Tracking Habitat Change

Educator's Guide

March 4, 2004

Bureau of Land Management
Share the Adventure
Electronic Field Trip

Copies available from:

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Acknowledgments

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Tracking Habitat Change
Educator's Guide
Grades 4-9 Electronic Field Trip

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Welcome

Dear Educator,

It is our great pleasure to welcome you and your class to *Share the Adventure! Tracking Habitat Change.*

The Bureau of Land Management (BLM) is bringing you this year's satellite broadcast to help you and your students better understand the concept of habitat change and the challenges involved in managing that change to conserve wildlife habitat and serve the needs of people.

Our 1-hour, live, interactive satellite broadcast is intended to be informative and fun. As with many of our programs, education is our first priority. Each component of the broadcast and the educator's guide supports specific learning objectives that are tied to national education standards.

During the broadcast, your students will have an opportunity not only to visit sites around the country but also to watch scientists in action—asking questions, coming up with ways to answer them, and using technology to help gather and interpret data. Perhaps most importantly, your students will be able to talk with wildlife biologists and other scientists who study our country's natural resources.

We hope you encourage your students to call in and talk to our specialists. And we thank you for allowing them to take part in this special program.

Sincerely,

Kathleen Clarke
BLM Director

An Electronic Field Trip: Bring the World to Your Classroom

An electronic field trip is a distance learning event. It allows students to see and interact with people and environments that are far away at virtually no cost to the school. In this case, the field trip will take students to several locations:

- Nevada
- New Mexico
- Colorado

This is all done through a live satellite television broadcast. This 60-minute instructional program supports the learning objectives and national education standards outlined on the following page. While geared for the middle school student, the broadcast should be of educational value and interest to students at all levels of learning.

A question-and-answer period during the broadcast will provide students with the opportunity to interact with scientists via phone and fax.

The Curriculum Connection

Share the Adventure! Tracking Habitat Change covers the topic of habitat from several perspectives. Specific Learning Objectives are listed below. The broadcast can be aligned with the following National Science Education Standards:

Content Standard A: Science as Inquiry

Understanding about science inquiry: Based on their observations, scientists pose many questions about habitat change.

Content Standard C: Life Science

Regulation and behavior: The behavior of the sage-grouse and the prairie chicken evolved through adaptation to their environments.
Populations and ecosystems: As the short-grass prairie and sagebrush ecosystems decline, so does the number of organisms they can support.
Diversity and adaptation of organisms: The survival of both the sage-grouse and the prairie chicken is threatened by changes in their habitats.

Content Standard E: Science and Technology

Understanding about science and technology: Technology is essential to science…It provides tools for investigation, inquiry, and analysis of habitat change.

Content Standard F: Science in Personal and Social Perspectives

Populations, resources, and environments: There are many causes of the degradation of the sagebrush and short-grass prairie habitats.
Natural hazards: Natural hazards, such as drought and fire, can change or destroy human and wildlife habitats, and human activities can accelerate natural changes.
Science and technology in society: Scientific knowledge of wildlife habitat needs affects our understanding, attitudes, behavior, and management decisions.

Learning Objectives

After participating in the broadcast, viewers will be able to:

1. Describe how and why scientists study habitats from multiple geographic scales
2. Discuss ways in which habitats are constantly changing and some of the causes of those changes
3. Explain how science and technology can help us understand both habitat changes and the implications of those changes for wildlife and people
4. Identify ways in which people can work together to try to conserve habitat while meeting the needs of people.

How to Use This Guide

This guide includes several suggested readings and activities for you and your students to do before and after the broadcast. The readings are primarily designed to give students some contextual background before the broadcast. Depending on the reading level of your students, you may want to make copies of these pages to hand out, read them aloud, or read them in advance and summarize the contents for your students. The suggested activities provide you with a variety of ways to enhance the learning experience in the classroom. Some can be accomplished easily within the class period, while others will take more time. We encourage you to choose activities that match your students' interests and abilities and complement your lesson plans.

We want to hear from you!

The guide also includes an evaluation form. Please be sure to complete the form and return it to us. This will help us design future programs targeted to your needs. The first 100 educators to complete and return the evaluation form will receive a set of habitat-related teaching materials, including posters.

Share the Adventure: Viewing Tips

Date:

Thursday, March 4, 2004
See broadcast times on **next page.**

How to Participate in the Program

Anyone with a C-band satellite dish can participate in the program. You will need access to the satellite receiver, a monitor, and—if you want to tape the show for future use—a videotape recorder. There are no restrictions on rebroadcasting. For interactive participation, you will need either a phone or fax machine.

If You Don't Have a Satellite Dish

The morning show will also be available on the Satellite Cable TV provider DISH Network through the cable channel University House. This channel shows up on almost all DISH Network channel packages as cable channel 9411. For more information and viewing times, you can also visit the website for University House at www.universityhouse.nau.edu.

In addition, many cable companies, school systems, school districts, district or regional media centers, or State educational television stations have access to a C-band satellite dish and may be able to provide your classroom with the program through an internal cable channel. Check with them early. You will need to provide the satellite coordinates listed on the next page.

Television Receiver

Plan your setup before the day of the event. Check the technical information page for the satellite coordinates. Tune in the satellite and make sure you can receive the satellite listed. Check to see that all other equipment is working properly. You may want to use more than one television depending on the number of viewers. For large groups, a projection TV is recommended.

Plan to Interact with Us

Make sure you are ready to participate via phone or fax. Check all equipment the day before the event. Place the phone in the back of the room away from the TV. An operator will answer your phone call. When the operator indicates that you are live on the air, turn your television volume down to avoid feedback. Wait for the host to ask for your question.

By reviewing the "Meet the Players" section of this guide in advance, students will learn who is who. This will help them decide to whom they should direct their questions. Encourage students to make each question as clear and brief as possible, and to ask one question at a time.

Broadcast Coordinates and Times

Satellite Coordinates

Transmission	Satellite	Location	Transponder	Polarity	Frequency
C-Band; DirecTV DISH Network	Galaxy 3	95-degrees W	2	Vertical	3740 MHz

Time Zone Reference for First Broadcast

Time Zone	Test Signal	Program Starts	Program Ends
Hawaiian Standard Time	5:30 am	6:00 am	7:00 am
Alaskan Standard Time	6:30 am	7:00 am	8:00 am
Pacific Standard Time	7:30 am	8:00 am	9:00 am
Mountain Standard Time	8:30 am	9:00 am	10:00 am
Central Standard Time	9:30 am	10:00 am	11:00 am
Eastern Standard Time (incl. Puerto Rico)	10:30 pm	11:00 am	12:00 Noon

Time Zone Reference for Second Broadcast

Time Zone	Test Signal	Program Starts	Program Ends
Hawaiian Standard Time	8:00 am	8:30 am	9:30 am
Alaskan Standard Time	9:00 am	9:30 am	10:30 am
Pacific Standard Time	10:00 am	10:30 am	11:30 am
Mountain Standard Time	11:00 am	11:30 am	12:30 pm
Central Standard Time	12:00 N	12:30 pm	1:30 pm
Eastern Standard Time (incl. Puerto Rico)	1:00 pm	1:30 pm	2:30 pm

Videotaping the Broadcast

If you are unable to view the live broadcast, we encourage you to tape and use the program in future lessons. You may also rebroadcast this program over the school cable system. We will have a limited number of copies available for schools that are unable to tape the broadcast. Contact us through our web site ***http://www.blm.gov/education/LearningLandscapes/teachers/fieldtrip_04/index.html*** to obtain a copy.

Visit Our Web Site

This guide, an evaluation form, and additional information on BLM's education programs are available on our web site at *http://www.blm.gov/education*.
This site also includes links to other web resources.

Interactivity

During the telecast, students and teachers may phone in questions. The toll-free number is:
1-877-862-5346
Student questions will also be accepted by FAX:
FAX numbers (caller pays): 602-906-5701 and 602-906-5702
The local Phoenix metropolitan area call-in number is: 602-943-2279.

Habitat Facts

What is a Habitat?

