Ecology: Adaptations & Habitats
The Wilderness and Land Ethics Box
Wilderness Curriculum by Arthur Carhart National Wilderness Training Center, Co

Objectives:
- Students will understand adaptations as specific survival mechanisms contributing to species diversity
- Students will recognize the associations between adaptations and habitats
- Students will understand if habitat is reduced or changed, species diversity will be reduced.

Background:
These activities focus on adaptation, which is genetic behavior or physical characteristic that is environmentally determined. Living Treasure: Saving Earth’s Biodiversity provides excellent background for the connections between adaptations, habitats, and the preservation of biodiversity. The definition of ‘biodiversity’ is in the glossary. Before beginning the activities read through the “Adaptations & Habitats” student/teacher information found at the end of this lesson, to review or introduce these concepts.

Activity 1: Birds & Bills Game

Materials: Bird Book
Bill Types
- Chopsticks or toothpicks for 1/5 of class to each have 2
- Spoons for 1/5 of class
- Tweezers or forceps for 1/5 of class
- Straws for 1/5 of class
- Nut crackers or pliers for 1/5 of class
- Cup of small bag for each student

Food Sources
- Popcorn and/or Cheerios
- Several small glasses of water or juice
- Whole nuts or seeds with hard covering
- Rice
- Pretzel sticks (or fake worms!)
- Nails, washers, misc. tool items may also be used for non-edible activity, in which case it is interesting to add a magnet to selection of bill types.

Procedure: 1). Ask students to think of birds they have seen, how they were feeding and what they might have been eating.
2). Lead students in a discussion that many birds have bills adapted for specific food sources. For instance, with its sharp hooked bill, a hawk would have little success feeding on water plants like a duck. Similarly, the flattened bill of a duck would be poorly adapted to capture and consume small mammals, like a hawk. Use the bird book to show pictures.
3). The following feeding adaptations will be demonstrated in this activity:
   • Hummingbirds whose long thing beaks (straws) can reach into flowers for Nectar (cups of water or juice).
   • Sparrows, finches, and grosbeaks with short, stout beaks (pliers or nutcrackers) that can break open the hard coverings of some seeds (whole nuts).
   • Swifts & swallows whose large mouths (spoons) scoop up insects as they fly (popcorn or Cheerios)
   • Warblers with ting pointed bills (tweezers) pluck insects (rice) from the leaves and bark of trees.
   • Many shorebirds have long thin bills (chopsticks or toothpicks) used to probe mud or sand for worms or small crustaceans (pretzels or fake worms).

   The symbolic bill types and foods are included in parentheses for your reference; however, students may experiment with using their bill to gather any of the food types. (Please refer to Familiar Birds of North America for more information and photographs of these birds).

4). Distribute the food sources. You may wish to place particular food items together to represent specific habitats where these food sources are found.

5). Distribute bill types to class members as described in the procedures.

6). Before you begin the feeding time, discuss the following “table manners.”
   • Students are NOT to consume food until end of activity, except for the liquid food sources that may be drunk during the collecting time.
   • Tools other than straws may be used only once in liquids.
   • As they collect items students may save them in a bag, or a cup.
   • To collect a nut, your bill type/tool must be able to crack it open to utilize the food source inside the shell.

7). When all food has been collected regroup and compare collections obtained with different bill types. Experiment and try another bill. Which bill works best with which food type? Try some of the following:
   • Graph or record amount of each food taken by each bill type.
   • Make a graph of bill types to number of different foods taken. This may demonstrate the difference between specialists that can only feed on specific foods in contrast to generalists that utilize a variety of food sources.
   • Remove one food source and repeat the activity observing results. Discuss phenomena that could cause this situation. For example, if fish are killed by pollution or a particular plants decimated, or habitat lost through development, birds that specialize in these foods will leave an area or reduce to such numbers that they may become endangered. Conversely, discuss ways to improve habitat with water and a diversity of vegetation.
• Explain biodiversity as the number of different species of plants, animals, organisms, and different types of ecosystems, which include genetic diversity and population diversity in an area. Repeat the same activity with only two different food sources. Note the effect on the food acquired by different bill types. Discuss how this loss of diversity in terms of food sources could affect birds and other interdependent organisms.

• Distribute food as before, and use string to divide the area into three or four sections. Explain that these represent barriers to movement, and students from one section will no be able to cross into another to feed. How does this affect the amount of food acquired by different bill types? By barriers to travel created by fences, roads, highways, or urban development can reduce the availability of resources to species that live in the area.

8). Ask students what is the role of Wilderness in preserving large tracts of undisturbed habitat and the importance of this in preserving diversity of species as well as insuring that individual species will meet their habitat needs in these places. What are other reasons? Why is Wilderness important? Lands left undistributed by human manipulation provide opportunities of natural adaptation to continue.

