

Exploring San Diego's Shrublands

Grade 4 Curriculum



Exploring San Diego's Shrublands is an interdisciplinary curriculum anthology produced by the San Diego Children and Nature Collaborative for grade 4. This curriculum and related resources are available online at: <http://www.sdchildrenandnature.org>.

The San Diego Children and Nature Collaborative is a regional collaborative of organizations, individuals, and companies with the mission of inspiring communities to nurture, empower, and engage youth in cultivating their relationship with nature.

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Cover photo by Crystal De Soto

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To the Educator

Exploring San Diego's Shrublands was developed by the San Diego Children and Nature Collaborative (SDCaN) to integrate native habitat content into your existing classroom curriculum. Utilizing local habitats and outdoor activities brings your classroom content to life in an authentic and engaging way.

This curriculum is tailored for students in grade 4, supporting interdisciplinary 4th grade California State Content Standards. Activities may be completed individually, yet student learning is most effective when all of the lessons are completed. To assist you in integrating these activities into your existing curriculum, we have identified the most common textbook sections that each lesson can supplement or replace. While these activities are designed for grade 4, they can be modified for other elementary grades.

Do you have comments or suggestions regarding the activities in this Teacher's Guide? We'd love to hear about what works well and what you would change. Send comments to the San Diego Children and Nature Collaborative at sdcanature@sandiegoaudubon.org.

How to Use This Guide

Students	Recommend using a science notebook or folder for this unit to consolidate materials.
Preparation	Describes the steps that need to be taken prior to conducting the activity (e.g., copy handouts, gather plant samples, set up stations).
Engage, Explore, Explain, Elaborate, Evaluate	These sections describe the steps to conduct the activity using the 5 E's Learning Cycle Model.
Extension	Suggests further activities to expand the study or deepen understanding of the concepts.

Additional Resources:

Vocabulary List. Can be copied for students to refer to when reading about San Diego native habitats. Vocabulary words are bolded in student readings and worksheets.

Background Reading. The background section provides the teacher with information on the natural history of Chaparral and Coastal Sage Scrub habitats (shrublands) that will help the teacher lead the activities in this guide. This section may also be used with advanced student readers.

Tips for Teaching Outdoors. A guide from the National Wildlife Federation that gives teachers practical steps for leading nature visits in Lessons Two and Five.

Species Common to Shrubland Habitats. This list shows some of the plants, birds, and animals common to the habitat. Students may see these species on their nearby-nature visit and could also use the list to make their own species ID cards.

California State Content Standards. Detailed description of the 4th grade science and English language arts content standards aligned with this curriculum.

Community Resources. Listing of organizations and websites that assist students and teachers in learning more about shrubland habitats. Nature providers offer trained naturalists that can assist with Lesson Two or any of the lessons in this guide. Many offer this service either free or for a small fee.

Species ID Cards (Provided separately.) 27 color shrubland species identification cards are provided with this Teacher's Guide to aid in students' exploration of shrubland habitats. Cards contain a color photo, a brief field guide description of the species, their role in the food chain (P-producer, C-consumer, D-decomposer), and an interesting fact. We encourage teachers to use these cards as a starting point and consider having students make their own Species ID Cards as they progress through the unit.

Unit at a Glance

	Lesson 1 <i>Introduction to Native Habitat</i>	Lesson 2 <i>Native Habitat Hunt</i>	Lesson 3 <i>Shrubland Food Chains</i>	Lesson 4 <i>Shrubland Survivors</i>	Lesson 5 <i>Helping Native Habitats</i>
Pages	1-8	9-11	12-14	15-16	17-20
Objectives	<ul style="list-style-type: none"> Compare writing samples looking for evidence of opinions and scientific facts. Make scientific observations. Write a scientific (factual) description of a plant. 	<ul style="list-style-type: none"> Observe the habitats near school. Explain what the shrubland habitat is and what it provides. Observe plant and animal adaptations. Understand what happens to an animal if it is not able to meet its needs. 	<ul style="list-style-type: none"> Classify organisms as producers, consumers, or decomposers. Demonstrate how energy flows through a shrubland food chain Recognize that plants are the primary source of energy for living things in an ecosystem. Explain how living things meet their needs and survive. 	<ul style="list-style-type: none"> Review the environmental conditions of native habitats. Identify the adaptations of shrubland species. Apply an understanding of shrubland adaptations by designing an imaginary species. 	<ul style="list-style-type: none"> Participate in a project to improve shrubland habitat. Analyze and creatively solve authentic public problems. Plan, collaborate, and take responsibility for project tasks.
Time Required	Prep: 20 min. Lesson: 60-90 min.	Prep: 30 min. Lesson: 90 min.	Prep: 15 min. Lesson: 50 min.	Prep: 10 min. Lesson: 60 min.	Varies by project <i>*Start prep during Lesson 1</i>
CA Standards	4 LS 3.a 4 IE 6.a, 6.c 4 ELA R 2.1, 2.2, 2.5, 2.6 4 ELA W 2.1a, c	4 LS 3.c 4 IE 6.a, 6.c 4 ELA LS 1.1, 2.4	4 LS 2.a, 2.b, 2.c 4 IE 6.c, 6.d 4 ELA R 2.5, 2.7	4 LS 2.b, 3.a, 3.b 4 IE 6.c, 6.f 4 ELA R 2.2, 2.6 4 ELA W 2.3b, c	4 LS 3.b 4 IE 6.a, 6.c, 6.f 4 ELA LS 1.1 4 ELA R 2.4
Text: Harcourt	p. 206-207, 208-223,	p. 240-253	p. 150-151, 152-179	p. 208-223, 224-239	p. 224-239
Text: MacMillan/McGraw Hill	p. 82-91	p. 94-101	p. 36-47, p. 50-59	p. 50-59, p. 82-91, p. 104-111	p. 104-111, p. 114-123
Text: Pearson Scott Foresman	p. 120-139	p. 160-168	p. 90-106	p. 90-106, p. 151-159	p. 151-159
Text: Delta Education	Investigations 1,2,4	Investigation 2	Investigation 3,4	All Investigations	Investigations 2,3,4,5
Text: Houghton Mifflin	p. 6-36	p. 46-49	p. 66-72, 86-100	p. 54-64, 86-100	p. 20-28
Vocabulary	Adaptation Habitat Naturalist Shrublands Species	Predator Prey Scat Shrublands	Consumer Decomposer Energy Food chain Predator Prey Producer	Adaptation Native Species	Conservation Wildlife

Student Reading

Get to Know San Diego Shrublands

San Diego's Native Habitats

California and San Diego County in particular, are places unlike any other in the world, because there are so many **native habitats** that are found only in our region. A native habitat is an area that has everything an animal or plant needs to survive. It is also an area where animals and plants have survived for thousands of years. San Diego's native habitats include beaches, salt marshes, freshwater marshes and lagoons, grasslands, oak and pine forests in the mountains, stream sides, oak meadows, deserts and shrublands.

Thousands of living things make their homes in San Diego's native habitats. In fact, there is more



Figure 1: California quail taking shelter under a scrub oak.

biodiversity, or variety of living things, in San Diego than any other county in North America. San Diego County has so much biodiversity, scientists

consider it a **conservation** "hotspot." Our native habitats, and the plants and animals in them, need protection if they are to survive.

Shrubland Climate

Climate is the word scientists use to describe weather patterns in a particular place over hundreds of years. The climate of San Diego is called "Mediterranean." It is like the climate around the Mediterranean Sea, between Europe and Africa. Other places that have this climate are central Chile in South America, southwest Australia, and South Africa.

Mediterranean climates have wet winters and dry summers. Most of the yearly rain falls in the winter, leaving the rest of the year very dry. In San Diego, the average rainfall along the coast is less than 10 inches. Dry "Santa Ana" winds blow from the desert to the sea in the fall. Fires sometimes spread when these winds blow.

Shrubland Habitat

Shrublands are areas of land covered with different species, or kinds, of shrubs. They often grow in places trees don't grow, like steep hillsides. They shade the ground so other plants can't live under them. They grow so thickly that the ground is often completely covered with plants.

San Diego's shrublands include **chaparral** and **coastal sage scrub** habitats. Chaparral is the most common habitat in California. The name comes from the Spanish word "chaparro," meaning "place of the scrub oak." Plants in the chaparral habitat have thick, woody stems like trees and hard leathery leaves. They are usually between 4 and 20 feet tall.

Coastal sage scrub is found within 10 miles of the ocean. The plants have small, good-smelling leaves and have softer stems and leaves. They are smaller than chaparral plants, standing about 1 to 4 feet high. In the past, coastal sage scrub was the most common habitat in San Diego. People like to be near the ocean, so they built their homes and businesses in this habitat. Now there is only a little bit of this habitat left in San Diego. Around the world, coastal sage scrub is one of the most endangered habitats.



Figure 2: Toyon has straight toothy leaves.

Student Reading

Shrubland Relationships

Plants and animals that live in shrubland habitats must be able to survive without much water during the hot dry summers. They must be able to protect themselves from the drying wind and burning fire in the summer and fall. They must also take advantage of heavy winter rainfall to grow and spread.



Figure 3: Woodrats can build lodges as tall as an adult male.

Shrubland Animals and Plants Need Each Other

Shrubland animals and plants depend on each other. Just like people, animals breathe in and breathe out carbon dioxide. Plants take in carbon dioxide and release oxygen. Animals depend on plants for food and shelter. Plants depend on animals to scatter seeds, pollinate flowers, and fertilize the soil.

The thick shrubs of the chaparral make good homes for animals. The California gnatcatcher and the wren-tit build their nests in the shrubs. The California quail builds its nest on the ground under bushes for shelter.

Some animals make nests, dens, and burrows using chaparral plants. Wood rats make large “lodges” using sticks and twigs. Other animals, such as mice, lizards, and insects, move into these homes. The lodges are warm in winter and cool in the summer.

Many animals eat chaparral plants, too. In fact, every part of a plant is food for some animal. Brush rabbits, mule deer, and caterpillars all like soft plant leaves.