Our broadcast focuses on habitat and measuring habitat change. The term habitat refers to the place where an organism lives. For an animal, this place must contain features necessary to sustain life: food, water, space, and shelter. There are many different types of habitats, from forests to grasslands to oceans and even cities. Different habitats support different communities of plants and animals. This broadcast will take viewers to two special types of habitats: sagebrush habitats in Nevada and Colorado and short-grass prairie habitat in New Mexico. Our broadcast turns a spotlight on two birds, each an important inhabitant of these two habitat types. The sage-grouse and the prairie chicken both belong to the order *Galliformes*, and because of their dependence on specific habitat characteristics, they are important indicators for the health of these habitats.

Stop and Smell the Sagebrush!

As anyone who watches old cowboy movies knows, sagebrush dominates much of the western landscape. But look across a sagebrush plain and you will not see a flat pattern of solid sagebrush. Instead, you will see a pattern of several types of vegetation alternating with patches of bare soil. Sagebrush ecosystems consist of sagebrush and perhaps other shrubs growing with a variety of grasses and forbs (annual plants that flower). In many sagebrush communities, bare soil between plants is actually a thin crust of tiny lichens, algae, fungi and other microscopic living material (called the microbiotic crust) growing on or just underneath the soil. The exact composition of a sagebrush community depends on a number of factors such as climate, precipitation, soil type, and elevation.

Sagebrush (*Artemisia)* is a member of the sunflower family. It is a flowering woody shrub that has some fascinating characteristics. There are about 25 species and/or subspecies of sagebrush ranging in height from less than one to several meters. They all have a distinctive smell caused by volatile oils held in the leaves. This keeps most animals from eating them. A few animals, however, such as mule deer, antelope, and sage-grouse, have specially adapted digestive systems that can tolerate sagebrush. For these animals sagebrush is an important winter food source when other plants are scarce. The oils in sagebrush leaves, when dropped to the ground, keep other plants from growing close by. Sagebrush is specially adapted for hot, dry conditions in summer. Its leaves are small (minimizing contact with the sun), light colored (reflecting the sun), and fuzzy (to hold moisture and deflect wind).

Scientists believe that sagebrush once covered some 63 million hectares (nearly 245,000 sq. miles) of western North America. That's nearly as big as the state of Texas. Much of this ecosystem type has been altered or lost over the years. More than 200 years ago, European settlers began to graze cattle and sheep over vast areas of western sagebrush communities. This long history of grazing has changed sagebrush plant communities in a number of ways. To provide forage for livestock, people removed large areas of sagebrush by a variety of means and then replanted the areas with nonnative grasses preferred by cattle. This resulted in grass monocultures appetizing to livestock. In addition, agricultural development, mining, energy production, recreational activities, urbanization, and the expansion of road and highway systems have all contributed to further fragmentation and degradation of sagebrush habitat across wide areas.

Another major factor affecting sagebrush communities is the invasion of nonnative plants such as cheatgrass into vast areas. Cheatgrass is an invasive annual grass that burns easily and regrows quickly, outcompeting native grasses and forbs. This creates a destructive cycle that benefits the invasive plants and further destroys sagebrush habitats. Today, fire and nonnative plant invasions are the most significant causes of large scale alteration of the sagebrush ecosystem.

Meet the Sage-Grouse

The sage-grouse is a striking upland bird that has inhabited the sagebrush ecosystems of the western plains for thousands of years. Sage-grouse are known for the colorful ritual that plays out on special areas called "leks" each spring. Male birds congregate in large numbers, fanning their tail feathers, making a distinctive "popping" noise, and swelling their bright yellow air sacs in hopes of attracting the smaller, and more reserved, female sage-grouse.

Sage-grouse are ground-nesting birds that depend on sagebrush ecosystems with an understory herb layer of grasses and forbs to hatch and raise their young. The sagebrush itself provides cover protection from predators and a winter food source. The forbs and grasses help conceal the nests and provide food either directly or by attracting insects that can be eaten. Insects are a major part of the diet of sage-grouse chicks, which need the high protein for fast growth. Sage-grouse do not migrate, but may move up to 80 kilometers between activity habitats throughout the year.

Sage-grouse populations have declined dramatically over the past 100 years, primarily due to a decline in suitable sagebrush habitat. While Federal agencies are working to restore sagebrush habitat in many areas in hopes of reversing this population decline, state wildlife agencies are working with private landowners to do the same thing. Most of the remaining sage-grouse habitat is on Federally managed and privately-owned lands. BLM manages just over half (51 percent) of this remaining habitat.

There are two species of sage-grouse: the greater sage-grouse (*Centrocercus urophasianus*), which inhabits parts of 11 western states; and the less widely distributed Gunnison sage-grouse (*Centrocercus minimus*), which lives only in southern Colorado and Utah. The Gunnison sage-grouse has lost 90 percent of its habitat, and now occupies only 10 percent of its original range.

Sage-grouse Facts

Weight: Around 2 kg, the female is smaller than the male
Life Span: Up to five years
Range: Parts of 11 western states (Washington, Oregon, California, Idaho, Nevada, Utah, Montana, Wyoming, Colorado, North Dakota, and South Dakota)
Home Range: Up to 1,300 square kilometers
Diet: Sagebrush in winter; grasses, forbs, and insects when available
Reproduction: Clutch size 6 - 9; nests in spring
Habitat Requirements: Large areas of sagebrush with understory vegetation of forbs and grasses.

A Walk in the Prairie

The short- to mid-grass prairies occur in the midwestern and western United States. The lesser prairie chickens featured in the broadcast live in the short-grass prairies of the high-desert plains of southeastern New Mexico, a flat and mostly treeless expanse of low-lying shrubs and grasses. The plant most closely identified with the lesser prairie chicken here is shinnery oak, a deciduous shrub associated with sandy soils that occurs in parts of Oklahoma and New Mexico. Shinnery oak provides ground cover for nesting, brood-rearing, foraging, and protection from predators and the hot high-prairie sun. The chickens eat the acorns produced by the shinnery oak as well as the insects attracted to its leaves. The underbrush is primarily sand sage and yucca, good for nesting and foraging. Shinnery oak is disappearing at a rapid rate, due primarily to herbicides that were used to establish forage for cattle-grazing.

Shinnery oak does not reproduce by seed. The plant reproduces by growing new sprouts from underground rhizomes. The knee-high plants seen above ground actually represent the very top of what is actually a single, giant underground tree with a vast root system. When herbicides take out the root system, the plant will not grow back.

Meet the Lesser Prairie Chicken

The lesser prairie chicken is related to the sage-grouse and shares some of its behavioral traits such as annual gatherings at leks for a unique courtship display. The lesser prairie chicken occupies a very different habitat, however, and has a much smaller range. It lives in the dry short-grass prairies of Texas, Oklahoma, Colorado, Kansas, and New Mexico.

Lesser prairie chickens prefer a diversity of grasses and forbs interspersed with low shrubs to provide protective cover. Habitat is often associated with shinnery oak. The birds' diet includes insects, seeds, leaves, and buds. It does not migrate, so its winter and summer range are similar. The prairie chicken's main predators are snakes and coyotes, but the recent additions of power poles and drill pads in the area have attracted raptors (birds of prey), increasing the danger to nests and hatchlings.

It is estimated that the occupied range of the lesser prairie chicken has been reduced by more than 90 percent compared to pre-settlement conditions. With the loss of habitat, populations have declined significantly. Most of the remaining habitat of the lesser prairie chicken is on private lands.

The lesser prairie chicken is one of two species of prairie chickens. The greater prairie chicken occupies a larger range. However, the Attwater's prairie chicken, a subspecies of the greater prairie chicken, is on the Federal endangered species list.

Lesser Prairie Chicken Facts

Weight: Less than 1 kg
Life Span: 2 – 5 years
Range: Extends from western Kansas and southeastern Colorado south to the Texas panhandle and eastern New Mexico.
Home Range: Can be as large as 500 hectares for males and 230 hectares for females
Diet: Mostly plants, some insects
Reproduction: Clutch size is 8 - 14; nests in spring
Habitat Requirements: Short to mid-grass prairie

Activities: Exploring Habitats

A. Take a Hike!

Objective

Students take a walk to observe wildlife and look for the four habitat components.
(Note: This activity can be done in a schoolyard, or by walking through a nearby neighborhood. It can be done in both urban and rural areas. Urban areas include habitat for a wide variety of species. More than 400 species of birds spend at least part of the year in New York City, for example. Ask students to look for niches in the urban environment that provide the four components of habitat.)

