GRAY WOLF EDUCATOR GUIDE

EXPLORING A KEYSTONE SPECIES WITH STUDENTS IN GRADES K–12

Photograph by Jim and Jamie Dutcher

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ABOUT THE DUTCHERS

National Geographic is collaborating with wildlife filmmakers Jim and Jamie Dutcher to bring educational content about wolves to learners of all ages. For 25 years, including six years living in a tented camp on the edge of Idaho's Sawtooth Wilderness, the Dutchers have focused on the study and documentation of wolf behavior, intimately observing the social hierarchy and behavior of the now famous Sawtooth Pack. As two of America's most knowledgeable experts on wolves, they are devoted to the betterment and understanding of this keystone species. The Dutchers are the founders of Living with Wolves, a nonprofit organization dedicated to raising broad public awareness of the truth about wolves, their social nature, their importance to healthy ecosystems, and the threats to their survival.

For more information:

Living with Wolves

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LivingWithWolves.org

INTRODUCTION: WHY TEACH ABOUT WOLVES?

The purpose of this guide is to provide educators of students from kindergarten to high school with activities that will enrich students' understanding about the gray wolf of North America. The activities are intended to dispel common myths and prejudices that are held about these animals and to encourage youth to get involved in conservation efforts.

Wolves are more like humans than many realize. Students will find that they can relate to this animal because the lives and experiences of wolves mimic those of humans in many and often surprising ways—from their social structure and family roles to the experiences of bullying and being misunderstood. Because of the myths and prejudices held by many and a history of persecution that continues today, wolves also serve as a way to motivate students to become active citizens in environmental stewardship and conservation.

For educators, the study of wolves serves as an engaging topic to help meet a wide variety of science, social studies, and English language arts learning objectives and standards. This guide provides educators with springboards to illuminate the interconnected world, the importance of our ability to reason about those interconnections, and to make far-reaching decisions that positively impact the world.

Photograph by Jim and Jamie Dutcher

USING THIS GUIDE IN DIFFERENT SETTINGS

IN THE CLASSROOM

The activities in this guide have been designed to introduce content about wolves that can be used as part of a lesson or unit on endangered or threatened species or the optimum conditions that support the survival needs of animals. It is also uniquely suited to studies about conservation, our stewardship of the planet, and how the attitudes of humans can lead to the eradication of an entire species. The study of wolves lends itself to alignment with a wide range of curriculum standards in science (life science, ecology), social studies (geography, history, civics, current events/issues), and English language arts (reading, writing, speaking and listening). At the end of each activity, look for standards codes, which are mapped to sets of national standards listed in the appendix.

IN AFTERSCHOOL SETTINGS

Many of the activities in this guide are also appropriate for out-of-school settings such as boys and girls clubs, latchkey programs, and scout functions or camps. Although learning opportunities are embedded in the activities, many do not require educational expertise to facilitate. Afterschool personnel can use the springboards provided here to lead lively activities and discussions about the topic.

Photograph by Jim and Jamie Dutcher

IN MUSEUMS OR ZOOS

Museums and zoos that contain exhibits about wolves, endangered species, or balancing nature can use the activities and ideas in this guide to host wolf-themed events and workshops or for school field trips. They can also create packets to distribute to children with select activities that can be completed after the visit, at school, or at home.

USING THE GUIDE WITH DIFFERENT GRADES

This guide contains a wealth of information about wolves to share with children and youth, but not all of it is appropriate for all ages. We have organized the activities on a continuum—from simple concepts of awareness for the very young to increasingly complex concepts and tasks for older grades.

Note that some activities may overlap into different grades, so it is recommended that you review the activities in the grade bands above and below your own to determine if there are activities that can be used with your students.

HOW THIS GUIDE IS ORGANIZED

This guide is divided into four main sections that serve as a framework for learning about the gray wolf. Within each section, activities are divided into grade bands, from kindergarten to high school, but even some post-secondary instructors of courses in the social sciences may find ideas they can incorporate into their curriculum.

BEFORE DOING THE ACTIVITIES

The activities in this guide are designed to work as stand-alone activities and can be done in any order, but the following suggestions may help you organize the learning into a more structured unit.

ACTIVATE PRIOR KNOWLEDGE

Before beginning the activities in this guide, take a few moments to learn what your students already know about wolves.

FOR TEACHERS OF ALL GRADES
Create a list of statements about gray wolves on the board or chart paper. Make sure the list is a mixture of facts, such as those listed in the Fast Facts sidebar, as well as some misleading or outright false statements. (Ask older students to come up with their own statements about wolves from their experiences or prior knowledge.)

FAST FACTS

A GRAY WOLF . . .

- weighs about 0.45 kilograms (1 pound) when it is born.
- can weigh from 31–59 kilograms (70–130 pounds).
- can eat up to 9 kilograms (22 pounds) of food per feeding.
- generally feeds every 5–7 days.
- has paws that are about 10 centimeters (4 inches) wide by 12.7 centimeters (5 inches) long on average.
- doesn't like to live alone.

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GRADES K–3

- Read each statement aloud. Ask students to vote on whether it is true or not true (or if they don't know).
  - o K–1: have students raise their hands to vote, and tally the number voting for each category.
  - o 2–3: have students write their answers on a numbered list for you to collect.
- Save the group votes or individual lists for a post-test activity when you have completed all of the activities you select from this guide. For example, you can repeat the activity, show students the changes in their answers, and discuss how or why they changed.

GRADES 4–12

- Download and duplicate the three-column chart from NatGeoEd.org/three-column-chart. Have students label the three columns "Fact," "Fiction," and "Unsure."
- Using the list of accurate, misleading, and false facts, have students write each statement below the category in which they think it belongs. Discuss their decisions, inviting students to debate whether a statement was classified correctly as fact or fiction.
- Collect the papers to use as a post-test activity when you have completed the activities you select from this guide. Consider using the same list of statements in a written test format to distribute at the end of the activity. After grading the post-tests, return their original three-column charts to allow students to compare their previous answers. Have them write an essay on how and why their ideas about gray wolves changed.

CREATE WOLF JOURNALS (GRADES K–6)

To help structure the learning for your wolf activities, as well as to create a keepsake for students to remember their experiences, have students create "Wolf Journals" to hold their notes, sketches, and ideas about wolves as they complete the activities in this guide. NOTE: Students in middle and high school can use a regular, spiral-bound notebook for the same purpose.

CREATE YOUR OWN JOURNAL

① First, show students images to illustrate that not all "gray wolves" are gray. Use pictures from books on gray wolves or project images from the web, such as those available at NatGeoEd.org/wolves.
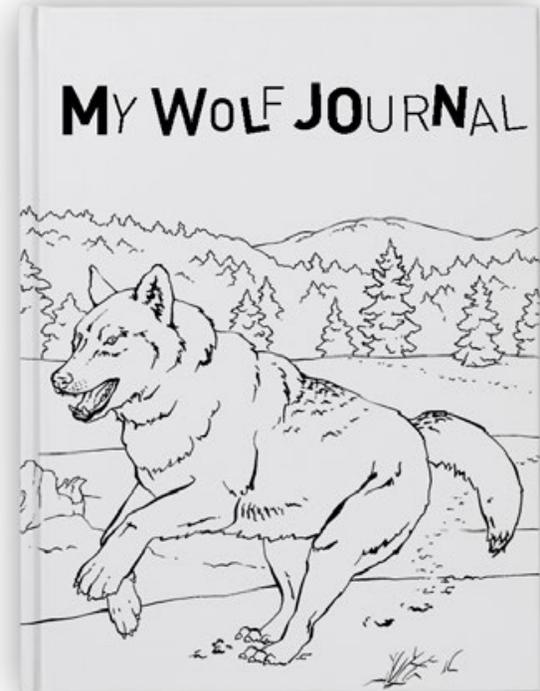
Illustration courtesy National Geographic Kids

② Distribute a manila, or file, folder to each student. For younger students (K–2) you might want to duplicate the cover from page 32 of this guide. It provides both a title and a ready-to-color wolf outline. Have students glue the cover to the front of the folder. Older students (Grades 3–6) can use their creativity to design a cover.

③ Have students add their names to the covers of their journals.

④ Distribute 16–20 sheets of blank paper to each student. Have them insert the sheets into the folder. Staple the booklets together. The booklets will hold facts, sketches, and reflections during the wolf unit.

IDEAS FOR USING THE JOURNALS

Look for references to this wolf journal in activities throughout the guide. You might also:

- Designate one page toward the back of the journal for students to record new terms and their definitions (see the Glossary on page 27 of this guide for selected terms and definitions).

- Begin each day with a wolf trivia question written on the board, the answer to which will be embedded in that day's lesson. Have students write the answer to the daily question on a page in their journal whenever they hear it come up in discussion. At the end of the day, invite volunteers to share their answers to the daily question.

- Reduce and reproduce handouts of your own design (or from NatGeoEd.org/graphic-organizers) that go with a lesson, and paste or staple them directly into the booklets.

- Collect the journals or notebooks periodically to review students' work and/or to ensure the journals aren't lost before the unit is over.

SECTION 1

THE GRAY WOLF

Activities in this section relate to the physical characteristics of gray wolves, their location, and habitat.