Seeds and acorns are a favorite of ground squirrels, mice, harvester ants, and scrub jays. Pocket gophers eat plant roots. Berries and other fruits are a tasty treat for birds, coyotes and raccoons. Even **decomposers** such as earthworms and darkling beetles eat dead plants and turn them into soil. Nothing goes to waste in the shrubland habitat.

The Shrubland Food Chain

In nature, a plant uses energy from the sun to make food. Later, the plant is eaten by an animal. That animal is, in turn, eaten by another animal. This cycle of eating and being eaten is called a **food chain**.

A food chain passes energy from one **organism**, or living thing, to another. For example, the black sage plant gets nutrients and water from the soil. It uses the sun’s energy to make its own food and grow. The seeds of the black sage are eaten by a quail. Then a bobcat eats the quail. When the bobcat dies, decomposers break down its body into nutrients, turning the body back into soil.

In the shrubland ecosystem, California buckwheat uses the sun’s energy to make food. The Western scrub jay and California mouse eat buckwheat seeds. The jay may be eaten by a Red-tailed hawk. The mouse may be eaten by a Gopher snake, which is eaten by a coyote.



Figure 4: Barn owl perched with its prey.

Student Reading

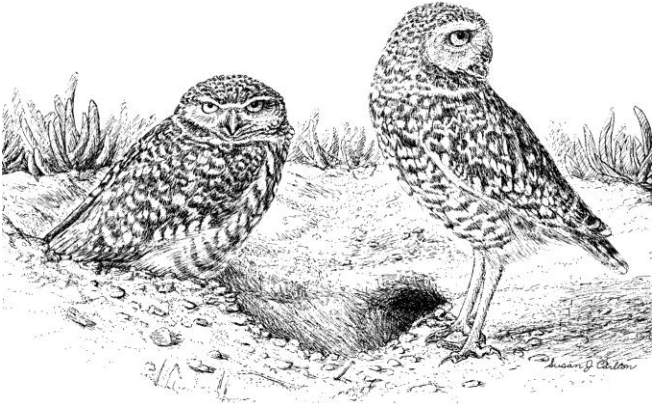


Figure 5: Burrowing owls guarding their nest.

Animals' Adaptations to Shrubland Habitats

Adaptations are physical qualities or behaviors that help animals and plants survive. Animals have adapted to the shrubland habitat in two different ways. First, their bodies are adapted, inside and out, to survive in low-water conditions and hot sun. These are called **physical adaptations**. Second, their behaviors, or the way they act, help them survive. These are called **behavioral adaptations**.

Physical Adaptations

Some shrubland animals are colored just like the plants around them. Wrentits, for example, are small brown birds that can blend in with dry shrubs.



Figure 6: California gnatcatcher perched on California buckwheat.

Coyotes are also light colored, with fur that can be grey, tan, or brown.

Nocturnal animals also have physical adaptations to help them

survive. Their bodies are adapted to help

them find food and avoid being eaten in the dark. Great horned owls, for example, have large eyes, sharp claws, and silent wings to help them catch mice at night. Kangaroo rats also have large eyes to see **predators** such as owls who want to eat them, and they have strong legs with large feet for leaping away quickly.

Shrubland animals also have adaptations inside their bodies. The western fence lizard, for example, has special kidneys that help save water. These small reptiles do not need to drink water at all. They get all the moisture they need from the insects they eat.

Behavioral Adaptations

Some animals, such as kangaroo mice and owls, are **nocturnal**; they are only awake at night. This behavior helps them survive because they can stay out of the sun and heat.



Figure 7: Western fence lizard warming itself on a boulder.

Other animals, such as gophers, burrowing owls, ground squirrels, toads, and snakes dig burrows underground, rarely coming outside. This behavior helps them survive in heat and wildfires.

Animals such as wood rats, build large nests to protect them from predators. Their nests may have many doors. This adaptation allows them to escape when they are in danger.

Student Reading

Plants' Adaptations to Shrubland

Habitats

Plants living in shrubland habitats have also adapted to live in hot, dry conditions. Plants grow in the winter when the rain falls. They have adapted to need little water in the summer and to survive hot Santa Ana winds. Shrubland plants are even adapted to survive when wildfires sweep through the region.

Low Water Conditions and Santa Ana Winds

Plants that live in shrublands must be able to get along without much water. Deep roots help plants gather as much water as possible from far away. Some plants have roots that are three or four times as large as the plant above the ground.

Santa Ana winds can pull water from plants' tender leaves. The leaves of shrubland plants have adapted in a number of ways to prevent the plant from losing



Figure 8: Scrub jay collecting acorns.

water. Scrub oaks, for example, have a waxy or leathery coating on their leaves and stems that keep water in. Other plants, such as California

buckwheat, have tiny, hard, thin leaves that prevent water loss.

Some plants' leaves are turned away from the sun to prevent water loss. Toyon's leaves point straight up and laurel sumac's leaves are folded like tacos so the sunlight only hits the leaf edges.

A plant's color can help it stay cool too. Dark colors absorb sunlight. Light colors reflect it. Plants such as white sage and California sagebrush are light grey. This adaptation helps them reflect sunlight and stay cool in the heat.

Most shrubland plants are green all year round. But some shrubland plants, such as black sage, lose half their leaves when rainfall is especially low. This adaptation helps them prevent water loss through leaves. Black sage also has smaller leaves during **droughts**, or times of little rainfall. When rains increase, the leaves grow larger.

Some plants, such as yerba santa, have hairs that collect water from the air. Near the cloudy coast, fog can be a good source of water for these plants.

Wildfires

Wildfires burn the parts of shrubs that are above the ground. Shrubland plants survive wildfires in several ways. Some plants resprout from their deep roots and hardy stems after a fire. Laurel sumac and chamise sprout from their root collars between the root and stem. Within a month of a big fire, these shrubs have new stems and leaves.

Other plants sprout from seeds. Seeds of the ceonothus are cracked open in the heat of a wildfire and grow when the rain comes. Manzanita seeds open when they are exposed to the chemicals found in smoke and charred wood. When larger plants burn away, the new plants have nutrients and room to grow. Many beautiful wildflowers show up after a big fire. If the time between wildfires is too short, the shrubland habitat may not survive and weeds will take over.

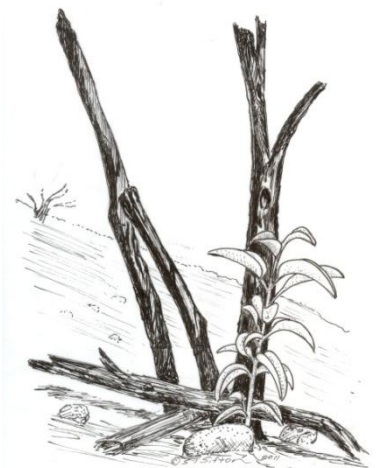


Figure 9: Laurel sumac resprouting after a fire.

Lesson 1 Introduction to Native Habitat

Time

Preparation 20 min

Lesson 60-90 min

CA Standards

4 LS 3.a

4 IE 6.a, 6.c

4 ELA R 2.1, 2.2, 2.5,
2.6

4 ELA W 2.1a, c

Materials

📖 *Get to Know San Diego Shrublands* (p. 1)

📖 *Shrubland Relationships* (p. 2)

📖 Internet access

📖 Paper

📖 Pencil or pen

📖 Plant samples

📖 Student Worksheet

📖 Vocabulary List

📖 Rulers

📖 Magnify glasses

Vocabulary

Adaptation

Habitat

Naturalist

Shrublands

Species

Hint

Assign video segment as an activity in the computer lab.

Overview

This introductory activity provides an overview of shrublands, emphasizing observation skills.

Objective

Students will:

- Compare writing samples looking for evidence of opinions and scientific facts.
- Make scientific observations.
- Write a scientific (factual) description of a plant.

Preparation

Bring in a selection of potted plants or branches, enough for one plant sample per group of 4-6 students. If you can, include some native plant material. Do not collect from native habitats. Some nurseries carry native plants, eg. Las Palitas Nursery, Escondido. Put a number on the plant samples. Provide each group a metric ruler or tape measure. Make copies of *Get to Know San Diego Shrublands*, *Shrubland Relationships*, Student Worksheet (p. 7), and Vocabulary List (p. 21) for each student.

Engage

Brainstorm with students what they know about habitats in San Diego.

- What is a habitat? *A place where plants and animals live.*
- What kinds of habitats do we have in San Diego? *Beaches, mountains, deserts, canyons, wetlands.*
- What kinds of wildlife live in these habitats? *All kinds of things! Birds, squirrels, lizards, coyotes, trees, flowers, shrubs, etc.*

Explore

Students will explore shrublands by reading the first two pages of *Get to Know San Diego Shrublands* and watching a brief video segment about the shrubland habitat. Suggested segments include:

- Nature Bytes, *Comparing Scrub and Chaparral Habitats in a Canyon*
http://naturebytesvideo.com/bytes_C/comparing_scrub_chaparral.html

Next, students will investigate plant samples in small groups of 4-6. Each student will write down observations about their group's plant.

Guiding Questions:

- What color are the leaves?
- Is the edge of the leaf serrated (toothed), smooth, or lobed?
- What pattern do the veins of the leaf make? *Parallel, Pinnate (featherlike), Palmate (handlike), needle-like leaves have a vein in the center.*
- How are the leaves arranged?
- Are they alternate, opposite, or whorled?

After 5-10 minutes, students will sort their descriptions into two categories, opinion and scientific facts. A recorder will copy for the group all of the scientific facts onto one page and include the number of the plant. Move all of the plants to a place in the room where all the students can see them. Groups will trade lists of facts. A reporter will read the list out loud for their group while the other students try to identify the plant which is being described.

On the board write O = Opinion, F = Fact. After five minutes, students will sort the descriptions into two categories: opinion and scientific facts. On the board, divide the fact category into SO for Scientific Observations and SC for Scientific Conclusions. Scientific observations are what they can count, measure (using metric measurements), see, feel, and smell.

