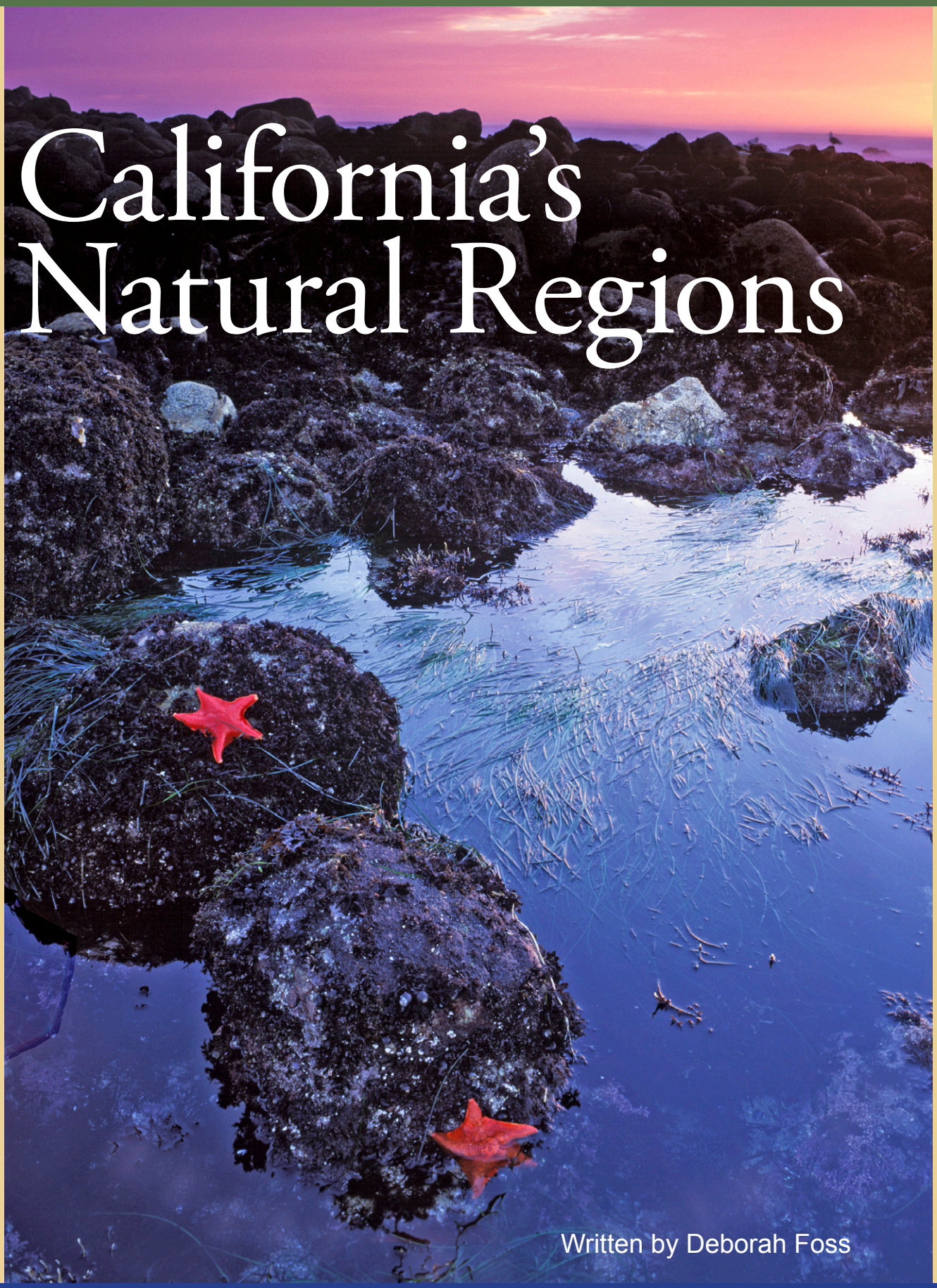
California Connections

California's Natural Regions



Written by Deborah Foss

California Education and the Environment Initiative

History-Social Science Standards 3.1.1. and 3.1.2. | History-Social Science Standard 3.2.2. | Science Standard 3.3.a.
History-Social Science Standards 4.1.3. and 4.1.5. | History-Social Science Standard 4.2.1.

California Education and the Environment Initiative

Approved by the California State Board of Education, 2010

The Education and the Environment Curriculum is a cooperative endeavor of the following entities:

California Environmental Protection Agency

California Natural Resources Agency

Office of the Secretary of Education

California State Board of Education

California Department of Education

California Integrated Waste Management Board

Key Leadership for the Education and Environment Initiative:

Linda Adams, Secretary, California Environmental Protection Agency

Patty Zwarts, Deputy Secretary for Policy and Legislation, California Environmental Protection Agency

Andrea Lewis, Assistant Secretary for Education and Quality Programs, California Environmental Protection Agency

Mark Leary, Executive Director, California Integrated Waste Management Board

Mindy Fox, Director, Office of Education and the Environment, California Integrated Waste Management Board

Key Partners:

Special thanks to **Heal the Bay,** sponsor of the EEI law, for their partnership and participation in reviewing portions of the EEI curriculum.

Valuable assistance with maps, photos, videos and design was provided by the **National Geographic Society** under a contract with the State of California.

Office of Education and the Environment

1001 I Street • Sacramento, California 95812 • (916) 341-6769

http://www.calepa.ca.gov/Education/EEI/

© Copyright 2010 by the State of California

All rights reserved.

This publication, or parts thereof, may not be used or reproduced without permission from the Office of Education and the Environment.

These materials may be reproduced by teachers for educational purposes.

California's Natural Regions

Contents

Introduction 1

Alpine Meadow 2

Mixed Evergreen and Conifer Forest 6

North Coastal Forest (Redwood) 10

Oak Woodland 14

Scrubland and Chaparral 18

Sagebrush Scrub and Pinyon-Juniper Woodland 22

Grasslands 26

High Desert 30

Low Desert 34

Rivers and Lakes 38

Ocean and Coast 42

Introduction

Pronghorn antelope

Millions of years ago, earthquakes and volcanoes pushed high mountain peaks to the sky. As the mountains rose, the land between them sank. High valleys and low deserts stretched out in the east. In the west, the land we now call California reached its end at the ocean.

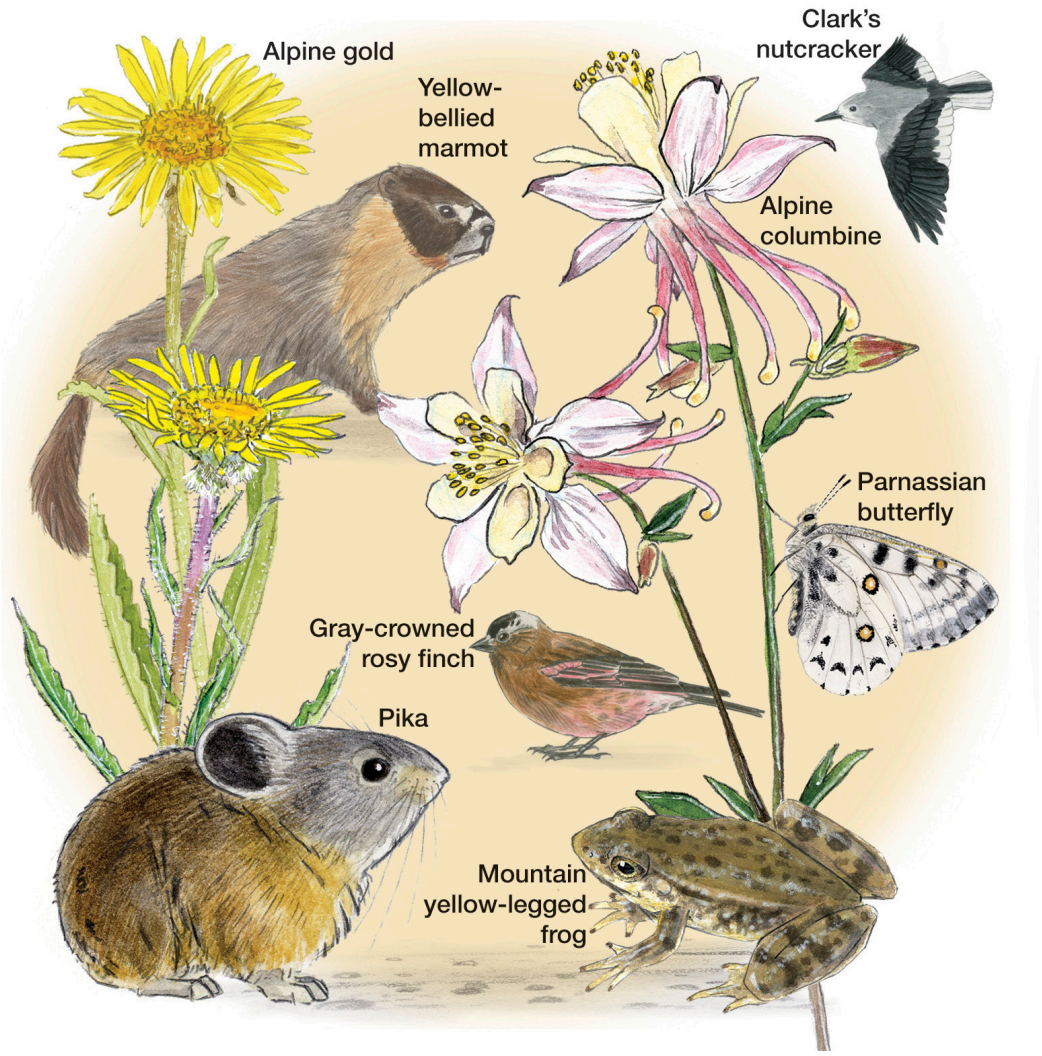
California lands include deserts, mountains, valleys, and coasts. Summers were warm and winters were mild and wet. There was plenty of water to drink and for growing food. Trees provided shade and wood for building things. Humans have used these gifts from the land, coasts, and ocean for thousands of years. We still use its forests, water, and minerals.

Today, California has more kinds of plants and wildlife than any other state. In fact, many of these living things are only found here. We depend on these plants and animals. These rich resources are found in many different places. We call these places ***California's Natural Regions***.

With the help of your teacher, you will visit these natural regions. You will read about the tallest trees in the world and some very special wildflowers. You will discover that some plants cannot grow without the heat of fire. You will learn that others can only live in constant rain and fog. You will get to know the tiny pupfish and the big black bear. You will read about the loud pinyon jay and the quiet kit fox. From the mountains to the sea, our state is rich with different kinds of living things. Enjoy reading and learning about this land called California.

Tarantula

Alpine Meadow



High in the Mountains

The mountain peaks seem to touch the Sun. The sky is the deepest blue. The air is clear and the nights are cold. More snow falls here than rain. Plants and animals have changed to live high in the mountains. This special place is called the alpine region.

The alpine region is found on the highest mountains on Earth. It is found between 9,500 and 11,000 feet in California. Trees cannot grow at these high altitudes. The growing season is too short. There is little water. Strong winds blow away most of the soil. Wildflowers hug the ground in tiny mounds. Alpine plants are beautiful, but fragile.