Credit: This activity is used in a variety of environmental education programs. For a more extensive description, refer to Ranger Rick’s Nature Scope, “Birds, Birds, Birds!”
Activity 2: Wacky Adaptations

Materials: Paper (1 larger piece/student if done individually)
          1 very large piece/group if done in small group
          Drawing the materials (pens, markers, etc.)

Background:
Review the background information about basic needs of animals. Explain that just as animals are adapted for particular feeding habits, they are also adapted for survival in particular environments with a variety of abiotic factors. Discuss examples of how an animal that lives in a cold habitat has different adaptations than one that lives in a hot environment.

Procedures:
1. Present the following scenario: Students are to create an animal that has never been discovered. This particular animal is found only in wild and remote places. They are to design a plant or animal that is adapted to meet its needs under particular environmental factors. For animals they must describe their height and weight, fur or feathers, food, and social habits as outlines in the Data Sheet. Remind students that these animals may have incredible features. However as they are found in remote wilderness areas, they may not be mechanized.
2. Distribute large paper, drawing materials, and data sheet. Assign or have students select from the following, or create your own descriptions:
   - Hot & Dry
   - Bottom of Ocean
   - Hot & Wet
   - Hot & Acidic
   - Moving freshwater
   - Cold & Windy
   - Cold & Icy
   - Warm & Swampy
3. Students present their animals to the class. In preparation for this you may wish to use the Wacky Adaptation Data Sheet, included at the end of this lesson. If you class is interested in competitions, give 'awards; for species that are most creative, most likely you succeed, best looking, best ideas, etc.
4. Review the importance of providing appropriate habitat for species adapted to meet their needs in these environments.
   - Switch environment cards between species. Would they survive if their habitat changed in this way?
   - Are there wild animals similar to those you created? Where do they live? What would threaten their existence? What would help them survive?
**Activity 3: Adaptations Game**

**Materials:** Index cards

**Procedure:**

1. Copy the following list of adaptations below, one each, onto index cards.

2. Discuss the student/teacher information sheet with students included at the end of this lesson. Together create a definition of adaptations. Emphasize that whether or not adaptations are viewed as the result of dramatic genetic mutations, or slow change over time, they are all closely connected to the habitat in which species live.

3. Present the adaptation cards and discuss what each one means.

4. Have the group divide into at least two teams. Spread out cards on a table in front of the class. One or two members at a time are designated to represent their teacher for each challenge. Those students stand next to the table within equal proximity of the cards.

5. Read a habitat/community feature listed below and allow team representatives 10-15 seconds to collect adaptation cards that describe adaptations you might expect to find in plants and animals meeting their survival needs in this community or habitat type.

6. Have students explain why they selected their cards. You may wish to designate a panel of judges, or to allow other team members to contribute to these explanations.
<table>
<thead>
<tr>
<th>Adaptation Cards</th>
<th>Community Interactions &amp; Habitat Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hibernate</td>
<td>Cold temperatures</td>
</tr>
<tr>
<td>Thick Fur</td>
<td>Hot temperatures</td>
</tr>
<tr>
<td>Fly South</td>
<td>Strong Winds</td>
</tr>
<tr>
<td>Migrate North</td>
<td>Limited Water Supply</td>
</tr>
<tr>
<td>Migrate to Lower Elevation</td>
<td>Seasonal Food Source</td>
</tr>
<tr>
<td>Migrate South</td>
<td>Predator Eats Eggs</td>
</tr>
<tr>
<td>Migrate to Higher Elevation</td>
<td>Lives in Water</td>
</tr>
<tr>
<td>Store Food within Body Cells</td>
<td>Food Source is Nocturnal</td>
</tr>
<tr>
<td>Store Food in Caches</td>
<td>Able to Fly</td>
</tr>
<tr>
<td>Lay Lots of Eggs</td>
<td></td>
</tr>
<tr>
<td>Lay Camouflaged Eggs</td>
<td>Prey Species Lives in Herbs</td>
</tr>
<tr>
<td>Male &amp; Female Feed on Different Foods</td>
<td>Food source is Plants</td>
</tr>
<tr>
<td>Feed at night</td>
<td></td>
</tr>
<tr>
<td>Good Night Vision</td>
<td></td>
</tr>
<tr>
<td>Camouflaged Body</td>
<td></td>
</tr>
<tr>
<td>Strong Grinding Teeth</td>
<td></td>
</tr>
<tr>
<td>Long Legs for Speed</td>
<td></td>
</tr>
<tr>
<td>Predator Hunts in Packs</td>
<td></td>
</tr>
<tr>
<td>Store Water in Thick Leaves</td>
<td></td>
</tr>
<tr>
<td>Webbed Feet</td>
<td></td>
</tr>
<tr>
<td>Light Body With Hollow Bones</td>
<td></td>
</tr>
<tr>
<td>Long Sticky Tongue</td>
<td></td>
</tr>
<tr>
<td>Seeds Disperse in Wind</td>
<td></td>
</tr>
</tbody>
</table>
7. You might wish to conclude by having students choose adaptations to illustrate and/or write about. These cards could also be used for a game of “adaptations charades” in which students draw card and act out the adaptations.