Scientific conclusions are facts that are known from background knowledge (e.g. plant uses photosynthesis) or conclusions that may be factual, but are not observed (e.g. plant is living, plant is a geranium.) They will then look at the scientific facts and decide whether they are scientific observations or scientific conclusions. A recorder for the group will combine all of the scientific observations (SO) onto one page and include the number of the plant. Move all of the plants to the front of the room. Groups will trade lists of facts. A reporter will read the list out loud while the other students try to identify the plant which is being described. They may also comment on any statements that are not scientific observations. Use student's examples to reinforce types of observations.

Explain

Have students read *Notes from the Field*. Ask students to look for examples of facts and opinions in the piece. Discuss student findings and further explore the difference between factual scientific observations, scientific conclusions, and opinions. An example of a factual scientific observation would be that the plant has 47 oval leaves. A scientific conclusion would be that the plant is a ceanothus. An opinion would be that the plant is ugly (or pretty).

Elaborate

Naturalists record both facts and opinions when they visit an area. Many naturalists use journals when they are out in the field. Journals are a way to keep track of impressions, feelings, and observations, and can become a log of important scientific data to be referred to later. Their notes can reflect changes in ecosystems, vegetative types, and animal populations, as well as personal attitudes about things. A journal entry may also include sketches, photographs, and samples from the field.

Evaluate/ Extension

Have students write a naturalist's description of a favorite place in nature that they have visited. They should include details about what the area looks like, how they feel when they are there, and what they liked about this particular place. Remind them to include both facts and opinions.

Evaluate/Extension

Locate an area on the school grounds, such as under a shady tree or out on the grass. Ask students to sit quietly, listening carefully for any sounds. Encourage them to look with "squirrel eyes" (eyes that do not focus on any one thing, but broadly sense the environment). "Hawk eyes," by contrast, are good for looking closely at something specific, like a mouse in a field. Encourage students to try both methods to see how they feel and what they notice. Both ways of seeing are useful. Have them write a sensory narrative about their experience in the moment.

Notes from the Field

A. In the **naturalist's** journal entry below, look for examples of facts and opinions. Underline facts and circle the opinions. An example of a fact is that the plant has 47 oval leaves or that the plant is a white sage. An example of an opinion is that the plant is ugly or pretty.

May 15, 2011 @ Canyon behind my house

The weirdest thing happened today. We were walking home on a trail and this wrentit almost flew right into me. A wrentit is a little brown bird with this long tail and bright, yellow eyes. So this wrentit was acting agitated, making a rattle kind of sound in short and little bursts. It sounded like an alarm clock ringing, but when the clock is covered by a pillow. Then I saw there was another wrentit on the other side of the trail chattering the same way. They both almost crashed into each other

and jumped around on the on the ground in front of each other for like five minutes. They eventually flew up and went their separate ways.

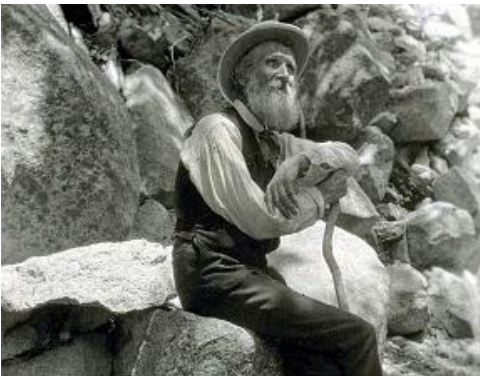
Then both of them did their ping-pong song at each other for a long time. It's a whistle that has the beat of a bouncing ping-pong ball. I hear it all the time, when I'm out in the chaparral. This is one of the reasons I like the chaparral so much. It teaches me things about all sorts of interesting things. - Chappie, Age 10



Figure 12: Wrentit perched on a lemonade berry.

B. Write your own **naturalist** journal entry. Describe one of your favorite places in nature. What did the area look like? How did you feel when you were there? What made this place special to you or what did you like about it? Remember **naturalists** record both facts and opinions, so make sure to include both in your journal entry.

Naturalist in History: John Muir (1838 – 1914)



"Trees go wandering forth in all directions with every wind, going and coming like ourselves, traveling with us around the sun two million miles a day, and through space heaven knows how fast and far!"

John Muir was a famous **naturalist** and early supporter of wilderness **conservation** in the United States. His letters, essays, and books telling of his adventures in nature, especially in the Sierra Nevada Mountains in California, have been read by millions. His writings helped to save the Yosemite Valley, Sequoia National Park, and other wilderness areas. The Sierra Club, which he founded, is now one of the most important **conservation** organizations in the United States.

Lesson 2 Native Habitat Hunt

Time

Preparation: 30 min

Lesson: 90 min

CA Standards


4 LS 3.c


4 IE 6.a, 6.c

4 ELA LS 1.1, 2.4

Materials

 Species ID Cards

 Teacher Field Backpack

 Nature Identification Practice (p.

Vocabulary

Predator

Prey

Scat

Shrublands

Hint

Use *Species ID Cards* as a whole sheet.

Assign student groups a sheet to explore on the trail.

Overview

This activity takes students outdoors into nearby nature in search of native shrubland habitat.

Objective

Students will:

- Observe the habitats near their school.
- Explain what the shrubland habitat is and what it provides.
- Observe the plant and animal adaptations that help them survive in the native habitat.
- Understand what happens to an animal if it is not able to meet its needs.

Preparation

Review *Tips for Teaching Outdoors* (p. 25) and identify your school's nearest natural area using online maps such as Google Earth. If native habitat isn't available, conduct a habitat hunt in your schoolyard. Consider inviting a naturalist from the *Community Resources* (p. 29) on your hike. Assign *Nature Identification Practice* as homework before the nature visit and encourage students to skim *Get to Know San Diego Shrublands*.

Engage

Today your class is going on a habitat hunt in search of wildlife and native habitat near your school. You are on the lookout for shrublands, which are made up of chaparral and coastal sage scrub. As a class, review *Get to Know San Diego Shrublands*. Guiding questions:

- What kinds of habitats do you see on your way to school?
- Have you seen or visited a shrubland habitat before?
- Have you seen any shrubland habitats on your way to school?
- What kinds of plants and animals might we expect to find in a shrubland?

Explore

Go on your native habitat hunt. Review field safety before you get to the site:

- Cover hike rules, including staying on the trail, treating each other with respect, and respecting the environment by not collecting any plants or animals.
- Use the four senses (no tasting).
- Walk quietly and be observant so you don't scare away the little animals.

Look for signs of life:

- Can you find narrow trails through the shrubs perhaps made by rabbits, coyotes, or foxes?
- Are their patches of flattened grass left behind by sleeping animals?
- Is there scat on the trail? Look at the size. Is it small and pellet-like, from a rabbit or ground squirrel? Or larger like from a dog, coyote, or bobcat?
- Are there tracks (prints) or scratch marks on the trail? Size can give you a clue about who might have been there.
- Are there holes or chew marks on the leaves? Insects often leave these signs behind.
- Are there spider webs? Look high and low. Can you see the spider that built it?
- Are there large piles of sticks perhaps left behind by woodrats?

Explain

Use the *Species ID Cards* to help students discover life in the habitat. As students make observations, discuss what they think they have discovered. Remember that the point of this activity is to engage in a process of discovery. Neither you nor your students need to know the names of all the plants and animals.

Elaborate

Back in the classroom after exploring the nature area, have students share out their favorite discovery. Jot down by name or general description some of the special plants and animals the class found during the hike. Are the plants and animals they found from a shrubland habitat? Is their nearby nature a native habitat? How could they tell?

Evaluate

Native Animal Poetry. Using the *Species ID Cards* for inspiration, students choose a native animal they would like to be. The diamante poem should be structured as follows: First line, write a noun that describes the animal you selected. Second line, write two adjectives that describe how your animal looks. Third line, write three adjectives describing how the animal moves or where it lives. Fourth line, write two nouns that describe how the animal contributes to the ecosystem or how it lives. On the last line, write the name of the animal. For example:

Bird
Large, Strong
Soaring, Diving, Twisting
Predator, Hunter
Hawk

Extension

Conduct a Native Plant Scavenger Hunt at the exploration site or in the schoolyard. Distribute the plant *Species ID Cards* to teams of 3-4 students. Teams will explore the site for native shrubland plants. As students discover plants, they can lay their card next to that plant. Together, they will be creating a temporary interpretive garden.



Figure 13: Nature walk with Ocean Discovery Institute.

Nature Identification Practice

Practice your naturalist identification skills by matching the plants and animals in the image to the correct name on the list. Use field guides (print or online) to help you correctly match the species. Color in the plants and animals to help you recognize the plants and animals in the field.



Shrubland Species

- ✓ Laurel Sumac (*Malosma laurnia*)
- ✓ Brush Rabbit (*Sylvilagus bachmani*)
- ✓ California Towhee (*Pipilo crissalis*)
- ✓ Anna's Hummingbird (*Calypte anna*)
- ✓ White Sage (*Salvia apiana*)
- ✓ Monkeyflower (*Minulus aurantiacus*)
- ✓ Black Sage (*Salvia mellifera*)
- ✓ Song Sparrow (*Melospiza melodia*)
- ✓ Deer Weed (*Lotus scoparius*)
- ✓ Checkerbloom mallow (*Sidalcea malvaeflora*)

Lesson 3 Shrubland Food Chains

Time

Preparation: 15 min

Lesson: 50 min




CA standards

4 LS 2.a, 2.b, 2.c

4 IE 6.c, 6.d

4 ELA R 2.5, 2.7

Materials

-  *Shrubland Relationships* (p. 2)
-  *Shrubland Chain Game Rules* (p. 14)
-  *Species ID Cards* (4 sets)

Vocabulary

Consumer
Decomposer
Energy
Food chain
Predator
Prey
Producer

Hint

Students can use sticky notes to draw the sun and arrows to further demonstrate the flow of energy through the food chain game.

Overview

This activity uses local San Diego shrubland species to explore the concept of food chains.

