ACTIVITIES

The following activities will help your students understand concepts and issues surrounding the topic of endangered species, as well as increase their awareness about their role in global conservation of endangered species. The heading for each activity is organized in the following manner:

Title of the Activity
Objectives
Grade Level; Subject Codes
Materials needed for the activity

Any background information for teachers is italicized.

We have suggested appropriate grade levels for each activity, but we encourage you to adapt activities for the level of your class. The subject codes list the different core subjects covered by the activity. These codes are based on core subjects outlined in the Essential Academic Learning Requirements (EALRs). Codes are as follows:

A = arts, crafts, drama, dance, music
C = communication
E = social studies - economics
G = social studies - geography
H = social studies - history
M = math
R = reading
S = science
W = writing
V = social studies - civics

If a certain part of an activity addresses a specific component or components under one of the Essential Learnings, the component(s) will be listed in parentheses following that part of the activity. For example, if one section of an activity targets the third component under Essential Learning 2 in the core subject of mathematics, (Math 2.3) would be listed after that section of the activity. (Refer to your copy of the Washington State Essential Academic Learning Requirements for listings of the Essential Learnings and components.)

THE TILT OF THE EARTH

Objective: To help students understand why Alaska, specifically the Arctic region, has drastic seasons of daylight and darkness.

Grades K-4, S, G

Materials:

Felt-tipped pen
Lamp without its shade (or a flashlight)
Tennis ball, orange or other round object
Globe (preferably one mounted on its axis on a stand)
Stick or pencil (optional)

1. Using a pen or marker, mark a tennis ball to represent the north and south poles.
2. Draw a circle 1/2 way between the north and south poles to represent the equator.
3. Draw a circle approximately 1/2 inch from the top and 1/2 from the bottom of the ball to represent the Arctic and Antarctic Circles.
4. Compare the tennis ball with a globe.
5. The light (or flashlight) represents the sun.
6. Demonstrate how the earth revolves around the sun
   a. Tilt the tennis ball approximately 23 1/2 degrees. Begin with your designated North Pole facing away from the lamp. Explain that this is how the earth is tilted.
   b. Walk slowly around the lamp without changing the tilt of the ball. Tell your students that the earth moves around the sun. It takes one year to do so.
   c. Ask your students to record or share their observations about what happens during the earth's rotation.
   d. If they need assistance, ask them to note how much light is shining above the line marked as your Arctic Circle when you are at different points around the lamp.
7. Ask students to make observations about what is happening at each of the three locations, marked on the ball—the Arctic Circle, the equator and Antarctica—when the earth (ball) is in three or four locations around the lamp. Ask your students to record or discuss the meaning of these observations.

Optional:

1. Drive a stick through the ball to represent the earth's axis.
2. Explain that not only does the earth rotate around the sun, but as it is rotating, it is also spinning on its axis (the stick).
3. Move around the lamp again, this time rotating the pencil as you go.
4. Ask the students:
   a. What happens when the earth spins on its axis? *Day occurs when we spin to face the sun, night occurs when we spin away from the sun's light.*
   b. When the top half of the earth is tilted away from the sun, what happens when the earth spins on its axis? *It is dark almost 24 hours per day in the arctic.*
   c. When the top half of the earth is tilted away from the sun, what is happening on the equator and the Antarctic? *The equator always has equal amounts of daylight and darkness and it is light almost 24 hours per day in the Antarctic.*

UNDERSTANDING PERMAFROST

Objective: Students will discover the properties of permafrost (permanently frozen soil) by simulating its formation in a freezer.

Grades K-5, S

Materials:

2 cake pans (or smaller containers such as margarine tubs if freezer space is limited)
Source for water
Ruler
Access to a freezer
2" of moist potting soil for each pan (container)
Forks
A plastic spray bottle (optional)
Sticks or other objects which can represent trees (optional)

1. The equipment listed above is for one class wide experiment. Activity can be done as a class or in pairs.
2. Ask students what is meant by permafrost *(Permanently frozen soil.)* Does permafrost occur around their school or in their neighborhood? *No, we do not live in a cold enough climate. Northern British Columbia and Alberta would be the nearest place where we could find permafrost on a discontinuous (scattered) basis. The farther north one travels in North America from northern Canada through Alaska, the more likely one would find permafrost* (see background information).
3. Encourage students to find out more about permafrost in the school library.
4. Have students fill each cake pan with moist potting soil. Use the mister to spray each pan with water for extra moisture.
5. Put one pan of soil in the freezer and leave the other pan on a windowsill. Leave the soil in the freezer for 24 hours.
6. Ask students to make some predictions about what they will discover:
   a. Are there differences between the frozen soil and the unfrozen soil? Which sample will be warmer? Colder? Harder? Softer? Will they be able to dig in both samples? Which soil sample will soak up more water?
7. Write down this list of predictions on a class list or in student notebooks for later comparison.
8. Take the frozen soil sample from the freezer and place it next to the unfrozen sample. Have students compare the two pans of soil and test their predictions and record their findings:
   a. Which sample is warmer? Colder? Harder? Softer? Were students able to dig in both samples?
   b. Have students pour a tablespoon of water on each sample. What happens? Which sample absorbs the water? Why or why not? What happens to the water that is not absorbed?
   c. Ask your students to record their observations and compare the answers to their original predictions.

Grades 5-8, S

1. Complete the above activity and observations.
2. After students have recorded their observations, ask them to explain how the phenomena they have observed would affect life in the arctic tundra.
3. Put the following questions on the board, then provide thinking and discussion time.
   a. Do you think plant growth would be affected by the presence of permafrost? If so how? What will happen if it rains? Will the frozen ground affect animals?

Extension:

1. Have students develop a method for testing the following question:
   How might plant growth in or on top of the frozen soil be affected? *Plants in the north have adapted to growing in colder soils and have shorter growing seasons but almost nothing can grow directly in continuous permafrost.*

Extension: A pan will work better than a small container for this extension.

1. Have your students place sticks or other objects upright in the soil to represent trees.
2. Freeze and then thaw the soil several times over the next week.
3. Does the freezing and thawing affect the "trees?" What if you place the pan at a slight angle to simulate a gentle slope?
4. Ask students to draw their own conclusions about the effects of seasonal melting and freezing of the upper layers of arctic soil.

Extension:

1. Discuss with your students the effects of building on the tundra. What might happen if roads or buildings were built on permafrost? *Dark material, such as asphalt, placed on top of permafrost will absorb solar radiation and transfer the heat into the permafrost causing it to melt. This action, in turn, will cause a road or foundation to buckle or slump. Many buildings or structures must be built above the ground to ensure that the building does not transfer heat into the permafrost. That's why some Alaskan dwellings and the oil pipeline are built on stilts.*
2. Describe this phenomenon to students and ask them how they could illustrate the concept using the frozen soil sample.

UNDERSTANDING PERMAFROST

STUDENT ACTIVITY SHEET

1. What is permafrost?

2. Day 1: Setting up and predicting
   a. Using the two containers provided, fill each one with moist soil.
   b. Put water in the spray bottle and dampen each soil sample with water.
   c. Place one of the containers in a freezer and one on a windowsill for 24 hours.
3. Predicted outcomes, write down your predictions for each of the following questions:
   a. How will frozen soil be different from unfrozen soil?
   b. Will it be warmer or colder?
   c. Will it be harder or softer?
   d. Will you be able to dig in both samples?
   e. Which soil sample will soak up more water?

Frozen	Unfrozen

4. Day 2: Results
   a. Take the soil sample from the freezer and place it next to the sample from the windowsill. Compare the two pans of soil.
   b. Answer the following questions:

Check your predictions. Were they correct?