Procedure

First review the four components of habitat (food, water, space, and shelter). Explain to students that they will be taking a walk around their school. Tell students that they will look for habitat areas – places where they see wildlife or suspect that wildlife might be located. Have students make a list of every wildlife species they observe, making an attempt to identify each or describing each species in enough detail in their notes that they can identify it later with the help of nature guides back in the classroom. After they have noted at least five animals (you may choose a higher or lower number depending on the area you're investigating and the amount of time you have), have students identify the four habitat components for each of the animals they have observed. For example, a robin might find worms and insects in the ground, water in a nearby creek, shelter in shrubs near a house, and a nesting place in a tree in the backyard of the house.

Back in the classroom, students should choose one of the species they observed and conduct further research into its habitat needs. Among the questions they should consider are:

- What does the animal eat?
- How many young does it typically have and where does it raise them?
- Where, besides your immediate area, does this animal live?
- Is it a year-round resident of your area or does it migrate to another region?
- If it is a migrating species, what habitat needs does the animal need to find elsewhere during part of the year?

B. Design a Habitat

Objective

If a hike is not realistic, students can demonstrate understanding of habitat components by examining the minimum requirements for human life and comparing these with the needs of a particular wildlife species.

Materials

Crayons, markers, or watercolors
Paper

Procedure

1. Have students draw pictures of their own homes. Ask them to think about and draw pictures of the four most important things in their homes.
2. Make a list of what the students feel are important. Differentiate between needs and wants. Challenge the group to think about what is essential for survival—not only for humans but for wildlife as well. Make sure this includes food, water, space, and shelter. Explain that these must also be available in a suitable arrangement. Whenever one of these basic needs is threatened or removed, an animal may not be able to survive.
3. Have each student choose one animal and draw a picture of it in its habitat. Make sure the drawing includes where the animal gets food, water, space, and shelter.
4. Compare the needs of humans with those of other animals.

C. Habitat Match

Objective

Younger students match illustrations of several animals with the habitats where the animals are likely to be found.

Procedure

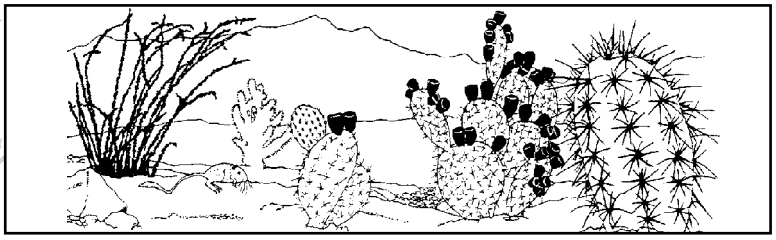
1. Copy and distribute the worksheet on the following page.

As an extension: Older students can research the specific habitat needs of one or more of the animals in the activity and describe where in its habitat the animal is likely to find each of the four components necessary for life—food, water, space, and shelter.

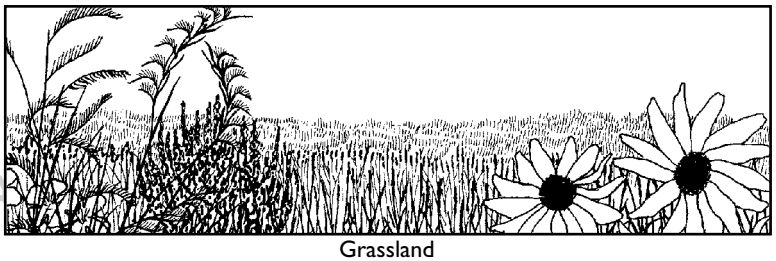
ACTIVITY

Habitat Match-up

Animals are adapted to the habitats in which they live. This means they have characteristics that help them get what they need to survive there. Below, in the left column, are drawings of some of the habitats you'll find on BLM lands. On the right are some animals looking for a home. Draw a line from each animal to its habitat.

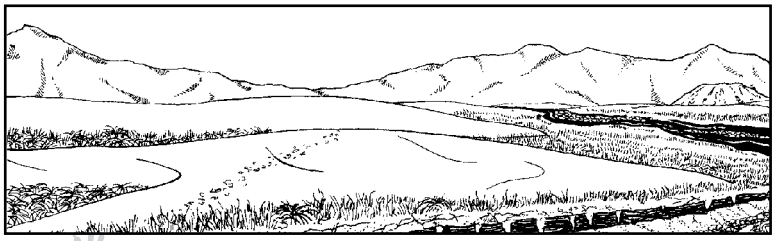


Desert

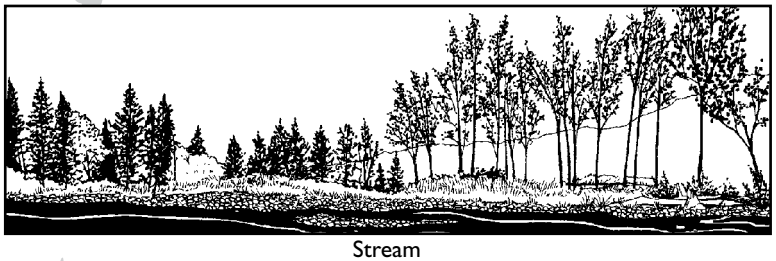


Grassland

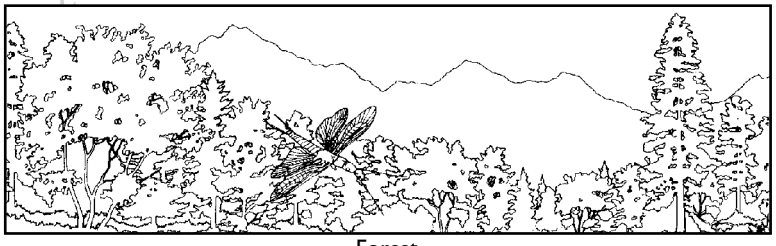
Wetland



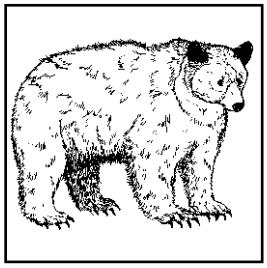
Tundra



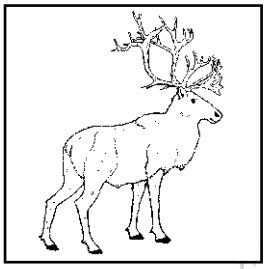
Stream



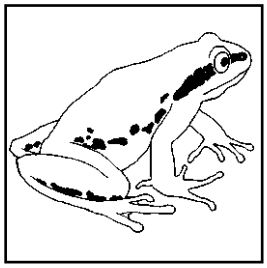
Forest



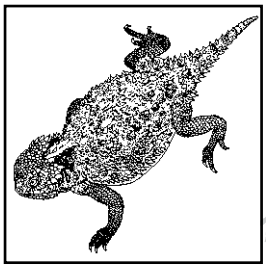
Bear



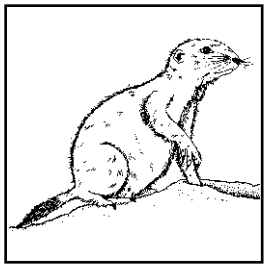
Caribou



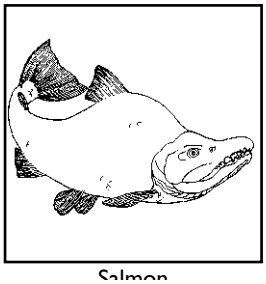
Frog



Short-horned lizard



Prairie dog



Salmon

Changing Habitats

Habitats are constantly changing. Sometimes, this change is caused by natural occurrences such as droughts, disease, fire, hurricanes, mudslides, volcanoes, or earthquakes. Less obvious natural changes include slight increases or decreases in seasonal temperature or precipitation, or the slow succession of plant communities. Many plants and animals can adapt to or evolve with habitat changes that occur slowly over hundreds, thousands, or millions of years. They have been doing so since life began.

Changes that occur suddenly, however, can affect a population or an entire species. Consider hurricanes, which can cause a dramatic change in habitat overnight. While hurricanes kill numerous plants and animals directly, the greater impact on a species is often felt indirectly through the alteration of its habitat. Hurricanes blow down trees used by birds for nesting, for example. In 1989, Hurricane Hugo destroyed 87 percent of the trees used by endangered red-cockaded woodpeckers in one forest in North Carolina. Healthy populations of wildlife often rebound naturally after such sudden events, but endangered or rare species may require special assistance to recover. In the case of the woodpecker, nest boxes were built to replace the nesting trees destroyed by Hurricane Hugo. This helped populations of the woodpecker to recover over time.

