 5. Perceived as Valuable by Humans:** Many animals and plants, and products made from them, are sold for their beauty, use in medicines, fashion, and the pet trade. There are both national laws and an international treaty controlling this trade (the Convention on International Trade in Endangered Species), but many species are still endangered by human use.





- 6. Perceived as a Threat:** Large predators, such as wolves, may be perceived by humans as a threat to livestock. Grizzly bears and large cats that come into contact with humans are often feared by people, even in cases where they are not posing a significant danger.

Species of plants and animals that are considered at risk” because they fall into one or more of these categories are particularly vulnerable to the effects of climate change. Many of unique and iconic animals that inhabit Yellowstone National Park are at risk species.

Teachers please note to your students: Because many factors affect a species’ vulnerability, it is often difficult to determine which species are more “in danger” than others. Since many species are at risk of becoming extinct and in need of help, stress to your students that these are relative classifications, and no single species is “the most endangered.

WHAT YOU DO:

- 1.** Lead students in a brainstorming session. Have them think of species they know are endangered, or exist in unusually low numbers, and list them on the board.
- 2.** Next, have students look over this list and think of characteristics the animals and plants have in common that might relate to the fact that they are endangered (i.e., large, specialized diets, migratory, etc.). Write the new list of common characteristics on the board, too.
- 3.** Draw lines between the species listed on the board and the list of common characteristics you just added, to show which characteristics apply to which species. Hopefully your list will include several species which will be connected to more than one of these characteristics, showing that these plants or animals are especially vulnerable, or “at-risk.”

You should be sure the students cover most of the following (or you can help your students along to these conclusions): Specialized (diet and/or habitat); Large Body Size; Slow Reproductive Rate; Migratory Lifestyle; Valuable; Perceived as a Threat (Note: these mainly, but not exclusively, apply to animal species).

Try to assist your students in coming to these conclusions themselves, by asking guiding questions, and having them ask questions of each other. What kinds of factors can they imagine would have an impact? Why?

4. Have students research endangered and threatened animals in the Yellowstone region. Next, have students create Species Cards for five animals, including a picture or sketch and the following information for each species: Range, What They Eat, What Eats Them, Habitat, Threats, Reproductive Rate. Use the example card in this guide as reference.
5. Next, hand out the student page. Have students write in the top risk factors they have just determined into the top row of the chart. Work through an example in the Species Risk Chart with the whole class. Then divide students into small groups to use the Species Cards they created to complete the worksheet.

Each group should list at least five plant or animal species in the left hand column. By using the information on the Species Cards, and any other supplemental information provided by the teacher or researched by the students, each group should rank the risk of each species.

6. When everyone has finished, have groups share their results with each other. As a class, have students brainstorm ideas for how humans can help these species survive despite their risks. What kinds of things are scientists and conservationists doing to help these species? What can we do?

ADAPTATIONS:

For older students. Introduce the vocabulary words producers and consumers, predators and prey. Have small groups of students group their KWA Cards into each category, thinking about possible feeding relationships between the species. Next, still in small groups, students should use the diet information on their KWA Cards to draw food chains, adding species if necessary to make a complete chain. They could take it a step further and make logical feeding connections between chains, and add in decomposers to create food webs. Do not forget to have the sun as the originating source of all of the food chains! After students have completed their webs, discuss with them how human actions such as pollution and habitat destruction can impact food webs. How do these relationships affect their vulnerability to endangerment? You may also wish to discuss how pesticides tend to accumulate in organisms' bodies as they move higher in the food chain (this is called bioaccumulation), and what effects this may have on species vulnerability.

USEFUL LINKS:

US Fish and Wildlife Endangered Species Program: www.fws.gov/endangered/map/state/mt



STUDENT PAGE

SPECIES RISK CHART

List 6 primary factors that determine a species' risk of becoming endangered:

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____

For each of the plant or animal species that your group is investigating, learn about the species characteristics on your KWA Species Cards. Then, rank each species in each of the six risk (more likely to become endangered) categories using the following scale:

- 0:** does not apply
- 1:** low vulnerability
- 2:** medium vulnerability
- 3:** highly vulnerable

After you have ranked each species, total the points in each row. Which species has the most points, and would you therefore expect to have the most risk of extinction?

RISK FACTOR

	Large Size						Total Score
Species Name	1	2	3	4	5	6	
Ex: grizzly bear							



ACTIVITY SIX

WRITER'S CORNER

Subjects: Language Arts, Visual Arts, Social Studies

LEARNING OBJECTIVES:

- Communicate thoughts and opinions effectively using a variety of media.

MATERIALS:

- Writing supplies or computer access
- Optional: audio or video recording equipment, art supplies

BACKGROUND:

Refer to the Introduction of this guide.