BACKGROUND INFORMATION

Today, the North American gray wolf (*Canis lupus*) ranges across the Northern Rockies, the Pacific Northwest, the Western Great Lakes region, from the U.S./Canadian border into the Arctic (including Alaska and Greenland), and in a small region along the Arizona-New Mexico border, with very few wolves struggling to survive in Mexico.

Photograph by Jim and Jamie Dutcher

Current taxonomic classification divides North American gray wolves into four to six subspecies (e.g., Great Plains or Timber Wolf, Rocky Mountain Wolf, Mexican Wolf, Arctic Wolf). However, the subspecies vary more by geographic range than physical characteristics. Gray wolves around the world share similar characteristics.

An average-size North American male gray wolf weighs 31–59 kilograms (70–130 pounds), stands 66–91 centimeters (26 to 36 inches) at the shoulders, and stretches 1.5–1.8 meters (5–6 feet) from the nose to the tip of the tail. Females are about 20 percent smaller. The coat or fur of a gray wolf can be many shades of gray, tan, brown, rusty red, cream, solid black, and white. Arctic gray wolves tend to be creamy white.

Wolves roam over large territories and are built for distance running. Their chest is narrow, which makes forging through snow easier. Their legs are long and closely set together at the front, so that the rear paws follow the front paws in the same track. Their paws are large for easier travel across snow and other terrain. As befits dominant carnivores, wolves have large teeth, and jaws with a bite force of 1,500 pounds per square inch, capable of crushing the thighbone of a moose. But, at the same time, the wolf's mouth provides a similar function to human hands for holding and carrying.

SECTION 1 ACTIVITIES

GRADES K–2

- **Introduce the Wolf** Ask students if they have a dog at home. Take a few minutes to invite volunteers to share information about their dogs: the breed, dog's name, some stories about their pets, and so on. If they have more than one dog, ask them to tell how the animals act toward each other and the humans that live in the house with them. Show or project images of wolves (from library books or online from NatGeoEd.org/wolves) and ask students how wolves are like dogs. How are they different? *NGSS: 2-LS4-1, 3-LS3-1; NSES: (K-4) C.1; CCSS.ELA-LITERACY.CCRA.SL.1, SL.2*

- **Basic Needs of Animals** Ask what kinds of things people have to do for their pets to keep them healthy and happy. Discuss how all animals, including dogs, humans, and wolves, have basic needs. Write students' ideas on the board or chart paper, and have students turn to a page in their wolf

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journals to write or draw pictures of a dog having its basic needs met in a home. Then ask how students think wolves, which live in the wild, meet these needs when they don't have humans to provide food and shelter. Ask students to draw that on the next journal page. *NGSS: 2-LS4-1, LS1.C; NSES: (K–4) C.1; C3.SSSS: D4.1.K-2, D4.2.K-2*

- **Learn About the Gray Wolf** Gather at least one copy of the book *National Geographic Readers: Wolves* (it may be readily available in your school or local library; if not, see the Resources section of this guide) and conduct a guided read-aloud of the first 11 pages (note that the remainder of the book will be discussed in other sections). Stop frequently to discuss images and facts about wolves during the reading, such as pages 8–11, which describe wolves' relationship to domestic dogs. Use the first three questions in the Stump Your Parents section on pages 30–31 to begin a discussion about what students have learned about wolves, and have them record notes or sketches on the next blank page of their wolf journals. *NGSS: 2-LS4-1, 3-LS3-1; NSES: (K-4) C.1; CCSS.ELA-LITERACY.CCRA.R.7, SL.1*

GRADES 3–5

- **Introduce the Wolf** Discuss the background information with students and have them record notes or sketches in their wolf journals. Brainstorm and include additional information about the basic needs of animals. *NGSS: 3-LS3-1, 3-LS2-1, 3-LS3-1, 3-LS4-2, 4-LS1-1; NSES: (K-4) C.1; C3.SSSS: D4.2.3-5*

- **Wolves and Dogs**
  o Play a group game to highlight the ways in which wolves and domestic dogs are alike and different. First, create a set of cards with facts about both gray wolves and domestic dogs (see Resources for places to find these facts). Divide the class into teams, and play a game in which a representative of each team competes to call out the category of a fact you read aloud as a characteristic of wolves, domestic dogs, or both. *NGSS: 3-LS3-1, 3-LS4-2, 4-LS1-1; NSES: (K-4) C.1; CCSS.ELA-LITERACY.CCRA.R.7*

  o Read and discuss the Aesop's fable titled "The Dog and the Wolf" (see Resources). Ask what other "pros and cons" are associated with being a dog versus being a wolf. *NGSS: 2-LS4-1, 3-LS3-1; NSES: (K-4) C.1; CCSS.ELA-LITERACY.CCRA.R.7*

  o Have students turn to a blank page in their wolf journals and create a simple T-chart, labeling one side "Wolves" and the other "Dogs." Have them record the differences and similarities in size, physical traits, food, and behaviors on the chart. *NGSS: 3-LS3-1, 3-LS4-2, 4-LS1-1; NSES: (K-4) C.1a*

- **Recognizing Tracks** Project the tracks of different animals (see Resources) and discuss what makes the different tracks unique. Students should observe the shapes of the prints, whether claws are evident, how many toes, and so on. Have students sketch in their wolf journals the tracks of several animals, including the gray wolf. As a follow-up activity, you can create your own animal tracks; each day display or lay out on the floor a different track, and tell students that the first one to identify that day's track wins a treat or special privilege. *NGSS: LS1.C; NSES (K-4) C.1, (K-4) C-3*

Photograph by Jim and Jamie Dutcher

GRADES 6–8

- **Wolves and the Origin of the Dog** Select one or both of the following activities to review members of the *canid* family. *NGSS MS-LS1-5, MS-LS2-1, MS-LS4-4, MS-LS4-6; NSES (5-8) C.1, C-2, C-5*

  ○ Project the Wolves' Family Tree found at NatGeoEd.org/wolves (Tip: click "go to this website" and select full-screen size) and have volunteers read each section. Discuss how domestic dogs and wolves have evolved over time. Facts to cover: how they compare (size, physical traits, prey, behavior); how, according to current research and unlike other members of the canid family, domesticated dogs and modern gray wolves share the same wolf ancestor; traits of each (e.g., superior sense of smell, trackers and retrievers on human hunts; skill at maneuvering big grazing animals to help humans with livestock); human breeding efforts to create a dog that guards human flocks and property; how dogs offer companionship and loyalty to people the same way wolves do for one another in a pack, and so on.

  Photograph by Jim and Jamie Dutcher

  ○ Read and discuss the editorial "Opinion: We Didn't Domesticate Dogs. They Domesticated Us." from *National Geographic News* (see Resources).

- **Wolf Ranges and Habitats** Project the National Geographic interactive map at NatGeoEd.org/mapmaker-interactive. Click the "Add Layer" button, select the Gray Wolf data layer, and click "Done." Read aloud the information found in the legend. Using that information, the map itself, and the following prompts, discuss the range of the gray wolf territory. *NGSS: MS-LS1-5, MS-LS2-1, MS-LS4-4, MS-LS4-6; NSES: (5-8) C.1, C-2, C-5; NGS: Standards 1, 8*

  ○ Look at the green area of the map, showing the current gray wolf territory. What states does this territory encompass?

  ○ How far north does the territory extend?

  ○ What biomes are part of this area? How do wolves thrive in such a diversity of habitats?

  ○ Explain that the gray wolf used to roam throughout all but the southeastern section of the United States. Point out the additional areas on the map. Are other biomes located in those areas? What types of animal adaptations would be required to live in some of those habitats?

THE GRAY WOLF

GRADES 9–12

- **Learn About the Gray Wolf** Make copies of books about wolves available to the class, such as *The Hidden Life of Wolves* (see Resources). Divide the class into small groups and have each group take on one aspect of the gray wolf: information about the species, its physical characteristics, or territory. Give groups time to research their topic (see Resources, as well as the background information in Section 4: Making a Change) and then design a creative presentation to share their findings with the class. They might create PowerPoint (or other software) presentations; board, role-playing, or video games; books; or oral presentations. All presentations should include references and use any media that will help their audience understand the topic: still or video images, charts, maps, artifacts, and so on. *NGSS: HS-LS2-2, HS-LS2-6, HS-LS2-8, HS-LS4-4, HS-LS4-5; NSES: (5-8) C-2, (9-12) C.4, C.6; CCSS.ELA-LITERACY.CCRA: W.1, W.2, W.6, W.7, W.8, W.9; SL.2, SL.4, SL.5; C3.SSSS: D4.1.9-12, D4.2.9-12, D4.3.9-12*

Photograph by Jim and Jamie Dutcher

Topics, with accompanying information to look for during grading, might include:

- ○ *The Parallel Evolution of Wolves and Dogs*—Look for information about how both wolves and dogs came from the same *canid* origins and how dogs were domesticated.

- ○ *Wolf Adaptations*—Look for information about color differences and connection to environment, different layers of fur coat and how it protects wolves from the elements, animal diet and reaction to loss of food sources, how wolf bodies are built for distance running (10–30 miles per day at 5 mph) and snow (narrow chest to forge through snow; long, closely set legs that follow in same track; large paws for easier travel across snow and other terrain), and the characteristics of a carnivore.

