

## Everest Education Expedition Curriculum



### Lesson 6: Everest Extremes: Biodiversity

Created by Montana State University Extended University  
and Montana NSF EPSCoR

<http://www.montana.edu/everest>

#### Overview:

Identify and categorize plants and animals living in the Mount Everest ecosystem with an emphasis on which species are endangered, threatened or a species of special concern. Gain a deeper understanding of and connection to the biodiversity of the Himalayan Ecosystem by studying individual species and creating a Himalayan food web. Develop an appreciation of how connected all ecosystems are including the one in your own backyard.

#### Objectives:

Students will be able to:

1. Define the terms endangered, threatened and species of special concern.
2. Identify mammal, bird and plant species that live in the Himalayan region.
3. Explain how mammal, bird and plant species of the Himalayan region are connected.

#### Vocabulary:

**adaptation:** the evolutionary process whereby changes in behavior, physiology, or structure of organisms improve their ability to survive in their habitat(s)

**biodiversity:** a term that describes the number of different species that live within a particular ecosystem

**biome (BY-om):** a large distinctive complex of plant communities created and maintained by climate

**ecosystem:** a system involving the interactions between a community of living organisms in a particular area and its nonliving environment

**endangered species:** a species that has diminished to such small numbers due to natural or man made changes in its environment, that it is in high danger of becoming extinct in the wild in the near future

**food chain:** the sequence of how food (energy) moves through an ecosystem by illustrating where a food source begins and who eats whom

food web: all of the interacting food chains in an ecological community

**glacier:** a massive river of ice that moves slowly downward from the high mountains

**habitat:** the place or environment where a plant or animal naturally or normally lives and grows

**species of special concern:** species that are declining in population or range at a rate that could lead to being listed as endangered or threatened under the Endangered Species Act

**threatened species:** any species that is likely to become endangered in the foreseeable future within all or a significant part of its range and is monitored for changes in population

#### Background Information:

The Himalayan Mountains are a land of extremes and considered one of the most threatened regions in the world. Both the World Wildlife Fund and Conservation International have listed the Himalayas as being 'in need of protection.' The Himalayas are rich in culture, landscape and biological diversity (**biodiversity**). What may seem desolate to many is in fact inhabited by

thousands of different species of plants and animals and home to over 60 different indigenous peoples of Nepal and Tibet. As the world's climate changes, causing increasing temperatures and unpredictable weather patterns, extreme environments like the Himalayas are the first areas affected by these changes. Plants, animals, and other native Himalayan species are being strained by the change in their habitat and with adaptations specific to the extreme cold, many may not be able to adapt as quickly as the climate is changing. Pollution and higher human populations are also straining the region. Harmony and balance within this complex and rapidly changing **ecosystem** is imperative to its survival.

Due to the extremely diverse topography, elevation, latitude and geography of the Himalayas, scientists have divided the area into four different **biomes** (or climatic zones). Ranging from thick tropical forests to barren, frozen peaks — plants and animals living in these hierarchical zones have specific **adaptations** that allow them to survive in their **habitat**. For example, many alpine animals have thick coats of fur and shortened limbs to keep them warm and prevent heat loss. Bears go into hibernation in the winter when food is most scarce and the native yak has an extra set of ribs allowing for bigger lungs that are needed to survive in the oxygen deprived environment in which they live. Most animals live in the lower and middle alpine zones.

The four climatic zones of the Everest region include:

- The **lower alpine zone** lies between 9,843 feet (3,000 meters) and 11,483 feet (3,500 meters). Sherpa villages are located in this forested zone due to its warmer weather and protection from harsher weather at higher elevations.
- The **middle alpine zone** is found between 11,483 feet and (3,500 meters) and 14,764 feet (4,500 meters). This area is home to dwarf and shrub-like plants.
- The **upper alpine zone** lies between 14,764 feet (4,500 meters) and 18,865 feet (5,750 meters). The lower limit of this zone (14,764 feet) is considered **tree line** and the upper limit of the zone is the highest place on the mountain that plants can be found. Lichen, fungi, mosses and dwarf grasses are all found in the upper alpine zone.
- From 18,865 feet (5,750 meters) to the top of the mountain is the **arctic zone**. This is permanently covered with snow and **glaciers** and is too harsh for plant life.

### **Activity 1: Species Study**

*Activity Length: 30 minutes (or longer depending on presentation/project)*

*Materials:*

- *Species cards (one per every two students)*  
[http://www.montana.edu/everest/resources/other/Lesson\\_06\\_BioDiversityCards.pdf](http://www.montana.edu/everest/resources/other/Lesson_06_BioDiversityCards.pdf)
1. Tell your students that they will be learning about a plant or animal living in the Himalayan region. With a partner, they will choose a 'species card'. This card will have a picture and several facts listed on it to study and eventually teach the rest of the class.
  2. As a class, define and discuss the terms: **endangered**, **threatened** and **species of special concern**. Explain to the class that many of the animals and plants they will be learning about will fit into one of the categories defined above.
  3. Have students randomly choose (or you can assign) the names of the species to partners.