A Rocky Start

The mountains were formed millions of years ago. Earthquakes shook the land. The land rose and fell. It tore into

steep granite cliffs and peaks. It split into deep canyons. During many ice ages, glaciers moved slowly over the land. They hollowed out basins in the solid rock.

The climate changed over time. Glaciers began to melt. They left clear alpine lakes in the basins they had carved. As the climate warmed, these lakes began to shrink. They left rich soil around their edges. Eventually, lush alpine meadows replaced the lakes.

Today, alpine meadows have very cold, windy winters. Most get snow instead of rain. The summers are dry and cool. In spring, soil dries out faster at the upper end of each meadow. This soil is thin and sandy. As the Sun warms the soil, wildflowers bloom. Phloxes, paintbrushes, lupines, and elephant's heads all grow in the dry part of the meadow. So do many sunflowers.

Another flower that blooms in the meadow is the scarlet gilia. In the spring, the gilia's flowers are bright red. Hummingbirds like red flowers. They pollinate this plant. Late in the summer the gilia's flowers are white. The white flowers attract the sphinx moth, a different pollinator.

Water runs downhill when the snow melts. It makes pools in the lower part of the meadow. The wet part of the meadow is the last to dry out. Many kinds of grasses grow there in the spring. These plants spread by sending out long roots called rhizomes. Rhizomes combine with fertile black soil to make a mat called sod.

Sometimes the meadow does not dry before the ground freezes again. Ice forms underground. This pushes the ground up into large bumps called hummocks. The frozen ground pulls up the roots of the meadow grass. The roots are exposed to snow and wind. Some of the roots and the soil blow away. Some of them stay in the meadow. They form rich organic material called peat. Peat enriches the soil of the meadow.

Alpine meadow habitat

Lupine and California poppies

Melted snow runs off the mountains in spring. The water runs through the meadow. It goes into small creeks and streams. Some streams flow into lakes. Some streams join into rivers. People take water from the lakes and rivers. They use this water in many places. Most of California's drinking water comes from melted snow.

California corn lilies are common in the wetter parts of the alpine meadow. They have a large, wide leaf. The corn lily is one of the first plants to poke through the snow after a long winter. It melts snow by using oxygen to raise its temperature. Deer will not eat this plant. It is poisonous. The poison protects the plant. This allows corn lilies to spread throughout the meadow.

There are many interesting life forms in the alpine meadow ecosystem. Tiny microorganisms called snow algae are food for tiny protozoa and nematode worms. Insects like ants, springtails, and ladybird beetles are food for alpine spiders. Birds feed on insects and seeds from plants. They spread these seeds when they fly from place to place. Plants and animals depend on each other for survival.

Coping with the Elements

The Sun's light in the mountains is very intense. Some of the Sun's rays can be dangerous. Insects and spiders that live in alpine meadows have changed so they can live in this very bright sunlight. They have adapted to their environment. These animals have a thick layer of wax on their legs and bodies. The wax acts like a natural sunscreen.

Some insects that live in alpine meadows stay warm throughout winter. They make natural antifreeze in their bodies. This is like the antifreeze used in a car. It keeps the car running in the winter. It keeps these tiny insects running too!

Mammals that live in alpine meadows must also adapt to the harsh winters. They have different ways of staying alive. Some animals hibernate (sleep) through the winter. Some move to a lower elevation. A few stay in and around their homes through the cold winter months.

Bighorn sheep graze in the alpine meadows during the summer. They move to lower slopes in the winter. The

Sun shines longer each day on slopes that face south. The sheep can find enough grass to eat there.

Voles, yellow-eared pocket mice, alpine chipmunks, and squirrels sleep (hibernate) through the winter. Belding's ground squirrel lives in the dry parts of alpine meadows. It digs tunnels, called burrows, under the ground. This little squirrel gets fat eating seeds and insects. It doubles its weight in the summer months. In late August, it goes underground. It sleeps for eight months. In spring, the Sun melts the snow from the top of the burrow. Then, it wakes up and starts eating again!

A pika looks like its cousin the rabbit, but it has small ears. This little mammal collects grass from the alpine meadows for food. It also eats lichen, which it scrapes off rocks. The pika does not hibernate like a squirrel. Instead, it stays in the rocks all winter. Its high body temperature helps keep the pika warm.

Belding's ground squirrel

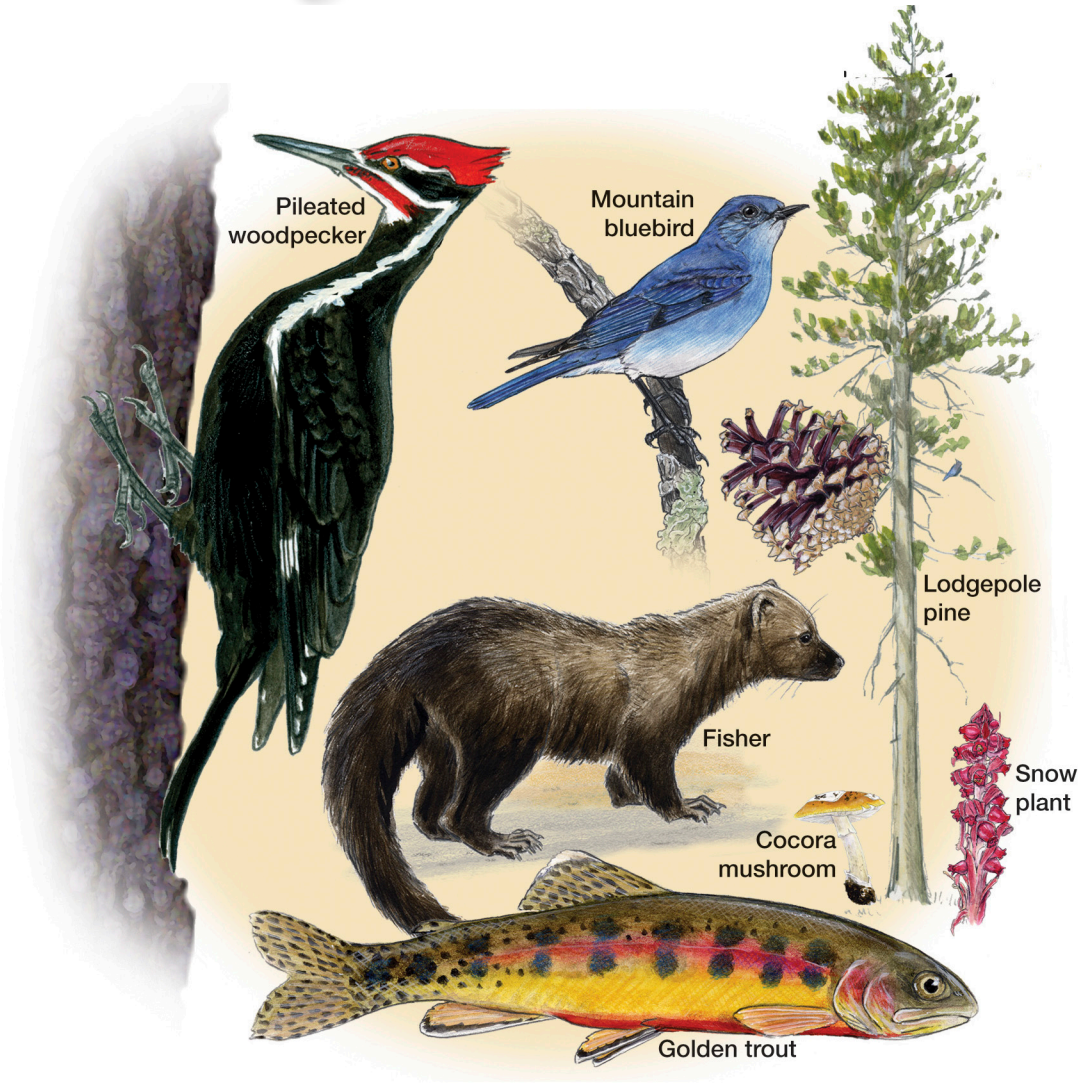
California corn lily

People and the Alpine Region

In many places in the world, people live in alpine regions. They graze their sheep and cattle there. People also collect sod and peat to enrich their rocky soils. Some people even use peat fuel for cooking and for heating their homes.

California ranchers graze cattle and sheep in high alpine meadows when it is hot in the valleys below. Some people pack into the mountains with mules and horses. The animals eat the alpine grasses while the people camp in the high meadows.

Mixed Evergreen and Conifer Forest



A Mix of Pines and Oaks

The red-tailed hawk flies high above the mountains of the Sierra Nevada. It looks down on ridges, valleys, and meadows. There are trees everywhere—as far as the hawk can see. From an airplane, the forest looks like a green blanket. There are many kinds of trees in the forest.

There are white firs, Douglas firs, ponderosa pines, sugar pines, and incense cedars. These are all evergreen trees. Evergreen trees do not lose their leaves in the fall. They always look green. New leaves or needles are always growing. They take the place of old needles as they fall.

Evergreen trees are also called conifers. Conifers have cones that hold seeds. Cones come in different shapes and sizes. Some are big and long. Some are small and round. Conifer leaves are usually needles. Cedar trees do not have

needles. They have flat, scaly leaves instead.

California black oaks are also part of the mixed forest. Unlike evergreens, they lose their leaves in the fall. All winter, their branches are bare. In the spring, small buds form. These buds become leaves when the weather warms. Black oaks are called deciduous trees.

Conifers and black oaks need around 15–40 inches of rain a year to live. Most of this water falls as snow. There is little rain in the summer. Instead, trees must live on water stored in the ground. This water comes from melted snow.

Wildlife of the Forest

Animals that live in the mixed conifer forest are active in the summer. When winter comes, many animals move to the low foothills. Others stay and store food for the winter. Still others, like the black bear, sleep on and off through the winter.

Most birds fly south for the winter. Some birds stay in the forest. Steller's jays collect acorns and pine seeds all summer. They store enough to last through the snowy months. Dark-eyed juncos fly below the snow line in the winter. Juncos have a special way of keeping other animals away from their nests. If another animal comes close by, the junco moves away from the nest and pretends to have a broken wing. The other animal moves toward the junco, thinking the junco will be easy to catch, and the junco's nest and young are safe.

California black oaks grow from 30–120 feet high. Sometimes they grow in groups of four or five trees. Black oaks have large leaves and large acorns. These oaks are very important to wildlife. Black oaks shade the ground under their big canopy. The ground under this shade is moist for plants, fungi, and

Mixed evergreen and conifer forest habitat

Steller's jay

salamanders to live. Owls, woodpeckers, and tree squirrels use holes in their trunks as dens.

Deer, woodpeckers, Steller's jays, and mountain quail have something in common. They all eat black oak acorns. Squirrels bury acorns in summer and fall. They dig little holes around the trees and fill the holes with acorns. When winter comes, they dig through the snow to find their food.