- ○ *Wolves as a Keystone Species and Apex Predator*—Look for information about how wolves help restore stability to their ecosystems by providing scavenging opportunities for other animals and improving riparian areas by hunting herbivores. And research how wolves control coyote populations, strengthen ungulate herds, and so on.

- ○ *Wolf Family Structure*—Look for information about the social structure of wolves: how they live in families, educate their young, and care for one another.

- **Wolf Ranges** Have students plan a route that a lone dispersing wolf might take, starting at the Sawtooth Pack Wolf Camp where the Dutchers lived with wolves (at the foot of the Sawtooth Mountains, running southeast out of the town of Stanley, Idaho), and from there travel north to a location in Canada and create a map illustrating that route. Have them use the MapMaker Interactive found at NatGeoEd.org/wolves, the one found in *The Hidden Life of Wolves* (p. 211), or other maps to inform their own map-making. Students should explain what caused the wolf to take the path that it did, including landforms, human populations, availability of prey, and other factors that would affect a wolf's route. Ask them to explain what aspects of the reference maps were most useful to their research. *NGSS: HS-LS2-1, HS-LS2-2, HS-LS2-6, HS-LS2-8, HS-LS4-5; NSES: (9-12) C.4, C.6; NGS: Standards 1, 8*

WOLVES AND HUMANS

Activities in this section relate to the ways that wolves and humans connect: human perceptions about wolves and the impact those perceptions have on wolf populations, distribution, and survival.

Photograph by Jim Brandenburg/Minden Pictures

BACKGROUND INFORMATION

PERCEPTIONS ABOUT WOLVES

There are many perceptions of what a wolf is or isn't. In their years studying this animal, Jim and Jamie Dutcher have identified at least four perceptions people have of wolves. Although very different, these perceptions often exist side by side.

The first of these perceptions is what the Dutchers call the "Wolf of Nightmares," a beast of ancient fears and the concept of the wolf that Europeans brought with them to the New World. It remains today the wolf that many ranchers and hunters imagine—a wasteful and bloodthirsty killer of livestock and big game animals, and a menacing threat to human beings. This view remains in the minds of many people, despite evidence to the contrary. Although many people think that wolves are the greatest threat to livestock like cattle and sheep, there are other more significant dangers facing livestock on the open range, including severe weather, disease, and respiratory and birthing complications. While wolves and other large predators sometimes attack livestock, the overall impact of wolves on the livestock industry is minimal.

The second perception is the "Wolf of Science." Wolves are studied by scientists such as biologists, ecologists, and zoologists. They record valuable information on wolf breeding, predation, physiology, pack structure, diet, habitat and much more. They also study human impacts on wolves, which is very important for the conservation of this species. But scientists can't get too close to the wild animals without influencing pack behavior. Much research is therefore conducted remotely with the use of technology such as camera traps, "howl boxes," tracking devices such as radio collars, and/or by collecting DNA from scat, fur, and tissue samples. Data, indicating health, age, diet, gender, and reproductive history are also collected from wolves that are darted and temporarily sedated.

The body of knowledge produced by scientists continues to expand and enrich our understanding of wolves. But studying wild wolves has limitations in what can be observed with regard to behavioral research. Observing a captive pack up close, as the Dutchers have done, offers an intimate and nuanced perspective on the wolf's character, social bonds, individuality, devotion to its family, and capacity for emotion.

The third perception is what the Dutchers call the "Spirit Wolf." This perception of the wolf as a symbol has its origin in the culture of many Native American tribes and has been borrowed and often distorted by modern wolf enthusiasts. This wolf is an animal of great wisdom to be revered as a spiritual guide. Although this view holds the wolf in great esteem, it often does so at the expense of science.

Section 2 explores these first three perceptions. The fourth perception, the "Social Wolf," will be covered in Section 3: The Pack.

SECTION 2 ACTIVITIES

Because the activities in this section can be extended across multiple grade ranges, they have been divided into only two grade bands.

GRADES K–5

Image courtesy Library of Congress

- **The Wolf of Nightmares** Have students turn to a blank page of their wolf journals and fold it in half. Read any version of a classic tale (see suggestions below) in which a wolf is portrayed as the villain, and ask students to sketch or describe what they think the wolf looks like in the first section of the journal page. Then read a book that turns that story around to make the wolf the "hero" (also in the suggestions below) and have students draw or describe a wolf from that story in the other section of their page. Lead a discussion about how each story made students feel differently about the wolf/wolves, simply by the way the author portrayed them. Ask if students can think of other animals that have either positive or negative reputations because of their portrayal in stories. *CCSS.ELA-LITERACY.CCRA.R.3, R.6, R.7, R.9*

  o **Suggested stories for younger grades:** *The Three Little Pigs* versus *The Three Little Wolves and the Big Bad Pig*

  o **Suggested stories for older grades:** *Little Red Riding Hood* versus *Little Bad Wolf and Red Riding Hood* from *Newfangled Fairy Tales*

- **Are Wolves a Threat to People?** Wolves are generally afraid of people and avoid them. Wolves—like moose, cougars, bears, deer, bees, and other wildlife—can be dangerous, but attacks by wolves are exceedingly rare. Discuss with students how to properly behave around wildlife (e.g., don't get too close, don't feed wild animals, store food properly, clean up trash). *NSES (K-4): C-3*

- **Are Wolves a Threat to Livestock?** Less than one percent of all livestock in the U.S. that die before going to market are lost to wolves. *CCSS.MATH: 1.MD.4, 2.MD.10, 6.RP.3.C*
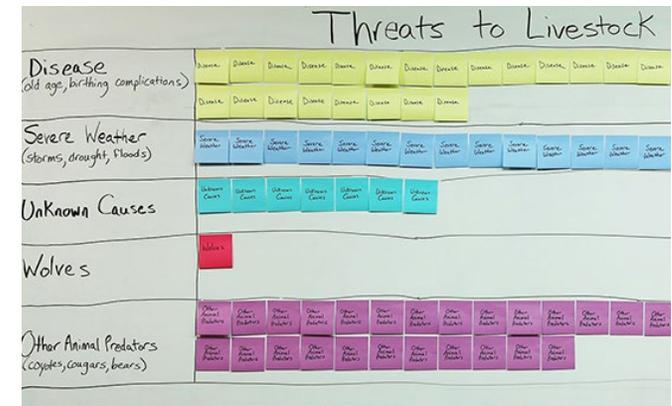
  Select an activity according to the ages of your students to help them understand what that figure, less than one percent, means:

Photograph by National Geographic

  o Have young children create a role-play game where each child represents one cow, sheep, or other type of livestock. Create a stack of 100 3″ x 3″ sticky notes, each labeled with one danger to livestock, in the following numbers:

  ▪ Disease (includes old age and birthing complications): 33

  ▪ Unknown causes (no way to tell why it died): 7

  ▪ Severe weather (e.g., storms, drought, flood): 23

  ▪ Other animal predators (e.g., coyotes, cougars, bears): 36

  ▪ Only ONE of the sticky notes should be labeled "wolf"

List each category on the board, leaving room beside or above the labels for students to add their sticky notes in a growing line. Randomly pass out one sticky note to each student. Have students place their note above or beside the correct category, producing a picture graph of dangers. Pass out another round of notes and repeat the procedure until all 100 notes have been added to the chart. Then discuss the fact that "one percent" means one out of 100. Modification: If you do not have access to a large enough space for the 3"x3" sticky notes, you can also conduct this activity on chart paper with colored sticky dots.
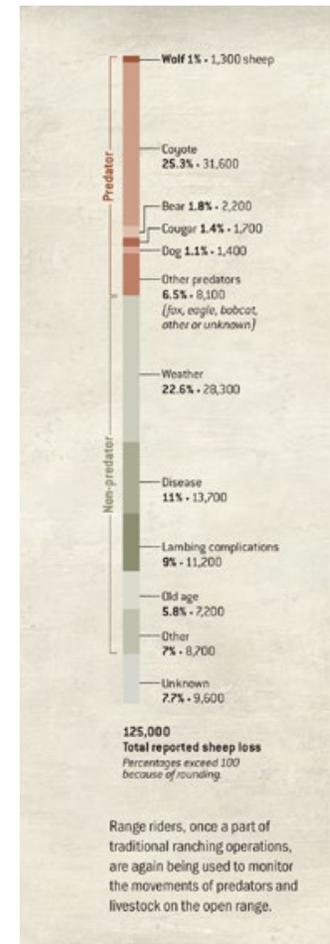
o Show students a bowl of 100 small, multicolored items (such as lego bricks, Unifix Cubes, tiddlywinks, marbles, or small candies), only one of which is red. Have each student reach into the bowl and take out one item, repeating until all 100 have been distributed. Discuss: What does 1 out of 100 mean in percentages? What were the chances that a student could pull out the red one?

o Have older students create a pie chart or a line or bar graph illustrating the same data. Discuss what one percent looks like on a line graph like the one to the right.