People initiate many habitat changes for a variety of purposes, including urbanization, agriculture development, manufacturing, recreation, or transportation. Many of these changes are obvious, such as building a new shopping center in a forested area or building a road through a meadow. Other human-caused changes are more subtle, such as moving a herd of cattle to a new area on the rangeland or inadvertently introducing invasive plant seeds. Impacts on the land from changes such as these develop over many years. Road corridors can provide access for invasive plants, for instance, and power lines provide perch sites for predators such as common ravens or raptors.

The broadcast focuses on habitats in the western United States, in particular the sagebrush and short-grass prairie habitats. Both of these habitats have undergone dramatic change in the last century. As human populations have grown and expanded into lands that once were wild, there has been an increased demand for resources from these lands. Changes associated with urban expansion and development of rural areas directly influence the number and kinds of plants and animals that remain. Scientists study natural and human-caused habitat change over time in order to understand the associated impacts on plants and animals. Once impacts are understood, something can be done to prevent or minimize them.

Activities: Changing Habitats

A. The Changing World Around Us

Objective

In this activity, students look at several visual representations or animations of both natural and human-caused change.

Procedure

Start with a discussion of change. Have students give examples of change in their lives (the seasons, the weather, their growing up, attending different schools, people moving in and out of neighborhoods, etc.). To help students understand that change happens all around them, have them look at some of the following websites.

The GLOBE program's Earth Systems Science website includes animations that show changes in natural weather and associated patterns over a year's time. It includes solar energy, precipitation, cloud cover, vegetation, soil moisture, and average temperature.
See this website for GLOBE animations:
http://www.globe.gov/fsl/html/templ.cgi?esmovie_solar&lang=en&nav=1

Students can observe annual changes in precipitation patterns with the help of the Spatial Climate Analysis Service at Oregon State University: http://www.ocs.orst.edu/prism/
From this website, students can click on "Monthly Data" and then select maps that display monthly precipitation data nationwide for several years. Have them compare patterns from one month to the next or from one year to the next. Discuss how changes in precipitation can affect living things.

In addition, the USGS National Atlas Tapestry of Time shows vegetation changes over a year at this website: http://nationalatlas.gov/greennes.html

By checking these and other websites, students will understand that natural forces are always at work changing patterns on the landscape. Encourage your students to conduct further research on this subject and to prepare reports—including charts and graphs—on changes that have occurred in your area over a period of time. A good place to start is the website of the U.S. Geological Survey: http://www.usgs.gov

For climate and weather information, consult the National Climatic Data Center website:
http://www.ncdc.noaa.gov/oa/ncdc.html
or the United States Historical Climate Network website:
http://cdiac.ornl.gov/r3d/ushcn/ushcn_r3.html

Activity continues on next page

A. The Changing World Around Us (cont'd.)

Humans also cause many changes in the landscape. Resources from the "Human Footprint" project give students a visual representation of human-caused changes. This project maps human impacts all over the world and focuses on four areas: human population densities, human access (such as roads), land transformation (such as agricultural development), and power infrastructure (such as electricity and lights). The creators use satellite data to produce land cover maps that are then layered using Geographic Information Systems (GIS) technology. The project indicates that about 83 percent of the earth's land surface has been influenced by humans. This website contains a visual representation:
http://earthobservatory.nasa.gov/Study/footprint/

A related project is the "Human Footprint of the West," which focuses on shrubland ecosystems and changes associated with urban and rural development in these areas. To find out more about this project, check this website: http://fresc.usgs.gov/products/fs/fs-127-03.pdf

One of the U.S. Geological Survey's Earthshots websites, "Satellite Images of Environmental Change," shows the growth of the city of Las Vegas, Nevada, from 1964 -1992. Follow the instructions on this website to see satellite imagery paired with actual site photos, and change over time:
http://edcwww.cr.usgs.gov/earthshots/slow/LasVegas/LasVegas

B. Who Lives Here?

Objective

Students examine the effects of habitat change on their local area.

Procedure

Have the class compile a list of natural events and human activities that have changed and are changing habitats in their local area. The list could include recent storms or droughts, as well as home construction, road and highway building, increased pursuit of recreational opportunities in natural areas—to name just a few. Have students research descriptions, accounts, and photographs of their local area as it was seen by early pioneers and explorers. They could also interview some long-time residents of your community to find out about changes during their lifetimes. Compare and contrast the area today with how it was in the past, focusing on changes that might have affected plant and animal populations.

As an extension, have students research the effects of the eruption of Mount St. Helens in 1980 or the fires that occurred in Yellowstone National Park in 1988. Have them report on the long- and short-term consequences of these events for the plants and wildlife that lived in the area.

Tools and Technology for Studying Change

Scientists use a variety of tools and methods to understand habitat change. They rely on simple tools and advanced technology. Habitats come in many sizes, so first scientists must define the area they are studying. Is it large or small? Some desert fish are confined to a small pool of water only a few meters wide. It would be relatively easy to make on-the-ground observations of changes that affect a pool of water. Sage-grouse, by contrast, occupy millions of hectares of habitat in 11 western states. Studying these large landscape-scale habitats involves collecting data at different scales. Scientists often use images of the land taken by satellites hundreds of kilometers above the Earth—sometimes over an extended period. This satellite imagery can be combined with on-the-ground assessments to provide an accurate picture of what's happening on the ground and to record change over time.

Way Out in Space

The BLM's National Science Center in Denver uses satellite imagery to help scientists assess habitat. Satellite imagery is obtained through the LANDSAT Project. This is a government program that gathers data on the Earth's resources in order to monitor changes on the Earth's surface and associated environment over time. The first LANDSAT satellite was launched in 1972, and since then, millions of images of the Earth have been created. LANDSAT satellites operate some 700 kilometers up in space and stay in the same path, creating a new image every 16 days. These images help scientists note changes over time and can help them determine, for example, which plants are surviving, which are thriving, and which are diminishing or disappearing altogether.

Satellite images reveal important characteristics of the land, such as the location, the degree of slope, the aspect (which direction a given geographic feature faces), precipitation, elevation, and amount of surface water. They also can identify the different plants and shrubs that grow there. The satellites don't use cameras to take pictures. They use sensors to detect the rate of light absorption of the different entities on the ground, such as plants, shrubs, burned areas, rivers, and ponds. The information collected by the sensors is assigned digital values, which are then generated as digital images of the land. Some satellites can zero in on areas as small as 3 meters square, so scientists can actually pick out individual shrubs and identify them. The near-infrared band reveals the moisture content of the features of the landscape, including the land itself. This helps scientists determine where to focus their efforts.

Even though pictures are made from data obtained from space, it is still necessary to look at the habitat on the ground. Satellite imagery can only reveal so much. It cannot always specify all species of plants or determine the species of wildlife that inhabit an area. For that, a closer look is required.

Up Close and Personal: Tools for Monitoring on the Ground

Scientists use a variety of tools for on-the-ground monitoring. Here is a description of some of them.

Transects and plots: It would be impossible to count all of the plants, insects, or other animals in many areas, because of the immense number of species or the large scale of the area to be studied. So scientists use transects and vegetation plots. A transect is a line along which certain measurements are taken. A plot is an area delineated by a tape, line, or fence. The locations of transects and plots are carefully recorded using a GPS unit. GPS stands for Global Positioning System. A GPS unit is a small, battery-operated, handheld device that uses at least three satellites to determine a location on the Earth. Coordinates are measured in degrees latitude and longitude. It gives a precise location of an area on the ground. Once they have noted their exact location, scientists can then count and study the plants and animals along a transect or within a plot. This gives a sampling of what is occurring in the larger area. Using transects and plots, scientists can measure vegetation canopy, ground cover, and other habitat details, and note changes over time.