A Forest of Tall Trees

Incense cedars are tall evergreen trees. They can grow up to 150 feet tall in the forest. Cedars grow in the shape of a cone with the narrow part at the top. They have flat, yellowish green leaves that have a strong smell. Small seed cones grow on this tree. They look like they have little wings. The bark of the incense cedar is reddish in color. Their wood is made into pencils, because the wood is so soft and easy to sharpen.

Ponderosa pines grow all over the West. Pacific ponderosa pines grow in California. These pines have bright green needles. They have cones that are five inches long. The cones are very sharp—they can cut your finger if you are not careful!

Pandora pine moths attack Ponderosa pines. They lay their eggs under the trees in June and July. The eggs hatch in August. The Pandora moth's larvae (caterpillars) are green and brown. They blend in with the color of the pine. These larvae eat pine needles all winter! Even though they can hurt the trees, they also help the forest. They change the pine needles into a rich fertilizer.

Sugar pines grow in the mountains of Oregon and California. They also grow in Mexico. They are the tallest of all pine trees. These trees can grow 200 feet tall. Some of their trunks are 11 feet wide. Sugar pines have needles that grow in clumps of five. Their cones are 10–20 inches long. These cones are the longest cones found in the forest. The cones bend the sugar pine's straight branches because they are so heavy.

Douglas firs are found all over the West. The cones of the Douglas firs have an odd shape. Each lobe looks like it has a small tail and two tiny legs sticking out. An American Indian story tells about a mouse that was caught in a forest fire.

The mouse hid from the fire in the cones of a Douglas fir. Now each cone has its own little “mouse.”

In some places, the forest is very thick. Almost no light reaches the ground. In other places, the trees are not so close together. Sunlight shines through the branches to the ground below. Plants like deerbrush, bitter cherry, and wild rose grow under the trees. This is called the understory of the forest. Wild currants and gooseberries also grow in the shade under forest trees. Bears eat these berries. They eat plenty of them before they hibernate (rest) in the winter.

Forest fires are also important to the growth of the forest. Fire takes out all the dead trees. It thins the dense forest and lets sunlight reach the forest floor. When fire burns conifers, it forces pinecones to open. The cones drop their seed onto the forest floor. Snow waters the seeds in the winter. The seeds sprout in the spring, and new trees begin to grow.

People and the Forest

Humans have been using the forest for thousands of years. American Indians ground acorns into flour. They made acorn soup and bread. This tradition is carried on today. Pine nuts were another important food for people in the past, and they still are.

People also use the hard wood of oaks to build cabinets and furniture. They use it to build fires in their fireplaces and wood stoves, too. Black oak gives off a lot of heat. It burns for a long time before it goes out. Pine and cedar trees were used to build homes, fences, and lodges. Later, people built mining shafts and sluices to transport water with wood from the forest. Lumber companies cut wood for buildings, such as homes and schools. The forest is still used and enjoyed today. Many people come to hike, camp, or to live in this beautiful part of California.

Slender salamander

Whitebark pine cones

North Coastal Forest (Redwood)

In the Mist

On the northern coast of California, fog rolls in off the ocean. The ocean is cool. Its currents move south from Alaska. Fog forms when the cool ocean and the warm air above it meet. Near the shore, fog moves into a forest of tall trees. The branches of the trees drip water from their needles. The fog is so thick you cannot see the tops of the trees. You wonder how tall they are. The trees are coast redwoods. They are natural treasures.

Coast redwoods grow near the coast of northern California. They are also found in some parts of Oregon. They do not grow anywhere else in the world. These tall trees are hurt by salt spray from the ocean, but helped by the fog. This is why they grow about a half-mile from the beach, but no more than 25–35 miles from the coast.

The redwoods live in sandy soil. They grow where there used to be sand dunes, or where flooding rivers left sand along their banks. Sometimes they grow in soils made of worn down sandstone. Redwoods do not grow where the soil is rocky.

Ancient Trees

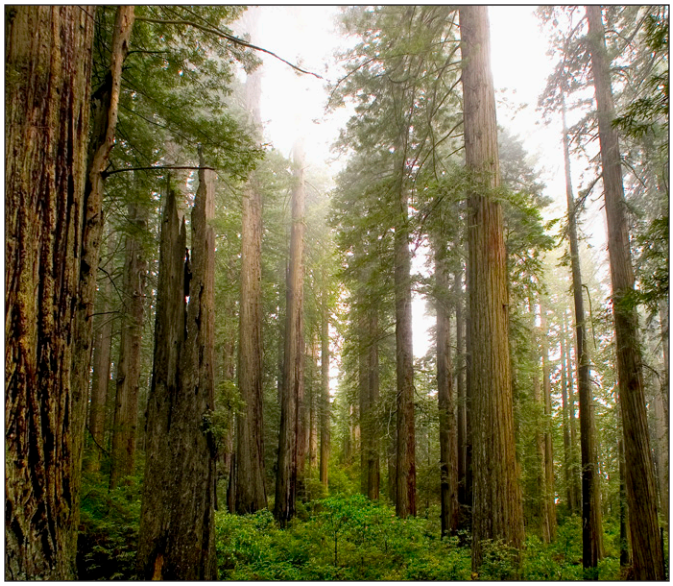
Scientists have studied redwoods for a long time. Redwood fossils tell their story. Redwoods have grown on Earth for more than 160 million years. In the past, there were many more redwood forests than there are now. Close relatives of the coast redwoods were living when dinosaurs walked on Earth.

Today, the forests have some very old trees. They are between 500 and 700 years old. Coast redwoods can live a lot longer—more than 2,000 years. The oldest living redwood is 2,200 years old.

Coast redwoods need a lot of water to stay alive. It rains from 25–122 inches every year in the redwood forest. Rain falls mostly in the winter. It is foggy in the summer. The trees absorb moisture from the fog through their needles. Fog also leaves water on their branches. This drippy fog runs off the needles to the ground below the trees. Fog keeps the coast redwoods watered all year long.

When the fog clears a little, you can see the tops of the trees. They are very tall! Most coast redwoods are 200–300 feet from top to bottom. Some redwoods grow more than 360 feet tall. They are the tallest trees in the world.

The redwoods are conifer trees. Conifers have cones that hold their seeds. Redwood cones are about one inch long. They contain 14 to 24 tiny seeds. The cones turn from green to brown when they dry out in the fall. When they are dry enough, they open and the seeds drop to the ground. Each small seed has two tiny “wings.” The wings help to carry the seeds away from the tree when they fall. One redwood tree makes millions of seeds each year. Only a few



North coastal forest (redwood) habitat

Dogwood

of these seeds will become seedlings. Steller's jays, winter wrens, squirrels, and chipmunks collect seeds on the ground under the trees.

Coast redwoods have another way of making new trees. They can sprout from the roots of older trees, from fallen trees, or from a bud that forms at the base of a tree. This bud is called a "burl." Burls form when a tree is cut or burned by fire. The next year, tiny trees sprout in a circle around the stump. They form a "fairy ring" of new trees.

Most conifers are evergreens. Evergreen trees do not lose their leaves in the fall, like many other trees. Instead, evergreens shed old leaves all year. Coast redwoods are evergreens. Their leaves are needles. As new needles grow, most of the old needles fall to the forest floor. Earthworms and slugs break the needles into small pieces. They help the needles decay, and this enriches the forest soil.

Some needles land in branches on the way down. As the needles decay, they make a rich mat of soil. The branches hold this soil hundreds of feet above the ground. Ferns, and even new redwood trees, sprout and grow in the soil mat. Beetles, banana slugs, earthworms, and clouded salamanders live there too. Marbled murrelets, a seabird, return each night to nest in the redwood trees.

Redwood trees have very thick bark. Their bark is more than a foot thick in older trees. Fires sometimes burn the redwood forest. Intense heat from fire may damage the outside of the trees. The inside layers are protected by this very thick bark.

Fire is important for the health of redwood forests. Fire removes trees that compete for light and food. It clears old trees that have fallen and recycles minerals in the soil. Fire opens redwood cones, so seeds can fall to the forest floor.

In the Shade

The thick redwoods form a dark canopy. Only a little sunlight can reach the forest floor. On slopes that face south, there is more light. Douglas firs, sitka spruce, tanoaks, and madrones grow best on the sunny side of the redwood forest.

Dogwoods, ferns, and poison oak also grow under the redwoods. Berries

grow there too. This is called the understory of the forest. The understory provides shelter and food for many animals. Frogs, toads, salamanders, snakes, and lizards live there. Black bear, deer, and elk eat berries in the summer and fall.

Fallen trees are also part of this understory. They help keep the soil in place. They also hold water for the lichens and mosses that live on them. As the trees decay, they add to the rich soil of the forest floor.

Dead trees that have been burned or struck by lightning are called "snags." They stand out in a forest of living giants. Moss and lichen also grow on these trees. Small animals and birds make their homes in the hollowed out trunks. Sometimes you can see a spotted owl using the snag as a perch.

People and Redwoods

Redwoods are strong and healthy. Humans have used the wood of these trees for thousands of years. California Indians built their small villages with redwood planks. They held the planks together with leather straps. Redwood was also used to build boats for fishing.

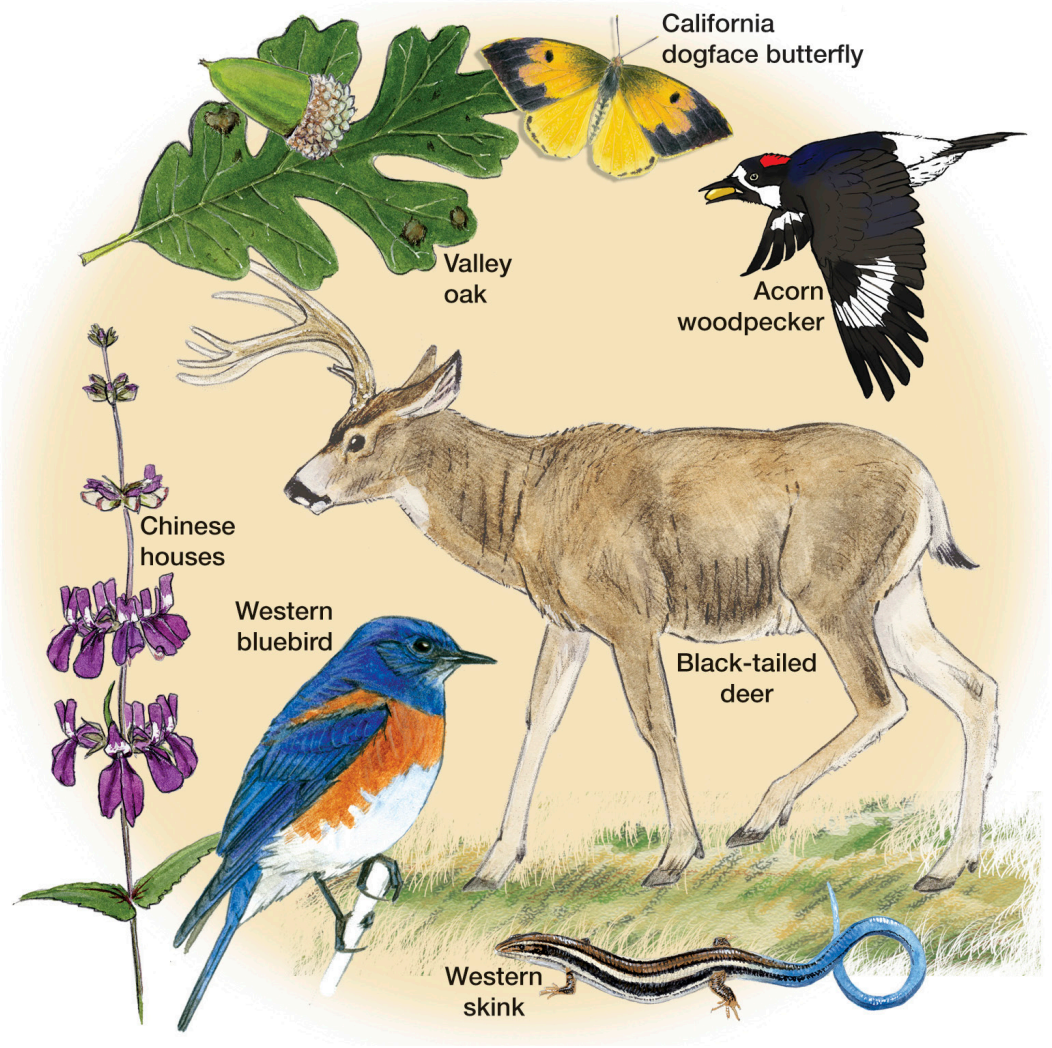
There were two million acres of original, or "old growth," coast redwoods in California in 1850. Then the Gold Rush came, bringing many people to California. After the Gold Rush was over, many gold miners got jobs cutting trees. California's redwood trees were used for lumber to make the homes and stores for California's cities up and down the coast. Now there are about 200,000 acres of old growth redwoods left, mostly in state and national parks.