Preparation

Cut out *Species ID cards*. Make copies of *Shrubland Chain Game Rules* (p. 14).

Objective

Students will:

- Classify organisms as producers, consumers, or decomposers.
- Demonstrate how energy flows through a shrubland food chain.
- Recognize that plants are the primary source of energy for living things in an ecosystem.
- Explain how living things meet their needs and survive by using resources from their environment.

Engage

Write the word “chain” on the board. Ask students to define and describe a chain. Next, add the word “food.” Ask students what they think a food chain represents. (*It shows the chain of feeding among organisms. It shows how energy moves from one organism to another in the form of food.*) Students can skim *Shrubland Relationships* for ideas.

Explore

Write this sample food chain on the board: leaf → deer → mountain lion. Explain that these words show a food chain and ask students to describe what it represents. (*It is a food chain. The leaf is eaten by the deer; the deer is eaten by the mountain lion.*) Point out the arrow and explain that it points from the “primary” source of food (the first thing to be consumed in a food chain) to the next thing that eats it, and so on. The arrows show the direction that the energy is flowing. Use the following questions and teaching points to further explore the flow of energy through the food chain:

- Where does the leaf get its energy? *It converts energy from the sun through the process of photosynthesis.* Leaves are producers.
- Where does the deer get its energy? *From eating the leaves.* Deer are consumers, specifically herbivores.
- Where does the mountain lion get its energy? *From eating the deer.* The mountain lion is another kind of consumer called a carnivore.
- What about animals like us who eat plants and animals? *We are omnivores.* A very specialized omnivore that eats dead and decaying material is a decomposer.

In groups of four, distribute a deck of *Species ID Cards* and the *Chain Game Rules* to each group. Have students arrange the *Species ID Cards* into food chains using the instructions provided in the *Chain Game Rules*. Remind students that all food chains begin with the transfer of energy from the sun to a plant. For the first round, students must independently choose how to play their cards. They should try to make the longest chains possible. After students have completed the first round, ask them to record their score on the board. On the second round, students will work together to construct food chains, attempting to improve their group score from the first round. Again record groups scores on the board. Compare group scores from round one and discuss why scores varied. Did collaboration improve scores? Share examples of the longest food chains created by each group.

Explain

Using information from the game cards, have a few students write sample food chains on the board. Explain that the sun provides an enormous amount of energy to the earth.

However, only plants are able to convert this energy to a usable form. Some of the energy is used by the plants for their own functions, and the energy is stored up inside the plant. When another organism eats the plant, that organism gets the energy that the plant had stored. Write this food chain on the board: "plants → insect → bird → hawk." Use this example to address the following questions:

- What kind of organism begins most food chains? *Most food chains begin with plants.*
- In this food chain, does the hawk eat the plants? *No*
- How does the hawk get energy from the plants? *The hawk eats a bird that ate insects, which ate plants.*

Elaborate

Using the *Species ID Cards* as a resource, students will individually sketch a shrubland food chain, making sure to use and label a producer, herbivore, omnivore, carnivore, and a decomposer. Students will include the name of species with an arrow displaying energy flow from each species to the animal that consumes it.

Evaluate

Students will think, pair, and share their food chains with each other.

Extension

Food Web: Pass out a *Species ID Card* to each student. Students can hold up their card or you can hole-punch it and have them wear it as a necklace. Designate one person to be the sun. They will start the web, sending rays of yarn to the producers, making sure to hold onto their piece of yarn. Next, the producers then send yarn to the herbivores, the herbivores to the omnivores, etc. until all students are connected to each other by the yarn. The teacher will now give a scenario from the list below and pluck (like a guitar) the string of the affected organism. Students who feel the string as it is plucked represent organisms that have also been affected by the change in the ecosystem. Here are several scenario ideas. Feel free to develop your own or ask students to come up with some:

1. Someone releases their pet cat into the ecosystem and it begins to hunt the towhees, squirrels, and lizards. It greatly affects the population of towhees.
2. A friend's group hosts an invasive plant removal project restoring vital habitat for wildlife.
3. Two homeowners plant iceplant in their backyard that sits on the canyon. The iceplant quickly spreads and takes over space and nutrients, pushing out many of the native plants.
4. The neighborhood votes to keep their pet cats indoors. The population of small birds expands.

Continue the game until all species are affected. When complete, have the students drop the yarn and have a volunteer wind it up.

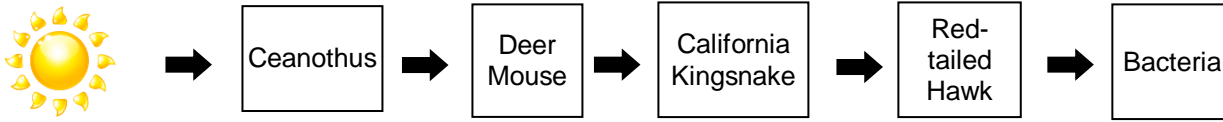
Note: Best to do this activity with a smaller group of 10-12, or go outside so the whole group can participate.

Adapted from "Chain Game" in *Plants: The Ultimate Energy Resource, California Education and the Environment Initiative Curriculum Teacher's Guide*

Shrubland Chain Game Rules

Objective of the Shrubland Chain Game is to get the highest points as a team for your rows of **food chains**. **Food chains** should flow from left to right: **producer**, 1st **consumer**, 2nd **consumer**. The descriptions on the *Species ID Cards* will tell you how they fit into the **food chain**.

Food chain Example:



*Hint: **decomposers** are like wild cards because they can fit into a **food chain** at almost any point.*

SCORING		
0 points for single cards	2 points for each three-link chain	7 points for a five-link chain
1 point for each two-link chain	4 points for each four-link chain	

How to Play:

1. Place the deck of cards face down in the center of the group.
2. Designate one person to go first. Player 1 will turn the first card over and place it next to the pile.
3. The person to the left, Player 2, will take the top card from the deck. If the drawn card links to the upturned card, place it to the right or left depending on the **energy** flow. If a link is not possible, create a new row.
4. Player 3 will repeat this process, creating **food chain** links with the upturned cards on the table. Cards must be added to the beginning or end of a row. You cannot break a chain to play your card.
5. Continue clockwise until all the cards have been played.
6. Tally your group score, using the scoring table above and report your team total to the class.
7. On the back of this page, or in your science notebook, draw a diagram of your team's highest scoring **food chain**.
8. Reshuffle the cards and play again. Select a different person to go first. In this round, try to make longer chains to improve your team score.
9. Record your highest scoring **food chain** from Round 2. Did you improve your score?

*You can draw arrows on blank cards to demonstrate how **energy** flows through your **food chain**.

Lesson 4 Shrubland Survivors

Time

Preparation 10 min

Lesson 60 min

CA Standards


4 LS 2.b, 3.a, 3.b


4 IE 6.c, 6.f

4 ELA R 2.2, 2.6


4 ELA W 2.3b, c


Materials


 *Adaptations to Shrubland Habitats* (p. 3-4)

 *Shrubland Survivors* (p. 16)

 Art paper

 Colored pencils or markers

 *Species ID Cards*

 Vocabulary List

Vocabulary

Adaptation

Native

Species

Hint

For this activity focus on physical and behavioral adaptations since internal physiological adaptations cannot be observed.

Overview

Native plants and animals can be distinguished by their specialized adaptations for living in shrubland habitat. Students will explore native adaptations and design their own shrubland species.

Objective

Students will:

- Review the environmental conditions of native habitats.
- Identify the adaptations of shrubland species.
- Apply their understanding shrubland adaptations by designing an imaginary species.

Preparation

Prepare copies of *Animals'* and *Plants' Adaptations to Shrubland Habitats* and *Shrubland Survivors*.

Engage

Individually or in pairs, students will list the characteristics of shrubland habitats. As a class, share out these key features and record on the board. In pairs or small groups, brainstorm ways that plants and animals could adapt to survive in a shrubland habitat.

Explore

Students will skim *Adaptations to Shrubland Habitats* searching for three adaptations plants or animals use to survive in shrublands. Students list these features on the worksheet and further describe how that adaptation helps the species survive.

Explain

Discuss the three ways that species can adapt to survive in their environment. Write on the board: In a body (physiological), on a body (physical), what a body does (behavioral). Elicit several examples from students for each category. Physiological examples include kidney function of lizards to save water or lungs for breathing. Physical adaptations include body shape, color, waxy leaves, or leaf size. Behavioral adaptations include being nocturnal or living underground.

In small groups, students will use the *Species ID Cards* to find examples of other plants or animals that use their selected adaptations from the worksheet. Are the adaptations they chose common for other shrubland species?

Elaborate

Using their imagination, students will design a shrubland plant or animal. In pairs, have students recall some of the features their imaginary shrubland creature might have. Next, they will design the shrubland species to include at least three adaptations. The species should have a special name and a brief explanation of how the adaptations help it survive. *Note: Use worksheet to describe the three adaptations and how they help the creature survive.*

Evaluate

Students share their species and explain its adaptations with a partner, in small groups, or with the whole class (depending on time available).

Extension

Share student species on bulletin board or publish in a book. Encourage research into adaptations of species on *Species ID Cards* or on other species that students may have mentioned during class review.

Student Worksheet

Shrubland Survivors

A. Read *Adaptations to Shrubland Habitats*. Choose three **adaptations** that plants or animals use to survive in the shrubland **habitat** and list them below. Describe how the **adaptation** helps the **species** survive. List several **species** that use the **adaptations** you selected.

Adaptation (including names of species that use it)	How does this adaptation help species survive?
1	
2	
3	

B. Using a separate sheet of paper or the back of this page, think creatively to design a plant or animal that is adapted to live in the local **shrublands**. Your **species** should have at least three **adaptations** and a brief explanation of how each **adaptation** helps the creature survive. Make sure to give your special creature a name.

CHALLENGE: Can you design a creature that has a behavioral, physiological, and physical adaptation?