Radio telemetry: Radio transmitters help scientists track and find animals in the wild. First, the animals to be tracked must be caught. Then a radio transmitter is attached—either to a collar worn around the animal's neck or by implanting the small transmitter in the animal. The transmitter emits a beeping signal, which is picked up by a receiver and directional antenna. Radio telemetry is used to track a wide variety of animals—from wolves to ducks to fish. The radio collars on sage-grouse can provide scientists with information on habitat use, nesting success, and population trends. Tracking the movement of sage-grouse gives scientists valuable information about seasonal habitat preferences. This information is useful to land managers making decisions on land use and habitat designations.

Just for fun

This website tracks radio-implanted trout adopted by schoolchildren in the Adopt-a-Trout program. http://fwp.state.mt.us/adoptatrout/

Bird bands: A bird band is a small metal ring that fits around a bird's leg and has numbers or a code on it. There are many types and sizes of bands used for different purposes such as identification, research, and tracking. Many migratory birds have Federal bands. If you find one of these, the inscription, location, and species should be reported to the National Bird Banding Laboratory in Laurel, Maryland, at this address: http://www.pwrc.usgs.gov/bbl or call toll-free 1-800-327-BAND (2263). Chicken-like birds such as sage-grouse and prairie chickens usually will have State bands and should be reported to the appropriate State Fish and Game Agency. Reporting the date and locations of these birds gives scientists valuable information on their location, movements, and habitat preferences throughout the year.

Robel pole: The Robel pole is a tool used to measure vegetation height. The pole has obvious stripes at set intervals. It is set vertically into the ground and the observer walks a set distance from it and reads the last number visible. This is just above the lowest point that is covered by vegetation. This also is called a "visual obstruction" pole.

Densiometer: This is a device used to measure canopy cover, or density, of vegetation. By looking up through a densiometer, researchers can note the approximate percentage of sky that is blocked by vegetation. Measuring this canopy cover is frequently done in association with a survey of ground cover.

Bionic ear: This device magnifies sounds and is used in wildlife observation and study. The "ear" can be pointed in certain directions to pick up sounds that otherwise would be too faint to hear. This equipment is used in prairie chicken research.

An Innovative Tool

Radio (boom box): O.K., this is not really a specific tool, but scientists often use innovative approaches to their wildlife research. Loud music from a boom box can mask out the sound of researchers' footsteps as they approach the sage-grouse they are trying to capture.

Activities: Tools and Technology

A. Investigate a Transect

Objective

Students will use some basic scientific tools to examine a transect and record the organisms living there.

Materials

Measuring tape
Rope or twine (at least 30 meters)
Brightly colored permanent marker
A ball of string
2 stakes
Hand lens
Meter stick
Notebooks or paper, pencils, clipboards
Field guides

Procedure

1. Choose a site where your students will be able to lay out a 30-meter long piece of rope or twine across a natural area. Divide the students into working groups of three to five students each. If you have a large group, you may want to set up more than one transect line. Choose different habitat types if this is the case; for instance, a wooded area, a grassy lawn, or a well-traveled area near the school building.
2. Using the marker, color a small section on the rope at 3-meter intervals and then stretch the rope—your transect line—straight across the area or areas you have chosen. Attach the rope to the stakes at each end.
3. Each group will be assigned to investigate a one-meter-square plot of land around the marked spot on the transect line. These plots should be given identification numbers from 1-10. Students can use the meter stick and string to delineate their study plot.
4. Have students record the types of organisms they observe within their study plot. They can use a hand lens to observe small creatures, such as insects. They can use the meter sticks to measure the height of vegetation they observe. They should create a data sheet in their notebooks that allows them to identify each organism (with the help of the field guides), write descriptions of each, note the number of each organism that they see in their plot, and possibly include a small drawing of the organism. Remind students that in addition to actual animals, they might be able to find evidence of their presence, such as tracks, nests, or webs.
5. Back in the classroom, each team of students should do follow-up research on any organisms they could not identify in the field. Once this task is completed, team members should summarize their observations by considering such questions as:
    - How many different kinds of plants did they observe in their plot?
    - What plant type represented the largest percentage? For instance, was the plot composed of 20 percent shrubs, 30 percent ivy, and 50 percent grasses?
    - Were there any nonnative plants in their plot? (This may take additional research or consultation with a local nature center.)
    - How many types of animals were observed in their plots?
    - Were these animals found in association with a particular plant type?

A. Investigate a Transect (cont'd.)

- How would they characterize the non-living parts of their plot? For example, was it located in the sun or shade? Was the soil moist or dry? Were there rocks or other non-living material in the plot?

6. Next, student groups should compare and contrast their results. Can they come to any conclusions about the following question: Was there any relationship between the variety of plants found in a plot and the number of animals located there?
7. This might be an opportunity to hold a class discussion on the subject of biodiversity. (See the "Resources" section of this guide for some suggestions of where to find more information on this subject.)

B. Animal Tracks

Objective

Students will be able to identify various animal tracks and make some inferences about animal behaviors based on the positioning of the tracks.

Materials

Sketch books/blank paper
Digital cameras
Notebook,
Pencils, pens, colored pencils,
Resource books about animal tracks,
Various websites (see list below)

Teacher Background

When wildlife biologists are out in the field, they gather information about animals not only by observing them directly but also by studying the evidence they leave behind. Pellets, burrows, and tracks, for example, can tell scientists a great deal about wildlife behavior. And by studying evidence rather than the actual animals, scientists reduce the risk that they will disturb the wildlife they are studying.

In the first phase of this activity, students will explore an example of some tracks and are asked to infer what could have been happening based on the way the tracks are aligned. In the second phase of the lesson, teacher and students together will discuss the tracks and make inferences about the likely behaviors of the animals making the tracks.

Finally, the teacher will discuss the idea that tracks can tell us some surprising things about animals in addition to identifying the animals. Students will then be reminded about making observations and writing good descriptions as they will be making observations of different animal tracks they find.

Procedure

1. Have students look at the animal tracks diagram (see next page). Ask them to try and figure out what they think happened here and why.
2. Have students record their answers in notebooks.
3. Discuss students' findings. Ask them what evidence they have for their understanding.
4. Ask students what an "inference" really is. Discuss with students how they can learn more about an animal from inferring what its tracks tell us.
5. Discuss with students the importance of making complete observations (e.g. writing and drawing everything they see). Where possible, teach students how to use digital cameras to collect observations.
6. Discuss identifying tracks using resource materials and the internet. Several web sites are listed below for your use.
7. Students will make a track identification book. This could be done individually or as a class project, with students contributing pages to the book.
8. Students will sketch or photograph actual animal tracks they find outdoors. Students can do this in their own backyard, in a local park, or some other area available to you and your students.
9. Students will then identify the animals from the prints they have collected. Resources books may be available in your room or from your school or local library. The Internet has a host of sites that can be visited to aid in the identification of the tracks.
10. Ask students to write a short description of the animal as well as their thoughts about what the animal was doing based on their tracks. (e.g. were they collecting food, running, being hunted, etc.?)

Websites to test your skills as "Animal Tracks" observers:

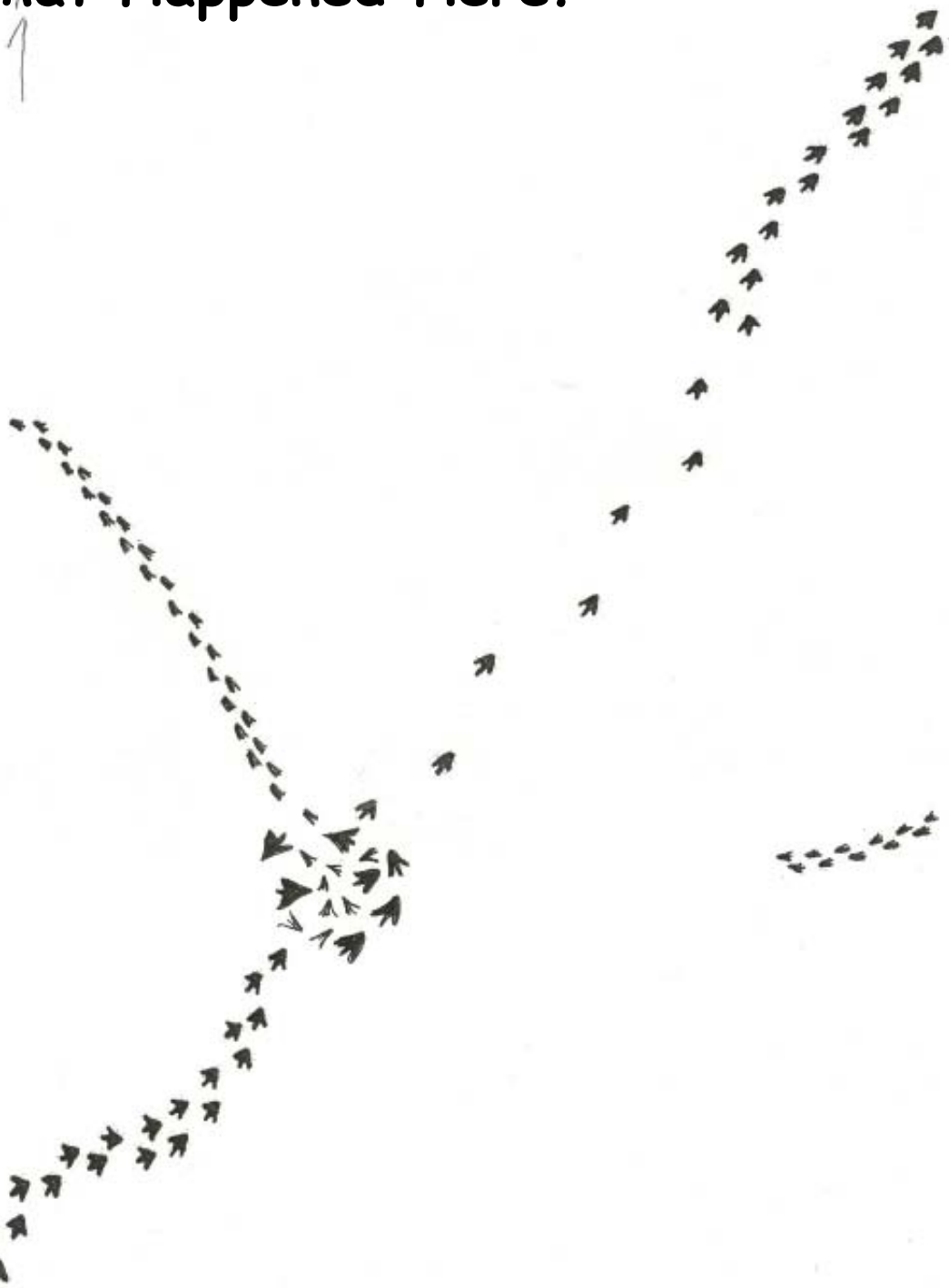
http://www.dnr.state.wi.us/org/caer/ce/eek/nature/track.htm

http://midwest.fws.gov/portlouisa/info/refugephotos/animals/turtle_tracks_1.htm

http://www.dnr.state.mn.us/young_naturalists/tracks/index.html

http://columbiariver.fws.gov/games/concentration/tracksconcentration.htm

Animal Tracks
What Happened Here?



C. Seeing at Multiple Scales

Objective

Students describe the differences in a landscape or environment seen at various distances and give reasons to look at a landscape or environment at several scales, with different objectives in mind.

Materials

Select a poster or picture with a natural scene that has considerable detail. The image should be new to the students. It is best if the subject or theme of the image is not readily apparent until the students get closer. You will also need a measuring tape and masking tape.

Procedure

1. Hang the image at one end of a large room. Measure 15 meters from the image and mark the floor with tape. Then measure and mark the floor at 3-meter intervals coming toward the image. Repeat the markings three or four times to form an arc.
2. Align the students single-file along the outermost edge of the arc (15 m). Give the students about 30 seconds to 1 minute to observe the image and write a description of what they see from this distance. Ask students not to share this information. Next, advance the students together to the next arc (12 m) and repeat for each successive distance.
3. When the students arrive at the closest mark, allow small groups (five or six students) to advance slowly until they can get their nose on the image and record their observations at this point.
4. After all students have completed the activity, ask the following questions:
    - What did the students see at the farthest point?
    - Did the images look different as they got closer to the image?
    - What did they learn at different distances?
    - How much of the image could they see when their nose was on it?
    - How is this picture different from the one they saw at a distance?
    - At what point did they learn the most about the subject of the poster?
    - How was their perspective enhanced or limited by each stop?
    - How does this apply to the habitat analysis of sagebrush or other areas? (Scientists study habitat on a site-specific level but also are looking at the bigger picture through regional, ecosystem-based analysis.)

Putting it All Together: Integrating Data, Taking Action

Scientists have come to realize that one of the best ways to protect individual species is to focus not so much on the needs of the individual species but instead to look at entire ecoregions. These large, landscape-scale areas have similar living organisms and environmental conditions. Some parts of these ecoregions may be healthy; some may be in trouble, while others may be damaged beyond repair. By assessing the large-scale situation, scientists can decide where best to focus their efforts.

The way scientists are approaching the problems of sage-grouse decline provides a good example of range-wide habitat conservation. Today the BLM manages over half of the remaining habitat for the sage-grouse**.** Over the past five years, BLM has worked with several western states on cooperative sage-grouse conservation projects and has established partnerships with communities throughout the West to conserve and restore sage-grouse habitat. BLM also is preparing a national strategy to conserve sage-grouse and their habitats on BLM managed land throughout the West. These efforts are designed to address continued loss of America's important sagebrush ecosystems, which support hundreds of plant and animal species, including sage-grouse.

Because sage-grouse habitat occurs on hundreds of thousands of hectares across the vast western landscape, habitat conservation efforts must address large landscape-scale issues. To this end, the BLM and other agencies are analyzing large-scale and range-wide factors that may be causing declines of sage-grouse populations. BLM range-wide efforts will complement conservation strategies being developed by western state wildlife agencies. BLM is working with multiple Federal, State, and Tribal agencies as well as special interest groups and private landowners on this range-wide habitat conservation effort.

A. Searching for Sage-Grouse: A Web Quest

Objective

Students work in teams to research and make presentations on the sage-grouse.

Materials

Access to the Internet

Procedure

Present the following scenario to your students:

Introduction

Your team has been invited to make a presentation at a very prestigious scientific conference on sage-grouse. Your group was chosen for this task because the conference committee had heard about the great research work you have been doing in many different areas of science, especially in the area of habitats.

As you already know, sage-grouse are an indicator species for shrub-steppe habitat. Conference attendees might need to know more about the shrub-steppe habitat and more about what an indicator species is. Do you think that people know how many types of sage-grouse there are and where they might be found in America? There may also be some confusion as to whether or not all sage-grouse are exactly the same species. These are the questions that you are going to answer in your presentation.

The Task

Your task will be to prepare a presentation for the meeting that answers the questions posed below:

1. What is an indicator species?
2. What is shrub-steppe habitat?
3. Where are sage-grouse found in America?
4. How many types of sage-grouse are found in America? (Note: There is some controversy associated with the answer to this question. Be sure to include some background information on the nature of this controversy.)
5. What is the conservation status of the Gunnison Sage-Grouse?

These questions will make an interesting introduction to your major presentation topic: sage-grouse.

You may find that the best way to construct this presentation is through the use of PowerPoint. You will be expected to present your findings at the very prestigious science conference to be held shortly. Your teacher will announce details of the conference to you.

The Process

1. First you will be assigned to a team of three students by your teacher.
2. The three roles in the group are a) Researcher, b) Writer, and c) Presentation Designer. You need to pick a role that best suits your talents; however, remember that this is a group project and every-

A. Searching for Sage-Grouse: A Web Quest (cont'd)

one will need to help in completing the project.
3. Once you have picked a role to play, then you will work to answer the questions listed in the task above and your researcher will begin to find information for the writer.
4. The presentation designer will need to review how to make a PowerPoint and begin to design slides that can be used for the presentation.
5. The researcher may also assign tasks such as finding graphics, maps, and other visual aids to the group members.
6. The researcher will access online resources, as well as others, to answer the questions and find information about sage-grouse. The links listed below may help in this search. You may need to find other Internet sites. Always check with your teacher before launching your own search so that he or she can be aware of what you are doing.
7. Your group will need to figure out how to collect and organize all the information you find. If you are keeping your information on your computer, perhaps a new folder for this project can be used. You might want to check with your teacher to find out how all three of you can access this information. Email might be appropriate if you have it or a shared folder system could work well.
8. Your teacher will assign time and a schedule for you to complete this project.
9. Your teacher will decide on assessment criteria based on the grading scheme that is already in place in your classroom. You will be expected to have a PowerPoint (or similar) presentation that answers all the questions listed above and researches in depth the topic of sage-grouse. Your teacher will decide when and where you and your group members will present your findings to a larger group.