Today, the redwoods are still an important resource in California. Redwood lumber can be bought and used to build buildings and fences. Redwood mulch is sold in garden stores. Redwood burls are used to make beautiful furniture and sculptures.

Many of the older coast redwoods are now protected. So are the animals and plants that live in the redwood forest. People from all over the world visit Redwood National and State Parks. These parks are perfect places to enjoy the beauty of the coast redwood forests and learn more about them.

Northern flying squirrel

Oak Woodland



California's Oaks

It is spring in California. The hills are green with new life. Wildflowers dot the hills with splashes of blue, purple, and orange. Oak trees spread their thick branches over the green meadows.

The oaks grow closer together in some places. The tops of the trees almost touch. Other trees, like bay laurel and madrone, grow next to these oaks. Plants, shrubs, and wildflowers grow under the trees. They make great homes for insects, lizards, and other small animals. Trees and plants often live together. They live in "plant communities." Communities with many oak trees are called "oak woodlands."

There are 19 kinds, or "species," of oak trees in California. Oaks grow in the foothills and inland valleys of the state. They are also found on islands off the coast. Most of the oaks like warm, dry summers,

and mild, wet winters. Where most oaks grow, it rains from 19–58 inches per year. Oaks that grow in the southern part of the state receive less water than oaks in the north.

Rainfall and climate decide which oaks can grow in a place. Island oaks grow in the Channel Islands. They need moist soil and some fog. Oregon oaks grow on ridges and in valleys in northern California. They need more water than other oaks. Douglas fir, madrone, and black oak often grow with them. Some coast live oaks rely on fog for added moisture. Each oak needs different amounts of water to stay healthy and alive.

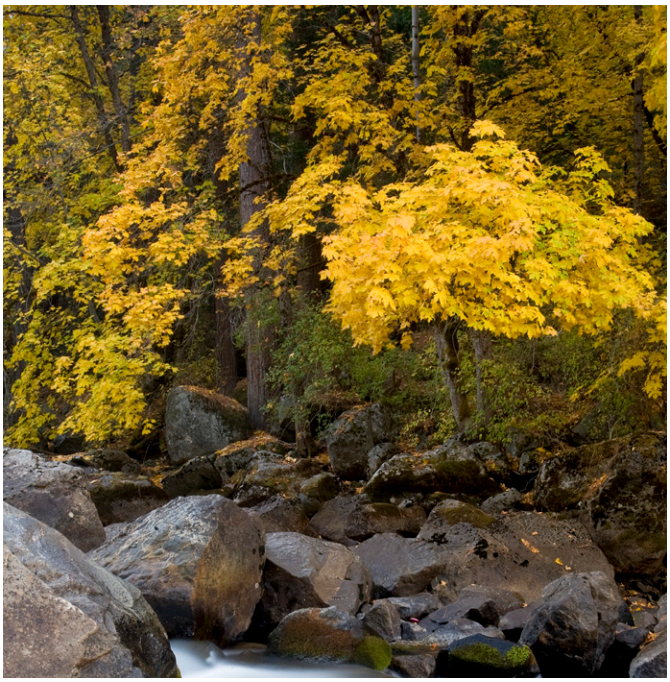
Dropping Leaves and Acorns

Blue oaks and valley oaks only live in California. They can survive in very hot summer weather. If it gets too hot and dry, the blue oaks will drop their leaves. This helps the trees save moisture and keeps them alive. Blue oaks often grow on the edge of grasslands. Other oaks and gray pines often grow with them.

Black oak acorns

Valley oaks are most often found in the Central Valley. Their huge branches stretch upward to the sky. They are taller than blue oaks and their roots go deeper. These roots tap into water that runs deep underground.

Oaks can be evergreens or deciduous trees. If they are evergreens, they do not lose their leaves in the fall. Instead, they shed old leaves and grow new ones all year. Coast live oak, canyon live oak, and interior live oak are all evergreen trees. So is the Channel Island oak. Deciduous trees lose their leaves in the fall and grow new leaves in the spring. Blue oak, black oak, and valley oak are all deciduous oaks.



Oak woodland habitat

Black bear

Some oak trees are about 15 years old when they start to make acorns. After that, one oak tree can make 400 pounds of acorns a year! An acorn starts out as a tiny cell (egg) at the base of a leaf. In the spring, the wind blows pollen from other oak trees through the oak woodland. This pollen fertilizes the cell and an acorn begins to grow.

Food and Shelter for Wildlife

Black bears, deer, woodrats, gray squirrels, and many different kinds of birds and insects eat the acorns. The acorns that are not eaten will sprout in the late fall or winter. They send a long taproot down into the soil. In the spring, seedlings sprout from the rooted acorn. They shoot up around the oaks. Most of the seedlings will not live for even a year. Deer and other animals will eat them before they grow tall.

Oak woodlands do more than provide food for wildlife. They provide homes for them too. Oaks provide a large surface for fungi and lichens to grow. More than 300 types of birds, reptiles, and mammals live on or under their big leafy branches and roots.

Some oak trees look like they have green plants hanging from their branches. These are not plants, they are lace lichen. A lichen is a combination of fungus and algae. The lace lichens need a lot of sunlight and water. They grow better on oaks that lose their leaves in the winter. They also grow well on dead branches. This is because more light falls on branches without leaves.

Lace lichen does not hurt oak trees. In fact, it is very good for them. It gathers important nutrients from the wind. When it rains in the winter, the water runs off the lichen to the ground. This water is full of nitrogen. The nitrogen feeds the soil beneath the oak, and the oak grows. Deer, rabbits, and other animals that live around the oaks eat lace lichen. They eat it off the trees or as it falls to the ground.

Some insects use oak trees as nurseries. For example, tiny wasps lay their eggs in the oak trees. The eggs hatch and become larvae (caterpillars). The wasp larvae get hungry. They chew on the tree's tissues. When they do, they cause a swelling to grow. This swelling is called a gall. The gall

protects the larvae and gives them a source of food. When they are ready to fly away, the larvae chew their way out of the gall. Many types of insects cause galls to form. Galls are formed on many different kinds of trees. Some galls look like small apples, and some look like spiny sea urchins.

People and Oaks

Oaks have been growing in California for millions of years. California Indians used acorns for food. First, they pounded the acorns into flour. Then they washed the flour with water until all the bitterness was gone. They made this flour into a mush, soup, or baked it as bread. Today, acorns are still prepared in much the same way.

California Indians used fire to keep the oak woodland healthy. They burned dead trees and brush under the older trees. Today, fire is still important to the oaks. It gives the acorn seeds room to put down roots so that more seedlings can grow. Fire also releases important nutrients. These nutrients enrich the soil.

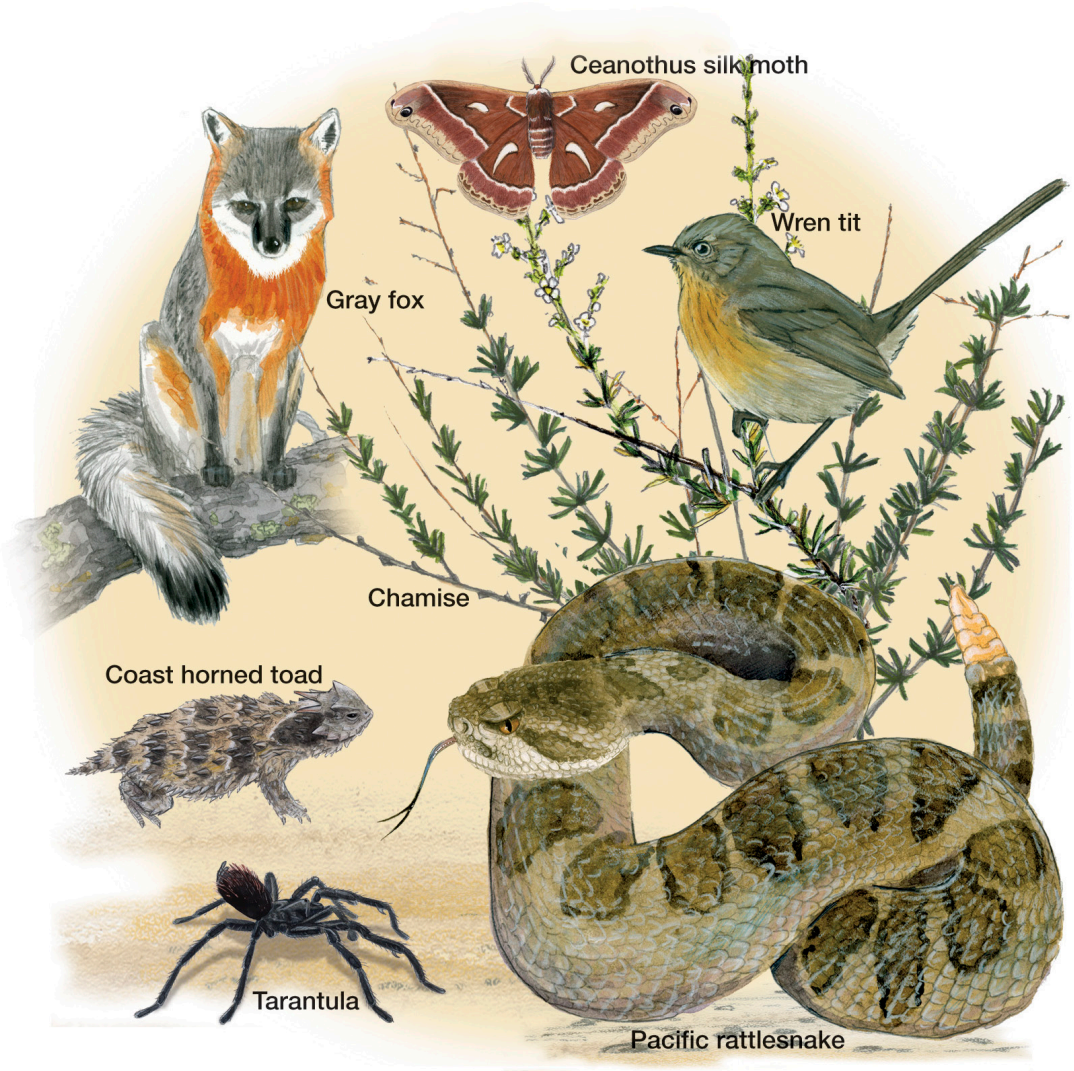
Lace lichen

Mountain garter snake

Oak wood was used for many things in the past. People used the wood from oaks to build and repair their ships. During the Gold Rush, oak wood was burned for fuel in train engines. It was also used to make wagon wheels and tool handles. Its greatest use by far was for fuel and charcoal. Blacksmiths and bakers used oak wood to fire their ovens. Oak wood is still used as firewood because it burns for a long time.