4. Students read and decide how they would like to present on their species and the facts on the card to the class. (This can be a simple oral presentation or an elaborate poster board display, PowerPoint, or assigned as a home-project.)
5. Allow students time to read over their species cards with their partner and practice presenting.
6. Have each pair of students present their species. (This can be conducted quickly in one class period or over several days.)

### **Activity 2: Climate Zone Map**

*Activity Length: 10 minutes*

*Materials:*

- *Mount Everest Climate Zones Worksheet (one per student)*  
[http://www.montana.edu/everest/resources/worksheets/Worksheet\\_Lesson6\\_ClimateZones.pdf](http://www.montana.edu/everest/resources/worksheets/Worksheet_Lesson6_ClimateZones.pdf)
- *Colored pencils or crayons*
- *Species cards*

1. Explain the Climate Zone Map to your students. Tell your class that each area is one of four distinct climate zones in the Everest region.
2. Have your students locate the lowest zone on the map. Explain that this is the lower alpine zone. As the students color this zone in orange, describe what makes this zone unique. (See the Background Information for descriptions of each zone.)
3. Repeat this process for the remaining three climate zones using the following colors to shade each: lower alpine zone (orange), middle alpine zone (green), upper alpine zone (yellow), arctic zone (blue).
4. Ask your students which climate zone their species can be found. Have your students write the names of the plants and animals from the species cards in the appropriate zone on their individual maps.
5. Ask your students the following questions:
  - a. Where are most of the plants and animals located? (Lower alpine: warmer climate and lower elevations)
  - b. Why are the plants in the middle and upper alpine zone so small? (They are smaller to conserve energy. High winds would make survival difficult for taller plants)
  - c. Why aren't any species living in the arctic zone? (The weather is too cold, winds too high, no food source and not enough oxygen)
  - d. How are these species connected? (They depend on each other for food.)

### **Activity 3: Himalayan Food Web**

*Activity Length: 15 minutes*

*Materials:*

- *Species cards (one per student)*
- *Yarn*

1. Give each student a species card from Activity 1 and 2.
2. Give a ball of yarn to one student. Ask this student to share the name of the species they are holding and what other species it depends upon or what other species depends

- upon it. Have that student pick one of the species they are connected to, and pass the ball of yarn to the student holding that species card.
3. Repeat step #2 until all students are holding on to the strand of yarn. Each student will only hold the strand of yarn in one place. This process will become more difficult for last few students. It will be challenging for them to identify how their species are connected to other species that have not been used yet.
  4. Share with your students that they have created a **food web** showing that every species is connected.
  5. Have one student let go of the string. Ask your students:
    - a. What happened? What might happen in the real environment?
    - b. What species are affected?
    - c. What if one of these species became extinct? Would any other species be affected? (Use species cards to see how the species depend on each other including what animals depend on particular plants. If the plant disappears, wouldn't the animal? Would it adapt fast enough to survive on something else? If an animal became extinct that was the primary food source for another animal, would it die out as well?)
    - d. What if a new species was introduced? (A new species could affect many aspects of the ecosystem. If the species were an animal, competition for food would increase, other species could become threatened or the introduced species may not thrive. If a plant were introduced, it could spread and take over a native species, therefore affecting other species, including animals, that depend upon it for food, once again, warping the system and pulling it out of balance.)
    - e. Does your local food web work the same way? Give some examples and remind students that all species are connected, both here at home, and far away. (For example, in Yellowstone National Park before the wolves were reintroduced the elk population was too large and out of balance. Elk ate the young trees which affected the beavers. The beavers declined in population and this affected the animals that lived in the beaver ponds. Once wolves were re-introduced, the elk population declined and stabilized. The trees grew back, and the beaver population returned to previous levels.)

### **Tying it All Together:**

Use the following ongoing activities to check for student understanding of each lesson's concepts. Grade for completion, management of data collection, effort and participation throughout unit.

1. **“Mount Everest and Me” Worksheet**

[http://www.montana.edu/everest/resources/worksheets/Worksheet\\_EverestandMe.pdf](http://www.montana.edu/everest/resources/worksheets/Worksheet_EverestandMe.pdf)

This worksheet will be an ongoing activity for your students. In a table format, the “Mount Everest and Me” Worksheet compares Mount Everest, Granite Peak (the highest peak in Montana), and your hometown. Using comparisons, the worksheet reinforces the lesson's content while helping students put this knowledge into perspective by comparing their home state and hometown. Have your students fill in the correlating rows of the table after completing each lesson. This can be completed as a class or individually.