Lesson 5 Helping Native Habitats




Time

Varies by project

CA standards

- 4 LS 3.b
- 4 IE 6.a, 6.c, 6.f
- 4 ELA LS 1.1
- 4 ELA R 2.4

Materials

-  *Habitat Heroes* (p. 19)
-  Internet access
-  *Project-based Learning Steps*(p. 20)

Vocabulary

Conservation
Wildlife

Textbook Alignment

California Science,
MacMillan/McGraw-Hill p. 2-7, Ch. 2 L 3

Project Hints

Start small: The process is just as important as the product.

Let students be the leaders: The more responsibility the students take the better.

Be flexible: Projects tend to shift. Stay mindful, but adjust as needed.

Tie the project to other curriculum: Substitute or cut back on part of your instruction if the project helps students understand the same material.

Overview

As a class, students will conduct a service project to benefit the local native habitat.

Objective

Students will:

- Participate in a project to improve shrubland habitat.
- Analyze and creatively solve authentic public problems.
- Plan, collaborate, and take responsibility for project tasks.

Preparation

Review the *Project-based Learning Project Steps*. Identify your school's nearest natural area using online maps such as Google Earth. Refer to the *Community Resources* (p. 29) to locate an environmental group that works to protect your natural area for project assistance. Copy *Habitat Heroes* and assign for homework before starting this lesson.

Project Preparation

The preparation phase of the *Project-based Learning Project Steps* will guide you through this process. Depending on the resources and time available, projects could take place on school grounds, such as planting several native plants, or at a nearby natural area, perhaps removing trash or performing some other kind of clean-up in partnership with an environmental group doing habitat restoration. See *Habitat Heroes* for some examples of local student service projects.

Preparation begins with planting the seed, cultivating your students' interest in a local habitat-related project, and inspiring them to do something about it. This effort can involve use of students' observations from the Native Habitat Hunt, material learned in preceding activities or from a presentation by a local environmental organization.

Engaging students in the preparation process teaches them how to analyze and creatively solve problems. It enhances their decision-making skills and invests them as stakeholders in the project outcome.

Onsite your School	Offsite at Nearby Natural Area
Paint a mural of native plants.	Visit the site, if you haven't done so.
Make a video or slide show to share with the community.	Invite a naturalist guide to lead your class on a hike.
Write a news article for a local newspaper or the school newsletter.	Lead another class on a tour of the site.
Replace non-native school yard plants and add native plants.	Join a restoration effort with a nature provider, such as a Canyon Friends group.
Pick up trash along the school fence line.	Conduct a trash clean-up.
Remove weeds from your schoolyard.	Start a campus nature club.
Write letters to protect your nearby natural area.	Create a public relations campaign with press release, letter to the editors, public service announcement.
Create a field guide to use at the nearby natural area.	

Project Planning

Help the students construct a work plan using the *Project-based Learning Steps* as a guide. Student participation in the work plan process provides training in planning, collaborating, and taking responsibility. It will also deepen the students' sense of responsibility and commitment to the project. Be sure to emphasize the principles of collective responsibility and collaboration, which are critical to success of the project.

Project Implementation

The implementation phase involves a great deal of collaboration and sharing of responsibilities. It is important for students to document and reflect on their experiences throughout implementation. Documentation gives students practice in describing and summarizing various aspects of the project, and in thinking critically about what they are doing and why. They might keep journals, write articles, make a video or digital photo report, or connect their "in the field" learning to readings and other in-class activities. Refer to the *Project-based Learning Steps* for more details on implementation.

Project Reflection

Reflection provides a great opportunity to maximize student learning. Be sure to provide structured time for students to think, talk, and write about what they did and observed during the project. There are several types of reflection that are useful to engage your students in: Cognitive reflection examines the new knowledge and skills that students gain from their service experience. It includes the kind of learning that is addressed in the curriculum (math, science, writing, social studies, etc.). Affective reflection looks at what students feel as a result of their experience. Process reflection considers what students learn from the process itself. It includes things like how to work with others, and understanding the consequences of actions. By engaging the students in all these different kinds of reflection, you can optimize the learning part of the service-learning experience.

Potential Guiding Questions

- What did you do today that made you feel that you made a difference? Why?
- What needs does your project help fill?
- What expectations do you have about your service experience?
- How does your understanding of the shrubland habitat change as a result of your participation in this project?
- How can you continue your involvement with this environmental issue?
- How can you educate others or raise awareness about shrubland habitats?
- What are the most difficult and most satisfying parts of the service you are performing? Why?
- What do you think is your most valued contribution to the project?
- Is there a person or activity you find interesting or challenging in your project?
- How do you see your role with this project? How does that compare with how others may see your role?
- Have you learned from any disappointments or successes in your project?
- How is your service relevant to what you are learning in class?

Extension

Here are some ideas for reflection activities that can occur during and after the service part of a project:

Doing: Draw a picture, create a collage, or make a scrapbook.

Telling: Have informal discussions about the project issue; invite community partners and agencies to hear about the service completed; make a presentation to the PTA, other classes, the whole school, etc.

Writing: Write a personal journal; write a group journal or article for the school paper; write thank you notes to all who were involved in the project.

Student Reading

Habitat Heroes

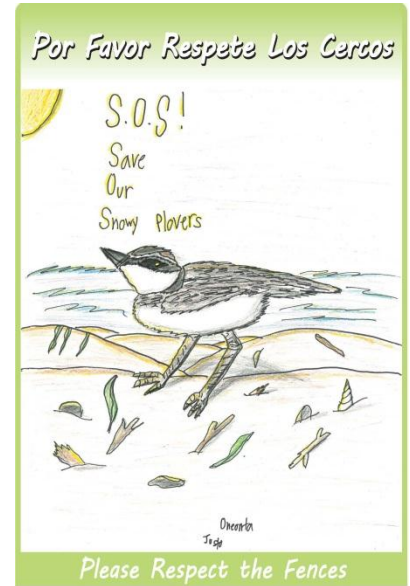
San Diego Audubon Society Installs Children's Art at South Bay Beaches to Protect Shorebirds

In an effort to conserve one of California's most endangered birds, the San Diego Audubon Society is using children's art to protect beach nesting sites for the Western Snowy Plover. Students from local schools designed signs to be placed near nesting sites cautioning beachgoers of the birds' presence.

Five winning designs were selected from Imperial Beach Elementary and Oneonta Elementary schools to be mass produced and installed at Tijuana Slough and Silver Strand State Beach.

The Western Snowy Plover is a small Pacific Coast shorebird that makes its nest in the sand between March and August. In recent decades, human activity on the beach has taken a tremendous toll on the bird. Vehicles crush nests, dogs chase adult birds away from eggs, and development removes more and more **habitat** each year.

Audubon California was inspired to create the program for local chapters after witnessing the success that the Morro Coast Audubon Society had when it placed signs made by local children around Snowy Plover nests in Morro Bay. Beachgoers tended to obey the kids' signs more than more official warnings. This project is the result of a local collaboration between the San Diego Audubon Society, California State Parks, and the US Fish and Wildlife Service, as well as participating South Bay schools.



Kids in Canyons



More than 60 ten-year-old students from Kimbrough Elementary got a fresh look at their own neighborhood on Monday, February 28th, when they spent the morning in San Diego's 32nd Street Canyon. Led by **naturalists** from Ocean Discovery Institute, students walked to the "nature classroom" from their school campus in South Park. This visit marked the first upstream field trip and kickoff of the new "Kids in Canyons" program developed in partnership with San Diego Canyonlands.

Students helped to restore the canyon by planting cuttings from a native plant called "mule fat" along the stream banks and sowing **native** deer grass seeds. This effort was their contribution to an ongoing restoration project in the canyon, led by the 32nd Street Canyon Friends Group.

Students explored the importance of **native habitat** to the many endangered and threatened **species** found in San Diego County. They found out that settlers used to tie their mules to the streamside vegetation, and the mules would eat it; thus the common name "mule fat" was born.

Ocean Discovery Institute hopes to bring kids from six different schools per year into their local neighborhood canyons. There they will learn that they live in a watershed and what that means, and how urban pollutants are carried by the rain from our yards and streets and through the canyons before reaching the coast where we love to swim, surf, and otherwise enjoy our aquatic environment. The hope is that the kids and their families will become part of their local canyon friends group and continue a legacy of nurturing the **wildlife** oasis that San Diego canyons have become.

Project Based-Learning Steps

Adapted from www.goodcharacter.com

PREPARATION	Identify Needs or Opportunities Hold a class brainstorming session to identify needs within the community or opportunities to do something beneficial for native habitat. Challenge the students to think of as many ideas as possible. Encourage them to build on each other's ideas, to be spontaneous, to take risks, to think creatively.		
	Workable Solutions What can realistically be done? Ask the students to tell what they like about each proposed idea, and to share their questions and concerns.		
	Available Solutions Some preliminary research may need to be done before a final decision is made. Identify resources available to help or support the project. This could include a community environmental organization, campus staff, or parent volunteers. Invite an individual with expertise in the area of interest in order to provide relevant information before a final decision is made.		
	Decide on the project When making the final decision, try to assure that all the students have adequate input, understand the proposed decision, and are willing to support and implement the decision.		
ACTION	Planning		
	<ul style="list-style-type: none"> ✓ Brainstorm a list of tasks. ✓ Organize tasks into a logical sequence. ✓ Determine the initial action steps to begin the work. ✓ Create a realistic timeline and set milestones for intermediate goals. 	<ul style="list-style-type: none"> ✓ Determine methods to track progress. ✓ Identify potential resources, people, or community organizations needed. ✓ Identify potential obstacles and ways address them. ✓ Define the roles of each student and group of students. ✓ Allow students to share the leadership of the project. 	<ul style="list-style-type: none"> ✓ Decide on a fair distribution of work among students. ✓ Discuss and agree how students will support and coordinate with each other's efforts to attain the common goals of the project (e.g. who will depend on whom to carry out the work?).
Implementation			
<ul style="list-style-type: none"> ✓ Students will document their experiences during implementation. ✓ Documentation could be in the form of journals, written articles, video or digital photo reports, or reflection on the connection between their "in the field" learning to other in-class activities. ✓ Hold periodic discussions to get feedback from the students and to discuss and solve problems. ✓ Ask the students how the work plan could be improved. This is an opportunity to share information, insights, make recommendations, and develop a continued work plan. 	<ul style="list-style-type: none"> ✓ Encourage students to voice concerns, speak their mind, and to challenge others in a mutually respectful environment where there are no negative consequences for differences of approach or opinion. ✓ Provide constructive feedback to encourage and motivate students through the process. ✓ Acknowledge the efforts of the students. Recognize both incremental progress on the part of one or more students and the major accomplishments of the class. ✓ Identify and agree on what actions to take next. 		
REFLECTION	Provide structured time for students to think, talk, and write about what they did and observed during the service activity. Reflection should be encouraged during the action phase as well as at the end of the project. Utilize guiding questions to facilitate student reflections. Guiding Questions: What? So what? Now what? <ul style="list-style-type: none"> • What? These are questions that ask, "What are we doing? What have we accomplished? What have we learned?" • So what? These questions ask, "What difference does/did it make? Why should we do it? How is it important? How do we feel about it?" • Now what? These questions ask, "What's next? Where do we go from here? What has this prepared us for?" 		