Oaks are as important today as they were in the past. Wildlife and other animals use their shade in the hot summers. Humans use their wood for furniture and firewood. They build their houses in and around oak woodlands. Oaks hold so much life in their strong branches. They are an important resource for all who live in California.

Scrubland and Chaparral



In the Thicket

The hills are covered with brush so thick you cannot see the ground. Walking through these bushes is hard. The plants have sharp branches and tough leaves. These shrubs are found on the hills near the coast and in steep canyons. They grow on the slopes of inland valleys and the sides of mountains. Pushing their roots through rocky soil, they survive heat, drought, and even fire.

Scrubland and chaparral are found from southern Oregon to Baja California in Mexico. They grow in Southern California near the coast, where winters are mild. It often rains less than 10 inches a year. Rain falls mostly in the winter. Chaparral plants can live with a little frost. They do not live well in a lot of snow. In the summer, the weather is hot and dry. Sometimes in summer there is no rain at all.

Living with the Heat

Chaparral plants live through long, hot, and dry summers. The leaves of some are stiff, leathery, and shiny. The shine reflects sunlight. The hard leaves keep some moisture in. Other plants trap moist air inside their leaves by rolling them up.

Evergreen shrubs make up most of the chaparral. These shrubs keep their leaves in the winter months. The shrubs grow for about four months in the winter and spring. Their roots push down to find water deep underground. Some plants “die back.” This means that a plant will look dead except for one or two branches. When it rains again, sprouts will shoot up from the living branch.

In Southern California, hot dry winds blow from the desert to the sea in the summer and fall. These winds are called Santa Ana winds. Fires often happen when these winds blow. Fires can burn thousands of acres of shrubs, trees, and other plants in one season. Chaparral fires are very hot. They sometimes reach 1,000° F at the center of the blaze.

Chaparral plants deal with fire in special ways. After their branches and leaves are burned, most plants sprout again very quickly. Tiny shoots appear on branches or on a root burl at the base of the plant.

Some plants have seeds that will not sprout unless they are heated. Ash from burned chaparral fertilizes the soil and helps the seeds grow. The cones of some pine trees that grow in and around the chaparral will not open unless fire heats them. Fire cleans out old brush and brings about new growth. Animals eat the tender, young leaves as well as berries and seeds.

Scrubland and chaparral habitat

Manzanita

Plant Life in the Chaparral

Chamise is the most common type of chaparral plant. It has tiny thin leaves and scratchy branches. This shrub is so thick that other plants cannot live under it. There is too much shade. The leaves and branches of chamise have resin in them. This resin can make the plant easily catch fire. Chamise loses its branches and leaves when the summers are too hot. This leaf litter provides fuel for the next brush fire.

Manzanitas are also found in chaparral plant communities. There are many different kinds of this common shrub. They come in many shapes and sizes. Some grow close to the ground. Others look like small trees. Manzanitas have smooth red or orange bark. Their branches are stiff and twisted. They bloom in the winter and grow berries in the late spring and summer. Animals also eat these berries.

California Indians used manzanita bushes in many ways. They made a special drink with the berries. Sometimes they dried the berries before eating them. They made tea from the bark and used it to help people with stomachaches. They also used manzanita leaves to brush their teeth. Some of these traditions are carried on today.

In the spring, coffeeberry and California lilac bloom with colorful flowers. Chaparral honeysuckle and wild cucumber wind their long vines through the shrubs. Holly-leaved cherry, chaparral pea, and gooseberry grow there too. Coyotes and wood rats feed on their fruit. Birds carry seeds in their beaks. New plants will grow wherever they drop their seeds.

Toyon is a shrub with bright evergreen leaves. Butterflies land on its flowers. In the fall and winter, toyon has bright red berries. California Indians dried and stored the berries and used them for food later. Berries and leaves were also used for dyes. Birds eat them too. Some birds, like cedar waxwings, depend on toyon berries for food as they fly south for the winter.

The word chaparral comes from the Spanish word *chaparro*, which means "place of the scrub oak." Scrub oaks are more like shrubs than oak trees. If they live in a protected spot, they can grow up to 12 feet tall. They have evergreen leaves with sharp edges. Their acorns

are small and wide. Holly-leaved redberry and holly-leaved cherry grow near scrub oaks. Poison oak grows under them.

Fence lizard

Wildlife of the Chaparral

The acorns of scrub oak are an important food for animals. Wood rats make nests in old leaves beneath the oaks and in their branches. They build large “lodges” from sticks and twigs. Many animals use the wood rat lodges for their own homes. Mice, lizards, and insects can be found there.

Gray foxes make a meal of smaller animals. They dig through the wood rats’ lodges to find ground squirrels, chipmunks, and pocket mice.

Pocket gophers dig under the ground. They block their holes to keep foxes and gopher snakes out.

Snakes live under the plants of the chaparral. Pacific rattlesnakes and striped racers eat pocket gophers and mice. Gopher snakes do too. Fence lizards and horned lizards also make their homes under the shrubs. They live in leaves or under branches. These reptiles eat insects and spiders that live there too.

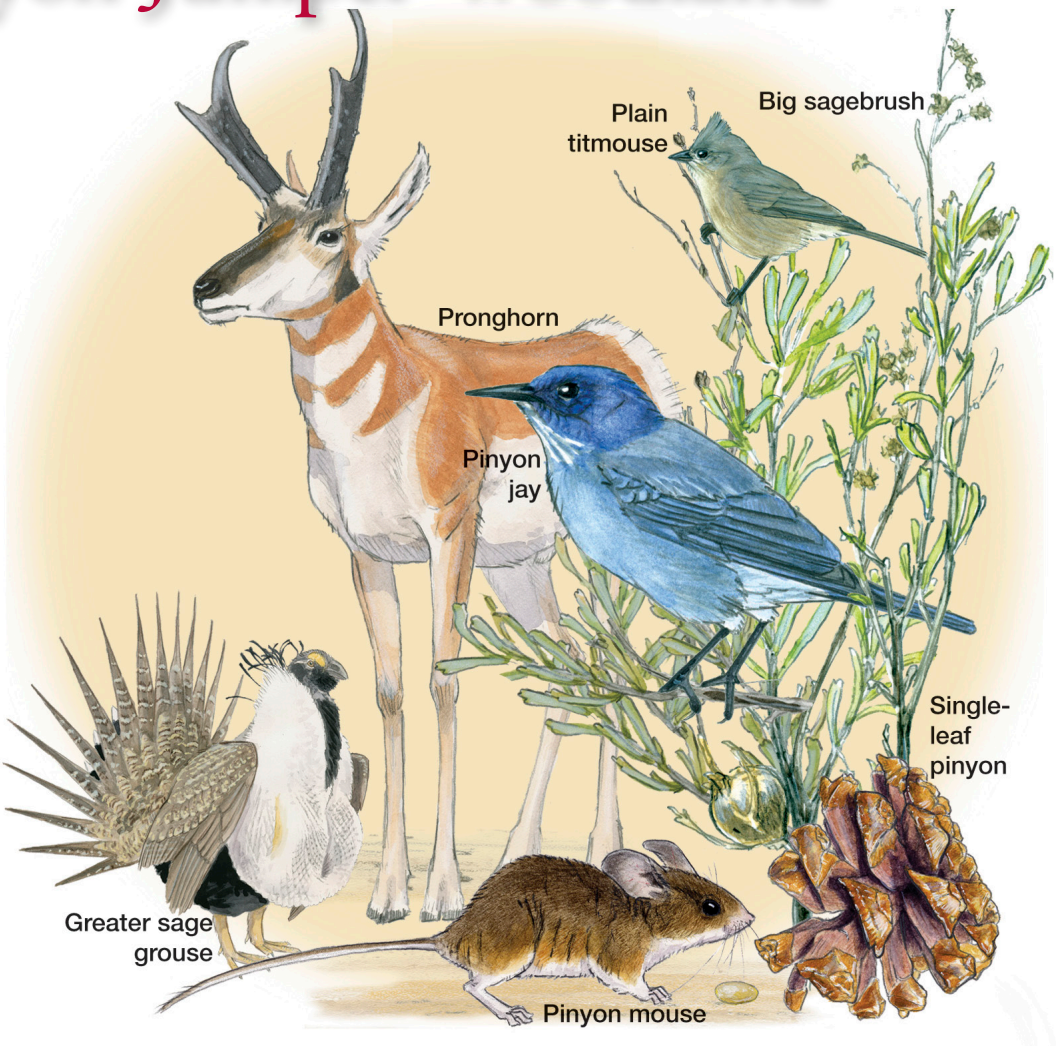
Wrentits, like many other birds that live in the scrublands, are brown or gray. They blend with the color of the chaparral. This makes it easier for them to hide while they eat seeds and berries. California quail move quickly under branches. Goldfinches, sparrows, and kinglets fly from shrub to shrub. Scrub jays make a lot of noise as they dive from one lookout to the next.

People and Chaparral

You cannot walk through chaparral. Its thick shrubs make a bushy wall. It is difficult for large animals and humans to go through it. Still, people build houses on ridges and hills covered with chaparral. They clear the brush away from their yards to avoid fire. Yet, in summer and fall, the fires still burn. They are a part of life. The chaparral can teach us about survival. This region is one of California’s lasting treasures.

Pocket gopher

Sagebrush Scrub and Pinyon-Juniper Woodland



The Making of a Valley

On a bright summer morning, you can see Mount Whitney above the valley. Its jagged peaks look like sharp white teeth. They cut the sky into a rough edge. You can see snow on the rugged peaks. The peaks are above Owens Valley, a dry desert. It is already 90º F in the valley. The wind is blowing. The air is so clear, you can see the mountains on the other side.