• **The Wolf of Science** Have students brainstorm different jobs that people might have that would bring them in contact with wolves. Talk about what people who have that job do and how it relates to wolves. Ask if any students would like to have that job someday and why or why not. *NSES: (K–4) G-1, (5-8) A-1, E-2, G-1*

• **The Spirit Wolf** Identify Native American myths and legends related to the wolf (see Resources). Conduct a guided read-aloud of two or three stories, each of which portrays the wolf differently, and discuss how different groups have viewed this animal differently. *CCSS.ELA-LITERACY.CCRA.R.3, R.6, R.7, R.9; C3.SSSS: D2.His.4.3-5, D2.His.6.3-5*

GRADES 6–12

• **The Wolf of Nightmares** Discuss the etymology of the term *myth* and how myths have been a part of all human cultures throughout history. Ask students to consider why wolves have entered the mythology of some cultures as dangerous predators or monsters that kill for sport (in other words, hunting for some other reason than for food). *CCSS.ELA-LITERACY.CCRA.R.3, R.6, R.7, R.9, W.3, W.6*

Assign one of the following writing projects:

o Write a new fairy or folk tale, in which the wolf plays the hero of the piece. Younger students can take an existing story and rewrite it from a different perspective.

o Write a comparative literature report, discussing the origins of werewolf literature. Contrast classic werewolf literature with the current trend in romances featuring werewolves as heroes.

• **The Wolf of Science** Brainstorm a list of careers related to the study of wolves. Include wolf biology, zoology, wildlife filmmaking, wildlife management, big-game veterinary medicine, and so on. *NSES: (5-8) A-1, E-2, G-1; (9-12) A-1, E-2, G-1; CCSS.ELA-LITERACY.CCRA.W.3, W.6*

Predator

Wolf 1% · 1,300 sheep

Coyote
25.3% · 31,600

Bear 1.8% · 2,200
Cougar 1.4% · 1,700
Dog 1.1% · 1,400
Other predators
6.5% · 8,100
(fox, eagle, bobcat, other or unknown)

Non-predator

Weather
22.6% · 28,300

Disease
11% · 13,700

Lambing complications
9% · 11,200

Old age
5.8% · 7,200

Other
7% · 8,700

Unknown
7.7% · 9,600

125,000
Total reported sheep loss
Percentages exceed 100 because of rounding.

Range riders, once a part of traditional ranching operations, are again being used to monitor the movements of predators and livestock on the open range.

Graphic courtesy Jim and Jamie Dutcher

    o Assign a research/report activity where students discover the education required for this career, the work it includes, and the impact such a position has on wolves, wolf packs, and the future of wolves.

    o Assign small groups to safely create a 5–10 minute wildlife documentary of a local animal, or even a pet, focusing on the life of the animal. After previewing all the films, conduct a whole-group debriefing to focus on what makes a good documentary about an animal.

- **Humans as a Threat to Wolves** Tell students that although our culture is filled with legends, myths, and beliefs about the threat that wolves pose to humankind, it's actually humans that pose a threat to the survival of the wolf, not the other way around. Have students discuss and brainstorm human threats. (Remind students that wolves don't understand human borders; they have their own ideas about territory. Humans encroach on that territory through development, leaving sheep where wolves den, by shooting wolves that unknowingly migrate in and out of protected areas like national parks, and by hunting/poaching without licenses.) *NGSS: MS-LS2-2, HS-LS4-5, HS-LS4-6.*

- **The Spirit Wolf** Have students work in pairs or small groups to compare two or more Native American legends or European myths, folktales, or fairy tales, some worshiping or revering the wolf, others fearing or vilifying it (see Resources). After researching each belief system, have teams create posters, skits, or presentations to share both the story and the meaning behind it with the rest of the group. As a whole group, consider why some cultures choose a positive and some a negative characterization. *ccss. ELA-LITERACY.CCRA.R.3, R.6, R.7, R.9; W.3, W.6; SL.1, SL.2, SL.4, SL.5; C3 SSSS: D2.His.4.6-8, D2.His.6.6-8*

THE PACK

Activities in this section relate to the gray wolf as a social being, its relationships with other wolves (family, pack) and with other animals, and how wolves adapt to their environment.

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BACKGROUND INFORMATION

UNDERSTANDING THE SOCIAL WOLF

Section 2 described three perceptions humans have of wolves. This section focuses on the fourth perception and the wolf that the Dutchers have come to know—the "Social Wolf." In their years living with and observing the Sawtooth Pack, the Dutchers came to see wolves as individuals, each with its own distinct personality. Intensely social creatures, the wolves exhibited extreme devotion to their family or pack. The Dutchers observed them as animals that are capable of emotion—they care for one another and demonstrate this on a daily basis. The Dutchers captured a unique and close-up view and they, like many wolf scientists, offer a perspective of the gray wolf that is neither demon nor deity, nor merely biological statistics. It is an animal that is both intelligent and social. It is an animal that cares for its sick and injured and protects its family.

A wolf pack usually consists of parents and their offspring of various years. In a wolf family, each wolf communicates with one another according to their familial roles. The parents are in charge, with the older siblings next in order, followed by the pups of the current year. Wolf packs have members that may become dispersers. A wolf disperses by leaving the pack to seek another pack to join or to create a new pack.

The social hierarchy of a pack is similar to that of a family unit, with parents (founding pack members) making decisions like who eats first and who gets more food. Wolves frequently communicate, regularly employing a complex mix of vocal and physical communications to express their needs and emotions. For example, a pup may solicit adults for regurgitated food by licking their muzzles. If there is food around, the adult male and female may growl at pack members to keep them away until they are finished eating. Mistakenly, people often interpret this language as being vicious and evil, but it is simply one of the many ways wolves communicate.

A wolf pack is an exceedingly complex social unit—an extended family of parents, siblings, aunts, uncles, and sometimes dispersers from other packs. Wolf families can include old wolves that need to be cared for, pups that need to be educated, and young adults that are beginning to assert themselves—all altering the dynamics of the pack.

The job of maintaining order and cohesion in the pack falls largely to the parents or breeding pair, also known as the alphas. They, especially the alpha female (the mother of the pack), keep the pack together.

THE PACK

The alphas bear the responsibility for the welfare of the entire pack. Typically, one of the two will act as its decision maker and alert others of signs of danger. The alpha female is the dominant female of the pack, and is mated to the alpha male. Often there is a beta wolf, second in rank. Betas may serve as peacemakers and puppy-sitters or guardians. The lowest ranking wolves in a pack are the omegas, often both a male and female. The omegas must constantly submit to their fellow pack members, as they are often dominated by them or treated as scapegoats. But, omegas are often the instigator of play, helping to alleviate pack tension, thus filling an important role within the family group. No other position requires as much skill in diplomacy and appeasement. Both mid- and low-ranking positions are somewhat fluid. Although an omega, for example, may hold that position for many years, its not unheard of for the pack to pick a new omega and let the other retire. Sometimes young, sexually-maturing males and females may become dispersers. A wolf disperses by leaving the pack to seek out another disperser of the opposite sex to create their own pack or family or to join another pack. They've even been known to return to their original family after spending time in another pack.

Vocalizations such as growls, barks, whines, yips, and whimpers are equally important to the non-vocal body language of baring teeth in a warning of pending aggression or the tucking of the tail in submission. Whines and whimpers indicate friendly interaction but also show frustration or nervousness. Growls and snarls are threatening or defensive. Barking is rare and is usually used as an alarm signal. Howls seem to be about togetherness, whether the wolves are gathering for a hunt, after making a kill and after feeding, mourning a lost pack mate, or announcing territorial or mating intentions. A wolf's posture when encountering other wolves says a lot about its status in the pack. Subordinates crouch and often lick at the dominant wolf's muzzle like a puppy, while higher-ranking wolves, like alphas, sometimes bite at the muzzles of subordinates and are readily identifiable by their stiff-legged gaits and high tails.

Photograph by Jim and Jamie Dutcher

SECTION 3 ACTIVITIES

GRADES K–2

- **Learn About the Pack** If possible, use the book *National Geographic Readers: Wolves* and read aloud pp. 12–23, discussing pack and family life. Or relate the information from the Background Information to the class. Stop frequently to discuss facts and share photographs of wolf packs as well as adults and pups interacting. Ask students to tell how wolf packs are like human families and how they are different. Have them draw pictures of wolf families in their wolf journals. *NGSS: 2-LS4-1, 3-LS3-1; NSES: (K-4) C.1; CCSS.ELA-LITERACY.CCRA.SL.1, SL.2*

- **Role-Playing Wolves with Masks and Tails** Stand in front of the class and silently demonstrate various feelings. Cross your arms, tap your foot impatiently, smile, frown, show fear, and so on. Ask students to guess your feelings by calling out emotions. Then let volunteers take turns demonstrating non-verbal communication. Discuss how the class was able to tell how the actor was feeling. Explain that animals, including wolves, show how they are feeling in very similar ways, through body language, facial expressions, and sounds. Explain that students are going to practice communicating like wolves. *NGSS: 1-LS1-2; NSES: (K-4) C.1, C.2; CCSS.ELA-LITERACY.CCRA.SL.1, SL.2*

THE PACK

AFFECTION   HAPPINESS   SADNESS   FEAR

Photographs by Jim and Jamie Dutcher

The following activities can be completed individually or in sequence:

- o Go to NatGeoEd.org/wolves to view the Wolf Language text and images from *The Hidden Life of Wolves*, pp. 58–59. Share the images with the class as you discuss wolves' communication skills (facial expressions, the position of the tail and ears, posture, and so on). Then show them the images of wolf "facial expressions" and have each create a wolf mask that demonstrates emotion (e.g., sadness, happiness, fear, affection). Have students model their masks and let the rest of the class guess the emotion. NOTE: Make sure the ears are flexible enough to stand up or fold down and to the side to indicate emotions.