Did both samples absorb the water? Why or why not? What happened to the water that was not absorbed?

What did you learn from this activity?

How might plant growth in or on top of the frozen soil be affected?

STAYING WARM

Objective: Students will discover why length and width (circumference) of appendages make a difference to arctic animals.

Grades 1-5, S, M

Materials: Provide each team with the following materials:
2 thermometers
2 pairs of plastic or rubber gloves (non-insulated)
2 rubber bands
1 measuring cup
Source for warm water

1. Discuss what climatic conditions might be like in the arctic, especially during winter. Ask if anyone has lived in or visited Alaska at different times of the year.
2. You may want to find a community member, student family member or faculty member who has lived in or visited Alaska (or another arctic area) to describe to the students what conditions are like in that part of the world.
3. Read a story about life in an arctic environment. See "Resource" section of this packet for suggestions.
4. Ask your students what would happen if they went outside on a very cold day during the winter without a jacket. How would they feel? What would their bodies do? *Shiver, curl up or tuck appendages in close to their bodies.* Which parts of their body would get cold first? *Fingers, toes, ears.* Why?
5. Go to your school library to locate illustrations of arctic and kit foxes, tundra hare and desert jackrabbit. Compare the ears of an arctic fox to those of the kit fox, and the ears of the tundra/arctic hare to those of the desert jackrabbit. Why do you think they are different?
6. Have your students read the "Staying Warm" student activity sheet so students understand the sequence of the experiment.
7. Prepare the classroom for potential water spills.
8. When working with younger students you may choose to do this activity in a large group, otherwise, student work teams can then be assigned to work stations that have been set up around the room with all the materials needed. Each team can select a different location where the pairs of gloves are left. Results can be compared among research teams.
9. After completing the activity, ask your students to think about animals that live in the arctic. The blood in their bodies is like the water in the gloves. Their toes, ears and tails are like the fingers in a glove. Considering what your students now know about gloves and water temperature, which animal do you think would stay warmer in the arctic—one with long ears, legs and tail or one with short ears, legs and tail? If an animal lived in a cold area and had larger body parts, like a wolf's long legs, how might the animal keep warm?

Extension:

Ask your students to compare illustrations of arctic animals to desert animals through research at the school library. Ask them to compare the shapes of the animals' bodies, ears and legs. How do the different parts of the animals help them survive in their environment?

Grades 5-8 S, M

1. Supply your students with the materials from the materials list. Ask them to work in teams to test the effects of appendages on body temperature, but allow them to design their own experiments.
2. Ask your students to compare illustrations of arctic animals to desert animals through research at the school library. Ask them to compare the shapes of the animals' bodies, ears and legs. How do the different parts of the animals help them survive in their environment?

STAYING WARM

STUDENT ACTIVITY SHEET

1. Which do you think keeps your hands warmer—gloves or mittens?_____
   Why?

2. Let's run a test to find out which one is warmer. Take a pair of rubber gloves. Use a rubber band to tie together the four fingers of one of the gloves. Be sure the rubber band is tight. This is the no finger glove; we'll call it a mitten. The other glove will not be changed. Let's call it the regular glove.

3. Fill your measuring cup with one cup of water. Measure the temperature of the water in the cup.
   Mitten starting temperature of water is _____ °F (or _____ °C)
   Now, pour this cup of water into the mitten and carefully close the top with a rubber band. Close it tightly so it doesn't leak!

   Follow the same procedure with the regular glove.
   Regular glove starting temperature of water is _____ °F (or _____ °C)
   Remember to close the top carefully so it won't leak either.

4. Place both gloves in a refrigerator, or if it is winter, outside in a cold spot. Wait 30 minutes, then collect both gloves. Pour the water in the mitten into a cup and measure the temperature. Do the same for the regular glove.
   Mitten ending temperature of water is _____°F (or _____ °C)

   Regular glove ending temperature is _____ °F (or _____ °C)

In which one did the water get colder? _____

Can you explain why there is a difference? _____

_____

Do you think it would have made a difference if the fingers of the regular glove had been wider?

If so why?_____

_____

Can you figure out a way to test this? _____

_____

Next time it is cold outside, will you wear gloves or mittens? _____

Why?

JACKRABBIT EARS ARE COOL

Objective: Students will be introduced to the concept that body shape affects heat retention.

Grades K-6, S
Materials:
2 hand towels
Hot water

Jackrabbits live in the steppe and have large ears which help to keep them from overheating. Blood circulating through the veins of a rabbit's ears is cooled by the air before it recirculates through the rabbit's body. Snowshoe hares live in Alaska and other cold weather regions. A round compact body, short legs and short ears help the hare to retain body heat and remain warm during cold weather.

Immerse the hand towels in hot water and quickly wring them out. Bunch one towel into a ball and lay the other towel flat on a table. Ask your students to predict which towel will cool off the fastest. After one to two minutes, stretch out the balled up towel. Quickly have your students place a hand on each towel. Which towel feels cooler? The towel with the most surface area! Because a greater surface area of the flat towel is exposed to the air, the flat towel, like large jackrabbit ears, cools off more quickly.

BODY SHAPE

Objective: Students will discover why body shape makes a difference to arctic animals.

Grades 5-12, S, M
Materials:
Thermometers
Low-lipped baking pans
2 pairs of plastic or rubber gloves (non-insulated)
Bowls
Rubber bands
Plastic jugs
Measuring cups
Source of warm water
Pails

Note: *You can use this activity to introduce surface to volume ratios or to extend a surface to volume ratio lesson.*

1. Complete "Jackrabbit Ears" (grades K-6) and/or "Staying Warm" (grades 5-8).
2. Discuss with your students how they think body shape is related to an animal's survival in a cold environment. *Animals living in colder regions tend to have rounder, more compact body shapes than their cold weather counterparts. A smaller surface to volume ratio helps to keep the animal warmer. See "Body Shape: A Survival Tool" in the background information.*
3. Provide your students with the above materials, or other objects of your choice (or theirs). If space in a freezer or refrigerator is limited have students work in larger teams or provide them with smaller containers. Containers should be able to hold the same measurements of water for accurate comparisons.
4. Ask students to work in teams to test the cooling and freezing attributes of water in different shaped containers.

5. Before they begin their experiments students should prepare an experimental plan, including a data collection form and an outline of how they will conduct their experiments.
6. Ask your students to record their observations in written form and through illustrations.
7. After running several experiments, ask students to compare and explain their results.
8. As a group, discuss how their tests and observations relate to the survival of animals in cold climates.

Extension: S, M

1. Use balloons which can hold the same amount of water but which form different shapes (i.e. long balloons and round balloons). Ask your students to fill two different shaped balloons with the same amounts of water.
2. Students can calculate the surface to volume ratios of the two balloons. Ask them to make predictions about which balloon will freeze more quickly. **Note:** do not fill the balloon to maximum capacity, or it will burst when water expands.
3. Students should then test these hypotheses.

INSULATION

Objective: To find out how body fat of an animal helps to keep them warm in the winter.