Owens Valley lies between two large cracks in Earth's crust. These cracks are called faults. Millions of years ago, the surface of Earth broke along these faults. The land shifted and tore. It pushed the mountains up on both sides of the valley. The valley sank as the mountains grew. The mountains on the west side of this valley are in the Sierra Nevada Range. The Inyo-White Mountains are on the east side.

Life in the Great Basin

This high desert valley is part of a large plateau. The plateau is called the Great Basin. The Owens Valley is on the west side of the Great Basin. The basin stretches east to Utah. The Great Basin is very dry. Most of the moisture falls as snow in the winter. The ground dries out quickly in the spring and summer months. Temperatures in the winter can fall as low as 0º F. In the summer, temperatures sometimes reach 122º F. Water does not stay on the ground for long. It heats in the Sun and turns to vapor. The water that does not turn to vapor sinks into the ground. It becomes groundwater.

Plants in the Great Basin live on little water. It can rain less than seven inches per year. The plants grow far apart. With lots of room to grow, each plant has enough water and minerals. The plants grow long roots close to the surface. These roots help the plants get as much water as they can. Great Basin sagebrush grows well in this region. So do bitterbrush, antelope bushes, and rabbitbrush. These plants often live together. They make up the sagebrush scrub plant community.

Sagebrush is the most common plant in this plant community. It is found on the floor and hills above the Owens Valley. It grows as far north as Canada and as far south as Baja California. It grows as far east as Colorado. It can grow in sand or in rocky soils. When it grows near water, it can grow 10 feet tall.

Sagebrush grows slowly. It has beautiful silver-gray leaves. The leaves are wider at one end, with two to four lobes. They are covered with tiny silver hairs. These hairs keep the leaves cool and slow down the loss of water in the hot dry months.

Sagebrush scrub and pinyon-juniper woodland habitat

Swainson's hawk

Sagebrush blooms in early fall with bright yellow flowers. Then the plants drop their seeds. If you ever walk through sagebrush after it rains, you will notice a strong smell! The plant has strong smelling oil in its leaves.

Mule deer and pronghorn antelope eat sagebrush all year. When snow falls in the winter, sagebrush sticks above the snow. It is sometimes the only plant animals can find. The sagebrush also protects them from the cold winter wind.

Sage grouse munch on sage seeds and leaves. Sage sparrows keep a lookout from the tops of the shrubs. Kangaroo rats, chipmunks, and pocket mice hide out in the sage. Coyotes watch and stalk these rodents. Jackrabbits hop everywhere you look. Hawks and ravens circle above, waiting for their next meal.

Higher and Higher

As you move up the hills, the landscape changes. Short trees pop up here and there on the valley floor and mountain ridges. These trees are part of a different plant community called the pinyon-juniper woodland. In the Great Basin, pinyon pines catch moisture on the tops of ridges. Junipers are found on dry, rocky slopes.

The weather where pinyon pines and junipers live is very harsh. Snow falls in the winter. Little or no rain falls during the hot summer. Strong winds blow almost every day. The temperature can swing from 90º F to 30º F in one week! Pinyon pines and junipers put down long roots. They can tap into water deep underground.

Sagebrush, bitterbrush, and blue sage grow under or around the trees. Golden bush and mountain mahogany also grow there. Sometimes a single rain shower will cause wildflowers like paintbrush and lupine to spring up under the trees.

Each year, pinyon pines and junipers grow for a short time, when the weather is mild in the spring and fall. Pinyon pines have needles that grow in one to three bundles. These pines are very slow growing. It takes one tree about 60 years to grow six feet tall. When the pinyon pine is 35 years old, it makes its first pinecones.

The seeds of the pinyon pines are like nuts. In fact, they are called pine

nuts. They are found between the scales of the cones. American Indians relied on these pine nuts for food during the long, harsh winters. People still eat these nuts today.

The animals that live in the pinyon-juniper woodland also use the "nuts" for food. Mule deer and pronghorn antelope often munch on them. So do woodrats and pinyon mice. Pinyon jays take the nuts out of the pinecones with their long beaks. They carry the nuts away from the trees and bury them. When the seeds sprout, they will send roots down into the ground. New seedlings will spring up in many new places.

Pronghorn antelope

Junipers are short and bunchy. They have leaves that are scaled and spiky. These leaves can hold water longer than the pinyon's needles. Junipers have gray-brown trunks. The wood shreds off them in long strips. They sometimes look like they were twisted by the wind.

The seeds of the juniper grow inside gray-blue berries. Birds eat the berries and spread the seeds in their droppings. New juniper trees sprout and grow where the seeds are dropped.

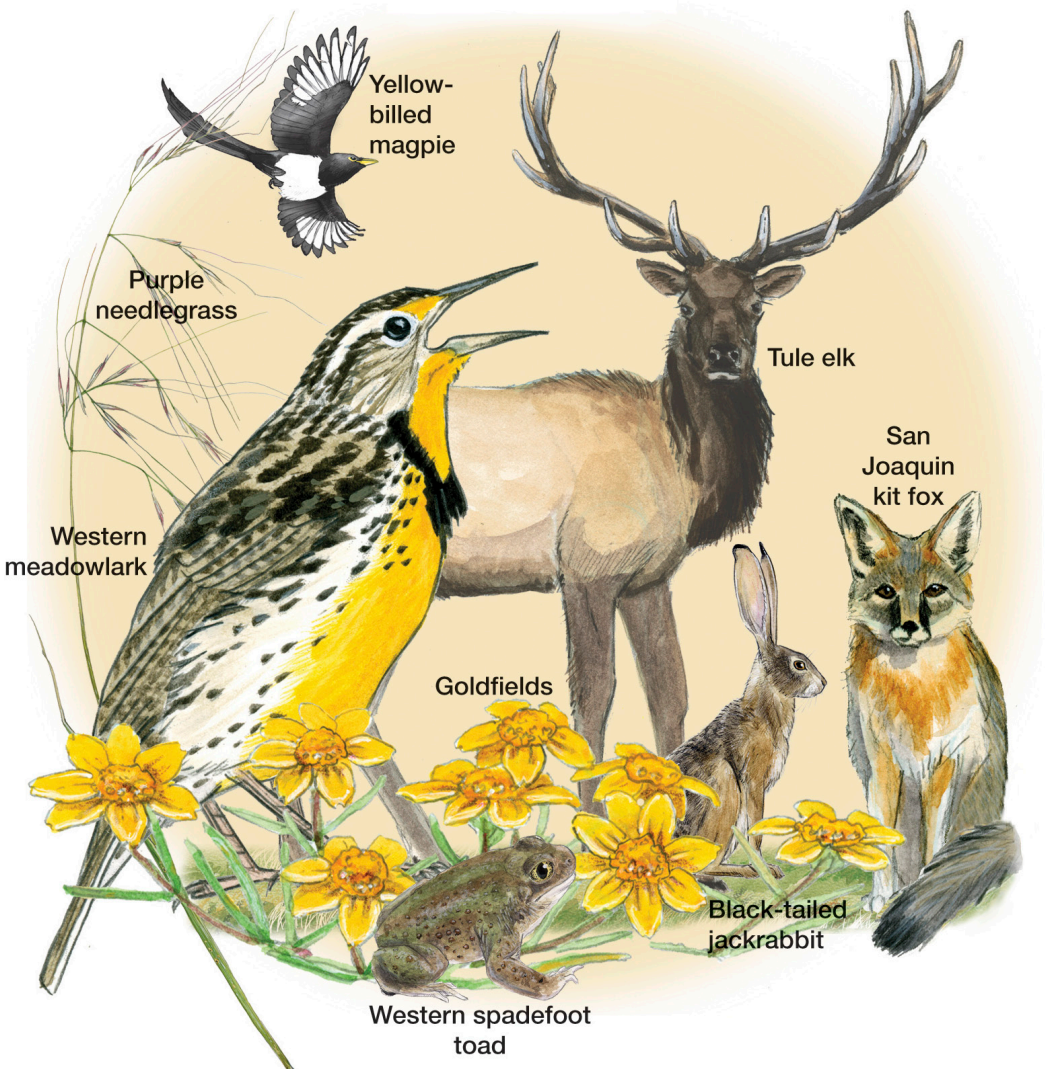
People, Sagebrush, and Juniper

People have long valued the plants of this region. California Indians used the leaves of sagebrush to heal wounds. Baskets and mats were made from the stringy bark. The bark was also used for making paper and for starting fires.

Early settlers made strong fence posts from the wood of juniper trees. They also used it as firewood. The smoke smelled warm and sweet. California Indians used juniper berries as medicine. They used the branches of the juniper for digging sticks. Sandals, mats, and baskets were made out of juniper bark. Juniper wood is still used today for special ceremonies.

Today, juniper wood is used to build fences and beautiful furniture. Its stringy bark is used for animal bedding.

Grasslands



Our Golden State

Soft grasses blow in the wind. In late spring, they begin to look gold in the afternoon light. Spring wildflowers add a burst of color. They are orange, yellow, purple, and blue. A few oak trees stand in the middle of the waving grass. They spread their thick branches over the golden fields. These are the grasslands. Their golden color is one reason why California is called the "golden state."

The grasslands' warm, dry summers and cool, moist winters are important for plant growth. Some of the plants that grow in grasslands are perennial plants. Perennial plants live for more than one season. They may die back in the winter. In early spring, they show new growth. Other grasslands plants are annuals. Annual plants live for only one season. They drop their seeds and new plants come up every year.

Purple needlegrass is a native grass. Native means that something, like a plant or animal, has always grown or lived in a place. Purple needlegrass is a bunchgrass. Bunchgrasses grow in clumps. They have strong stalks that grow tall. Their long roots tap water deep underground. When it rains in the late fall and winter, these native grasses begin to grow. At first, the growth is slow. In spring, the grasses grow much faster. Their seeds are ready in June.

Even grasses have flowers and leaves. They do not look the same as the leaves and flowers of other plants. The flowers of grasses are fuzzy on top. They have tiny leaves just below the flower. These flowers dry out in the late spring. Their fuzzy green tops dry to golden brown.

Blowing in the Wind

Grasses do not need pretty flowers to attract bees or birds. They are pollinated by the wind. Wind stirs the grasses and tosses them back and forth. Their fuzzy tops release the pollen. Grass pollen spreads as far as the wind will carry it. Many people are allergic to this pollen. If you are one of them, you may find yourself sneezing like crazy in May and June!

Hitching a Ride

The seeds and flowers of grasses sometimes have funny shapes. These unusual shapes help the grass to grow in new places. The fuzzy ends of grass stalks have barbs that catch on animals. Foxtail seeds will catch on your socks when you walk in the grass. Some seeds have tiny hairs that look like spirals. Other seeds open and close when moisture in the air changes. Needlegrass has long, thin bristles. These sharp bristles help drill the seed into the soil.