Vocabulary List

Adaptation: A physical or behavioral characteristic of a plant or animal that helps it survive in its natural environment.

Chaparral: The largest and most diverse plant community in San Diego County. Plants are composed of hard stemmed, leathery leaved shrubs.

Coastal Sage Scrub: Plant community named after the commonly-found coastal sagebrush. It is defined by waist-high shrubs on slopes or flats that receive much sunshine and little rainfall.

Conservation: The wise use or protection of natural resources.

Consumer: An organism that gets energy and matter by eating other organisms.

Decomposer: Bacteria and fungi that get energy from the matter in dead organisms and waste.

Ecosystem: A community of plants, animals, and their surroundings that depend on each other.

Energy: The capacity to do work or the source of power to do work.

Food chain: The path that energy takes from one organism to another in the form of food.

Habitat: The place where an organism lives and meets its needs.

Native: The plants, animals, and habitats that have existed in an area for thousands of years, before the arrival of Spanish settlers.

Naturalist: A person who studies or teaches about nature.

Non-Native Plants: Plants that did not originally grow in the geographic areas they now occupy.

Organism: A living thing, such as a plant, animal, or other life form that can grow and reproduce.

Predator: An animal that lives by killing and eating other animals.

Prey: An animal hunted or killed by another animal for food.

Producer: An organism that makes its own food.

Scat: Undigested foods and liquids that are not used by the body and are expelled.

Shrubland: A type of habitat that includes chaparral and coastal sage scrub plant communities.

Species: A living thing, such as a plant, animal, or other life form that can grow and reproduce.

Wildlife: Non-domesticated animals including but not limited to, insects, spiders, birds, reptiles, fish, amphibians, and mammals.

Background Reading

San Diego Native Habitats

These lessons are about the **chaparral** and **coastal sage scrub habitats** that are common in San Diego and all of southern California. Students are not expected to know the difference between them. And often the same natural area will have **coastal sage scrub** on a dry, south-facing slope, and **chaparral** on a north-facing slope.

What is chaparral?

Chaparral is California's most extensive **ecosystem** and can be found in every single county in the state. It is characterized by beautiful, woody shrubs like manzanita and ceanothus and is home to a wonderful array of animals. It is also where the now extinct California grizzly bear once roamed. **Chaparral** forms a dense cover of shrubs over many hills and mountains along the coast and on the slopes of inland valleys. Some old-growth **chaparral** stands can be more than fifteen feet tall.

Chaparral is a plant community made up of hard-stemmed leathery-leaved shrubs. Cacti may also be present. **Chaparral** is one of the most widespread vegetation communities in San Diego County comprising more than 630,000 acres. While there have been major losses of various forms of **Chaparral** to agriculture and urbanization, it still appears throughout the foothills and mountains on exposed slopes and ridges, often forming a mosaic with Oak woodlands and Pine forest.

What are some clues for chaparral habitat?

The most common **chaparral** subtypes are represented by several different **species** of Manzanita with smooth red bark, Scrub oak **species**, Chamise, and several **species** of Ceanothus which are sometimes referred to as wild lilac and have blue or white flowers. Common birds are the Spotted towhee, Wrentit, and Red-shouldered hawks. A number of reptiles also inhabit this community, including western fence lizard, San Diego horned lizard, gopher snakes, and the Pacific rattlesnake. Mammals include bats, deer mice, and pocket mice, Black-tailed jackrabbits, and Brush rabbits. Larger animals are the coyote, bobcat, Mule deer, and the occasional Mountain lion.

What is coastal sage scrub?

Coastal sage scrub consists predominantly of low-growing, aromatic, and generally soft-leaved shrubs. During spring, this community of plants gives the hills around the inland valleys their soft, gray-green color. During the summer drought, many of the shrubs lose their leaves entirely, but grow them again when the rain

returns in October or November. **Coastal sage scrub** was originally the dominant vegetation in San Diego County and once grew where there is now urban and agricultural development. Nearly 70% of its original area has been lost and much of what remains exists in small patches of isolated **habitat**.

What are some clues for coastal sage scrub habitat?

The dominant shrub **species** in this **habitat** community are California sage, Flat-topped buckwheat, Black sage, Laurel sumac, Bladderpod, and the San Diego sunflower. Many animals live in both the **chaparral** and **coastal sage scrub**.

Some birds and animals live only in the **coastal sage scrub**, including the California gnatcatcher (an endangered **species**) and the coast horned lizard.

What are non-native plants and animals?

Non-native plants and animals are called exotics, invasives, non-indigenous **species**, or aliens. These **non-native plants** and animals did not originally grow in the particular geographic area they now occupy. They may come from as far away as Asia or Europe, or as near as the next state. **Non-native plants** often have few natural controls such as the diseases and insect **predators** that affect them in their place of origin. This situation allows many exotics to grow out of control and crowd out **native species**, taking away space, available nutrients, and water. Some of these **non-native plants** and animals can overtake an entire **ecosystem**.

Plants and animals have been introduced into the environment on purpose and accidentally. Immigrants and tourists like to bring pets and plants from other countries, even though it is illegal. And sometimes animals, insects, and seeds are unknowingly brought on board ships, planes, trains, and trucks coming into San Diego. Many restoration projects are conducted in order to remove invasive plants and animals, such as Arundo, a giant weed that grows in creeks and chokes out the **native plants**.

Not all **non-native plants** are troublesome; some are very useful, such as wheat. Wheat was first brought to North America by Europeans in the early 17th century; it now thrives all over the world. It has fed and employed billions of people over many centuries and has contributed to the world's agricultural productivity. Many of our food crops are grown from plants that originally grew in other places, such as corn from Mexico.

Background Reading

Mediterranean Climate and Adaptations

The special combination of hot, dry summers and mild, wet winters is a type of climate called Mediterranean. Rain in the **chaparral** and **coastal sage scrub** almost always falls in late autumn and winter, rarely in the summer. This is unusual because most **habitats** in the world receive a lot of rain during the summer months. There are only five places on earth that have a Mediterranean climate: California, central Chile in South America, parts of southern Australia, South Africa, and the countries around the Mediterranean Sea.

The average rainfall in San Diego is 11 inches, measured at Lindbergh Field (the San Diego airport). The mountains get twice as much rain; the desert gets about 3 inches of rain. The warmest month is August, with an average high temperature of 78 degrees and an average low of 67 in downtown San Diego. The coldest month is January, with an average high temperature of 65 degrees and an average low of 48 degrees.

How do plants adapt to the Mediterranean climate?

To survive this type of climate, many shrubs have small, tough leaves with waxy coatings to prevent water loss. Nearly all **chaparral** shrubs are evergreen, meaning they keep most of their leaves all year. However, in the dry months of summer and autumn, some shrubs, like Ceanothus or black sage, drop nearly half their leaves. Fewer leaves mean less water will be lost through evaporation.

By mid-winter, after the first few rain storms have soaked the ground, **chaparral** and **coastal sage scrub** plants will begin to sprout new leaves. This is “springtime” for plants in this climate. As early as December, shrubs like manzanita will start blooming. Imagine, flowers in the winter! But this is how the **chaparral** has adapted to the Mediterranean-type climate in which it thrives.

How do native habitats respond to wildfires?

In the summer and autumn heat, **chaparral** and **coastal sage scrub** burn quickly if they catch fire, because the plants are so dry. In Southern California, strong Santa Ana winds from the desert are responsible for spreading the largest fires. Such large fires are natural and the **chaparral** can recover as long as fires are not too frequent. In the past, before humans came to California, the **shrublands** burned probably once every 50 to 100 years. Now, with so many fires caused by people, some areas are burning every ten years or less. With more frequent fires, the

chaparral does not have time to recover and is usually replaced by **non-native** weeds and grasses.

If given enough time, however, **chaparral** plants can deal with fire in special ways. Some shrubs send up tiny green shoots from their root collars a few days after the fire is out. Within a month or two, these re-sprouting shrubs decorate the burned landscape with little green bundles of leaves.

Other shrubs are completely burned up by fire, but live on through the thousands of seeds they have produced over the years. These seeds can hide in the soil for a century or more. They only become seedlings after their seeds have been cracked open by heat or are exposed to chemicals found in smoke and charred wood. Some shrubs can both re-sprout and produce seedlings after a fire.

There are also many annual wildflowers that appear after a fire. The seeds of these plants were produced after the last blaze and remain dormant until fire awakens them again. Then, during the first spring after a fire, burned **chaparral** hillsides are often covered with thousands of beautiful wildflowers like orange poppies, white snapdragons, and purple lupines. Sometimes these wildflowers will return a second year, but will then disappear until after the next blaze.

Within a few years after a fire, re-sprouting plants and shrub seedlings start to take over again. In 15-20 years, the **chaparral** is able to cloak the land with its green, soft velvet cover.



Figure 14: Chamise resprouting after a fire.