Websites for this project:
BLM's Draft Sage-Grouse Habitat Conservation Strategy:
http://www.blm.gov/nhp/spotlight/sage_grouse/
U.S. Fish & Wildlife Service Sage-Grouse Fact Sheet:
http://mountain-prairie.fws.gov/species/birds/sagegrouse/sagegrousefactsheet.pdf

A sampling of state conservation and recovery plans
Nevada Department of Wildlife Sage-Grouse Conservation Project:
http://ndow.org/wild/sg/index.shtm
Washington Dept. of Fish and Wildlife Draft Sage-Grouse Recovery Plan:
http://www.wdfw.wa.gov/wlm/diversty/soc/recovery/sage_grouse/index.htm
Idaho Department of Fish and Game: http://www.id.blm.gov/publications/data/sage_grouse.pdf
Utah Division of Wildlife Resources: http://www.wildlife.utah.gov/pdf/sagr_statusrpt01.pdf

Gunnison Sage-Grouse Information: http://www.western.edu/bio/young/gunnsg/gunnsg.htm
and http://www.nps.gov/cure/webvc/sagegrouse.htm
BLM's Gunnison Sage-Grouse Conservation Plan: http://www.co.blm.gov/gra/sagegrouse.htm

As an extension, have student groups discuss possible options for a sage-grouse conservation strategy. Or consider having your students engage in a similar project for the lesser prairie chicken or another species of their choice.

B. Mapping the "Human Footprint" in Your Area

Objective

Students will use an aerial photograph of their region and note areas where wildlife may be found or where habitat change may have occurred.

Procedure

1. Have your students check out the following website: http://terraserver.homeadvisor.msn.com/default.aspx By searching on the "Advanced Find" feature, you should be able to locate an aerial photograph of your region.
2. Students should note the date that the photo was taken and compare what their area looks like today with the way it appears in the photograph. Depending on the date of the photo (and some may be quite a few years old), students may discover that many changes have occurred. Discuss the nature of these changes with the class. Were they natural or human-induced?
3. Next, ask students to consider which locations in the photo are most likely to provide suitable habitat for wildlife. Are those areas still available to wildlife today? If not, hold a class discussion on what might have happened to the wildlife that once inhabited the area.

C. A Word for the Birds: Go Birding!

Objective

Students will use their observation skills to see and then identify local birds.

Procedure

By setting up bird feeders near your classroom, you and your students can become window bird watchers. Make sure you keep field guides to local birds handy so students can identify visitors to the feeder. Create a class bird list. If possible, make this a year-long project. Do the species change with the seasons? Are the birds at your feeder year-round residents or migrating species that are just "passing through"?

Even better, consider a class trip to a nearby park or wildlife refuge. Your students may be amazed to discover the variety of birds that inhabit these areas. Make sure they consider the habitat components that attract the birds. Hold a class discussion in which students compare the habitat they visit with the habitats inhabited by the sage-grouse and the lesser prairie chicken.

D. Take Action: Create a Schoolyard Habitat

Objective

Students work together to assess habitat conditions in their own schoolyard and develop a plan to improve conditions for local wildlife.

Procedure

Ask students to make a list of the habitat components that can be found in their own schoolyard. Are there places for animals to find food, water, space, and shelter? To assess how wildlife-friendly your schoolyard is, consider creating a map of your schoolyard. Have teams of students go outside and measure different sections of the schoolyard and create a scale drawing. Back in the classroom, the teams can combine their drawings to create one large map.

Once the current situation has been assessed, develop a plan for making your schoolyard more inviting to wildlife. Use the map you created to decide on a place or places in your schoolyard where such an effort would be most beneficial. If you've already seen birds in a field near your school, for example, think about providing an additional source of food or water for them near that area. Consult a local nature center or park to find out what animal species might be attracted to a schoolyard habitat in your area and what native plant species might attract them.

Be sure to involve other members of the community in your efforts too. Perhaps a team of students could create flyers describing your class project. They could distribute them to other classes, their parents, and nearby businesses. Contact local nurseries or hardware stores to see if they would be willing to donate supplies. Consider holding a community workday to construct your habitat. Once your habitat improvement project has been built, assign teams of students to monitor how it's working. And if your school is closed for a long period, ask for volunteers who might be able to maintain the habitat during that time.

For more information on creating schoolyard habitats, you can check the "Resources" section of this guide.

Appendices

Visit the Places

Nevada: The sagebrush habitat of northern Nevada has undergone many changes over the past 50 or so years, which have led to a decline in the numbers of sage-grouse. In the broadcast, scientists capture individual birds in an effort to monitor the status of the population. This segment was filmed near Winnemucca. Can students locate this town on a map?

New Mexico: Eastern New Mexico is home to the lesser prairie chicken, an upland game bird similar in many ways to the sage-grouse. Researchers in the broadcast use various technologies to gather data on the health of the prairie chicken and its habitat, the short-grass prairie. Students can discover where this segment was filmed by locating the towns of Roswell and Milnesand on a map.

Colorado: The shrub-steppe of southwestern Colorado is home to the Gunnison sage-grouse, one of two species of sage-grouse. In the broadcast, students from Western State College gather data on sagebrush, a habitat component that is particularly important to the sage-grouse during winter. To find out where this segment was filmed, have students locate the town of Gunnison on a map.

Meet the Players

Live from Phoenix, Arizona

Phoenix Studio Host: Sarah Spivey

Phoenix Studio Student Host: Ian Davis, Chandler High School, Chandler, Arizona

Mark Hilliard is a wildlife biologist with BLM's national wildlife group stationed in Idaho.

George Buckner is a BLM wildlife biologist stationed in Portland, Oregon.

Amber Munig is a wildlife biologist from the Arizona Game and Fish Department. Her studies with pronghorn antelope and other wildlife often involve the use of radio telemetry.

Phoenix Studio Audience

Dan Schindele's 8th Grade Class, Akimel A-al Middle School, Phoenix, Arizona

Marge Dillon's 6th Grade Class, Alta Vista School, Phoenix, Arizona

Student Reporters

Hoku Donovan-Smith, Monte Del Sol Charter School, Santa Fe, New Mexico.

Ryan French, Berendo Middle School, Roswell, NewMexico.

From Colorado

Matt Vasquez, co-leader of the project and a graduate of Western State College of Colorado. Matt received a B.A. in Ecology and Environmental Biology in 2002.
John Stanek, co-leader of the project and a senior at Western State College of Colorado. John is majoring in Ecology and Environmental Biology.
Sarah Barkman-Berndt, a junior at Western State College of Colorado. Sarah's major is also Ecology and Environmental Biology.
Mary Oswald, a graduate of Western State College of Colorado. Mary earned her B.A. in Ecology and Environmental Biology in 2003.

From New Mexico

Rand French is a wildlife biologist for the BLM's field office in Roswell, New Mexico.
Luke Bell is a graduate student working on a master's degree in range ecology at Oklahoma State University.