- o Discuss how and when a wolf's tail might change. Create tails using paper or other found materials. The tails can be attached to the backs of clothing with binder clips, and held up or down in whatever position best fits the emotion being displayed.

- o Have students play charades using the masks and tails as props (silently, or with a form of wolf vocalization), with teammates calling out the wolf's emotions or intentions. Debrief about the activity to discuss how wolves communicate. How does the position of the ears, tail, or even the whole body help show emotions? How is this similar to and different from the ways humans communicate?

GRADES 3–5

- • **Role-Playing Wolf Hierarchy** Go to NatGeoEd.org/wolves to view the Wolf Language text and images from *The Hidden Life of Wolves,* pp. 58–59. Discuss the roles in a wolf pack hierarchy, as well as the roles of male and females. Choose one or more of the following activities to demonstrate both hierarchy and communication among the pack. *NGSS: 3-LS2-1, 3-LS3-2, 4-LS1-2; NSES: (K-4) C.1, C.2; CCSS.ELA-LITERACY. CCRA.SL.1, SL.2*

- o Divide the class into two groups and have each work quietly to create a simple skit in which they demonstrate the hierarchy of the wolf pack. Have each perform their skit and ask the remaining group to try to identify which student played the alpha, beta, omega, and mid-ranking wolves.

- o Place the class into small groups ("packs") of 4 to 6. Each group should select one member to act as the alpha male or female of their pack. Call all the alphas to you and quietly give them a task for their pack to complete (e.g., moving to a particular location in the room, beginning a hunt, playing, all lying down, hiding). The alphas then return to their packs and attempt to communicate

this task non-verbally. After a few minutes, stop the activity and discuss how successful the alphas were at non-verbal communication. Repeat the activity with other alphas.

o Learn about the ways that wolf pups play and how the games that they play are actually lessons to help them become adults. Discuss what kinds of human games also teach kids things they need to know later in life. Play one or two of these games.

- **Animal Adaptations** Wolves have adapted to the habitats in which they live in many ways, including the color and thickness of their coats. To explore animal adaptations, share a slideshow of images from the Discovery animal camouflage web page (see Resources), and discuss how each animal survives

Photograph by Jim and Jamie Dutcher

because its physical attributes allow it to blend into the environment. Ask students how they think an animal might adapt to a change in its environment, for example, how would Arctic wolves that live in snowy landscapes adapt when the snow melts due to changes in seasons or climate change? Have students turn to a blank page in their wolf journal and draw two pictures of a gray wolf, each blending into a different environment (e.g., snow and a mountainous area). *NGSS: 3-LS3-2, 3-LS4-2, 3-LS4-3, 3-LS4-4, 4-LS1-1; NSES (K-4) C.1, C.3*

GRADES 6–8

- **Social Life of the Pack** Have students work independently or in pairs to explore the hierarchy of a wolf pack by writing a report comparing wolf behaviors to human behaviors. The report should include how positions may change in a wolf pack hierarchy, how wolves use both vocalizations and posturing to communicate and set the hierarchy, and so on. The final report should also consider the family, school, and work situations of both groups. *NGSS: MS-LS1-4; NSES (5-8) C-2, C-3, C.4; CCSS.ELA-LITERACY.CCRA. SL.1, SL.2*

Illustration by National Geographic

- **Placing the Four Perceptions Into Perspective** Review with students the perceptions about wolves by projecting and discussing the cartoon above from the National Geographic Kids book *Mission: Wolf Rescue.* See a larger version suitable for projection at NatGeoEd.org/wolves.

o Draw a concept web of one center circle with three circles branching out from it on the board and have students copy it in their journals.

o Above the three outer circles, add labels from the three perceptions of the gray wolf reviewed in Section 2:

- Wolf of Nightmares
- Wolf of Science
- Spirit Wolf

o Inside the outer circles, have students fill in information from the previous discussions related to each perception, and add a sketch of what the wolf looks like from that human perspective (e.g., the Science Wolf might be wearing a radio collar and two ear tags and be standing on a scale). Next, have them label the center circle: "The Social Wolf." Lead a discussion about how the three outer-circle perceptions about wolves are all answered by understanding the social wolf. How do the ways in which wolves live, communicate, and care for one another dispel the myths surrounding wolves? How would the image of the wolf change with that perspective? *NGSS: MS-LS1-4; NSES (5-8) C-2, C-3, C.4; CCSS.ELA-LITERACY.CCRA.SL.1, SL.2; C3 SSSS: D2.His.4.6-8, D2.His.6.6-8*

GRADES 9–12

- **The Lone Wolf or Disperser** Have students explore the phenomenon of the disperser—the wolf that leaves the pack. What reasons might cause a wolf to leave? How does this impact the pack, the lone wolf, and the health and vitality of the wolf species as a whole? *NGSS: HS-LS2-2, HS-LS2-6, HS-LS2-8, HS-LS4-5; NSES: (9-12) C.3, C.4, C.6; NGS: Standards 1, 8*

- **Pack Size** The number of individuals per pack can be highly variable, and a lot of factors are related to the population of a given pack in a given territory. Have students research and map the territory of one known pack, such as the Lamar Canyon Pack, Junction Butte Pack, 8 mile Pack, or Canyon Pack in Yellowstone National Park. *NGSS: HS-LS2-2, HS-LS2-6, HS-LS2-8, HS-LS4-5; NSES: (9-12) C.3, C.4, C.6; NGS: Standards 1, 8*

- **Habitats of the Wolf** Have students research and map the types and diversity of habitats in which gray wolves can thrive (e.g., open tundra, forests, prairies, deserts). Connect the wolves' physical features that help them thrive in each habitat, as well as the physical adaptations (e.g., fur color and layers, diet) that came about due to the features of a particular habitat. Collaborate as a class to create plot points comparing the carrying capacity (maximum population size the environment can support) of various biomes within the wolves' ranges in North America (see Resources for data). *NGSS: HS-LS2-1, HS-LS2-2, HS-LS2-6, HS-LS2-8, HS-LS4-5; NSES: (9-12) C.3, C.4, C.6; NGS: Standards 1, 8*

Photograph by Jim and Jamie Dutcher

MAKING A CHANGE

Activities in this section relate to efforts to protect the gray wolf, as well as suggestions for getting students involved in conservation efforts.

BACKGROUND INFORMATION

The Endangered Species Act (ESA) is a federal law that protects endangered and threatened plants and animals and the habitats in which they are found. Upon signing the Endangered Species Act on December 28, 1973, President Nixon stated, "Nothing is more priceless and more worthy of preservation than the rich array of animal life with which our country has been blessed." This statement defines the ESA's ultimate purpose, which is to conserve the nation's natural heritage.

To that end, the gray wolf, which had been hunted nearly to extinction in the U.S. during the 19th and 20th centuries, was reintroduced to the American West in Yellowstone National Park and central Idaho in 1995 and again in 1996. In the short time since wolves were reintroduced, much scientific research, especially from Yellowstone National Park, suggests that wolves have helped revitalize and restore ecosystems. For this reason, wolves are described as a "keystone species" and a critical part of healthy North American ecosystems. Wolves:

Photograph by Jim and Jamie Dutcher

- **Improve riparian areas**—After the reintroduction of the gray wolf in Yellowstone National Park, researchers noticed changes occurring. When wolves were absent, elk, the primary prey of the gray wolf, became abundant and fearless and began to damage their own habitat through overgrazing. After reintroduction, the fear of wolves forced the elk to stay on the move, freeing sensitive riparian areas from constant grazing pressure and allowing vegetation to recover along rivers and streams. More willows and aspens provide food for beavers. Beaver ponds benefit aquatic plants and animals. Shade from the trees cools the water, making the habitat better for trout.

- **Decrease coyote populations**—When wolves were absent, coyotes became "top dog" in Yellowstone. According to research, there are half as many coyotes in Yellowstone since wolf reintroduction. Wolves often kill coyotes, or chase them away, so rodent populations increase, benefiting struggling birds of prey. Coyotes specialize in feeding on pronghorn fawns. Fewer coyotes result in less predation pressure on these fawns. Wolves generally do not prey on pronghorn, focusing instead on slower moving elk or bison. Pronghorn have been known to choose to give birth in the vicinity of wolf dens, which are areas coyotes tend to avoid.

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- **Strengthen ungulate herds**—Wolves are opportunists, which means statistically they cull more of the sick, diseased, old, and genetically inferior elk and deer, allowing the healthiest individuals to breed and perpetuate their species, while helping keep potentially fast-spreading diseases in check. Wolves also keep herds moving and dispersed, which prevents overgrazing and the spread of disease. Wolves keep their prey on the move more than any other predator in North America.