Grades K-4, S, M

Materials:

1 pound solid vegetable shortening (such as shortening)
2 1-gallon plastic bags (Ziploc)
Bucket with cold water and 2-3 trays of ice cubes
Masking or duct tape (optional)
Thermometers

1. Spoon vegetable shortening (fat) into one of the Ziploc plastic bags. Spread shortening around inside bag.
2. Turn the second plastic bag inside out and insert it into the shortening filled bag. If you cannot get the shortening evenly distributed, you can explain that animals' fat is not evenly distributed either.
3. Zip the two bags together. You may want to tape the sides together to avoid leakage but do not seal the opening of the inside-out bag. You now have an insulated mitten.
4. Have each student stick one hand in the shortening bag set-up. A second student can hold the bag closed around the first student's wrist. The student wearing the bag should then briefly put both hands in the ice water bucket.
5. Ask your students to describe orally or in writing how each hand felt. Which was colder and which was warmer? Why?
6. Each student should then record his or her observations.
7. Place a thermometer in the bucket of ice and water and one in the shortening bag in the bucket. Compare the temperatures.
8. As a class, discuss the importance of fat for arctic survival. Ask them to explain how their observations would relate to the survival of animals in cold regions. *The shortening works the same way as a layer of fat under an animal's skin.*

Grades 5-8, S, M
Additional materials:
Polypropylene
Thermometers

1. Provide students with the materials from the K-4 materials list and the additional materials list. Ask them to develop an experiment to test the importance of fat for animals living in arctic regions.
2. Ask students to determine a means for testing the importance of fur. What about fur and fat as a combination? *Use the polypropylene as a fur substitute in this experiment to discuss additional layers of insulation. Although the polypropylene is not identical to fur, it can be utilized to discuss insulating properties, thus real animal fur need not be obtained.*

Grades 9-12 S, M
Materials: use any of the materials suggested for younger grades

1. Ask your students to create experiments for testing the effectiveness of various materials as insulators.
2. Which materials, or combination of materials, is most effective for providing warmth?
3. Can the information they have gathered be used to explain animals' survival during the winter?
4. Some animals in the arctic spend time in the water, others on land exposed to wind and snow, and still others underground or in dens. Ask your students to develop tests to determine which insulators are best in each of these conditions.
5. After completing these experiments, students can use scientific journals or other resources to learn more about insulating properties and animals' survival methods in cold environments.

SNOWY PTARMIGAN
BY RACHEL de GUZMAN

On a treeless tundra
I make my home in the wintertime.
I blend perfectly with snow
With my feathers fluffy and white
I'm camouflaged perfectly
Kept out of sight
I share the tundra with wolves and bears
A vast space with arctic foxes, snowy owls -
Plenty of space to share.
In summertime, I change a lot
When the snow has melted and the weather's hot.
Lovely shades of speckled brown and gray
My background of earth and rock
Doesn't give me away.

Camouflaged Pipe Cleaners

Objective: To introduce the concepts of camouflage and adaptation.

Grades K-5, A, S
Materials:
The poem "Snowy Ptarmigan" by Rachel de Guzman (found in this Activities section)
Pipe cleaners of various colors
Color pictures of wild animals (do not have to be arctic species)

1. Read to your students the poem "Snowy Ptarmigan" by Rachel de Guzman.
2. Discuss briefly the meaning and purpose of camouflage.
3. Ask each student to create a pipe cleaner animal.
4. Choose a 40- to 50-foo,t section of trail or outside space with plants and grass. If you do not have a suitable outside space, you can do this activity inside but it may be harder to camouflage the animals and will take a little more interpretation on your part.
5. Divide the class in half. Explain that half the class will hide their "animals" outside and the other half of the class will search for them. The groups will then switch.
6. Before hiding the pipe cleaner animals, discuss which animals the students think will be most easily seen. Why?
7. Have each group take turns hiding and searching for the hidden animals. You will want to limit the amount of time you allow students to search. The amount of time allotted will vary depending on your students' ages and abilities.
8. Were they right about which ones would be easier to find?
9. As a group discuss the importance of camouflage for animals in the wild.
10. Look at the color pictures you collected. Are all of the animals in the pictures able to camouflage? If so, where? If not, why not? For which habitats would the camouflaged animals be adapted?

More about Camouflage

Objective: Students will use art to demonstrate an understanding of camouflage.

Grades K-6, A
Materials:
Art supplies

1. Review the concept of camouflage.
2. Ask each student to create an art display illustrating the importance of camouflage for wild animals.

WHERE DO I GO? WHAT DO I DO?

Objective: Students will be able to name and explain the importance of adaptations which help animals survive in arctic (or other cold weather) regions.

Grades K-5 S, R, G
Materials:
Books and magazines containing pictures of cold region species

1. Read aloud, or have students read on their own, one or more stories about arctic animals (see the "Resources" section in this packet for suggestions).
2. Discuss methods animals use to survive winter in cold regions (migration, burrowing, hibernation, remaining active). Write each method on a blackboard or flip chart.
3. Ask your students to offer examples of animals that use each method of winter survival.
4. Using field guides or other resources, look up the range of the animals your students have listed. If a map is not included in the range information, point out or have students locate the animals' ranges. Using this information, make sure your list includes both Washington species and Alaskan species. You will then be able to discuss the similarities and differences between winter survival in Washington and Alaska.

Example:

Hibernate/Torpor	Migrate
Marmot (hibernate)	Caribou
Brown bear (torpor)	Arctic tern

5. Before you begin to study adaptations, have students brainstorm a list of adaptations they already know animals and plants use to survive.
6. If you have completed the "Body Shape" or "Insulation" activity, remind students about the importance of body shape in winter survival.
7. Using pictures from magazines and books, have students explain how each of the pictured animals would survive during the winter. Ask them to give supporting reasons for their answers.
8. When visiting the zoo, ask your students to identify how they think the zoo's species would behave in the wild during the winter. Do they behave the same in captivity? Why or why not? *Zoo animals are provided with food all winter long. Lack of food is one of the reasons wild species hibernate or migrate; zoo animals are not faced with this problem. However, some animals, such as the zoo's marmot will still hibernate.*
9. After your zoo visit, ask your students to look at the list of adaptations they made at the beginning of the lesson. Ask them if they have learned about more adaptations that they can add to their chart.

Objective: Students will recognize and understand some of the factors that help animals survive winter conditions.

Grades 5-8, S, R, W, C
Materials:
Access to library, Internet or other research resources

1. Ask your students to make a list of the methods animals of the north use to survive the winter.
2. What do your students feel determines, or is determined by which survival method (or combination of methods) an animal will use? For example: body shape might be related to whether an animal hibernates or stays active; food availability might determine whether an animal migrates, hibernates or remains active.

3. Students should work in pairs or groups to determine a research project they can conduct focusing on the survival of northern species. If you will be visiting the zoo, ask your students to focus their study on a species found at the zoo.
4. When visiting the zoo, ask your students to identify how they think the zoo's species would behave in the wild during the winter. Do they behave the same in captivity? Why or why not? *Zoo animals are provided with food all winter long. Lack of food is one of the reasons wild species hibernate or migrate; zoo animals are not faced with this problem. However, some animals, such as the zoo's marmot will still hibernate.*
5. When you return to the classroom, students should add any information they gathered at the zoo to their reports and then present their reports to the rest of the class orally or through visual presentations. Students should include a map of their species' ranges, and if the species migrate, summer and winter ranges should be included.

Objective: Students will recognize and understand some of the factors that help animals survive winter conditions.