Purple needlegrass and other native grasses can live for a long time. Some plants are at least 200 years old. Their

Grasslands habitat

Sandhill cranes

roots are like long thin pipes that reach deep into the soil. Sometimes they can reach 18 feet under the ground. When it rains in winter, the water moves through the roots up into the stems of the plants. Deep roots can keep soil from washing away. When a plant dies, nutrients from the decaying roots make the soil richer.

Living with Little Rain

Native grasses and wildflowers grow in many places in the state. One of the places they grow is the Great Central Valley. This valley is 400 miles long. It runs down the center of the state. The mountains on the west side are called the Coast Ranges. The Sierra Nevada Range is on the east side. Most of California's grasslands are in the hills and valleys between these mountain ranges.

Grasslands are found in places where there is little rain. To stay green, the grasses grow far apart. They must use what little water they have. The weather in the Central Valley is hot and dry in the summer. It almost never rains here during this season. In winter, it rains about 38 inches in the northern part of the Central Valley. It only rains 6 inches in the south. Cold air is trapped near the ground in the winter months. This causes thick fog to form. The fog is called tule fog. The hot Sun burns through the fog in the spring. When warm weather returns, wildflowers spring up, and grasses begin to grow.

The largest grasslands in the state are in a wide valley. The valley is west of the Great Central Valley in San Luis Obispo County. It is called Carrizo Plain. Mountains surround the Carrizo Plain on all sides. This valley is very dry. It only rains from 7–9 inches each year. Many native grasses and plants grow there. One plant is the California jewel flower. It grows on top of the tunnels where giant kangaroo rats make their homes. Other native plants that grow there are Hoover's woolly-star and San Joaquin woollythreads.

Wildlife in the Grasslands

Many special animals also live in the Carrizo Plain. Some of them do not live

San Joaquin antelope squirrel

anywhere else. The San Joaquin kit fox and the San Joaquin antelope squirrel both live there. The blunt-nosed leopard lizard and the giant kangaroo rat hide out in the native grasses. Tule elk and pronghorn antelope graze in the valleys. Sandhill cranes and mountain plovers make homes in Carrizo Plain in the winter.

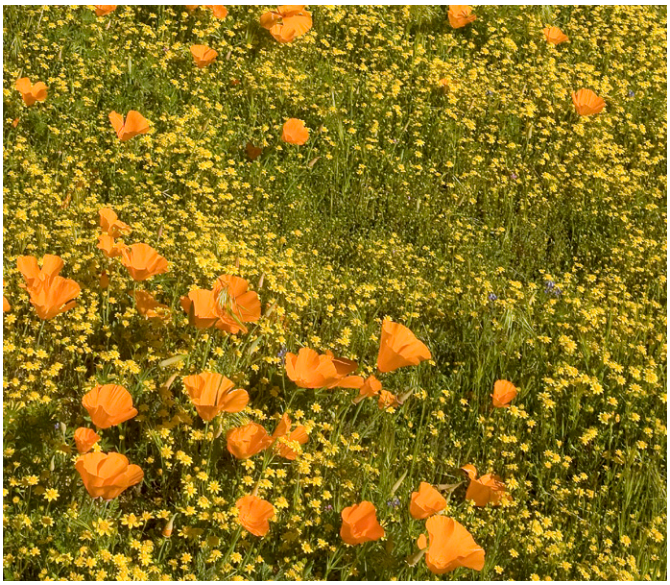
People and the Grasslands

The Chumash Indians lived on the Carrizo Plain for many years. The Yokut people lived there too. The people made drawings of their lives on the rocks. These drawings are called petroglyphs. Like other California Indians, they used grasses to make beautiful baskets. The people ground the seeds of goldfields and chia plants. They used the ground meal for food.

Many years passed. People came to California from all over the world. They built homes in the wide grassy valleys. Farmers planted vegetables and fruits. Ranchers grazed their cattle on the open land. There was plenty of room to grow and plenty of food to eat. People gathered and built small towns. The towns and farms grew larger as more people moved in.

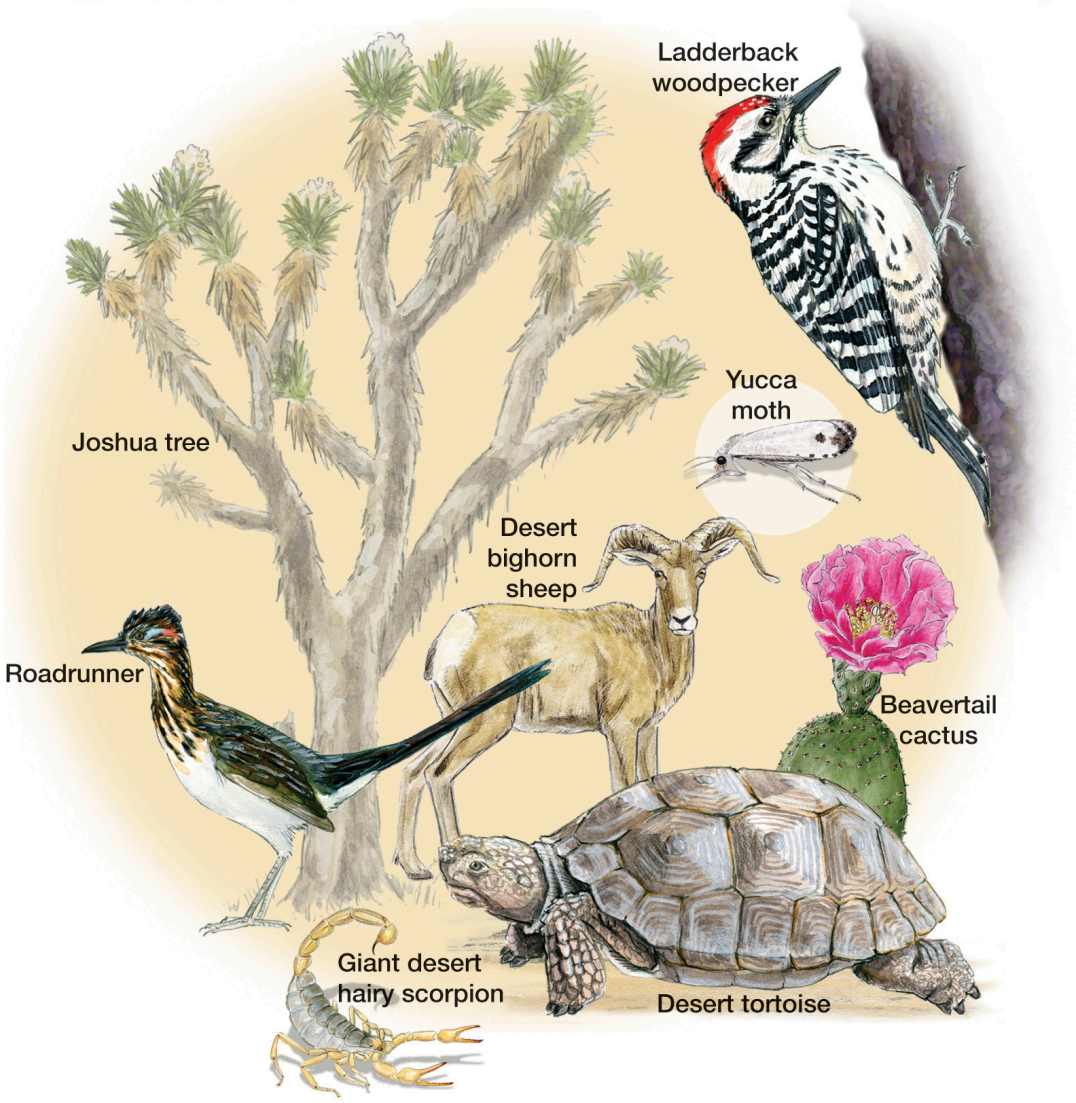
Things have changed over time. Animals that lived in the grasslands now have less room to live. Native wildflowers and grasses have less room to grow. These plants and animals are now protected in special places like the Carrizo Plain.

California poppies, our state flower, pop up everywhere. Our “golden state” is made more colorful by nature’s wildflowers.



California poppies and goldfields

High Desert



The Making of a Desert

The Sun rises over the high desert valley. It spreads a pink glow over the landscape. Joshua trees stretch their spiky branches to the sky. They stand tall in the soft morning light. A slight breeze makes swirls of dust around their trunks. The air is cool, but not for long. Above the valley, a desert bighorn sheep grazes. The breeze lifts the hair on his back. This is his home—California's high desert.

The high desert lies north and east of Los Angeles. It is called the Mojave Desert. The mountains in the Transverse Ranges form the desert's boundary to the south. The Tehachapi Mountains and the southern Sierra Nevada Range mark the north end.

The desert's northern tip rests between two faults. The San Andreas Fault lies west of this desert. The Garlock Fault crosses the San Andreas.

Faults are deep cracks in Earth's crust. Millions of years ago, plates deep beneath Earth moved along these faults. Mountains were pushed up when huge earthquakes shook the land. As the mountains grew, the land between them sank, forming flat basins and deep valleys. Some of this land became the high desert.

The Mojave Desert has many valleys. Some of these valleys are quite high in elevation. Antelope Valley, Yucca Valley, and Apple Valley are all around 3,500 feet. Death Valley is a long, narrow basin near the border of Nevada and California. It is 282 feet below sea level. The lowest elevation in all of North America is in Death Valley!

So Much Heat

The desert is hot and dry in the summer. It is cold and dry in the winter. Storms that move from the coast to the desert carry lots of moisture. Rain falls on the many basins and mountain ranges as these storms move east. The west side of each mountain range gets more rain than the east side. By the time the storms reach the desert, there is little or no moisture left in the clouds. This is called the rain shadow effect.

Even so, some rain does fall in the Mojave Desert. It mostly falls in winter and spring. Afternoon thundershowers cool off the desert in late summer. It even snows a little each winter! In most places, it rains from 4–10 inches per year. In Death Valley, however, it often rains less than 2 inches per year. Death Valley is the driest place in North America. It is also the hottest place. In the summer, the temperature often reaches 120° F in the shade.

High desert habitat

Prickly pear cactus

So Little Rain

The air in the Mojave Desert is very clear. Few clouds form in the sky. Almost all of the light and heat from the Sun reaches the ground, and the ground heats up. This makes the air very hot and dry. In Death Valley, steep mountains surround the desert basin. The valley is very deep, so this hot dry air becomes trapped. In 1913, Death Valley had the highest temperature ever recorded on Earth. It was 134º F.

Most of the soil in the high desert began as rock in the mountains. It was washed down mountain canyons into the desert basin. This soil is very coarse. When it rains, the soil does not hold water. Plants in the desert have developed special leaves and stems to help them find or store precious water.

A Desert Symbol

The oddly shaped Joshua tree thrives in the High Desert. These trees grow well in the loose gravel and sand of the high desert. They have been known to grow up to 40 feet tall. Joshua trees are really a type of yucca plant. American Indians used their spiny leaves for baskets and sandals. The seeds can be roasted and eaten. Some native elders still call this tree by its traditional name, “humwichawa.”

Miners and ranchers came to the high desert in the late 1800s. They used the spiny branches and trunks of Joshua trees for fences and corrals. Miners burned them for fuel. They used them to run steam engines for their mines.