- **Feed other animals**—The remains of a carcass left behind, unfinished by wolves, help feed grizzly bears, bald eagles, wolverines, and many other scavengers.

- **Boost ecotourism**—By the late 1990s, 150,000 winter visitors a year were visiting Yellowstone National Park, due in part to the reintroduction of wolves. The presence of wolves added $35.5 million to the local economy annually.

Photograph by Jim and Jamie Dutcher

The return of wolves to the American West is a direct outcome of the Endangered Species Act. But the ESA did not offer 100% protection for wolves because, upon reintroduction, they were given the designation of a "Nonessential Experimental Population," allowing for actions such as killing wolves for conflicts with livestock. Today, nearly all wolves have lost their federal ESA protections and are being killed—shot, trapped, and snared at alarming rates—and their numbers are in decline. They are in need of further protections. You can use the activities in this section to encourage students who are engaged in and motivated by this topic to get involved in conservation efforts.

SECTION 4 ACTIVITIES

GRADES K–2

- **Why Should Wolves be Protected?** If possible, use the book *National Geographic Readers: Wolves* and review pp. 26–29, discussing questions 6 and 7 on p. 31. Ask students to talk about why they think wolves should be protected. *C3.SSSS: D2.His.1.K-2, D2.His.2.K-2, D2.His.3.K-2; NGSS: K-ESS2-2, K-ESS3-1; NSES: (K-4) C-3*

- **Get Involved** Make a list or show students images of other animals or plants on the endangered species list (see Resources). Discuss why they are endangered and how people can help save those living things. Have each student "adopt" one of the animals or plants and draw a picture of it in their wolf journals. *C3.SSSS: D2.His.3.K-2, D4.1.K-2, D2.Civ.2.K-2*

- **What Have We Learned?** Return to the list of facts, misinformation, and falsehoods that were used in the pre-test before you began the activities in Sections 1–4. Read each item and ask students if it is true or not true. Remind them of the answers that they gave before, and discuss what they have learned about the gray wolf. *NGSS: 2-LS4-1, LS1.C; NSES: (K-4) C.1; C3.SSSS. D4.1.K-2, D4.2.K-2*

GRADES 3–5

- **Benefits of Wolves** Films like *Bambi* have led many children of this age to believe that the death of any animal is always a bad thing. This critical thinking activity is designed to have them question their assumptions. *C3.SSSS: D2.His.1.3-5, D2.His.2.3-5, D2.His.3.3-5, D4.1.3-5, D4.2.3-5; NGSS: 3-LS4-3; NSES: (K-4) C-3, G-1; CCSS.ELA-LITERACY. CCRA.SL.1, SL.2; C3.SSSS D2.His.4.3-5, D2.His.5.3-5, D2.His.6.3-5*

  o Explore with students the information provided in the Section 4 Background Information about the ways wolves have impacted elk and coyote populations.

  o Discuss unfamiliar vocabulary terms (e.g., *ungulates, riparian, apex predator*).

  o Divide the class into two groups and mediate a debate about whether or not it is a good thing for wolves to hunt for elk and other ungulates, and why. Are humans more sentimental about grazing animals like deer and elk than wolves and coyotes? How does the reintroduction of wolves in the area actually help the ungulates in the long term? How does it help the habitat?

Photograph by Jim and Jamie Dutcher

- **Dispelling Myths** Review with students the perceptions about wolves that they've already considered by projecting and discussing the cartoon to the right from the National Geographic Kids guide *Mission: Wolf Rescue* (visit [NatGeoEd. org/wolves](NatGeoEd.org/wolves) for a digital version suitable for projection). Hold a poster contest, asking students to work independently or in pairs to create posters about the "true" perception of wolves. *C3.SSSS: D2.His.1.3-5, D2.His.2.3-5, D2.His.3.3-5, D4.1.3-5, D4.2.3-5, D2.Civ.2.3-5; D2.Civ.2.3-5; NGSS: 3-LS4-3; NSES: (K-4) C-3, G-1; CCSS.ELA-LITERACY.CCRA.SL.1, SL.2*

  o The poster should include information from all three previous sections of the guide, dispelling myths and highlighting both the social nature of wolf packs and the benefits wolves have on the environment.
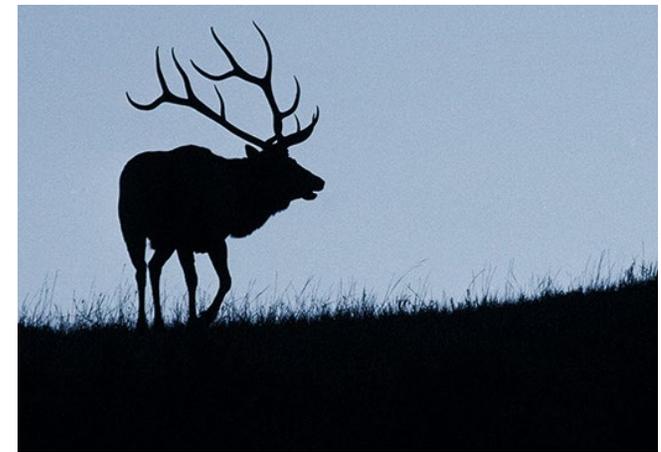
Illustration by National Geographic

NATIONAL GEOGRAPHIC

o Post the top 5–10 posters around the school or in libraries or other businesses around town.

- **Get Involved Bumper Stickers** Provide information to the class about an endangered or threatened species local to your area. Have the class "adopt" this animal or plant and discuss ways that they can help protect it. Assign an art project to design a bumper sticker to help save the endangered plant or animal. Photocopy the designs on blank bumper sticker paper (found in office supply stores) and either pass them out at a community function (or a school-wide community awareness evening event) or sell the bumper stickers at school functions, if that is permissible in your district. Donate the money to a local conservation group. *C3.SSSS: D2.His.1.3-5, D2.His.2.3-5, D2.His.3.3-5, D4.1.3-5, D4.2.3-5, D4.3.3-5, D2.Civ.2.3-5; NGSS: 3-LS4-3; NSES: (K-4) C-3, G-1; CCSS.ELA-LITERACY.CCRA.SL.1, SL.2*

GRADES 6–8

- **Encouraging Positive Perceptions** Conduct an Internet search for wolf logos such as the logos for the Minnesota Timberwolves or the Hartford Wolf Pack. Project and discuss the images. Discuss why wolves often appear in logos, symbols, statues, and crests. *C3.SSSS: D4.3.6-8, D4.3.6-8; NGSS: MS-LS4-4; NSES: (5-8) C-4, G-1; CCSS.ELA-LITERACY.CCRA.SL.1, SL.2*

Select one or more of these additional activities:

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- o **Research Wolves in Advertising** Have students go online to research other businesses that incorporate wolves into their logos or ads. Have them try to identify the type of meaning that the company is trying to convey by incorporating a wolf into the illustration.
- o **Design Your Own Logo Role-Play** Divide the class into teams of 4–5 students each. Ask them to imagine they work at an advertising agency that designs logos. Their team is working for a particular client that offers either a good or a service. First they must decide on a product or service for the client, as well as an ad slogan. Then they will design a new kind of wolf logo, highlighting not the ferocity of the wolf but a positive image (e.g., its devotion to the pack) as its symbol.

MAKING A CHANGE

HISTORIC GRAY WOLF RANGE

1974 GRAY WOLF RANGE

PRESENT-DAY GRAY WOLF RANGE

Maps courtesy Jim and Jamie Dutcher

- **Loss of Wolves in the U.S.** Project and discuss each of the U.S. wolf territory maps shown on this page, beginning with the historic map (see larger maps, suitable for projection, at NatGeoEd.org/wolves). *NGS: Standard 1; C3.SSSS: D2.His.1.3-5; D2.His.2.3-5; D2.His.3.3-5; NGSS: 3-LS4-3; CCSS.ELA-LITERACY.CCRA.SL.1, SL.2*

    o Have students turn to a blank page in their wolf journal and reflect on how they feel about what happened to the gray wolf in the past.

    o Discuss what events and human causes could account for the change from this first map to the 1974 map.

    o Finally, show the last map and talk about the Endangered Species Act of 1973. Does it seem like the Act has worked to restore wolves to their former habitat?

    o Explain that there are two types of Endangered Species Acts: state and federal.

    ▪ The U.S. Fish and Wildlife Service is responsible for determining when a species is in need of protection under the ESA, as well as when an animal is considered recovered. These decisions are made based upon the "best available science." But in 2011, in an unprecedented move, the U.S. Congress bypassed this process, delisted wolves in the Northern Rocky Mountains, and banned future judicial review of this decision. Since then, the federal listing of wolves as endangered, threatened, or recovered has been the subject of an ongoing battle—a tug-of-war between science, public opinion, and politics. The level of protection of wolves now varies from place to place and is continually shifting. For the latest protection status for wolves in the United States, please consult: http://www.fws.gov/mountain-prairie/species/mammals/wolf/ and https://livingwithwolves.org/wolf-issues/the-political-debate/.

