LESSON PLAN

Adapting to an Extreme Environment

Craters of the Moon National Monument & Preserve

Wildflowers that grow on cinder slopes are supremely adapted to harsh conditions

GRADE LEVEL:
Fifth Grade-Sixth Grade

SUBJECT:
Biology: Animals, Plants, Ecology

DURATION:
2 hours

GROUP SIZE:
Up to 36

SETTING:
Classroom

NATIONAL/ STATE STANDARDS

NGSS.SEP.1, NGSS.SEP.2, NGSS.SEP.4, NGSS.SEP.6, NGSS.SEP.8

OVERVIEW

Students match Craters plant adaptations to different habitat types and use their imaginations to create a species well adapted to a habitat of their design. (CLASSROOM ACTIVITY)

OBJECTIVE(S)

- Students will be able to name some adaptations plants have for living at Craters.
- Students will be able to match some common Craters plants to their appropriate microclimate.
- Students will be able to create their own species, well adapted to a student-designed habitat.

BACKGROUND

Every species has a unique set of adaptations that enables it to live in its environment. Some, like humans, starlings, and cheatgrass, have a wide tolerance to environmental constraints. Others, like Townsend's big-eared bats, three- toed woodpeckers, and the out-of-tune sticky tofieldia can survive only in the few niches where their unique habitat requirements are met. Most of Earth's biodiversity falls in the second category.

Over time, species adapt to changing environmental conditions structurally and behaviorally. Small, light-colored leaves covered with fine hairs are a structural adaptation some desert plants have to conserve water. Being nocturnal is a behavioral adaptation many desert animals adopt for the same reason. Humans have succeeded in exploiting every habitat on Earth because the structural adaptations of our big brains and our hands enabled us to make the myriad behavioral adaptations necessary to live in so many places.

Few environments are as hostile to life as Craters'. Temperatures range from -37 to 108 degrees F. and only about 15.3 inches of precipitation falls annually mostly as snow. In spring it quickly melts off or seeps into the porous ground in time for summer winds and heat to evaporate every drop of moisture from the black landscape. Nevertheless, over 750 plant species cling to the nooks, crannies, and thin soils where life can exist at Craters. They go about enduring a permanent drought through tolerance, avoidance, and/or escape.

Some plants are extraordinarily tolerant of drought. They can withstand cell moisture levels that would be lethal for other plants. Sagebrush and bitterbrush are exceptional at extracting water from dry soils and living on very little moisture.

Plants can avoid drought with physical adaptations like the leaves of silver leaf phacilia that funnel rain and dew toward its roots. Succulents like cacti collect water when it is abundant and retain it in their tissue. Rabbitbrush's small, light-colored leaves reduce evaporation.

Plants escape drought by living in the few places where water is actually plentiful. Others, like the dwarf monkeyflower, carry out their entire life cycle during three moist weeks in the spring and survive as seeds during the rest of the year.

The diversity of life at Craters is possible because of its microclimates. The bottom of crevices and cracks may be 15 degrees F. cooler than the surface. Windblown soil called loess collects there, like dust in the corners of your home, creating a place for plants to grow. The well established soil on the north side of old cinder cones can support Douglas fir trees. Water-loving ferns can live in the midst of a desert by living near the melting ice and cool air of a cave and in deep crevices. See "Additional Resources" below for an introduction to the ecology of Craters of the Moon.
From *the Teacher's Guide to Craters of the Moon.*

MATERIALS

- Work Sheet 4C
- Work Sheet 4C *(Teacher's Edition)*
- Clay for each student
- Construction paper, pipe cleaners, toothpicks

PROCEDURES

Part 1: Craters Adaptations

Start by having everyone tie their shoes without using their thumbs. The task was difficult because they weren't able to use one of our species' most useful adaptations-an opposable thumb.

Discuss adaptations with them and ask them to give examples. Generate a list of these on the board, like a bird's feather for flight; fur for warmth; claws for digging; down for lightweight insulation; keen sense of smell for detecting food and danger; fangs for injecting venom; an elephant's trunk for manipulating its environment; etc. See if they can come up with some behavioral adaptations too, like a wolf tucking its tail to show submissiveness; a robin singing to proclaim its territory; a sunflower following the path of the sun; a flower blooming at night to entice bats to pollinate it; a snake hissing when it feels threatened, and so on.

Once they have an idea what adaptation means ask them for examples of how plants are adapted to life at Craters. While they probably don't know much about plant adaptation at Craters, they likely know it's hot and dry in summer and cold and snowy in winter. Those

conditions are what plants must adapt to. What is the basic growth form of plants that live in such places? Are they big and showy with delicate bright green leaves or bent and gnarled with pale leathery leaves? If the latter, why?

Your class may need some help with understanding the difference between north and south aspect slopes. In temperate latitudes, slope exposure has a profound influence on plant communities. Here in the northern hemisphere, the sun is always to the south so south facing slopes receive its direct rays. North facing slopes stay wetter because they are in the shade more of the year. The difference in soil moisture often means south facing slopes are pure sagebrush while water-loving trees grow on adjacent north facing slopes.

Students will rate different habitat types in terms of temperature and moisture, 1 being wettest. Then they will receive information on plant species and be asked to match them to the habitat type where they would most likely grow. Copy the following worksheet pages back to back to save paper and give them to the students.

Part 2: Adaptation Artistry (adapted from Project WILD)
Now that students are adaptation experts with real life plant examples, let them use their imaginations to create their own well-adapted animals. They can draw them or use clay, construction paper, pipe cleaners etc.

Students should be able to answer the following about their species:

- What is its habitat and how is their species well adapted to it?
- What does their animal eat; how does it get its food?
- How does it move?
- What is the animal's sex?
- What is the name of the species?

Their creation should be well-adapted to all the devious environmental constraints they will hopefully create for it.

As an example, one student made a "flapper." Flappers live on school cafeteria floors where they forage on food waste. They are camouflaged to look exactly like a pancake. When no one is looking they scoot across the floor to find more food or leave before the janitor comes. Unfortunately, in schools where students are learning to waste less food, flappers are becoming endangered.

EXTENSIONS

In Part 2, students can also create a new well-adapted creature for Craters of the Moon.

ADDITIONAL RESOURCES
Ecology of Craters of the Moon

VOCABULARY

adaptation
diversity