From Nevada

Kim Toulouse, Nevada Department of Wildlife

Broadcast Credits

Produced by the Bureau of Land Management:
National Training Center and the Environmental Education and Volunteers Group

We would like to thank the following groups and individuals for donating time, talent and/or photographs to this project:
Arizona Game and Fish Department
Digital Visions Video Productions
ESRI GIS and Mapping Software
Leapfrog Productions
Nevada Department of Wildlife
New Mexico Department of Game and Fish
North American Grouse Partnership
U.S. Geological Survey
Western State College of Gunnison, Colorado

Photo Credits

Thomas Ager
Robert E. Bennetts
Nathan A. Burkepile
Kent L. Christopher
Hubert E. Quade
Michael A. Schroeder

Behind the Scenes

Bibi Booth, education specialist in BLM's Environmental Education and Volunteers Office in Washington, D.C., coordinated the purchase of educational materials for the program.
Chip Calamaio, Division Chief for Media and Graphics Production at BLM's National Training Center in Phoenix, is the Director of this broadcast.
Carolyn Cohen, education specialist in BLM's Environmental Education and Volunteers Office in Washington, D.C., coordinated the marketing and promotion of the program and served as an assistant producer for the broadcast.
Art Ferraro is the Producer of the live broadcast. He is a Producer/Director for the BLM National Training Center and serves as the media department's Technical Director.
Shelly Fischman, education specialist in BLM's Environmental Education and Volunteers Office in Washington, D.C., coordinated the purchase and distribution of the educational materials for the program.
Kevin Flynn, the web editor for BLM's Environmental Education and Volunteers Office in Washington, D.C., coordinated all web-related materials for the program and designed the Educator's Guide.
John Guerrero is a Producer/Director for BLM's Satellite Network, at BLM's National Training Center.
Randy Hayes is a videographer from BLM's National Science and Technology Center in Denver, Colorado. He videotaped the segment on the Gunnison sage-grouse research.
Jennifer Kapus, graphic designer for BLM's National Science and Technology Center in Denver, Colorado, designed the logos and artwork for the set, and promotional and educational materials.
Lemitchel King, Audiovisual Specialist at BLM's National Training Center, is the camera operator for the broadcast.
Alma Lively coordinated the graphics for the live telecast. She is a Producer/Director with the BLM National Training Center in Phoenix.
Kim Menning is a Video and Television Producer/Director at BLM's National Training Center.
Dr. Chris Purkiss is an education professor from Western State College of Colorado. She and her students wrote some of the activities for the Educator's Guide
Elizabeth Rieben is the producer of the show and co-author of this guide. She is an education specialist and writer for BLM's Environmental Education and Volunteers Office in Washington, D.C.
Mary Tisdale is an executive producer of the show. She manages BLM's Environmental Education and Volunteers Office in Washington, D.C.
Betsy Wooster, education specialist in BLM's Environmental Education and Volunteers Office in Washington, D.C., coordinated the content of the website and the Educator's Guide.
Dr. Jessica Young is a biology professor from Western State College of Colorado whose students are doing the research on the Gunnison sage-grouse.
Nancy Zimmerman, a freelance writer based in Santa Fe, New Mexico, wrote the script and contributed to the Educator's Guide.

Glossary

biodiversity: the number and variety of living things in an area or on the entire planet.

biome: a large area characterized by a distinctive plant community or communities, largely the result of the area's climate.

carrying capacity: the largest number of individuals an ecosystem can support for a long period of time.

community: all the populations of different species that live in one ecosystem.

ecoregion: a relatively large area characterized by similar geology, soils, climate, terrain, altitude, and plant and animal species. There can be many distinct ecoregions within a biome.

ecosystem: the living and non-living things that interact in a particular area.

forbs: annual plants that flower.

habitat: the place where an organism finds the food, water, space, and shelter it needs to survive.

indicator species: a species whose condition provides information on the overall health of the ecosystem, including the health of other species in that ecosystem.

lek: a site where sage-grouse engage in courtship displays and mating. Leks tend to be used year after year and are generally open areas, such as dry lakebeds, clearings on ridges, low sagebrush flats, or disturbed areas surrounded by sagebrush. Prairie chickens also perform courtship and mating rituals at leks.

microbiotic crust: bare soil between plants that is actually a thin crust of tiny lichens, algae, fungi, and other microscopic living material growing on or just underneath the soil. Microbiotic crust is found in many areas of the sagebrush ecosystem.

population: all the individuals of a particular species that live in the same place.

range: refers to an area of the western United States characterized by native grasses, grasslike plants, forbs, or shrubs and often used for grazing sheep and cattle. The term also refers to an area regularly occupied by a species.

shrub-steppe: a vast grassland that extends from eastern Washington and Oregon, across Idaho, Nevada, and Utah, and into western Wyoming and Colorado. As with the Russian steppe, or "treeless plain," grasses and shrubs are the predominant vegetation in the region. Sagebrush is the most common shrub found in the American shrub-steppe.

understory: an underlying layer of vegetation.

Resources

Earthshots: Satellite Images of Environmental Change: http://edcwww.cr.usgs.gov/earthshots/slow/tableofcontents

Several National Aeronautics and Space Administration websites offer information on Earth studies from space for teachers and students alike:
Landsat in the Classroom: http://landsat.gsfc.nasa.gov/main/education.html
For Kids Only: How NASA Studies Land: http://kids.earth.nasa.gov/land.htm

The GLOBE Program, a worldwide, hands-on education and science program: http://www.globe.gov/globe_flash.html

National Wildlife Federation Schoolyard Habitats Program: www.nwf.org/schoolyardhabitats/

The U.S. Fish & Wildlife Service Partners Program works with schools to restore habitat on school properties throughout the country: http://partners.fws.gov/OurPartners/schools.htm

Partnership for Arid Land Stewardship includes resources and information on the shrub-steppe ecosystem, focusing on the Columbia River Basin: http://www.pnl.gov/pals/

Partners in Flight, "Birds in a Sagebrush Sea: Managing Sagebrush Habitats for Bird Communities": http://www.partnersinflight.org/wwg/sagebrush.pdf

"GIS: A New Way to See," BLM's article from *Science & Children* magazine on geographic information and environmental science (includes classroom activities):
http://www.blm.gov/education/00_resources/articles/gis/index.html

National Geographic Society's Geography Action Program has features on biodiversity, habitats, and U.S. public lands: http://www.nationalgeographic.com/geographyaction/
And this National Geographic website has a clickable map with information on more than 800 terrestrial ecoregions across the globe: http://www.nationalgeographic.com/wildworld/terrestrial.html

Share the Adventure!
Evaluation Form

The first 100 educators to complete and return this evaluation form will receive a set of habitat-related teaching materials, including posters.

Name_____

School _____

Address _____

City, State, Zip Code _____

Audience_____

Number of students viewing the broadcast_____

Grade levels in audience_____

Students live in an area that is (check one or more) ____ urban ____ suburban ____ rural

Please rate the following from 1 (poor) to 5 (excellent), with 0 meaning "not applicable":

Technical

	Poor				Excellent	N/A
1. Overall quality of satellite feed	1	2	3	4	5	0
2. Video reception	1	2	3	4	5	0
3. Sound reception	1	2	3	4	5	0
Program content and presentation						
4. Overall quality	1	2	3	4	5	0
5. Appropriate content for grade level	1	2	3	4	5	0
6 Learning objectives	1	2	3	4	5	0
7. Adult host in studio	1	2	3	4	5	0
8. Student hosts	1	2	3	4	5	0
9. Phoenix studio segments	1	2	3	4	5	0
10. Colorado segments	1	2	3	4	5	0
11. Nevada segments	1	2	3	4	5	0
12. New Mexico segments	1	2	3	4	5	0
13. Set design	1	2	3	4	5	0
14. Length of program	1	2	3	4	5	0
15. Did you view this program ____ live ____videotape?						
Interactivity						
16. Live student activities	1	2	3	4	5	0
17. Jumble gaming segments	1	2	3	4	5	0
18. Q & A session	1	2	3	4	5	0

	Poor				Excellent	N/A
19. Website	1	2	3	4	5	0

20. Did your class phone in a question? ____ yes ____ no
21. Did your class fax a question? ____ yes ____ no

Educator's Guide

22. Overall quality of content	1	2	3	4	5	0
23. Background information	1	2	3	4	5	0
24. Activities	1	2	3	4	5	0
25. Appropriate level of activities	1	2	3	4	5	0
26. Resource list	1	2	3	4	5	0

Follow-up

27. As a result of the broadcast, do you intend to use any of the guide activities in your classroom?
____ yes ____ no
If yes, identify which ones (use additional sheet, if needed).

28. Would you be interested in future "Share the Adventure" broadcasts?
____ yes ____ no. If yes, what time of year? _____Fall ____Spring
If yes, please list topics that would interest you._____
_____

29. What were the strengths of the broadcast? _____
_____

30. What were the weaknesses of the broadcast?_____
_____

31. Were the learning objectives met?_____

32. Which standards were best met (see list on page 7)
_____

33. What changes could make this a more useful event for future participants?
_____

34. How did you find out about this broadcast?
_____
Other comments:
_____

Thank you for completing this evaluation. Please return by mail or fax to:
Bureau of Land Management, Environmental Education and Volunteers Group
1849 C Street NW, MS LS 406, Washington, DC 20240.
FAX Number: 202-452-5199