    ▪ Only some states have their own Endangered Species Acts. As of June 2015, wolves were protected by state ESA law in Oregon, Washington, California, and Illinois.

    ▪ Do students think that the wolves' territory will ever regain the size of the historic area? Why or why not?

- **Dispelling Myths About Wolves** Divide the class into pairs or small groups and provide each group with one of the prevailing myths still believed about wolves today. Have each group research the myth and prepare a presentation (e.g., PowerPoint, Public Service Announcement, song, skit) to the class to dispel it. *C3.SSSS: D2.His.1.6-8, D2.His.3.6-8, D2.His.4.6-8, D2.His.5.6-8, D2.His.6.6-8D4, D4.1.6-8, D4.2.6-8, D2.Civ.1.6-8; NGSS: MS-LS1-4, MS-LS1-5, MS-LS2-1, MS-LS2-2, MS-LS1-5, MS-LS4-6; CCSS.ELA-LITERACY.CCRA.W.1, SL.1, SL.2*

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MAKING A CHANGE

Myths to debunk:

o Wolves are very dangerous to people.

o Wolves kill many cattle and sheep.

o Wolves kill for sport.

o Wolves that were reintroduced to the American West are super-sized (bigger or more aggressive than their predecessors).

o Wolves are killing off all the elk and deer, endangering those species.

- **Get Involved** Additional activities to encourage students to take stewardship of endangered species might include the following: *CCSS.ELA-LITERACY.CCRA.W.1; C3.SSSS: D4.3.6-8, D2.Civ.1.6-8*

Photograph by Jim and Jamie Dutcher

o If you completed the logo activity on p. 23 of this guide, have students select one of the businesses that they researched and write a persuasive letter to convince the company that uses a wolf in its logo or ads to start giving a regular donation to an organization that works to protect wolves in the wild and to promote positive awareness of wolves.

o Write to your senator, representative, or governor (See Resources to find addresses) about wolves or an endangered or threatened plant or animal in your local community or region.

o Contact a local conservation group to ask about habitat restoration projects your class can get involved in as a group or individually.

GRADES 9–12

- **Human Attitudes and How They Change** Have students research and discuss the following attitudes and then work in groups to create timelines that demonstrate the changes in the wolf population of North America over the past 150 years. *NGSS: HS-LS4-5; HS-LS4-6; C3.SSSS: D2.His.1.9-12; D2.His.2.9-12; D2.His.3.9-12, D2.His.4.9-12, D2.His.5.9-12, D2.His.6.9-12; D2.Civ.2.9-12*

o **Unexpected Consequences of Eradication** Analyze the impact the near-destruction of wolf populations in North America has had on its prey populations (e.g., deer, elk, pronghorn) and other related species in their environment. Focus especially on Yellowstone National Park and how the removal of wolves changed the Yellowstone ecosystem. Look at, for example, how the exploding elk and deer populations destroyed the riparian zones (vegetation and habitat), thereby decreasing populations of other aquatic species such as beaver and trout. Consider how and why these consequences were unexpected and how the reintroduction of wolves in Yellowstone led to a healthier national park.

o **Attitudes That Lead to Government Involvement** Invite volunteers to tell what they think the Endangered Species Act is and when and why it was enacted. Assign reading the full Act as homework (see Resources). Then discuss it and have students select one or more of the following topics to research:

▪ What are some threats to species that could cause them to go extinct and therefore be placed on the endangered list?

▪ What are some species that are endangered in your state or region? What threats do they face?

- Many local economies thrive because of the wildlife and wild places in and around the community. For example, ecotourism improved around Yellowstone National Park when the wolf was reintroduced. Explain other ways in which the Endangered Species Act protects local, state, and national economies (e.g., ecotourism and outdoor recreation).

o **Attitudes That Lead to Protection** Discuss the role of human intervention in deciding whether and how to reestablish wolf populations in the wild. Select one or more activities:

- Research the reintroduction of wolves to Yellowstone National Park in 1995 and 1996 and its effect on the environment there.

- Visit the Endangered Species Coalition website (see Resources) to select and report on one species that has been successfully saved by the Endangered Species Act.

Photograph by Jim and Jamie Dutcher

- The U.S. Fish and Wildlife Service is currently considering a proposed rule to delist the gray wolf as an endangered species. Research why and explore opposing sides of the issue to determine whether or not you feel the current level of recovery of the gray wolf population is sufficient to justify delisting. Explain your reasons.

- **Changing Attitudes** Read aloud or project the poem "The Strength of the Wolf" from the WolfCountry.net website (See Resources). Discuss its style, imagery, and meaning. Have students design their own poem or song lyrics to promote a new perception of the wolf, using information they learned during the activities in Sections 1–4. Brainstorm ideas about how to spread awareness in your community through art. *C3.SSSS: D4.3.6-8; CCSS.ELA-LITERACY.CCRA.R.6, R.7; CCSS.ELA-LITERACY.CCRA.W1, W.3; CCSS.ELA-LITERACY.CCRA.SL.2; C3.SSSS: D2.His.4.9-12, D2.His.5.9-12, D2.His.6.9-12, D2.Civ.2.9-12*

APPENDIX

GLOSSARY

ADAPTATION An adaptation is a mutation, or genetic change, that helps an organism, such as a plant or animal, survive in its environment. Due to the helpful nature of the mutation, it is passed down from one generation to the next. As more and more organisms inherit the mutation, the mutation becomes a typical part of the species. The mutation has become an adaptation.

ANIMAL MIGRATION Migration is the movement of an animal group from one place or activity to another at different times of the year.

APEX PREDATOR Apex predators (also known as alpha, super, top, or top-level predators) are predators with no natural predators of their own. They reside at the top of their food chain. The removal of top-level predators, often caused by human impacts, can radically affect an ecosystem. A commonly cited example of apex predators affecting an ecosystem is Yellowstone National Park. After the reintroduction of the gray wolf in 1995 and 1996, researchers noticed drastic changes occurring in the Yellowstone ecosystem. Elk, the primary prey of the gray wolf, changed their behavior. As they began moving about the landscape differently, they freed riparian zones from constant grazing.

BIODIVERSITY Biodiversity (also known as biological diversity) refers to the variety of plants, animals, and other living things in a particular area or region. This diversity relates to the basic needs of the organisms and the area's ability to meet them. For example, desert plants and animals have different characteristics and needs from those in mountains, even though some of the same species can be found in both of those areas.

BIOLOGICAL DATA Biological data are measurements collected from biological sources, such as animals. Examples of biological data include DNA, tissue samples, and population measurements.

BIOME A biome is a community of animals and plants living together in a specific climate. Scientists have classified regions of the world into different biomes, such as desert, tropical rainforest, and grassland.

CAMERA TRAP A camera trap is a remotely-activated camera that is equipped with a motion sensor or an infrared sensor, or uses a light beam as a trigger. Camera traps allow scientists to obtain critical data about wildlife and their habitats.

CANID Canids are the group or biological family of carnivores that include dogs, wolves, foxes, coyotes, jackals, and other living and extinct dog-like mammals.

CARNIVORE A carnivore is an organism that mostly eats meat, or the flesh of animals. Sometimes carnivores are called predators. Organisms that carnivores hunt are called prey.

DELISTING The act of delisting removes a plant or animal from the list of endangered species when it is no longer in danger of extinction.

DNA (short for deoxyribonucleic acid) is the material that holds all the information about how a living thing, like an animal, human, or plant, will look and function. Each piece of information is carried on a different section of the DNA called genes.

DISPERSAL Dispersal is the act of an organism leaving its birthplace and moving to where it will live as an adult. Dispersal in wolves usually involves a young, sexually-maturing wolf leaving the pack, perhaps due to rivalry with other members of the pack, intense bonds formed with an individual wolf from outside of the pack, or lack of sufficient resources within the pack's territory to support the number of wolves present.

DISPERSER Sometimes called the "lone wolf," the disperser is a wolf that leaves the pack and strikes out on its own. Some of these "lone wolves" have no social territory, and they live on the fringes of established packs or in the areas where several territories come together. Their single status may make them vulnerable to malnutrition and to attacks by other wolves. Dispersers will sometimes hunt in unoccupied areas between pack territories called buffer zones. Some wolves are seeking a partner and may travel hundreds of miles from where they were born. Males and females may meet and form new packs if they can find unoccupied territory with sufficient prey. Dispersers ensure gene dispersal, genetic health, and variety.

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EAR TAG An ear tag is a plastic or metal object attached to the ear of an animal, which is used for the identification of animals. Tags can be applied to one or both ears.

ECOLOGY Ecology is the branch of science that examines the relationships organisms have to one another and to their environment. Scientists who study those relationships are called ecologists.

ECOSYSTEM An ecosystem is a geographic area where a community of plants, animals, and other organisms, as well as weather and landscape, interact. Ecosystems contain biotic, or living, parts as well as abiotic factors, or nonliving, parts. Biotic factors include plants, animals, and other organisms. Abiotic factors include rocks, temperature, and humidity.

ENDANGERED SPECIES An endangered species is a type of organism that is threatened by extinction. Species become endangered for two main reasons: loss of habitat and loss of genetic variation.

ENVIRONMENT The environment is the sum of all external conditions affecting the life, development, and survival of an organism.

