

SAN DIEGO NATURAL HISTORY MUSEUM



COAST TO CACTUS IN SOUTHERN CALIFORNIA

Curriculum and Lesson Plan Resource Guide Grade 3



www.sdnat.org/coasttocactus

Fire and the cycle of life

As any local can attest, fires are a part of life here in San Diego County. The exhibit of the virtual storybook in-the-round illustrates how plants and animals that live in chaparral areas have adapted to an environment shaped by periodic wildfires. By performing this activity, students learn about the cycle of life in the chaparral, a plentiful California plant community that covers much of San Diego's hillsides, and how it is affected by wildfire.



Guiding Question: How can fire possibly benefit plants?

Activity: This activity can be done as a demonstration by the teacher or by students working in groups.

- 1) Explain to students that models are not perfect examples of events; they are imitations that help us understand science concepts and how things relate to each other.
- 2) Bend 5 toothpicks in half, but do not let the two halves break apart. (Image labeled step 2).
- 3) Arrange bent toothpicks on a flat surface with the bent angles touching to make the shape of a star (Image labeled step 3).
- 4) Place a sunflower seed on top of where two toothpicks are side by side about halfway along the length as in figure 1 below.
- 5) Place 1 drop of water on the center where all of bent angles meet.
- 6) Observe the interaction between the water and the wood.
- 7) Have students draw a diagram of the experiment and label the parts that represent fire (red water), seed pods (toothpicks) and seeds (sunflower seeds).
- 8) Have a class discussion about effects of wildfires: include both positive effects and negative effects.

Standards: Grade 3.

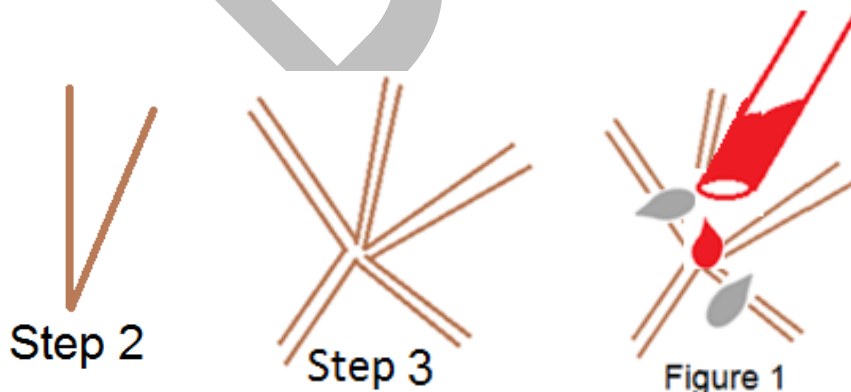
For details see pages #7-8 of CA's NGSS for K -12
<http://www.cde.ca.gov/pd/ca/sc/documents/ngss-ca-gr3-dci.doc>

Performance expectation: 3-ESS2-1

Science & Engineering Practices:	Disciplinary Core Ideas	Crosscutting Concepts:
Obtaining, Evaluating, Communicating Information. Engaging in Argument from Evidence.	ESS3.B: Natural Hazards.	Cause and Effect. Patterns.

Interdisciplinary Common Core Connections:

W.3.1 W.3.7 SL.3.1.d.



This is best as a pre-visit activity, but can be done post-visit

What's the point?

In this lesson (activity), students gain an understanding of how the heat from a fire is needed to open some seed pods so that seeds are released and plants can regrow in the area. Students also learn that fire, much like the water and tooth picks in the activity, spreads and does not move in a predictable pattern. Populations of organisms live in a variety of habitats and change in those habitats affects the organisms living there.

Science Concepts: Wildfire results from natural processes and can benefit an ecosystem. Some plants and trees create seed pods that will not open until they are exposed to the intense heat from a fire. In our demonstration, we use water to represent fire to make the **wood expand**. In nature, strong heat from a wild fire causes wood, for example, in a pine cone, to expand and release the seeds inside. Some plants survive by growing roots deep in the soil that will not be harmed by fire above ground. The plants can regrow from the roots protected underground. Fire clears out old dead leaves and other debris. Fires remove branches and leaves then expose the ground to sunlight. The ashes fertilize the soil and as plant life renews itself, animals return to the area.

