A Teacher's Guide to

Extreme Environments

Grades 3-up

Description

What does it take to survive in the frozen tundra, a harsh desert, or other specialized environments? Live animals and museum specimens help you examine the adaptations that enable different species to thrive in unusual habitats.

Outcomes

Students will understand that living things have certain need that must be met in order to survive. Students will understand that animals and plants have adaptations that help them meet those needs.

Suggested Activities before Your Visit

Vocabulary

Ecosystem	Adaptation	Biome		Habitat
Environment	Limiting Factor	Abiotic	Biotic	Carrying Capacity

- Discuss your upcoming trip to the Academy. Have your students brainstorm a list of good rules to follow while at the Academy.
- Have your students explore the diversity of different habitats by completing the "Torn Paper Habitats" activity.
- Have your students understand the complexity of habitats by completing the activity "Microclimates".
- Do the activity "Oh Deer" from Project Wild to cover limiting factors and carrying capacity in more depth.

Suggested Activities after Your Visit

- Have your students understand the concept of a biome by completing the "Rainforest in a Bottle" project.
- Have your students investigate the fragility of plants by completing "Plants and Extreme Habitats" project.
- Research humans at the extremes. For example, climbers of Mt. Everest or deep sea divers.
- Investigate extremophiles—bacteria that have been found in extreme environments here on earth—and how they are helping scientists predict what life might be like on other planets.

AAAS's Project 2061 Benchmarks
1B: Scientific Inquiry: Scientific investigations may take many different forms, including observing what things are like or what is happening somewhere, collecting specimens for analysis, and doing experiments. Investigations can focus on physical, biological, and social questions.

5D: Interdependence of Life: Organisms interact with one another in various ways besides providing food. Many plants depend on animals for carrying the pollen to other plants or for dispersing their seeds.

11A: Systems: In something that consists of many parts, the parts usually influence one another. Something may not work as well (or at all) if a part of it is missing, broken, worn out, mismatched, or misconnected.

Pennsylvania Academic Standards in Environment and Ecology

4.3.4A, Know that plants, animals and humans are dependent on air and water.
4.3.4C, Understand that the elements of natural systems are interdependent
4.6.4A, Understand that living things are dependent on nonliving things in the environment for survival.
4.6.7A, Explain the flows of energy and matter from organism to organism within an ecosystem.
4.6.10A, Explain the biotic and abiotic components of an ecosystem and their interaction
4.7.4A, Identify differences in living things.
4.7.7A, Describe diversity of plants and animals in ecosystems
4.7.4B, Know that adaptations are important for survival.
4.7.10A Explain the significance of diversity in ecosystems

Pennsylvania Academic Standards in Science and Technology

3.3.4A, Know the similarities and differences of living things.
3.3.4C, Know that characteristics are inherited and, thus, offspring closely resemble their parents.
3.3.7A, Describe the similarities and differences that characterize diverse living things
3.3.7D, Explain basic concepts of natural selection.

Rainforest in a Bottle

Objectives
- The students will understand how a rainforest functions if left undisturbed.

Materials Needed
- Clear 2-liter plastic bottle with a detachable plastic bottom
- Scissors
- Plastic wrap

- Gravel
- Charcoal (as sold for use in fish tank filters)
- Potting soil
- Small tropical plants

Methods
- Remove label and black plastic bottom from the bottle
- Cut off the top portion of the plastic bottle.
- Line the detached plastic bottom with plastic wrap folded several times over.
- Spread about 1 inch of gravel over plastic wrap. Spread a thin layer of charcoal over the gravel, and fill with potting soil.
- Plant one or two small tropical plants, and water with about 1/3 cup of water.
- Invert and place the clear plastic bottle over the plants, forming a dome.

Conclusion/Wrap-up
- If left undisturbed, the mini-rainforest should last several months. Discuss with your students why the mini-rainforest can be maintained without outside help, and what adaptations the plants have that help them survive their environment.

Torn Paper Art

Objectives
- The students will understand the variety of life and climates in extreme environments.