FUR In gray wolves, fur is made up of two layers. The first is an undercoat. It has almost a wool-like consistency, is the same color (gray) in all wolves, and also serves as an insulating layer. The second layer is made up of guard hairs; this is a long outer coat that gives each wolf its distinctive coloration and markings.

HABITAT A habitat is a place where an organism makes its home. A habitat meets all the environmental conditions an organism needs to survive. For an animal, that means everything it needs to find and gather food, select a mate, and successfully reproduce.

HERBIVORE An herbivore is an organism that mostly feeds on plants. Herbivores range in size from tiny insects, such as aphids, to large elephants.

HIERARCHY (alphas [breeding pair or parents of the pack], beta, omega, and mid-ranking) Hierarchy is a concept describing rank within a wolf pack established through breeding, individual disposition, competition, and conflict. According to this model, the breeding male and female are the "alphas," and the second in rank are the "betas." The "omega" wolf is the lowest ranking wolf, often the subject of dominance displays, and generally the most submissive wolf in a pack. While this status hierarchy may exist in captive packs comprised of unrelated individuals, natural wolf packs usually consist of parents and their offspring of various years. In a free-ranging wolf family, each wolf seems to know its standing and communicates it to the others. The parents are in charge, with the older siblings next in order of dominance, followed by the pups of the current year.

HOWL BOX A "howl box" is a computer with a speaker and microphone that broadcasts howls and records responses. Scientists sometimes use them to track wolves.

KEYSTONE SPECIES A keystone species is a plant or animal that plays a unique and crucial role in the way an ecosystem functions. Without keystone species, the ecosystem would be dramatically different or cease to exist altogether.

OMNIVORE An omnivore is an animal that eats both plant and animal matter. They range in size from tiny insects like ants to large creatures like humans.

ORGANISM An organism is an individual living thing that can react to stimuli, reproduce, and grow. It can be a virus, bacterium, protist, fungus, plant, or an animal.

PAIR BOND In biology, a pair bond is the strong affinity that develops in some species between a pair consisting of a male and female, or in some cases as a same-sex pairing, potentially leading to producing offspring and/or a lifelong bond.

PHYSICAL CHARACTERISTICS Physical characteristics are the defining traits or visible features of an organism. Examples of physical characteristics in a wolf include fur color, size, and shape.

POPULATION Population is all of the individuals from the same species or closely-related species that occupy a certain area.

PREDATION In ecology, predation is the preying of one animal or animals on other animals.

PREDATOR In ecology, a predator is an animal that captures and eats other animals.

PREY Prey is an animal that is captured and eaten by another animal.

RADIO COLLAR A radio collar is a collar with a radio transmitter in it that is attached to an animal, like a wolf, to locate and follow its movements. Scientists use this method to monitor and collect data about the movement of species.

RANGE A species' range is the area where a particular species can be found during its lifetime. Species range includes areas where individuals or communities may migrate or hibernate.

REINTRODUCTION Reintroduction is the deliberate release of a species into the wild in an area where it formerly existed but is no longer present. The species may come from captivity or be relocated from other areas where it survives. A species that is reintroduced is usually one whose existence has become threatened or endangered in the wild.

RIPARIAN AREAS A riparian zone or area is the interface between land and a river or stream. Riparian zones are significant in ecology, environmental management, and civil engineering because of their role in soil conservation, their habitat biodiversity, and the influence they have on fauna and aquatic ecosystems.

SCAT Scat is animal excrement, fecal matter, or feces. Scientists often use scat to determine what wolves eat.

SCAVENGER A scavenger is an organism that mostly consumes decaying biomass, such as meat or rotting plant material. Many scavengers are a type of carnivore, which is an organism that eats meat. While most carnivores hunt and kill their prey, scavengers usually consume animals that have either died of natural causes or been killed by another carnivore.

SOCIAL ANIMAL A social animal lives in a group with its own kind. Wolves are highly social animals because they live in a pack or family according to strict cooperative rules. The pack members are dependent on one another for survival, and they all participate in the care and nurturing of the young.

SPECIES A species is a group of similar organisms that can reproduce with one another.

STAKEHOLDER A stakeholder is anybody who can affect or is affected by an organization, strategy, or project. Stakeholders have the power to impact an organization or project in some way.

STEWARDSHIP Stewardship refers to responsible caretaking of the environment. Stewardship is based on the premise that humans are managers of natural resources and that we are responsible to future generations for conserving and preserving these resources.

TAXONOMY Taxonomy is the science of finding, describing, classifying, and naming organisms, and the principles underlying such a classification. The classification of organisms in a hierarchical system or in taxonomic ranks (e.g. domain, kingdom, phylum or division, class, genus, species) based on shared characteristics or on relationships inferred from the fossil record or established by genetic analysis (e.g., *Canis lupus* and *Canis rufus*).

TISSUE SAMPLES Tissue samples are matter, like fluid, cells, or tissue, gathered from the body of an animal to use for scientific study and analysis.

UNGULATE An ungulate is a hoofed mammal such as deer, elk, mountain goat, bighorn sheep, moose, antelope, caribou, and bison.

WILDLIFE MANAGEMENT Wildlife management is a range of careers that attempt to balance the needs of wildlife with the needs of humans. Careers in this field can include game-keeping, wildlife conservation, and pest control. It draws on disciplines such as mathematics, chemistry, biology, ecology, climatology, and geography.

WOLF PACK A wolf pack is an exceedingly complex social unit—an extended family of parents, siblings, aunts, uncles, and sometimes dispersers from other packs. Wolf families can include old wolves that need to be cared for, pups that need to be educated, and young adults that are beginning to assert themselves—all altering the dynamics of the pack.

RESOURCES

BOOKS

- Dutcher, Jim, and Jamie Dutcher, *The Hidden Life of Wolves*, Washington, D.C.: National Geographic, 2013.
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- Jazynka, Kitson, *National Geographic Kids Mission: Wolf Rescue: All About Wolves and How to Save Them*. Washington, D.C.: National Geographic Children's Books, 2014.

- Lansky, Bruce and Timothy Tocher, Free Story "Little Bad Wolf and Red Riding Hood" from Newfangled Fairy Tales. Minnetonka, MN: Meadowbrook Press, 2012.
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- Slade, Suzanne, *What If There Were No Gray Wolves?: A Book About the Temperate Forest Ecosystem*. North Mankato, MN: Capstone Press, 2010.
- Trivizas, Eugene and Helen Oxenbury, *The Three Little Wolves and the Big Bad Pig*. New York, NY: Margaret K. McElderry Books, 1997.

WEBSITES

- Animal Tracks Identification (including the gray wolf): http://www.almanac.com/content/animal-tracks-identification-critter-pictures
- Discovery: Ecology—Animal Camouflage Pictures: http://www.discovery.com/tv-shows/curiosity/topics/animal-camouflage-pictures.htm
- Endangered Species Coalition: Back from the Brink: http://www.endangered.org/campaigns/annual-top-ten-report/
- Endangered Species Coalition Citizen's Guide to the ESA: www.stopextinction.org/
- Fables and Fairy Tales: http://www.kidsgen.com/fables_and_fairytales/
- Native American Wolf Mythology: http://www.native-languages.org/legends-wolf.htm
- National Geographic Education: Collection—Graphic organizers: http://www.NatGeoEd.org/graphic-organizers

- National Geographic Education: Mapmaker Interactive (from the Themes menu, select the *Gray Wolf* Range data layer): http://www.NatGeoEd.org/mapmaker-interactive
- National Geographic News: "We Didn't Domesticate Dogs. They Domesticated Us." http://news.nationalgeographic.com/news/2013/03/130302-dog-domestic-evolution-science-wolf-wolves-human/
- United States Senate (lists of state senators for letter writing campaigns): http://www.senate.gov/general/contact_information/senators_cfm.cfm
- U.S. Fish & Wildlife Service: Endangered Species (sortable by state): http://www.fws.gov/endangered/
- U.S. Fish and Wildlife Service: Endangered Species Act: http://www.fws.gov/endangered/laws-policies/
- WolfCountry.net: The Strength of the Wolf: http://www.wolfcountry.net/information/myth_stories/wolfstrength.html
- WolfCountry.org: Myths, Legends, and Stories: http://www.wolfcountry.net/stories/

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NATIONAL STANDARDS ALIGNED WITH THIS CONTENT

National Geography Standards (NGS): http://www.NatGeoEd.org/geography-standards

Common Core State Standards for English Language Arts (CCSS.ELA): http://www.corestandards.org/ELA-Literacy/

Anchor Standards for Reading: http://www.corestandards.org/ELA-Literacy/CCRA/R/

Anchor Standards for Writing: http://www.corestandards.org/ELA-Literacy/CCRA/W/

Anchor Standards for Speaking and Listening: http://www.corestandards.org/ELA-Literacy/CCRA/SL/

Common Core State Standards for Mathematics (CCSS.MATH): http://www.corestandards.org/Math/

The College, Career & Civic Life (C3) Framework for Social Studies State Standards (C3.SSSS): http://www.NatGeoEd.org/C3Framework

National Science Education Standards (NSES): http://www.nap.edu/openbook.php?record_id=4962

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