Background Reading

San Diego History

How did native people live with the native habitats?

Humans arrived in San Diego between 10,000 and 30,000 years ago and settled along our coast. California was much colder then, with wetlands and lakes covering areas that are now dry. There were large animals that don't even exist today such as mammoths, giant sloths, and mastodons. Slowly, over many years, the climate got warmer and drier. The lakes dried up and the largest animals became extinct. Early people arrived and adapted to San Diego's environment. One group, the Kumeyaay, lived along San Diego's coast, from an area now called Mission Valley, down to Ensenada in Baja, California.

Native people lived in balance with nature and took care of the land to make sure there were plenty of animals, fish, and plants to feed everyone. They breathed pure air and slept in deep silence under dark skies. Rivers flowed freely all the way to the ocean and were filled with trout and bass. Trees and **chaparral** sheltered many animals such as deer, grizzly bears, and mountain lions. Thousands of birds sang, ate, and lived among the shrubs and trees. Snakes fed on the field mice as did the hawks soaring above. The Native people learned how to work with the land to encourage the growth of local plants that they used for food, medicine, and domestic items like baskets.

What animals and plants did the Spanish and settlers bring?

When the Spanish arrived in the mid 1500s to build a mission in San Diego, they also brought new plants and animals to the region. The Spanish brought seeds to grow wheat, oats, citrus fruits, mustard, and pepper. Animals such as horses, cattle, and sheep also joined as well. These grazing animals roamed the mission lands, eating and trampling the wild **native plants**. The seeds of new crops quickly spread outside the garden areas and started to compete with the **native plants**.

As San Diego started to develop, the Spanish offered free land to encourage skilled settlers like farmers, miners, and traders to move into the area. The new settlers built their homes in Old Town and other villages. In 1821, California won independence from Spain and became part of Mexico. Large ranchos, used to raise herds of cattle for leather and tallow for candles, spread across San Diego. Acres of **chaparral** and **coastal sage scrub** were destroyed by the numerous free-range cattle. Years later, San Diego had a great drought that ended the local cattle industry.

To find water, ranchers had to drive their cattle further south into Baja California or up into the mountains.

What changes happened to native habitats when cities grew?

During the 1880s and 1890s, San Diego became a city with a developing downtown that included hotels, theaters, the wharf, and new landscaping. Dams were constructed along the San Diego and Sweetwater rivers to provide water for the growing city. Plans were made to plant 100 **non-native** trees per year in what would become Balboa Park, and to provide 300 more trees each year for planting in the city. **Coastal sage scrub** and **chaparral** plants were quickly replaced in these rapidly developing areas.

The 1900s brought even more modern changes to the **ecosystem**. Museums, bridges, gardens, and a zoo were constructed in Balboa Park, which had once been covered with **coastal sage scrub**. And today, about three million people live in San Diego County, more than 100 times the number of Native people that lived here before Father Serra arrived.

With more and more people coming to San Diego, acres of **chaparral** and **coastal sage scrub** were replaced by large housing projects on the mesas. Buildings, subdivisions, and parking lots replaced more of the **chaparral**. Wide roads and freeways now cut through the middle of **habitats**, restricting movements of plants and animals. Outside the landscaped yards, the **native** shrubs and wildflowers are being replaced by Eucalyptus and pepper trees, mustard, oats, and pampas grasses. All of these alterations to the environment have resulted in removal of critical **habitat** for the remaining **native** birds, mammals, reptiles, and fish trying to survive in their changing world.



Figure 15: Mustard, a common invasive plant found in San Diego.

Tips for Teaching Outdoors

Source: Schoolyard Habitats® National Wildlife Federation www.nwf.org/schoolyard

The schoolyard or nearby nature can be a valuable extension of the indoor classroom, but some educators may initially feel uneasy about the absence of the four walls and chalkboard when they bring their classes outside. Keep the following suggestions in mind to ensure successful, worthwhile lessons and experiences with students in the outdoor site:

Set clear expectations for student behavior before going outdoors.

Set rules for positive outdoor behavior prior to your first outdoor venture with students. Students need to understand that “outside” is a classroom too. Involve the students in the rule-setting, just as you may already do when setting indoor rules.

Plan

Nearby nature can be a place for quiet contemplation, active play, intense observation, questioning, independent work, group projects, hard work, and relaxation. Before taking students outside, it is important to decide which type of experience(s) you want to provide on a given day. Be sure to communicate this to students indoors: discuss where the class will be working, how long they will be outside, what they will be expected to do, etc. before walking outside. Providing the background or first steps of an activity while in the classroom may help students unaccustomed to working outdoors to focus. The time indoors needed to prepare students for a successful schoolyard or nearby nature field trip will decrease quickly over time; providing this structure, with a short “pre-lesson” beforehand will be especially important before the first few outdoor lessons.

Keep the first experiences simple

Keep plans simple the first few times you teach outdoors. Don't worry if you do not finish all that you have planned. Both you and your students need time to adjust to this new classroom environment.

Recruit teachers, parents and/or volunteers to help

While not always possible or necessary, having an extra adult or two with you when teaching outdoors can be very helpful. Consider working with another teacher and taking both classes out together.

Visit your lesson site

Become comfortable with the site you will be teaching in prior to taking your students outside. Where can the whole group gather? Where can small groups work together? Are there areas that illustrate concepts you plan to teach? What are the benefits and challenges of the site? Many changes occur as the seasons change,

so remember to visit close to the time you will be using the site. Find shade areas for students to rest on warm days.

Decide on a way of getting students' attention outdoors

Have a clear signal for getting everyone's attention and gathering together. Practice it! Keep the sun in your eyes (out of students' eyes), the wind at your back (so your voice carries to your students), and stand in the center of a circle or line of students when sharing (so all can see).

Be a positive role model

Show enthusiasm, excitement and a positive attitude in all that you do. Make sure your students can hear this in your tone of voice and can see it in your body language. Create a sense of adventure or mystery. Enjoy what your students find; look at what they are showing you and share these discoveries with the whole group.



Figure 16: Child exploring scrub oak during the outdoor explore program.

Allow students the opportunity to explore their surroundings

To be safe, comfortable and excited about learning in the outdoors, students need time to explore the areas in which they will be learning. Many of today's children do not have the opportunity to explore outdoor areas and need the opportunity to adjust. Emphasize observation. By using all of their senses, students can learn more about the things they investigate.

Learn to use “teachable moments”

Nature's lessons will often be more compelling than the task at hand. Be flexible and remember that in the natural world everything is connected to everything else. Let the students experience nature in the moment and then link that moment back to your lesson.

Additional Resources

Design lessons that flow

Design your lesson so that activities transition your students from idea to idea and indoor to outdoor behavioral expectations. Identify an introductory activity to excite your students and acclimate them to the outdoors. Develop a list of fun strategies for moving your students from place to place, and use a closing activity to review what students have learned and to prepare them for returning indoors.

Become a “guide”, “explorer” and “learner.”

You do not/should not/could not know everything about nature! Don't let a lack of knowledge slow you down. Create an atmosphere of investigation and share your excitement about learning new things. If you are excited about learning then your students will be excited as well! Telling a student “I don't know, but let's look it up!” is a great way to encourage students to guide their own learning.

Ask guiding questions

Avoid giving direct answers to student questions. Help students discover the answers on their own. If a student wants to know the name of something, ask him or her questions such as “How large is it?” “Where does it live?” or “How do you think it avoids predators?” Engage all students during all activities

Students that are actively engaged in a lesson are less likely to have behavior issues. Give each child a role or task for each activity. For example, if your students are observing pollinators, have them work in small groups and have students in each group take on the following roles: observer, writer, artist, and identifier (uses field guides).

Use backpacks to manage supplies

Create an educator backpack for outdoor lessons. Include props or games that can be used in activities and to keep students focused. Also include a first aid kit, extra pencils, paper, gloves, hand lenses, rulers, a tape measure, field guides, viewing boxes, plastic bags, and anything else you think your students might use when outside.

Students can carry their own set of supplies in their backpacks. Backpacks allow students to keep their hands free for safer walking and participation in activities, and eliminate the chore of keeping track of loose items. Backpacks also allow students to take water bottles, layers of clothing, and anything else they might need to make their outdoor experience a pleasant one. Encourage students to take water bottles with them if they are going to be outside for more than 20-30 minutes at a time. Light snacks are also a good idea if your students are going to be outside for a long time, hiking or engaging in physical activities such as running games, building bird boxes or gardening.

Safety Considerations

- Be aware of any allergies, medications, and special precautions necessary for the safe involvement of all students.
- If participants explore an area by turning over rocks or logs, make sure they do so carefully. In areas where poisonous snakes may live, students and leaders should always turn rocks and logs over toward themselves, grasping the edge of the rock or log furthest from them. That way any alarmed creatures can escape in the opposite direction. Return rocks or logs to their previous positions when you are finished looking.
- When bees or wasps approach, encourage calmness and little movement. Usually, when bees and wasps find out that the sweet-smelling person they landed on is not a flower, they will move on. When people swat at them, on the other hand, they may attack.
- Encourage long pants and closed-toe shoes if exploring narrow trails.
- If poison oak grows in your area, teach students to recognize, identify and avoid contact with these plants.



Figure 17: California poppy, the state flower.

Additional Resources

Species ID List

Common species found in shrubland habitats. The bolded species are utilized in the *Species ID Cards*. Use this list for further research or to make additional ID cards.