Grades 9-12, S, G, R
Materials:
Access to library, Internet or other research resources

1. Review the methods animals use for survival (hibernation, migration etc.). Make a list of the adaptations of which students are already aware (warm fur, fat etc.). Brainstorm as a group a list of what other parts of the body will need to be specialized for winter survival.
2. Ask students to select an animal to study. If you will be visiting Woodland Park Zoo, ask them to select an animal at the zoo to observe (**Note:** the marmot is seldom seen.)
3. Using scientific journals and other research sources, have students work in groups or individually to identify different means of winter survival and the adaptations necessary for such survival. For example: how do the kidney functions of bears compare to those of animals which remain active all winter? How are mountain goat feet adapted for climbing the rocky slopes?
4. While visiting the zoo ask your students to observe their selected species, making notes and drawings to record their observations. Can they observe any of the adaptations they researched? Are any of the adaptations unobservable?
5. Returning to the classroom, students should compile the information they have gathered and create a report to be presented. Appropriate visuals and handouts should be utilized. Students should include a map of their species' ranges, and if the species migrate, summer and winter ranges should be included.

Extension: (Grades 5-12) Visit the Washington Department of Fish and Wildlife "Track-A-Bou" Web site at www.wa.gov/wdfw/wlm/research/caribou/trackbou
To practice migration mapping using telemetry data and Universal Transverse Mercator Map.

Extension: (Grades 5-12) Read Farley Mowat's book "Never Cry Wolf" (or watch the video). Use the information in this book as the basis for a discussion about the survival of wolves in northern regions. You may also wish to discuss some of the myths surrounding wolves and their behaviors.

CYCLING IN THE NORTH

Objective: Students will recognize how wildlife populations are affected by a variety of factors.

Grades K-6, S, M
Materials:
20 students
Gym or playground
Chalkboard or flip chart with stand
Chalk or markers
Resource cards for younger students—36 cards: 12 of each of 3 basic needs (food, water, shelter). Place half the cards at each end of the playing area.

In order to survive and reproduce, animals need five basic things (often referred to as their basic needs): food, water, air, shelter and space. These resources must be in a usable form (i.e. water cannot be frozen). If these basic needs are not met, wildlife cannot survive.

A variety of other factors also affect the ability of wildlife to reproduce successfully and maintain their populations over time. Predation (one animal eating another), disease, weather conditions, accidents, pollution, pesticide, and habitat alteration or destruction are a few of these factors.

Wildlife populations are not static but in a constant state of change. When there is plenty of food and few threats, populations can thrive. During times of famine or high predation, populations will decrease. This activity will help students realize how the availability of basic needs affects populations.

1. List the five basic needs that plants and animals need to survive—food, water, air, shelter and space. This activity emphasizes three of those five basic needs—food, water and shelter—but students should not forget the importance of air and space.
2. As a group decide on a hand signal for each of the basic needs. For example, hands placed on the stomach indicates food. Have each student learn the hand signals.
3. For younger students you may opt to create basic needs cards with a large picture of the basic need on it and a string to hang the card on the child's neck (or they could hold them).
4. Divide the class in half and have one half stand on either end of a gym or playground approximately 10 yards apart.
5. One group becomes the moose and the other the resources.
6. The two groups of students stand with their backs to each other.
7. Record on your flip chart or blackboard how many students are resources and how many are moose.

Round 1

8. Each resource student decides which resource they want to be and makes the appropriate hand signal. Young students can pick a card from the resource card pile at each end of the playing field.
9. Each moose decides which resource it is seeking and makes the appropriate hand signal (young students pick a card from the pile).
10. On a signal from the teacher, resources and moose turn around. Once they turn around, they cannot change their hand signals.
11. While maintaining the same hand signals, each moose runs across the playing area and tags a resource showing the same hand signal (food tags food).
    Note: the resource students should not move since resources (basic needs) don't run after the animals.
12. If a moose finds a matching resource, and is the first moose to tag the resource, he or she takes the resource student back to the moose side of the playing area. You can explain that this moose satisfied its basic needs and was able to reproduce—the resource student becomes a moose.
13. If a moose does not find a matching resource, or is the second moose to tag a resource, that moose dies and is recycled into a resource.
14. Record how many resources and how many moose there are now.

Round 2-8

15. Repeat activity several times. Students do not have to choose to be, or need, the same resource each time. After each round, record the existing numbers of moose and resources.
16. After completing all the rounds, examine your chart. As a class, or individually, students can graph the data.
17. Discuss the results. What can you learn from the data gathered? How did the moose population change? What made the population change? How did the resource population change? Why? What factors in nature would make moose or resource numbers change? *More animals need more resources. If there are too many animals for the available resources, many of the animals will not satisfy their basic needs and will die. Fewer animals will allow the resources to be replenished (or just more available) and the existing animals will be able to satisfy their basic needs. You can see fluctuations in populations of animals, depending on the availability of resources.*

Extension (Grades 4-6): After you have discussed the activity, provide the students with the raw data and develop a graph of surviving moose numbers over the different rounds (years).

Wildlife populations tend to peak, decline and rebuild over and over as long as there is good habitat and sufficient numbers of animals to reproduce. What do animals need to survive? Food, water, shelter and space in proper arrangement. Remember, the key to wildlife survival is habitat.

This activity was inspired by the activity "Oh Deer!" from Project WILD

PLANTS, ANIMALS AND OBJECTS

Objective: Students will be able to recognize and explain similarities between plant and animal adaptations and tools used by humans.

Grades 3-6, S,W
Materials:
Books, magazines, pictures and other available resources

1. Using available resources, examine animal adaptations to survival in the far north. Animals have a wide variety of adaptations that help them survive. Many of their adaptations are mimicked in things we make or use.

Example: Many evergreen trees are shaped like a cone to allow snow to fall off their branches, so that the branches don't get weighed down and break. Peaked roofs of houses allow snow and rain to roll off so that the weight does not break through the roof.

The following are examples of objects/tools we use that mimic plant and animal adaptations.

Plant/Animal	Object	Effect/Purpose
ptarmigan's sharp nails	crampons or cleats	grip
evergreen tree (shape)	slanted roofs	water and snow rolls off
snowshoe hare's large feet	snowshoes	stay on top of snow
caribou hooves	shovel/ice pick	dig
owl's beak	knife	slice food
porcupine quills	needles	stick into objects
magpie's beak	scissors	slice/cut
moss	sponge	soak up water
snowy owl's feathers	down jacket	keep warm

2. Can you and your students think of more pairs? Phil Gates' book, "Nature Got There First," is an excellent source for ideas.
3. Ask your students to choose one of the pairs from above or a new pair. Ask them to write (or dictate) a paragraph describing the object and one describing the animal and then a "connecting" paragraph describing the connection between the object and the animal.

LIVING OFF THE LAND

Objective: Students will understand the importance of certain plants for human survival.

Grades K-4, S, G

Materials:

"Athabaskan Utilization of the White Spruce" sheet (included in this packet), books or other resources

1. Ask your students to brainstorm a list of all the things they think people could use plants or plant materials for in order to survive.
2. As a group examine the sheet titled "Athabaskan Utilization of the White Spruce." Are there items on this list that the class did not put on their list? Discuss those items.
3. As a class or individually research other products we use that are made from plants.
4. Have each student interview his or her parents to gather ideas of nonfoods which were made from plants (medicines, furniture etc.).
5. Generate a discussion about why plants are important in all our lives.
6. Older students can read and discuss "My Side of the Mountain."

Grades 5-8, S, G, A

1. As a class, generate a list of the uses people have for plants.
2. Using the sheet titled, "Athabaskan Utilization of the White Spruce," and other resources such as Eleanor Viereck's book, "Alaska's Wilderness Medicines—Healthful Plants of the Far North," examine the use of plants for human survival. Using a chosen medium, create a display, play or other method for teaching others about the importance of plants.