Credit: Credit for the idea of this game is given to Pete McGee, field director for the Yosemite Institute 1995.

Activity 4: Endangered Species

Materials: Last Bit Bear
        The Lorax
        State Wildlife Reference books

Procedures:
1. Using familiarity with concepts of adaptation, habitat, and biodiversity discussed in the previous activities, students research individual species that are endangered or threatened in their state and identify their connection to Wilderness. You may wish to use the same questions included on the Endangered Species Data Sheet to structure this activity, or to assign a particular format for presentation.
2. The following list of species has held threatened or endangered status in Colorado within the past 10 years (please modify this list for your specific state).

<table>
<thead>
<tr>
<th>Grizzly Bear</th>
<th>Black-footed Ferret</th>
<th>Gray Wolf</th>
</tr>
</thead>
<tbody>
<tr>
<td>River Otter</td>
<td>Whooping Crane</td>
<td>Lynx</td>
</tr>
<tr>
<td>Wolverine</td>
<td>Peregrine Falcon</td>
<td>Bald Eagle</td>
</tr>
<tr>
<td>Piping Plover</td>
<td>Sandhill Crane</td>
<td>Lesser Prairie-chicken</td>
</tr>
<tr>
<td>Plains Sharp-tailed Grouse</td>
<td>Least Tern</td>
<td>Greater Prairie-chicken</td>
</tr>
<tr>
<td>Wood Frog</td>
<td>Colorado Squawfish</td>
<td>Humpback Club</td>
</tr>
<tr>
<td>Greenback Cutthroat Trout</td>
<td>Arkansas Darter</td>
<td>Bonytail</td>
</tr>
</tbody>
</table>

3. Encourage students to consider the aesthetic, ecological, and economic aspects of these species. What is their “valve” in these terms? Should areas be preserved specifically for endangered species?
In what ways do these species reflect the health of their habitat, or entire ecosystem?
How many depend on wild lands and rivers?

*Wildlife in Danger*, a publication by the Colorado Division of Wildlife, and its associated video, are excellent references for this information.

*Peregrine Falcons, The Path to Recovery* (Teacher Resource Packet, Colorado Division of Wildlife) is another excellent resource.

4. Conclude, or introduce this activity with *The Last Bit Bear* and/or *The Lorax*, books that creatively and symbolically address loss of biodiversity and associated species.

**Extension:** From *Project Wild*, conduct the following activities: “Habitat Lap Sit,” “Shrinking Habitat,” “Carrying Capacity,” and “Habitat Rummy.”

“The only thing we know for sure about the future is that it will be radically different from the past. In face of this enormous uncertainty, the least we can do for future generations is to pass on as many of the planet’s resources as possible…”

*Norman Myers, Author of The Sinking Ark*
Endangered Species Worksheet

Researcher(s): _________________________________________________________

Name of Species: _______________________________________________________

Where do your animals live? What is its habitat like?

In general, what size of space does your animal require? Could it meet all its needs in a natural area the size of your backyard? A city park? 10 square miles? On the back of this paper, draw a diagram of an area in which your animal could live. Include all the things it would need to survive and an estimate of the size of its territory.

What does your animal eat?

How does your animal find food and water?

If your animal makes a shelter, what is it like?

Describe some of your animal’s special adaptations.

Does your animal live alone or in groups?

Who are their predators? How does your animal protect itself against predators? If it is a predator, what might cause it injury or death?

Which of the above adaptations has become a problem for your animal as its habitat has changed?

Why is your animal endangered?
Wacky Adaptations Data Sheet

Student Designers: ________________________________________________

Environment:______________________________________________________

Name of species:____________________________________________________

What does your species eat? Does it eat lots of different things, or only a few special foods?

How does your animal find food and water? If your species is a plant, how does it get the sunlight, water, and nutrients it needs?

How does your species keep from getting too warm or too cold?

If your animal makes a shelter, what is it like? IF your species is a plant, how does it survive in these environmental conditions?

Describe some of your plant or anima’s special adaptations.

Does your plant/animal live alone or in groups?

How does it protect itself against predators?