## 2. Everest Education Expedition Vocabulary Crossword Puzzle

[http://www.montana.edu/everest/resources/worksheets/Worksheet\\_Lesson6Crossword.pdf](http://www.montana.edu/everest/resources/worksheets/Worksheet_Lesson6Crossword.pdf)

This crossword puzzle reinforces vocabulary presented in each lesson. Have your students fill in the correlating vocabulary words for each lesson's puzzle after each lesson.

### **Taking it Further:**

Activity: Species Reports (Optional Assessment Component):

*This activity can be assigned in place of 'Activity 1: Species Studies'*

*Teacher Prep Notes:*

- *Students will work in teams of two for this activity.*
  - *If there is access to a computer lab, schedule time for species research*
  - *Create chart paper with labeled columns titled: 'Endangered', 'Threatened' and 'Species of Special Concern.' Have the class work together to discuss and define these terms. Record which column each species belongs in as students give their presentations.*
  - *Download species list and create 'grab bag' of species from which students will pick.*
  - *Display or hand out 'Research Criteria' for student teams*
  - *Download and print or project on a screen the Climate Zone Cross Section Map and place species in the correct zones at the end of each presentation.*
3. As a class, define and discuss the terms: *endangered, threatened* and *species of concern*. Add the definitions to the class poster. (See 'Teacher Prep Notes') Explain to the class that many of the animals and plants they will be researching will fit into one of the categories defined above and that you will fill it in as the research unfolds.
  4. Tell students that they will be conducting research with a partner on a particular species that lives in the Himalayan ecosystem. They will present their research to the rest of the class in the form of a short PowerPoint or on a poster board. Tell them you will give them the criteria to look for and helpful resources to use in their research.

#### ***Research Criteria:***

- *Common and scientific name/other names (given by Native Peoples)*
  - *Category (mammal, bird, insect, plant)*
  - *Picture of animal or plant*
  - *Physical adaptations that allow it to survive in the Himalaya*
  - *Habitat (specific geographical location)*
  - *Diet (if it is an animal)*
  - *Who or what does it depend upon in the ecosystem? (What is its prey or what does it need to survive)*
  - *What or who depends upon it in the ecosystem? (Is it food for another animal or person? Is it used for any other purposes by people or animals; such as for medicine or shelter?)*
  - *Is it threatened, endangered, or a species of special concern?*
  - *Fun Facts (For example: The yak has an extra set of ribs to protect the larger lungs this species has developed over time to help them live at such high altitudes with so little oxygen!)*
5. Engage students by telling them that they will also be creating a riddle about their species for a class trivia game.

6. Make slips of paper, each with the name of one of the species below or another species written on it (Note: the species with \* next to their names have species cards with facts made for this lesson that you can use to check the students' answers). Have students draw the name of a species that they will research from a hat. Make sure that all categories (animals, birds, and plants) are represented to ensure that the concept of interconnectedness in the Himalayan ecosystem is understood. You will want to discuss the interconnectedness of the species after presentations are given.

**Animals:** Bengal tiger\*, Himalayan tahr\*, red panda\*, yak\*, snow leopard\*, musk deer\*, Himalayan black bear, one horned rhino, river dolphin, Himalayan jumping spider\*

**Birds:** Himalayan monal\*, blood pheasant\*, sunbirds, bee eaters, choughs\*

**Plants:** rhododendron \*, allium hybrid, Himalayan orchid\*, elephant grass, edelweiss\*

7. Display or hand out the following websites to pairs of students to start their research with and encourage them to find others.

[http://wwf.panda.org/what\\_we\\_do/where\\_we\\_work/eastern\\_himalaya/](http://wwf.panda.org/what_we_do/where_we_work/eastern_himalaya/)

[http://www.greathimalayannationalpark.com/GHNP\\_biodivAnim.htm](http://www.greathimalayannationalpark.com/GHNP_biodivAnim.htm)

8. Present Climate Zone Map. Plot plants and animals from student presentations and ask the following questions:

- Where are most of the plants and animals located?
- Why are the plants in the middle and upper alpine zone so small?
- Why aren't any species living in the arctic zone?
- How are these species connected?
- What if one of these species became extinct? Would any other species be affected?
- What if a new species were introduced?

#### What Himalayan Species Am I?

On an index card, have each student write five to six facts about the Himalayan species they researched. The first fact should be the most difficult clue with the last fact allowing the audience to easily guess the species. Collect all of the index cards. Divide the students into teams. Read one fact at a time allowing teams to confer and share their guess. Each group should answer only after consensus is reached for the entire group.

#### **Example:**

I am a mammal.

I live in the Himalayan Mountains.

I live above...

My favorite meal is...

I am hunted by...

I am threatened because...

**Answer:** I am a musk deer.