Grades 9-12, H, S, G, C

1. Begin by having students generate a list of uses people have for plants. Are there specific plants they are aware of that are used for such purposes?
2. Using available resources, such as the sheet titled "Athabaskan Utilization of the White Spruce" included in this packet and Eleanor Viereck's book "Alaska's Wilderness Medicines—Healthful Plants of the Far North," ask your students to examine the use of plants for human survival.
3. Are plants still used today to the same extent they were used in the past? Are they used in the same ways they were in the past?
4. Ask your students to research how environmental issues, such as global warming, deforestation, or introduced species, may or may not affect the use of plants and items made from plants.
5. After gathering all of their information, ask your students to create a report to be presented to the rest of the class.

RESEARCH PROJECTS

Extension (for each research project): Select one or more of the following report topics for your students. During this report project, ask your students to write a first draft, edit and revise their own work, get feedback from another, write a final draft and then present their report orally or in written form for others. This drafting and editing exercise will help students meet Writing 3.1-3.4 and 4.1. Furthermore, if they use a chosen art form to display one or more of the concepts they learned, then Art 3.3 and 4.1 can be incorporated into this lesson as well.

A. Alaska's Regions

Objective: Students will learn about the different regions of Alaska, and each region's plants, animals and people.

Grades 2-6, G, R, C, A

Materials:

Books, computer software and Internet access
Arts and crafts materials

1. Divide your class into five regional teams—the Alaskan Panhandle, the southwest (Aleutian islands), interior Alaska, the Brooks mountain range and the Arctic Coastal Plain (North Slope).
2. Give each team a map that indicates the region they are studying and access to research materials. (Map is included in this packet at the beginning of the "Activities" section.)
3. Ask your students to work as a team to research their region's climate, plants, animals, people, land (terrain) and water. You may choose to add other categories for them to research as well. Once each team has completed its research, ask them to create a report, poster or map they will present to the rest of the class. Each student should select (or be assigned) one of the components (plants, climate, etc.) on which to report.
4. The teams should enhance their presentation by creating a poster illustrating their region and the components they studied.

B. People of Alaska

Objective: Students will learn about the different cultures that have helped to form today's Alaska.

Grades 4-7, H, G, W, C

Materials:

Books, computer software and Internet access

1. Alaska was originally inhabited by native Alaskan tribes, such as the Aleuts and the Tlingets. At the end of the 1700s the Russians moved in to inhabit many parts of Alaska. In 1867 Alaska was sold to the U.S. Have your students work in groups or individually to research one of the various groups of people who have inhabited Alaska. Students should examine different cultural influences on the history of Alaska. Ask them to consider questions such as: 1) how did Alaska's ecosystems affect the lives of its inhabitants? 2) how did its inhabitants affect Alaska's ecosystems? What of their chosen group's influence can be seen in today's Alaska (History 1.3)?
2. After your students have completed their research report, generate a group discussion about the impacts of humans on their environment and the environment on human cultures.
3. Ask them how they think their lives are influenced by the climate, plants, animals and other ecological factors of Washington state.

C. Northern Trail Research Project

Objective: Through research, students will learn about animals of the taiga, tundra or montane, why these animals and ecosystems are threatened and how students can work to save them.

Grades 4-6 (Grades 7-12 can also do this activity if modified slightly), S, G, R

Materials:

Student folders

Copies of the "Northern Trail Research Project Student Activity Sheet"

Research materials including the "World Bioclimatic Zone" map and Northern Trail species fact sheets provided in this teacher packet.

Library resources and the Internet should also be used

1. Ask each student to choose a taiga, tundra or montane plant or animal species. If you will be visiting the zoo you may want students to report on an animal they will then be able to observe at the zoo.
2. Provide each student with a folder, including a copy of the "World Bioclimatic Zone" map and research work sheet provided.
3. Each student should design a cover for the folder in which they will keep their research.
4. Before beginning their reports, ask each student to record five points of information they think they already know about their selected species. During their project, students should try to determine whether this information is correct.
5. Using available research materials, including books and the Internet, students should find out as much as they can about their chosen plant or animal.
6. Ask your students to create a vocabulary list of new words they learned while doing their research. The class can compile a list of new words that they learned while researching the arctic regions. (Reading 1.2)
7. Before visiting the zoo, older students can work as a group to create a research form consisting of the questions they feel are most important to be answered during their visit and observations. Younger students can use the form included in this packet.
8. When you visit the zoo, ask your students to record their observations about their animal and the zoo's Northern Trail bioclimatic zone. When they return to the class, students can add their observations to the information they have already gathered about their species.
9. After completing their research and zoo visit, ask your students to write stories, poems, cartoons, comic strips, newscasts or other literary forms using their animal species as the focus. Where possible, have them use words from the class's new vocabulary list.
   Note: Depending on what forms of writing students are practicing, their arctic species can be used as a center piece for expository, creative or other writing pieces.
10. Students can then work together or individually to design a t-shirt, button, or bumper sticker that conveys a message about their animal(s).
11. Each student should then be asked to make a presentation to the rest of the class about their animal and what they have learned through their research and the visit to the zoo. Ask them to include in their report one to three points of information they confirmed during their research and one to three points of new information they gathered while researching their project. (Reading 3.1 and 3.4)

Extension:

Use local newspapers and current wildlife magazines, as well as television and radio news reports, to gather information on taiga, tundra or montane environmental issues and conservation legislation. Discuss reactions and suggestions concerning the issues.

D. Alaska's Survival Plan
Objective: Students will use research and reporting techniques to examine issues and solutions to some of Alaska's conservation problems.

Grades 7-12, S, G, H, V, R
Materials:
Writing and reporting materials
Access to newspapers, magazines and library or Internet research resources

For topic ideas, check Alaska's Department of Fish and Game Web site at www.state.ak.us/local/akpages/FISH.GAME/adfghome.htm

1. Ask your students to select a research topic focusing on the effects of technological developments on Alaska's wildlife and people. For example students can explore such topics such as the effects of the pipeline on local wildlife, how the development of high powered rifles or overland vehicles have affected wildlife or the lives of native people. (History 3.3)
2. What are the benefits and drawbacks of technological advancements? Hold a classroom debate to discuss this issue.
3. Following their research, have students work individually or in groups to develop a habitat management plan to help address conservation issues discovered during their research process. This plan should take into consideration the needs of the plants, animals and people of the region and the responsibilities of the local people and governments in meeting these needs.
4. During the development of their conservation plans, students must take into account, and explain how citizen participation influences public policy and therefore the role that individuals can play in accomplishing the developed conservation plans. (Civics 4.3)

E. Economics of Nature:
Objective: Students will use research and reporting techniques to learn about economic issues of Alaska.

Grades 7-12, R, E, W, C, V
Materials:
Books, computer software and Internet access

1. Ask each student to select one of Alaska's sources of income (e.g. oil or tourism). In groups or individually, students should research their topic: examine the impacts on the environment, the benefits to the Alaskan people.
2. Students, or groups of students should prepare written reports.
3. If your students work alone on this project, they should include in their reports whether they feel the income generating activity should be continued or disbanded. Ask them to support either argument. (Civics 4.2)
4. If they choose to discontinue the activity, then they must offer an alternative income solution.
5. In addition, students should examine the role that their chosen income activity plays in the world market, for example oil or lumber export or international tourist trade. (Economics 3.2 and Civics 3.1 and 3.2)
6. If several students research a particular topic, you could have them present a debate for the rest of the class. The debate should center around the benefits or consequences of the income source. Then, based on the points raised in the debate, have the class work together to decide whether the activity should be continued. If they decide it should not be continued, ask them to suggest a viable alternative means of income. (Civics 4.2)

NORTHERN TRAIL RESEARCH PROJECT

STUDENT ACTIVITY SHEET

(Use additional pages for recording your research)

My animal: _____

1. Scientific name:_____

2. In what habitat does your animal live?

3. What does your animal eat?

4. How does your animal get its food?

5. Name three of your animal's adaptations for survival:

6. On a separate piece of paper, draw your animal.

7. On a separate piece of paper, sketch you animals exhibit

8. Does this exhibit have any of the same characteristics your animal's natural habitat would have? If so, which ones?

9. Is your animal endangered or threatened in the wild? Why or why not?

10. Other Information:

SCIENCE EXPERIMENTS

OIL SPILL — ENVIRONMENTAL CATASTROPHE

Objective: Students will discover that there are a variety of methods that can be used to clean up an oil spill.