WHAT YOU DO:

1. Encourage students to choose one of the topics below or an idea of their own to reflect upon.
 - Identify bison characteristics. What adaptations do bison have to help them survive in the Yellowstone region?
 - A food web has species at the bottom, in the middle, and at the top. Which species do you think are most important? Defend your answer.
 - What makes the Yellowstone region unique? Should we care about what happens there? What would you tell someone to persuade him or her that it is important to protect the Yellowstone region?
 - With older students discuss the science of global warming and climate change. What are the effects of climate change on the Yellowstone region? Why does what happens there affect us elsewhere in the United States? Why does it matter to you?

2. Ask students to share their thoughts in writing, or give them a choice from among a variety of media. For instance, they may write a song or rap, or perhaps they'd like to make an audio or video recording, a blog post, or a collage or drawing with captions.
3. Provide an opportunity for students to share and discuss their work with each other.
4. Wrap up your study of the Yellowstone ecosystem and climate change by returning students' "What I Know about Yellowstone" page from Activity One. Give them a chance to add to their list or make changes based on what they know now. Then, as a group, ask them to reflect on what they have learned throughout this unit. How has their understanding changed? How will they use this new knowledge?

USEFUL LINKS:

Read about the science and impacts of global warming and climate change, and actions that help address global warming at www.epa.gov/climatechange/kids





ACTIVITY SEVEN

WHAT YOU CAN DO

LEARNING OBJECTIVES:

- Define climate change
- Define Public Lands
- Explain why climate change is a threat to wildlife in Yellowstone National Park
- List several actions students can take to help reduce their own contribution to global warming pollution.

MATERIALS:

- Access to the internet
- Student Page: "Climate Change Action"

BACKGROUND:

There are simple steps that you can take to help protect bison and other wildlife of Yellowstone that are vulnerable to the effects of climate change. Supporting National Parks, reducing your carbon footprint, and joining organizations that support and defend wildlife are just some of those steps.

WHAT YOU DO:

1. Use the concepts and resources presented throughout this guide or the suggestions below to lead a brainstorming session with your students on actions they can take to benefit wildlife and the environment as individuals, as a class or a school.
2. Ask your students to develop a plan for taking action as individuals or as a class.
3. Share your plan and measure progress. Make a chart to document progress on class activities or post everyone's pledges for individual actions in the classroom or in a common area of the school.

SIMPLE STEPS YOU CAN TAKE TO HELP BISON AND OTHER YELLOWSTONE WILDLIFE

Adopt a Wildlife Acre

Wild animals in Yellowstone National Park face serious danger when they wander beyond the park's borders. You can Adopt a Wildlife Acre and help protect them at www.wildlifeacre.nwf.org.

Support Your Park

Learn ways to support Yellowstone National Park from the National Park Service: www.nps.gov/yell/supportyourpark

Calculate Your Carbon Footprint

The combination of carbon dioxide and other greenhouse gas emissions caused by your home, transportation, and daily life is known as your "carbon footprint". Calculate your carbon footprint and learn ways to reduce it at: www.nativeenergy.com/NWF

Get Involved

Join an organization that works to protect bison and other wildlife, such as the National Wildlife Federation or a local group that works in your area. You can even join as a class at: www.nwf.org/everystepcounts.

Take Action

Visit the National Wildlife Federation Action Center online and participate in campaigns that support and defend wildlife: www.nwf.org/ActionHeader

USEFUL LINKS:

Want to help your school take big steps to protect wildlife and the environment? Join Eco-Schools USA! National Wildlife Federation's Eco-Schools USA is part of an international program that helps you form an Eco Action team and make a plan to green your school building, grounds, and curriculum. Learn more about how Eco Schools USA works at www.ecoschoolsusa.org. Find the Eco Schools USA Water Pathway at www.nwf.org/globalwarming/schoolsolutions/ecoschoolsUSA/Becomeanecoschool/Pathways/water.aspx

Find lots more about Gardening for Wildlife® and Certified Wildlife Habitat™ at www.nwf.org/habitats. Find plants native to your area at www.nwf.org/nativeplants.

Learn how wildlife and plants are affected by global warming at www.nwf.org/gardenersguide.

STUDENT PAGE

CLIMATE CHANGE ACTION

Directions: Use www.climateclassroomkids.org to help you answer the following questions.

PART ONE:

What is climate change?

What is causing it?

How do scientists measure it?

Why is it a problem?

What are some things people are doing to solve it?

PART TWO:

List five things you could do in your own life that would help save energy and reduce climate change pollution.

1.

2.

3.

4.

5.

STUDENT PAGE

CLIMATE CHANGE FAMILY ACTION CHECKLIST

Simple Steps

- Turn off the lights, computer, and TV when you're not using them.
- Unplug electronics and chargers between uses.
- Do laundry when you have a full load.
- Set your washer on the cold water setting.
- Take shorter showers and don't fill the tub full when you take a bath.
- Run your dishwasher when you have a full load. Use the energy-saving setting.
- Set your water heater no higher than 120 degrees.
- Set the temperature on your air conditioner a few degrees higher.
- Set the thermostat on your furnace a few degrees lower.
- Walk or ride a bike instead of riding in the car for short trips.
- Combine errands to reduce car trips.
- Recycle your paper, plastic, glass, and cans.
- Take reusable bags with you to the supermarket.