Materials for each group:

- 5 wooden toothpicks
- Room temperature water
- 1 container/cup to hold approximately $\frac{1}{2}$ cup water
- 1 vial of red food coloring
- 1 Eye dropper or 1 straw
- 5 sunflower seeds
- Paper towels for clean up

Advance Preparation:

- 5 wooden toothpicks for each group or demonstration.
- Put 1-2 drops of red food coloring in water
- Gather materials (seeds, paper towels, etc.)

Key words:

- Hazard
- Natural (as opposed to man-made)
- Seed
- Root
- Water
- Plants
- Cycle of life

Supplemental materials available from our **Nature to You Loan Program:** 619.255.0236 or loanprogram@sdnhm.org

- Big-eared Woodrat
- Dulzura Kangaroo Rat
- Western Small-footed Myotis Bat
- Red Diamond Rattlesnake
- Laurel Sumac
- Lemonade Berry
- Coyote

Websites with activities and more information on this topic:

- http://interwork.sdsu.edu/fire/resources/fire_education.htm
(SDSU Fire Education and habitats in southern California)

How do desert plants survive with so little water?

Typically, only a few inches of rain fall in southern California's deserts each year. Desert plants have developed many different features that allow them to live in very dry conditions throughout most of the year.

Only winter and spring bring welcome desert rainfall. Some plants, such as a cactus, can store enough water in their stems to survive years of drought. Plants that have leaves and stems with a waxy outer layer can survive without rainfall because the waxy layer acts like a sealant and holds in precious moisture. Yucca, Barrel Cactus, Notch-leaf scorpion weed and other plants that are part of the desert ecosystem survive where water is scarce and the heat is scorching. Desert plants are adapted to take advantage of water when it is available.



Guiding Question: What is it that cactus plants have that other plants do not that helps them to survive in the dry hot deserts of southern California?

Activity: This activity takes one class period for two days to complete and can be done by students working in groups of 2-3.

DAY 1:

- 1) Explain to students that models are not perfect examples of events; they are imitations that help us understand science concepts and how things relate to each other.
- 2) Begin by showing students two different types of plants: one tropical houseplant and a cactus (or substitute an aloe plant.)
- 3) Allow students time to observe each plant.
- 4) Have students record their observations of the differences and similarities of the two plants in their science journal or on a sheet of paper.
- 5) Ask students to draw and label a stem from each of the plants.
- 6) Pass out materials and the student sheet on the next page.
- 7) Have students complete the activity for Day 1.
- 8) Place trays with the models of the stems where they will not be disturbed overnight.

Day 2: Have students follow the directions labeled on their sheet as "Day 2."

- 9) Have students examine each stem, discuss findings and write answers to questions 1 - 5 on their sheet.
- 10) Lead a class discussion about questions 1 – 5, and check for understanding of the concept that different plants have different characteristics that help them to survive in the environment where they live.

Standards: Grade 3.

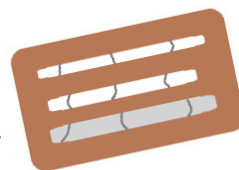
For details see page #1-2 of CA's NGSS for K -12
<http://www.cde.ca.gov/pd/ca/sc/documents/ngss-ca-gr3-dci.doc>

Performance expectation: Performance expectations: 3-LS4-2

Science & Engineering Practices:	Disciplinary Core Ideas	Crosscutting Concepts:
Developing and Using Models. Use evidence to construct explanations.	LS4.B: Natural Selection.	Cause and Effect.

Interdisciplinary Common Core Connections:
W.3.2 SL.3.4

This is a
pre-visit activity



Names of group members: _____

What characteristics does a cactus stem have that helps it to save water?

DAY 1: Directions:

1. Make a model of a regular plant's narrow stem:
 - a. Roll one paper towel tightly into a tube shape.
 - b. Tie three twist ties or rubber bands around the tube: one at the top, one at the bottom, one in the middle.
 - c. Put the paper towel tube in water.
 - d. Squeeze out the extra water and place the tube on the tray.
2. Make a model of a cactus plant's thick stem:
 - a. Stack six paper towels in a pile.
 - b. Roll the pile tightly into a tube shape.
 - c. Tie three twist ties around the tube: one at the top, one at the bottom, and one in the middle.
 - d. Put the paper towel tube in water.
 - e. Squeeze out the extra water and place the tube on the tray, not touching the first column.
3. Make a model of a cactus plant stem with its waxy outer coating:
 - a. Stack six paper towels in a pile.
 - b. Roll the pile tightly into a tube shape.
 - c. Tie three twist ties around the tube: one at the top, one at the bottom, and one in the middle.
 - d. Put the paper towel tube in water.
 - e. Squeeze out the extra water.
 - f. Wrap the tube with waxed paper, and add three more twist ties on the outside of the tube.
 - g. Place the tube on the tray, not touching the others.
4. Have students write down their predictions about which models of plant stems will hold the most water overnight and which will hold the least amount of water. (Which ones will dry out and which will not.)
5. Place the tray in a warm and dry spot, such as in the sun, to simulate desert conditions.
6. Leave undisturbed overnight. (*It is important for the models to sit only one night – not over a weekend.)