Grades 7-10, S
Materials:

- Copies of "Oil Spill—Environmental Catastrophe" worksheet
- Aluminum pie pan or other such container
- Water
- Cooking or salad oil
- Motor oil
- Kitty litter
- Eyedropper
- Cotton balls
- Straw
- Pebbles
- Nylon stocking (piece)
- Liquid detergent
- String (piece)
- Sand
- Cardboard (piece)
- Paper towels (Bounty or other strong towel)
- Polystyrene (piece)
- Spoon

Oil spills occur almost everyday somewhere around the globe. Some are small, others massive, but all significantly affect the environment in which they occur. During this activity, students will have the opportunity to create and clean up an oil spill.

1. Divide your students into pairs or teams. Provide each group with materials from the material list.
2. Ask each group to complete the "Oil Spill—Environmental Catastrophe" worksheet included in this packet.

FREEZING THE OCEANS

Objective: Through experimentation students will understand the role of salt concentration in the freezing process.

Grades 7-10, S
Materials:

- Salt
- Water
- Baking pans
- Bowls or buckets

Ever been to the seashore in the middle of the winter? Why is it the ocean is never frozen even when the lakes and ponds are frozen solid? The following experiment will give students the opportunity to examine this question.

1. Using the provided materials, test the effects of different levels of salt concentration on the freezing point of water.
2. Does the depth or surface area of the water affect its ability to freeze?
3. We know that sea water can freeze—think of the glaciers and ice flows in Alaska. Explain the conditions that would allow such freezing to occur. *(Seawater that actually freezes is closer to pure water. The crystallization leaves salt out.)*

Extension: When icebergs form, do they contain fresh or salt water? After completing the previous activity, take a high saline concentration pan of water and place it in the freezer. Allow the water to partially freeze. Remove the ice from the pan and place it in a clean container. Put both the pan and the new container aside. Allow the ice to melt, then test the salinity of the contents of both containers.

Extension: (For discussion or research and reporting) What effect, if any, do you think global warming would have on the formation of icebergs and iceflows? What effect will this have on arctic wildlife?

"Oil Spill - Environmental Catastrophe"

Student Activity Sheet

a. Aluminum pie pan or other such container
b. Water
c. Cooking or salad oil
d. Motor oil
e. Kitty litter
f. Eyedropper
g. Cotton balls
h. Straw
i. Pebbles
j. Nylon stocking (piece)
k. Liquid detergent
l. String (piece)
m. Sand
n. Cardboard (piece)
o. Paper towels (bounty or other strong towel)
p. Polystyrene (piece)
q. Spoon

1. Place 1-2" of water into a pan.
2. Add 15-20 drops of cooking or salad oil to the water.
3. Now that you have created your oil spill, you must determine the best method for cleaning up the spill. You can use any of the materials e-q from the materials list.
4. As a team, devise and write a plan for your oil clean-up. Also create a data sheet for recording your observations.
5. Using a stopwatch or clock with a second hand, have one team member time how long it takes to remove all the oil from the water.
6. Record your results on a data sheet.
7. Add new oil to the water and repeat activity three times, each time using a different removal technique.
8. Cooking oil is a light oil. How do you think this experiment might differ if you were to use heavier oil? Record your predictions on your team's data sheet
9. Now run the same experiment, using the same removal materials but heavier motor oil. Once again record the data on your data sheet.
10. Try variations on the same experiment (with heavy oil): have one team member blow gently on the water to create waves and attempt oil removal under "stormy conditions" or create a "beach" at one end of your pan. Can you use the same cleaning techniques to clean the beach? What about during a storm? If not, what might you utilize? What additional problems do you face in either of these situations?
11. As a team, decide which removal technique worked best for each type of oil.
12. After adding oil to your pan, add 10 drops of liquid detergent. Stir the oil, water and detergent mixture. Now repeat your removal experiment using the technique your team has determined to work the best. Record your times and observations.

Analysis and Interpretation:

Which removal technique was most affective on the light oil?

Which one was most affective on the heavy oil?

Could the same techniques be used to clean up the beach or during rough weather?

How do the simulations you ran relate to the problems faced by authorities attempting to clean up oil spills?

Did the introduction of detergent affect your ability to clean the oil spill? If so how? If not, why not?

What effect would oil spills have on the animals and other living organisms in the ocean?

On the beach?

Would any of the clean up techniques negatively affect the wildlife?

Are there any other techniques which could have been used but that you did not test in this experiment? If so, please explain.

When an oil spill occurs, who should be responsible for the clean-up?

How should this responsibility be enforced?

UNDERSTANDING ESKIMO SCIENCE

Objective: Students will be exposed to another culture's perspective on the environment.

Grades 5-12, G, R

Materials: "Understanding Eskimo Science" article (originally printed in Audubon, September-October 1993, has been reprinted with permission from the author).

Ask students to read the enclosed article entitled "Understanding Eskimo Science." Lead a class discussion using the following questions as a guide.

1. How does the Koyukon Indian relationship with animals differ from your experiences with animals? In what way is it similar? How is it different?

2. Do you know your neighborhood as well as the native hunters in the article know theirs? Why or why not?

3. If you or your family hunts, how well do you know the area where you hunt?

4. How would native Alaskan children learn about the outdoors growing up in their village?

5. How do you learn about the outdoor environment?

6. What can we learn from traditional societies such as the Koyukon or Inupiaq people?

Extensions: a) Ask students to write down their reactions to the article in a term paper or journal format. Students could also be asked to write about their experiences with wildlife and what they have learned. b) Using the school or public library, research natural history writers and how they portray wildlife.

Understanding Eskimo Science

by Richard Nelson

Traditional hunters' insights into the natural world are worth rediscovering.

Just below the Arctic Circle in the boreal forest of interior Alaska; an amber afternoon in mid-November; the temperature -20°; the air adrift with frost crystals, presaging the onset of deeper cold.

Five men—Koyukon Indians—lean over the carcass of an exceptionally large black bear. For two days they've traversed the Koyukuk River valley, searching for bear that have recently entered hibernation dens. The animals are in prime condition at this season but extremely hard to find. Den entrances, hidden beneath 18 inches of powdery snow, are betrayed only by the subtlest of clues—patches where no grass protrudes from the surface because it's been clawed away for insulation, faint concavities hinting of footprint depressions in the moss below.

Earlier this morning the hunters took a yearling bear. In accordance with Koyukon tradition, they followed elaborate rules for the proper treatment of killed animals. For example, the bear's feet were removed first, to keep its spirit from wandering. Also, certain parts were to be eaten away from the village, at a kind of funeral feast. All the rest would be eaten either at home or at community events, as people here have done for countless generations.

Koyukon hunters know that an animal's life ebbs slowly, that it remains aware and sensitive to how people treat its body. This is especially true for the potent and demanding spirit of the bear.