Bigger Steps

- Switch to compact fluorescent light bulbs.
- Hang your wash up to dry instead of using the dryer.
- Insulate your hot water heater.
- Weatherize your windows and doors.
- Check the tire pressure on your car regularly.
- Keep your car's engine tuned up.
- Plant a tree or two.

Super Steps

- Buy fresh, locally grown fruits and veggies.
- Buy less stuff.
- Choose recycled paper and other recycled products.
- Add more insulation to your home.
- Choose a well-insulated home that isn't bigger than you need.
- Choose a car that gets high gas mileage.
- Choose appliances with the Energy Star® label.
- Tell others how they can join the fight against climate change.
- Encourage elected officials to support laws to reduce climate change.

JOIN ECO-SCHOOLS USA!

National Wildlife Federation's Eco-Schools USA is part of an international program that helps you form an Eco-Action team and make a plan to green your school building, grounds, and curriculum. You choose to focus on one or more of the eight "pathways," which include Energy, Transportation, or Climate Change—a good fit if you're looking to do more to help African wildlife!

Find the Eco-Schools Climate Change Pathway at: www.nwf.org/Eco-Schools-USA/Become-an-Eco-School/Pathways/Climate-Change.aspx

Find the Eco-Schools USA Water Pathway at www.nwf.org/Global-Warming/School-Solutions/Eco-Schools-USA/Become-an-Eco-School/Pathways/Water.aspx[CH2]

FUN FACTS

(These facts are adapted from National Wildlife Federation's Ranger Rick® magazine)

KNOW YOUR ANIMALS

- Moose are the largest deer species in the world. Their antlers can be 5 feet across, and they can stand 8 feet tall at the shoulder and weigh 14,000 lbs.
- North American Great Egrets are actually herons. They are large birds, standing 3 feet tall, with beautiful white plumes. The destruction of wetlands, especially in the West, poses a current threat to these majestic birds.

ANIMAL FAMILIES

- Except during mating season, a herd of elk will be led by a female, or cow elk. She will lead the herd to food and water.
- During their winter migration, Canada geese pick one mate to stay with for the coming year.
- Most wolves live in packs. They work together to raise their young and to hunt their food.
- When a wolf wants to show that it is submissive to another wolf, it will crouch, whimper, tuck in its tail, lick the other wolf's mouth or roll over on its back.
- For wolves, howling is for long-distance communication to pull a pack back together and to keep strangers away.

ANIMAL ADAPTATIONS

- Bears are omnivores – that is, they eat all kinds of food. Bears eat plants, roots, berries, carrion and insects as well as salmon and other animals.
- Bighorn sheep live in mountainous, rocky areas and prefer dry places without much snow cover.
- Elk live in large herds and migrate from higher elevations in summer to lower elevations in winter.
- Canada geese will pause on their winter migration to eat, drink and rest.
- Once there were millions of bison all over the United States, but by the end of the 19th century fewer than 1000 bison were left. Currently there are about 12,000 wild buffalo on public lands in the US.
- Bison regularly migrate, or move on to new areas, when they've eaten the grass at each location. They visit different areas in winter and in summer.
- Male, or bull elk, shed their antlers in early spring. By fall they have re-grown a new pair of antlers weighing up to 40 lbs!
- Canada geese migrate from the northern part of North America to the southern regions in winter because they need open water to get food. They will spend the winter in snowy areas as long as they have open water.

NATIONAL EDUCATION STANDARDS

WHERE IN THE WORLD?

Science: NSES

Grades K-4 Standard C: Life Science

Organisms and environments

Grades 5-8 Standard C: Life Science

Regulation and behavior, Diversity and adaptations

Grades K-4 Standard D: Earth & Space Science

Changes in earth and sky

Grades 5-8 Standard D: Earth & Space Science

Structure of the Earth system, Earth in the solar system

FUN FACTS

SCIENCE: NSES

Grades K-4 Standard C: Life Science

Characteristics of organisms, Organisms and environments

Grades 5-8 Standard C: Life Science

Regulation and behavior, Diversity and adaptations, Populations and ecosystems

English/Language Arts: NCTE/IRA

Standard 1: Reading for perspective

WRITER'S CORNER

Grades K-4 Standard C: Life Science

Characteristics of organisms, Life cycles of organisms, Organisms and the environment

Grades 5-8 Standard C: Life Science

Regulation and behavior, Diversity and adaptations, Populations and ecosystems

Grades K-8: Standard A: Science as inquiry

Abilities necessary to do scientific inquiry

English/Language Arts: NCTE/IRA

Standard 1: Reading for perspective

Standard 4: Communication skills

Standard 5: Communication strategies

Standard 6: Applying knowledge

WHAT YOU CAN DO

English/Language Arts: NCTE/IRA

Standard 4: Communication skills

Standard 5: Communication strategies

Standard 6: Applying knowledge

Standard 7: Conducting research