Materials Needed
- White poster board
- Construction paper
- Glue

Methods
- Randomly assign of have students pick out of a hat one of the following biomes: rainforest, temperate, taiga, grassland, desert, tundra, estuary, saltwater, freshwater, or urban.
- Have students create a picture of their habitat using only torn paper and glue. Have students display environmental factors such as the temperature and average annual precipitation.
- At least two plants and four animals that live in the environment should be displayed.
- If students have questions about the project, host a general Q & A session. Have the students try to come up with solutions to the problems.

Conclusion/Wrap-up
- When the project is completed, the students can present their artwork. The other students can try to determine which biome is being shown, and what the defining characteristics of that environment are. Have the student whose artwork it is justify their artwork by pointing out items that the other students may have missed or misidentified.

Microclimates

Objectives
- The students will understand why organisms live where they do by comparing land cover and temperatures in different microclimates.

Materials Needed
- Thermometers
- Scale map of schoolyard
- Data recording sheet

Methods
- Assign each student to an area of the schoolyard that is to be plotted.
- Student will be looking for the hottest and coolest locations within their plot area. At each location they will record:
    1) Air temperature
    2) Observations of animals and plants in their plot and any other unique features
    3) The location of where they took the temperature

Conclusion/Wrap-up
- As a class, find out the hottest and coolest location.
- Determine why these locations are the hottest and coolest.
- Determine what plants and animals live in the locations. What were the differences between the plants and animals that live in the other locations?
- Determine how the lows and highs would change during the day and during the year. How would the changes affect the plants and animals?
- Have the students compare their data.
- Have the students create a class data sheet to look for patterns and make comparisons.

Plants and Extreme Habitats

Objectives
- The students will understand that plants and animals have adaptations that enable them to survive in specialized habitats.

Materials
- Small tropical plants
- Small desert plants
- Potting soil
- Planting pots

Methods
- Prepare each pot by filling with potting surface, moistening with water, and placing one plant into each pot.
- Water half the plants as instructed by the manufacturer.
- Water half of the tropical plants too little, and half the desert plants too much.

Conclusion/Wrap-up

- Determine what adaptations each plant utilizes in order to survive their environments. Discuss which plants did better than others, and why. Determine why each plant's adaptations did not help them survive in an extreme habitat to which they were not acclimated.

Websites and Other Resources

Habitat Webquests
www.biopoint.com/webquests/dist204/welcome.html

www.gracevilss.qld.edu.au/intranet/webquests/antarctica

www.geocities.com/biomewebquest/

Information Websites
Biomes
http://www.mbgnet.net/

www.cartwright.k12.az.us/starlight/index.html

www.memphis-schools.k12.tn.us/shcools/ibwells.aca/biomes.html

www.units.muohio.edu/cryolab/education/documents/msadaptation.pdf

Extreme ecosystems in Mono Lake
http://science.nasa.gov/headlines/y2004/13may_ecosystem.htm

Urban planning
http://en.wikipedia.org/wiki/Urban_planning

http://www.sciencenetlinks.com/lessons.cfm?DocID=276

Ecosystem
http://en.wikipedia.org/wiki/Ecosystem

Dynamic earth education exhibit (related to how humans can survive in future extreme environments)
http://www.dynamicearth.co.uk/education/journeyofcontrasts_science.asp

National Institute for Science Education
http://www.wcer.wisc.edu/archive/nise/

Magazine Articles

"Biome is Where the Art Is". Kelly Gooden. Science & Children. Vol. 43 Num. 1 Pgs. 28-32. Sept 2005.

"Deserts". H. Michael Mogil, Nancy Beller-Simms, Barbara Levine. Science & Children. Vol. 28 Num. 7 Pgs. 25-32. April 1991.

"Mountains Majesty". Elizabeth Rieben, Betsy Wooster, Leah Quesenberry. Science & Children. Vol 42 Num. 3 Pgs. 35-42. Nov/Dec 2004.

"Alaska's Cold Desert". Jeff Brune, Robert King, Mike Kunz, Richard Brook, Mary Tisdale. Science & Children. Vol. 33 Num. 8 Pgs 29-36. May 1996.