The leader of the hunting group is Moses Sam, a man in his sixties who has trapped in this territory since childhood. He is known for his detailed knowledge of the land and for his extraordinary success as a bear hunter. "No one else has that kind of luck with bears," I've been told. "Some people are born with it. He always takes good care of his animals—respects them. That's how he keeps his luck."

Moses pulls a small knife from his pocket, kneels beside the bear's head, and carefully slits the clear domes of its eyes. "Now," he explains softly, "the bear won't see if one of us makes a mistake or does something wrong."

Contemporary Americans are likely to find this story exotic, but over the course of time episodes like this have been utterly commonplace, the essence of people's relationship to the natural world. After all, for 99 percent of human history we lived exclusively as hunter-gatherers; by comparison, agriculture has existed only for a moment and urban societies scarcely more than a blink.

From this perspective, much of human experience over the past several million years lies beyond our grasp. Probably no society has been so deeply alienated as ours from the community of nature, has viewed the natural world from a greater distance of mind, has lapsed into a murkier comprehension of its connections with the sustaining environment. Because of this, we have great difficulty understanding our rootedness to earth, our affinities with nonhuman life.

I believe it's essential that we learn from traditional societies, especially those whose livelihood depends on the harvest of a wild environment—hunters, fishers, trappers, and gatherers. These people have accumulated bodies of knowledge much like our own sciences. And they can give us vital insights about responsible membership in the community of life, insights founded on a wisdom we'd long forgotten and now are begging to rediscover.

Since the mid-1960s I have worked as an ethnographer in Alaska, living intermittently in remote northern communities and recording native traditions centered around the natural world. I spent about two years in Koyukon Indian villages and just over a year with Inupiaq Eskimos on the Arctic coast—traveling by dog team and snowmobile, recording traditional knowledge, and learning the hunter's way.

Eskimos are famous for the cleverness of their technology—kayaks, harpoons, skin clothing, snow houses, dog teams. But I believe their greatest genius, and the basis of their success, lies in the less tangible realm of the intellect—the nexus of mind and nature. For what repeatedly struck me above all else was their profound knowledge of the environment.

Several times, when my Inupiaq hunting companion did something especially clever, he'd point to his head and declare: "You see—Eskimo scientist!" At first I took it as hyperbole, but as time went by I realized he was speaking the truth. Scientists had often come to his village, and he saw in them a familiar commitment to the empirical method.

Traditional Inupiaq hunters passed a lifetime acquiring knowledge—from others in the community and from their own observations. If they are to survive, they must have absolutely reliable information.

When I first went to live with Inupiaq people, I doubted many things they told me. But the longer I stayed, the more I trusted their teachings.

For example, hunters say that ringed seals surfacing in open leads—wide cracks in the sea ice—can reliably forecast the weather. Because an unexpected gale might set people adrift on the pack ice, accurate prediction is a matter of life and death. When seals rise chest-high in the water, snout pointed skyward, not going anywhere in particular, it indicates stable weather, the Inupiaq say. But if they surface briefly, head low, snout parallel to the water, and show themselves only once or twice, watch for a sudden storm. And take special heed if you've also noticed the sled dogs howling incessantly, stars twinkling erratically, or the current running strong from the south. As time passed, my own experiences with seals and winter stories affirmed what the Eskimos said.

Like a young Inupiaq in training, I gradually grew less skeptical and started to apply what I was told. For example, had I ever been rushed by a polar bear, I would have jumped away to the animal's right side. Inupiaq elders say polar bears are left-handed, so you have a slightly better chance to avoid their right paw, which is slower and less accurate. I'm pleased to say I never had the chance for a field test. But in judging assertions like this, remember that Eskimos have had close contact with polar bears for several thousand years.

During winter, ringed and bearded seals maintain tunnel-like breathing holes in ice that is many feet thick. These holes are often capped with an igloo-shaped dome created by water sloshing onto the surface when the animal enters from below. Inupiaq elders told me that polar bears are clever enough to excavate around the base of this dome, leaving it perfectly intact but weak enough that a hard swat will shatter the ice and smash the seal's skull. I couldn't help wondering if this were really true; but then a younger man told me he'd recently followed the tracks of a bear that had excavated one seal hole after another, exactly as the elders had described.

In the village where I lived, the most respected hunter was Igruk, a man in his seventies. He had an extraordinary sense of animals—a gift for understanding and predicting their behavior. Although he was no longer quick and strong, he joined a crew hunting bowhead whales during the spring migration, his main role being that of adviser. Each time Igruk spotted a whale coming from the south, he counted the number of blows, timed how long it stayed down, and noted the distance it traveled along the open lead, until it vanished toward the north. This way he learned to predict, with uncanny accuracy, where hunters could expect the whale to resurface.

I believe that expert Inupiaq hunter possesses as much knowledge as a highly trained scientist in our own society, although the information may be of a different sort. Volumes could be written on the behavior, ecology, and utilization of Arctic animals —polar bear, walrus, bowhead whale, beluga, bearded seal, ringed seal, caribou, musk ox, and others—based entirely on Eskimo knowledge.

Comparable bodies of knowledge existed in every Native American culture before the time of Columbus. Since then, even in the far north, Western education and cultural change have

steadily eroded these traditions. Reflecting on a time before Europeans arrived, we can imagine the whole array of North American animal species—deer, elk, black bear, wolf, mountain lion, beaver, coyote, Canada goose, ruffed grouse, passenger pigeon, northern pike—each known in hundreds of different ways by tribal communities; the entire continent, sheathed in intricate webs of knowledge. Taken as a whole, this composed a vast intellectual legacy, born of intimacy with the natural world. Sadly, not more than a hint of it has ever been recorded.

Like other Native Americans, the Inupiaq acquired their knowledge through gradual accretion of naturalistic observations—year after year, lifetime after lifetime, generation after generation, century after century. Modern science often relies on other techniques—specialized full-time observation, controlled experiments, captive-animal studies, technological devices like radio collars—which can provide similar information much more quickly.

Yet Eskimo people have learned not only about animals but also from them. Polar bears hunt seals not only by waiting at their winter breathing holes, but also by stalking seals that crawl up on the ice to bask in the spring warmth. Both methods depend on being silent, staying downwind, keeping out of sight, and moving only when the seal is asleep or distracted. According to the elders, a stalking bear will even use one paw to cover its conspicuous black nose.

Inupiaq methods for hunting seals, both at breathing holes and atop the spring ice, are nearly identical to those of the polar bear. Is this a case of independent invention? Or did ancestral Eskimos learn the techniques by watching polar bears, who had perfected an adaptation to the sea-ice environment long before humans arrived in the Arctic?

The hunter's genius centers on knowing an animal's behavior so well he can turn it to his advantage. For instance, Igruk once saw a polar bear far off across flat ice, where he couldn't stalk it without being seen. But he knew an old technique of mimicking a seal. He lay down in plain sight, conspicuous in his dark parka and pants, then lifted and dropped his head like a seal, scratched the ice, and imitated flippers with his hands. The bear mistook his pursuer for prey. Each time Igruk lifted his head the animal kept still; whenever Igruk "slept" the bear crept closer. When it came near enough, a gunshot pierced the snowy silence. That night, polar bear meat was shared among the villages. A traditional hunter like Igruk plumbs the depths of his intellect—his capacity to manipulate complex knowledge. But he also delves into this animal nature, drawing from intuitions of sense and body and heart: feeling the wind's touch, listening for the tick of moving ice, peering from crannies, hiding as if he himself were the hunted. He moves in a world of eyes, where everything watches—the bear, the seal, the wind, the moon and stars, the drifting ice, the silent water below. He is beholden to powers we have long forgotten or ignored.