Plants

1. Black Sage (*Salvia mellifera*)
2. **California Buckwheat (*Eriogonum fasciculatum*)**
3. California Poppy (*Eschscholzia californica*)
4. **California Sagebrush (*Artemisia californica*)**
5. California Sunflower (*Encelia californica*)
6. **Chamise (*Adenostoma fasciculatum*)**
7. Chaparral Broom (*Baccharis pilularis*) or Broom Baccharis (*Baccharis sarothroides*)
8. Coast Prickly Pear (*Opuntia littoralis*)
9. Laurel Sumac (*Malosma laurina*)
10. Lemonadeberry (*Rhus intergifolia*)
11. **Mission Manzanita (*Xylococcus bicolor*)**
12. Mule-Fat (*Baccharis salicifolia*)
13. Poison Oak (*Toxicodendron diversilobum*)
14. Ramona Lilac (*Ceanothus tomentosus*)
15. **Scrub Oak (*Quercus dumosa*)**
16. **Toyon (*Heteromeles arbutifolia*)**
17. Wild Mustard (*Brassica tournefortii*) NN

Mammals

18. Bat (*Myotis*)
19. **Big-eared Woodrat (*Neotoma macrotis*)**
20. **Bobcat (*Lynx rufus*)**
21. Botta's Pocket Gopher (*Thomomys bottae*)
22. **Brush Rabbit (*Sylvilagus bachmani*)**
23. California Ground Squirrel (*Spermophilus beecheyi*)
24. California Mouse (*Peromyscus californicus*)
25. **Coyote (*Canis latrans*)**
26. Grey Fox (*Urocyon cinereoargenteus*)
27. **Mountain lion (*Puma concolor*)**
28. **Mule deer (*Odocoileus hemionus*)**
29. Raccoon (*Procyon lotor*)

Invertebrates

30. Black and Yellow Orb weaver (*Argiope aurantia*)
31. Butterfly painted lady (*Vanessa cardui*)
32. **California harvester ant (*Pogonomyrmex californicus*)**
33. Ceanothus silk moth (*Hyalophora euryalus*)
34. Common millipede (*Tylobolus*)
35. Common pill bug (*Armadillidium*)
36. Convergent Lady Beetle (*Hippodamia convergens*)
37. Harlequin bug (*Murgantia histrionica*)
38. Orb weaver spider (*Argiope sp.*)
39. **Spittlebug (*Aphrophora sp.*)**
40. Tarantula (*Aphonopelma*)
41. Tarantula Hawk wasp (*Pepsis sp.*)
42. Trap door spider (*Bothriocyrtum californicum*)

Amphibians and Reptiles

43. **Gopher snake (*Pituophis catenifer*)**
44. **Red diamond rattlesnake (*Crotalus exsul*)**
45. Southern alligator lizard (*Elgaria multicarinata*)
46. **Spadefoot toad (*Scaphiopus couchii*)**
47. **Western fence lizard (*Sceloporus occidentalis*)**
48. Western rattlesnake (*Crotalus viridis*)

Birds

49. American Crow (*Corvus brachyrhynchos*) NN
50. American Kestrel (*Falco sparverius*)
51. Anna's Hummingbird (*Calypte anna*)
52. **Bushtit (*Psaltriparus minimus*)**
53. California Gnatcatcher (*Polioptila californica*) (Federal threatened species)
54. California Quail (*Callipepla californica*)
55. California Thrasher (*Toxostoma redivivum*)
56. California Towhee (*Pipilo crissalis*)
57. **Great Horned Owl (*Bubo virginianus*)**
58. **Greater Roadrunner (*Geococcyx californianus*)**
59. Lesser Goldfinch (*Carduelis psaltria*)
60. Mourning Dove (*Zenaidura macroura*)
61. Red-shouldered Hawk (*Buteo lineatus*)
62. Red-tailed Hawk (*Buteo jamaicensis*)
63. **Western Scrub Jay (*Aphelocoma californica*)**
64. Wrentit (*Chamaea fasciata*)

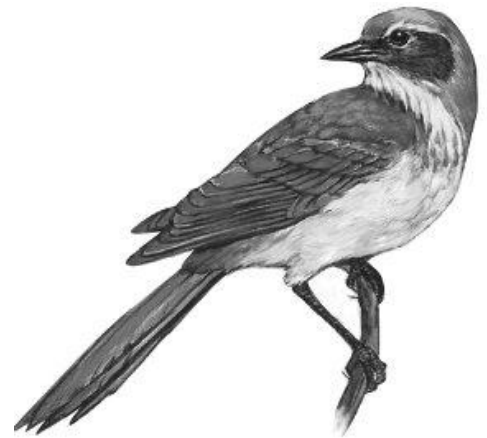


Figure 18: Perched Scrub jay.

Alignment

4th Grade California Content Standards

The following California content standards are addressed in this curriculum.

Science

Life Sciences (LS)

2. All organisms need energy and matter to live and grow. As a basis for understanding this concept:
 - a. Students know plants are the primary source of matter and energy entering most food chains.
 - b. Students know producers and consumers (herbivores, carnivores, omnivores, and decomposers) are related in food chains and food webs and may compete with each other for resources in an ecosystem.
 - c. Students know decomposers including many fungi, insects, and microorganisms, recycle matter from dead plants and animals.
3. Living organisms depend on one another and on their environment for survival. As a basis for understanding this concept:
 - a. Students know ecosystems can be characterized by their living and nonliving components.
 - b. Students know that in any particular environment, some kinds of plants and animals survive well, some survive less well, and some cannot survive at all.
 - c. Students know many plants depend on animals for pollination and seed dispersal, and animals depend on plants for food and shelter.

Investigation and Experimentation (IE)

6. Scientific progress is made by asking meaningful questions and conducting careful investigations. As a basis for understanding this concept and addressing the content in the other three strands, students should develop their own questions and perform investigations. Students will:
 - a. Differentiate observation from inference and know scientists' explanations come partly from what they observe and partly from how they interpret observations.
 - c. Formulate and justify predictions based on cause-and-effect relationships.
 - d. Conduct multiple trials to test a prediction and draw conclusions about the relationships between predictions and results
 - f. Follow a set of written instructions for a scientific investigation.

English Language Arts (ELA)

Reading (R)

- 2.1 Identify structural patterns found in informational text (e.g., compare and contrast, cause and effect, sequential or chronological order, proposition and support) to strengthen comprehension.
- 2.2 Use appropriate strategies when reading for different purposes (e.g., full comprehension, location of information, personal enjoyment).
- 2.4 Evaluate new information and hypotheses by testing them against known information and ideas.
- 2.5 Compare and contrast information on the same topic after reading several passages or articles.
- 2.6 Distinguish between cause and effect and between fact and opinion in expository text.

Listening and Speaking (LS)

- 1.1 Ask thoughtful questions and respond to relevant questions with appropriate elaboration in oral settings.
- 2.4 Recite brief poems (i.e., two or three stanzas), soliloquies, or dramatic dialogues, using clear diction, tempo, volume, and phrasing.

Writing (W)

- 2.1 Write narratives:
 - c. Use concrete sensory details.
- 2.3 Write information reports:
 - b. Include facts and details for focus.
 - c. Draw from more than one source of information (e.g., speakers, books, newspapers, other media sources).

Additional Resources

Community Resources

Habitat Information

Conservation International, Biodiversity Hot Spots
www.biodiversityhotspots.org

The California Chaparral Institute
www.californiachaparral.com

San Diego Natural History Museum Online Field Guide
www.sdnhm.org/fieldguide/index.html

San Diego Wildfires Education Project
interwork.sdsu.edu/fire/index.htm

Schoolyard Gardens

California Native Plant Society
www.cnpsd.org/schoolyard.html

National Wildlife Federation:
Garden for Wildlife
www.nwf.org/Get-Outside/Outdoor-Activities/Garden-for-Wildlife/Schoolyard-Habitats/Create.aspx

Eco-Schools
www.nwf.org/Global-Warming/School-Solutions/Eco-Schools-USA.aspx

Schoolyard Habitats® National Wildlife Federation
www.nwf.org/schoolyard

San Diego Master Gardeners
www.mastergardenerssandiego.org/schools

US Fish and Wildlife Service, Schoolyard Habitat Program
www.fws.gov/cno/conservation/schoolyard.cfm

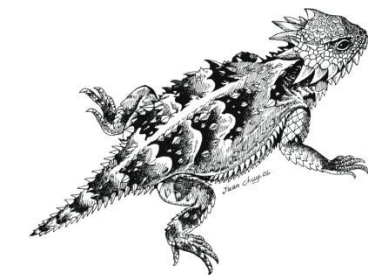


Figure 19: Coast horned lizard.

Nature Resources

Cabrillo National Monument
(619) 557-5450
www.nps.gov/cabr

Local Point of View Tours
Naturalist Guide Network
(619) 537-9286
localpointofview.com

Mission Trails Regional Park
One Father Junipero Serra Tr.
San Diego, CA 92119
(619) 668-3281
www.mtrp.org

San Diego Natural History Museum
PROBEA Project
1788 El Prado
San Diego, CA 92101
(619) 255-0184
www.sdnhm.org/education/binational/index.php

San Diego Audubon Society
(858) 273-7800
www.sandiegoaudubon.org

San Diego Canyonlands
(619) 284-9399
www.sandiegocanyonlands.org

San Diego Children and Nature Collaborative
www.sdchildrenandnature.org

San Diego City Parks and Open Space
www.sandiego.gov/park-and-recreation

San Diego County Office of Education Outdoor School
www.sdcoe.net/outdoored

San Diego County Parks
www.co.san-diego.ca.us/parks

Student Shrubland Quiz

___1. Which of the following represents an example of a biotic component of the environment?

- A) Temperature
- B) Water
- C) Phosphorous
- D) Decomposers

___2. Which of the following are producers?

- A) Termites
- B) Bacteria
- C) Plants
- D) Grasshoppers

___3. Which of the following is an adaptation to shrublands?

- A) Plants having very large leaves.
- B) Plants having leaves that directly face the sun.
- C) Plants having leaves that have a greyish color.
- D) Animals that require a lot of water to survive.

___4. Which of the following correctly represents a food chain in shrublands?

- A) ceanothus seeds → deer mouse → red-tailed hawk → bacteria
- B) bacteria → deer mouse → red-tailed hawk → ceanothus seeds
- C) deer mouse → bacteria → red-tailed hawk → ceanothus seeds
- D) deer mouse → red-tailed hawk → bacteria → ceanothus seeds

___5. What conditions must shrubland plants and animals be adapted to?

- A) Wildfire
- B) Little water
- C) Wind
- D) All of the above