Day 2: Directions: Put your answers to the questions 1 – 4 on the back of this page.

1. Unroll the one-towel tube that is a model of a regular plant's narrow stem.
Write a description of the inside. Is the inside still wet? How does it feel?
2. Unroll the six-towel tube that is a model of a cactus plant's fat stem.
Write a description of the inside. Is the inside still wet? Is it more or less wet than the narrow stem?
3. Unroll the six-towel with waxed paper tube model of a cactus plant stem with its waxy outer coating.
Write a description of the inside. Is the inside still wet? Is it more or less wet than the other two stems?
4. Discuss with your group and write your answer to this question: What physical characteristics does a cactus have that helps it save water?
5. Draw and label a diagram of this activity.



What's the point?

In this activity, students develop a model that helps them to understand how different types of desert plants, such as cactus, manage to survive with little to no water available most of the year. The waxy coating on the stem keeps moisture from evaporating into the dry desert air. **Students learn** one way that some desert plants have adapted to live where most plants would die.

Science Concepts: Organisms have characteristics that make it possible for them to survive in their habitat. Desert plants are adapted to beat the heat and drought during summer when temperatures soar. Desert plants only produce flowers when water is available, the bloom time is brief. Some plants, especially trees, have long roots that tap into water sources deep underground. Then in just a few weeks, the plant sprouts, grows, blooms, reproduces, and dies—so it doesn't have to endure the harsh desert summer.

Questions for class discussion and wrap up:

- Why did the rolled column with just one paper towel dry first? (Because the thin shape had fewer layers to keep in the moisture.)
- Why did the rolled column with six paper towels remain moist? (Because the thick shape and many layers helped keep water inside.)
- Why did the rolled column covered with waxed paper remain the moistest? (Because the waxed paper trapped the water and prevented it from evaporating into the air.)

Materials per group:

- 13 paper towels
- 1 tray
- 12 twist ties or rubber bands
- Small container of water
- 1 sheet of wax paper

Advance Preparation:

- Gather materials
- Cut wax paper to size
- Determine a location to place trays overnight
- *It is important to let the model stems sit one night – not over a weekend, to get desired results.

Key words:

- | | |
|-----------|---------------|
| • Habitat | • Evaporate |
| • Survive | • Temperature |
| • Desert | • Dry / Arid |
| • Cactus | • Moisture |
| • Stem | • Adaptation |

Lesson adapted from

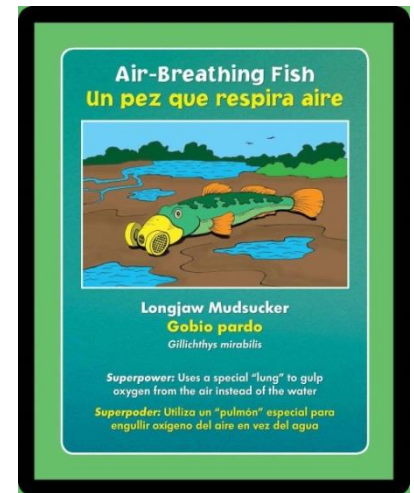
http://www.cbcs.scienceinstruction.org/2_habitat_sample_lesson.pdf

Websites with activities and more information on this topic:

<http://schoolmediainteractive.com/view/object/clip/671F2EAB15638D3E15823A4BA4FE218C/04> = 4 minute video, best to show after students have completed activity

Adaptations help animals survive

Animals have special characteristics, called adaptations, which help them survive tough conditions. Fish, worms and crabs live in the same habitat but all have different adaptations that allow them to stay alive even when their habitat changes. Throughout the day in southern California's intertidal mudflats, sometimes there's a lot of water and sometimes there's none. The giant mud core in the exhibit is a representation of the types of animals you would find if you dug out a piece of mud in a wetland. Explore the adaptations some animals have to help them survive underwater, out of water and even under mud – conditions found in coastal areas, such as mudflats in estuaries.