In Western society we rest comfortably on our own accepted truths about the nature of nature. We treat the environment as if it were numb to our presence and blind to our behavior. Yet despite our certainty on this matter, accounts of traditional people throughout the world reveal that most of humankind has concluded otherwise. Perhaps our scientific method really does follow the path to a single, absolute truth. But there may be wisdom in accepting other possibilities and opening ourselves to different views of the world.

I remember asking a Koyukon man about the behavior and temperament of the Canada goose. He described it as a gentle and good-natured animal, then added: "Even if (a goose) had the power to knock you over, I don't think it would do it."

For me, his words carried a deep metaphorical wisdom. They exemplified the Koyukon people's own restraint toward the world around them. And they offered a contrast to our culture, in which possessing the power to overwhelm the environment has a long been sufficient justification for its use.

We often think of this continent as having been a pristine wilderness when the first Europeans arrived. Yet for at least 12,000 years, and possibly twice that long, Native American people had inhabited and intensively utilized the land; had gathered, hunted, fished, sealed, and cultivated; had learned the terrain in all its details, infusing it with meaning and memory; and had shaped every aspect of their life around it. That humans could sustain membership in a natural community for such an enormous span of time without profoundly degrading it fairly staggers the imagination. And it gives strong testimony to the adaptation of mind—the braiding together of knowledge and ideology—that linked North America's indigenous people with their environment.

A Koyukon elder, who took it upon himself to be my teacher, was fond of telling me: "Each animal knows way more than you do." He spoke as if it summarized all that he understood and believed.

This statement epitomizes relationships to the natural world among many Native American people. And it goes far in explaining the diversity and fecundity of life on our continent when the first sailing ship approached these shores.

There's been much discussion in recent years about what biologist E.O. Wilson has termed "biophilia"—a deep, pervasive, ubiquitous, all-embracing affinity for nonhuman life. Evidence for this instinct may be elusive in Western cultures, but not among traditional societies. People like the Koyukon manifest biophilia in virtually all dimensions of their existence. Connectedness with nonhuman life infuses the whole spectrum of their thought, behavior, and belief.

It's often said that a fish might have no concept of water, never having left it. In the same way, traditional peoples might never stand far enough outside themselves to imagine a generalized concept of biophilia. Perhaps it would be impossible for people so intimately bound with the natural world, people who recognize that all nature is our own embracing community. Perhaps, to bring a word like biophilia into their language, they would first need to separate themselves from nature.

In April 1971, I was in a whaling camp several miles off the Arctic coast with a group of Inupiaq hunters, including Igruk, who understood animals so well he almost seemed to enter their minds.

Onshore winds had closed the lead that migrating whales usually follow, but one large opening remained, and here the Inupiaq men placed their camp. For a couple of days there had been no whales, so everyone stayed inside the warm tent, talking and relaxing. The old man rested on a soft bed of caribou skins with his eyes closed. Then, suddenly, he interrupted the conversation: "I think a whale is coming, and perhaps it will surface very close..."

To my amazement everyone jumped into action, although none had seen or heard anything except Igruk's words. Only he stayed behind, while the others rushed for the water's edge. I was last to leave the tent. Seconds after I stepped outside a broad, shining back cleaved the still water near the opposite side of the opening, accompanied by the burst of a whale's blow.

Later, when I asked how he'd known, Igruk said, "There was a ringing inside my ears." I have no explanation other than his; I can only report what I saw. None of the Inupiaq crew members even commented afterward, as if nothing out of the ordinary had happened.

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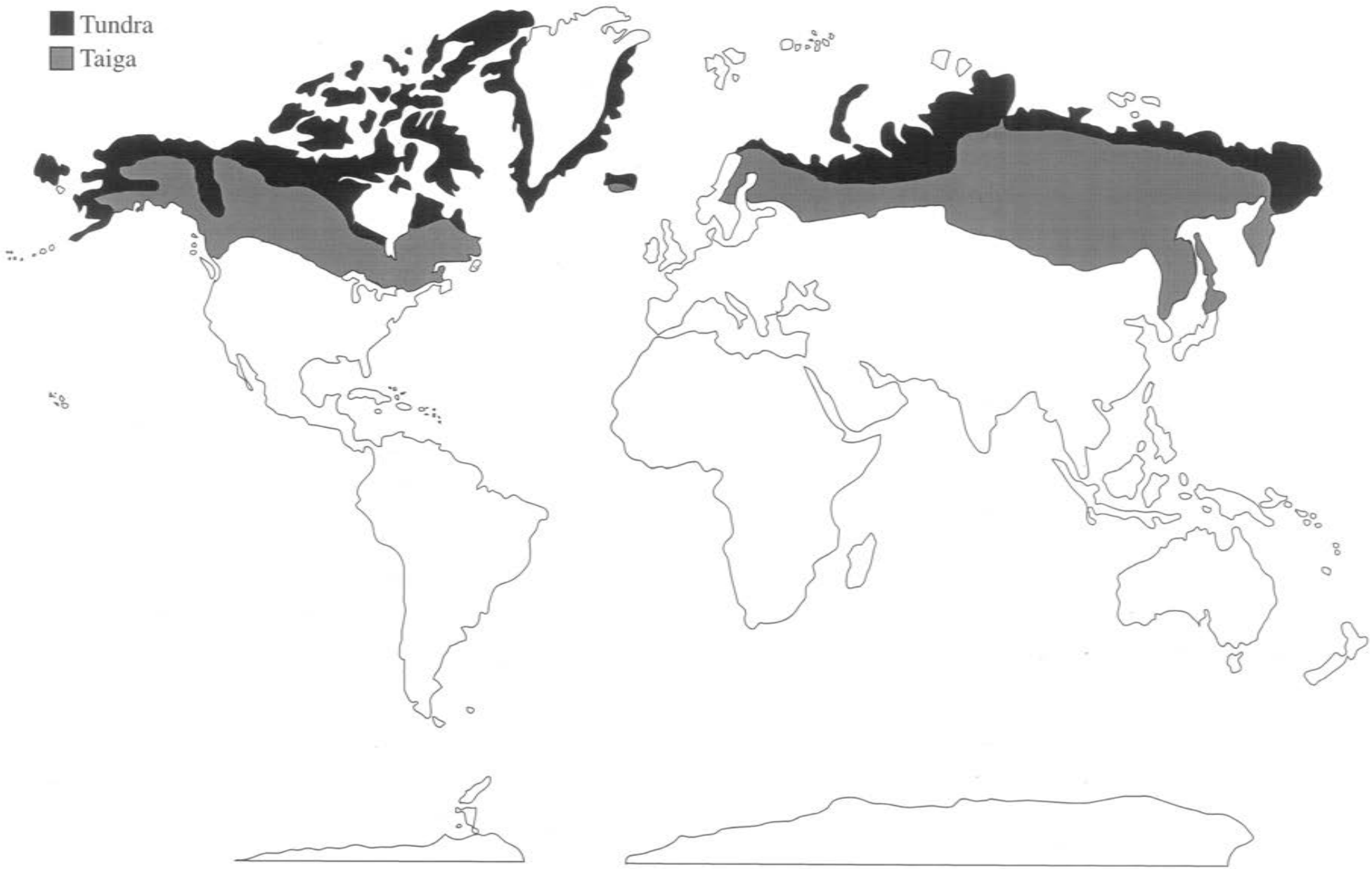
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