Guiding Question: How can animals survive in a place that is flooded one minute and then dry the next?

Activity: This activity can be done as students work in pairs.

- 1) Prior to visiting to the museum, explore the wetlands section on our website: www.sdnat.org/coasttocactus
- 2) At the museum exhibition, have each pair of students explore the wetlands exhibit area.
- 3) Encourage students to interact with the giant section of wetland mud. (Crawl through, move the fiddler crab's claw)
- 4) Assign an animal from the list below to each pair of students to locate and learn about during their visit.

- Ghost Shrimp
- Fiddler Crab
- Pea Crab
- Jackknife Clam
- Bent Nose Clam
- California Horn Snail
- Arrow Goby
- Longjaw Mudsucker
- Parchment Tube Worm
- Fat Innkeeper Worm
- Scale Worm
- Moon Snail

- 5) Give each pair a copy of the student page.
- 6) Students should take notes and be prepared to explain to the class about the adaptations that their assigned animal has and how the adaptations help it to survive in the mud in wetlands.
- 7) Students should be certain to read the green "Super Powers" cards next to the giant mud core exhibit. The cards explain the adaptations for each animal in the exhibit.
- 8) Collect papers when students have finished, so that their hands are free to explore the rest of the exhibits.
- 9) Back in the classroom, have each group "teach" the rest of the class about the adaptations their animal has.



This activity should be performed during your visit with follow up in the classroom

What's the point?

In any kind of habitat, some organisms can survive well, some survive less well, and some cannot survive at all. The characteristics an organism has, called adaptations, help it to survive in its habitat. Students learn about adaptations that animals in California's wetlands have and why they need them to survive.

Science Concepts: Animals that have the characteristics (adaptations) required to survive in their habit will live and reproduce. An animal's adaptations must be suitable for its habitat.

Materials:

- A copy of the student page for each pair of students.
- A clipboard for each pair of students.
- Pencil for each student

Advance Preparation:

- Make photo copies of the student page
- Assign each student a partner.
- Assign each set of partners an animal to learn about.

Key words:

- Wetlands
- Organism
- Habitat
- Adaptation
- Predator

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- Crab
- Ray
- Flounder

Websites with activities and more information on this topic:

<http://www.marinebio.net/marinescience/03ecology/mfunder.htm>

Names of group members _____

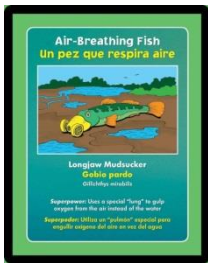
Super Powers Help Animals Survive!

Life is hard in southern California's intertidal mudflats. Sometimes there's a lot of water, sometimes there's none—and the creatures listed below that live in the mudflats never know what predator might be lurking among the reeds waiting to eat them!

- Ghost Shrimp
- Fiddler Crab
- Pea Crab
- Jackknife Clam
- Bent Nose Clam
- California Horn Snail
- Arrow Goby
- Longjaw Mudsucker
- Parchment Tube Worm
- Fat Innkeeper Worm
- Scale Worm
- Moon Snail



Directions: In the lists above, circle the name of the animal that your group is learning about as you explore the oversized section of mud in a wetland habitat. As you crawl through the mudflat and feel as if you have been reduced to the size of a snail, you will get an idea of how features, called **adaptations**, help an organism to survive in its habitat.



- 1) **While in the exhibit area**, locate the green cards that describe the super powers animals in the giant section of mud have to help them survive. These super powers are really the “adaptations” you are learning about.
- 2) Read about the animal you were assigned and take notes on the back of this paper so that, back in your classroom, you can teach your classmates about the adaptations that help your animal stay alive in the mud of the wetlands.
- 3) Find your animal on the giant model of the mudflat and try to understand how its adaptation helps it to survive. (You can look at and touch the model of your animal to help you think about the answer.)
- 4) While you are learning about your animal you might want to take notes about the following:
Where does the animal live in the mud? Does it live above or deep inside the mud?
What special adaptation does your animal have?
What problem or situation does the adaptation help your animal live through?
What are some other adaptations that your animal has that are not listed on the card?
- 5) On the back of this paper, draw your animal and label it to help you remember what you have learned, then hand your paper to your teacher so you can explore the other exhibits.
- 6) Answer these questions back in your classroom, as you prepare to teach classmates about your animal.

What do you like best about your animal?

How would you describe this animal to someone who has never seen it or heard of it?

What questions do you still have about your animal?