Joshua trees and yucca moths are interesting “partners.” Yucca moths lay their eggs in the trees’ white flowers. When the eggs hatch, the larvae eat some of the flowers’ seeds. In turn, the yucca moths pollinate the flowers and make sure the seeds are fertile.

Joshua tree seeds need rain to sprout. Seedlings do not grow if there is no rain. Young Joshua trees grow a few inches every year. Then their growth slows. Older trees only grow about one-half inch per year. Joshua trees do not grow branches from their trunks unless yucca weevils visit them. The weevil larvae eat the ends of stems. New branches form on the trunk when the stem dies.

Termites seem to like Joshua trees. They feed on branches or whole trees that have been knocked down by the wind. Ladderback woodpeckers feed off the termites. These birds drill their nests in the soft wood of the Joshua trees. Scott’s oriole also makes its nest in their branches.

Wildlife in the High Desert

You may see an odd bird with a long tail running around the high desert. This is the roadrunner. Roadrunners run more than they fly. They run about 15 miles per hour, faster than you may go on your bike. Roadrunners mostly eat insects and lizards. They also dine on mice and desert snakes.

Beavertail cactus grows in the high desert. It is a blue-gray color. In spring, it has bright pink flowers. Its special leaves, or pads, are shaped like a beaver's tail. Beavertail cactus has many short spines. These spines make your skin itch. Wood rats eat this cactus, spines and all! Prickly pear cactus also grows in the Mojave Desert. It grows at higher elevations than beavertail cactus.

Prickly pear has leaves like the beavertail but is a lot taller. It has bright red fruit with spines. The fruit is full of sugar. Humans enjoy jelly made out of this fruit. Coyotes also eat it. They eat and carry the seeds in their stomachs. New prickly pear plants grow where they leave their droppings.

Desert animals must be able to go a long time without water. Like desert plants, some animals can store water in their bodies. They use this water when they need it. Some animals get moisture from the foods they eat.

The desert tortoise can hold about a quart of water in its body. It digs a burrow and hides through the summer, fall, and winter. In the spring, the tortoise comes out of its burrow. It feeds on plants that store water in their leaves and flowers.

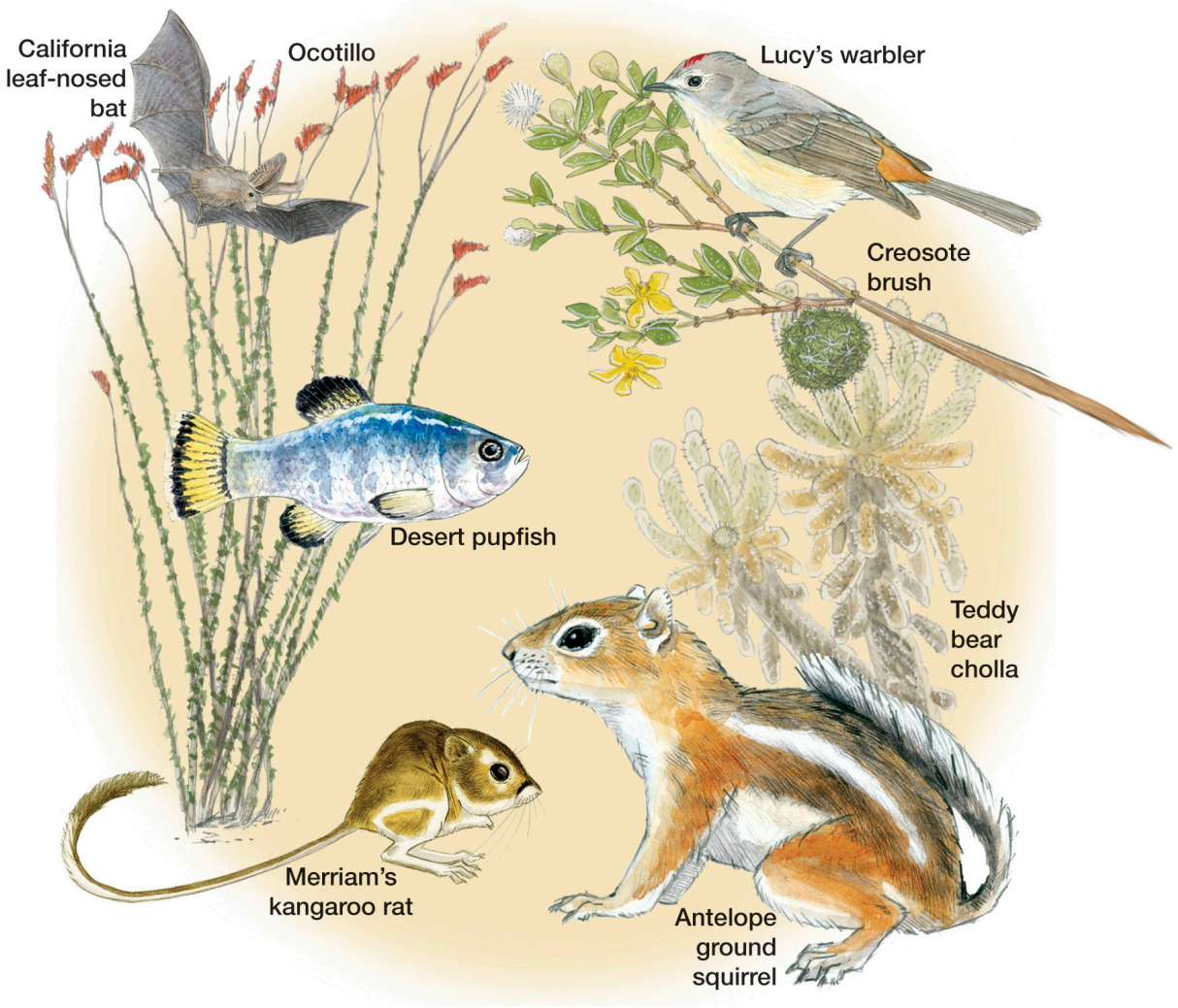
People and the High Desert

It is hard to live in a place where there is so little water. Early settlers who traveled through the Mojave Desert had to find water. If they built homes, they built them close to springs or rivers that flowed through the desert. They used what little water they had to grow food for themselves and their animals.

Many people live in the high desert today. They must be careful about how much water they use.

Desert kit foxes

Low Desert



Discovering the Low Desert

The century plant pushes its tall yellow blooms toward the sky. Desert bees hover around its flowers. Beavertail cactus opens its pink blooms, and ocotillo makes shooting sprays of red flowers.

The low desert is also called the Colorado Desert. It was named after the river that flows down its east side. Most of this desert lies in a deep valley. Mountains surround it on three sides. The elevation at the bottom of this valley is very low. The highest point is about 3,000 feet. The low desert is very hot in the summer, and cooler in the winter. Even though it is cool, there is rarely ever frost. No snow falls in the winter like it does in the high desert.

In the low desert, rain falls in two seasons. It rains about 2–6 inches every year. Most of the rain falls in the winter. In the low desert, however,

thunderstorms also bring rain in the summer. If it rains a lot, the rocky soil cannot hold all that water. It runs through the soil and down canyons and washes. The streambeds can turn into rivers of rushing water in a flash. It is called a "flash flood."

Storing Water

Desert plants must survive hot, dry weather. They live in soil that is rocky or sandy. Some desert plants have a way to store water in their stems and leaves. Cacti often store water in their stems. Other plants, like yucca and agave, store water in their leaves. These plants are called succulents. Lucy's warbler and other birds nest in their rubbery branches.

Succulents have shallow roots that spread out. They also have tiny hairs that grow on their roots. These root hairs fall off when it gets too dry. Water cannot leave or enter the roots of the plants when this happens. This slows the plant's growth, which saves water during hot weather.

Teddy bear cholla (choy-ya) is a cactus that grows in the desert. Its many branches grow close to each other near the top. They are covered with sharp yellow spines. These spines look soft from a distance, but they are not. Spines protect the plant from hungry rabbits and rodents. They also offer some screening from the Sun's rays because sunlight bounces off their shiny spines.

Surviving in the Desert

Sometimes animals or humans brush a teddy bear cholla as they walk by. The spines "grab on," and pieces of the cactus break off. Some people call this plant "jumping cholla." This is how the cactus reproduces. Pieces of the cactus that break off "hitch a ride" away from the mother plant. The cactus will try to grow wherever it falls to the ground.

Ocotillo plants lose their leaves when it does not rain for a long time. When

Low desert habitat

Teddy bear cholla

this happens, they look like a bunch of dead sticks tied together. Once it rains, the ocotillo quickly grows leaves again. It blooms with bright red flowers in the spring and summer. The flowers look like small red tubes at the tip of the stems. Hummingbirds and orioles sip their nectar. Ocotillo branches are strong and straight. People still use them today for fencing or as walking sticks.

Creosote bushes are found just about everywhere in the low desert. They grow well in sandy soils. These bushes are evergreens with dark green leaves. Evergreens do not lose their leaves all at once. They lose old leaves and grow new leaves all year. Creosote bushes have a large root system. Some of the roots reach deep down into the soil, and some stay close to the surface. These plants can live a very long time without water.

Desert Wildlife

Creosote bushes provide shade from the Sun for many animals. California leaf-nosed bats rest under their cover. So do millipedes and beetles. Kangaroo rats and pocket mice dig burrows deep in the soft soil around the roots. They feed on creosote seeds as they fall to the ground.

If you have ever smelled creosote after a rain, you will remember its strong smell. The smell comes from a sticky resin in their branches and leaves. This resin protects the leaves and stems from damage caused by the Sun. California Indians boiled the leaves and drank it warm as medicine.

The San Andreas Fault lies on the east side of the low desert. It is close to the Colorado River in some places. The fault is a crack deep in Earth's crust. Since the fault is so close to the river, water bubbles up from deep underground. The water forms a moist place called a desert oasis. Because there is water in the oasis, water-loving plants can grow here.

One of these plants is the California fan palm. The fan palm is very tall. It has a large gray trunk without any branches. Leaves spread out like fans at the top of the tree. Dried palm leaves hang down around the trunk. These dead leaves make a good hiding place for insects and nesting birds.

The fan palm has large black berries. California Indians ate this fruit. It could be eaten fresh or dried and ground into flour. Dried seeds could also be used to make rattles. The people also made sandals and baskets out of fan palm leaves.

Life-giving Water

In 1905, it rained a lot in the low desert. The Colorado River flowed over its banks. All of the water collected in the middle of the low desert in a huge lake. It became the largest lake in the state. They called it the Salton Sea.

In the spring and early summer, snow melts in the high mountains. It runs down many creeks and flows across the desert floor. Insects and small animals use this water while they can.

Near the Salton Sea, tiny pupfish live in two creeks and some marshy pools. These creeks and pools have water in them all year. Pupfish have lived in this desert for thousands of years. Long ago, they swam in a large inland sea that covered the desert. As time passed, this sea dried up. The pupfish were left behind. After all these years, small populations of them still survive. They have adapted to living in this harsh desert environment.

People and the Low Desert

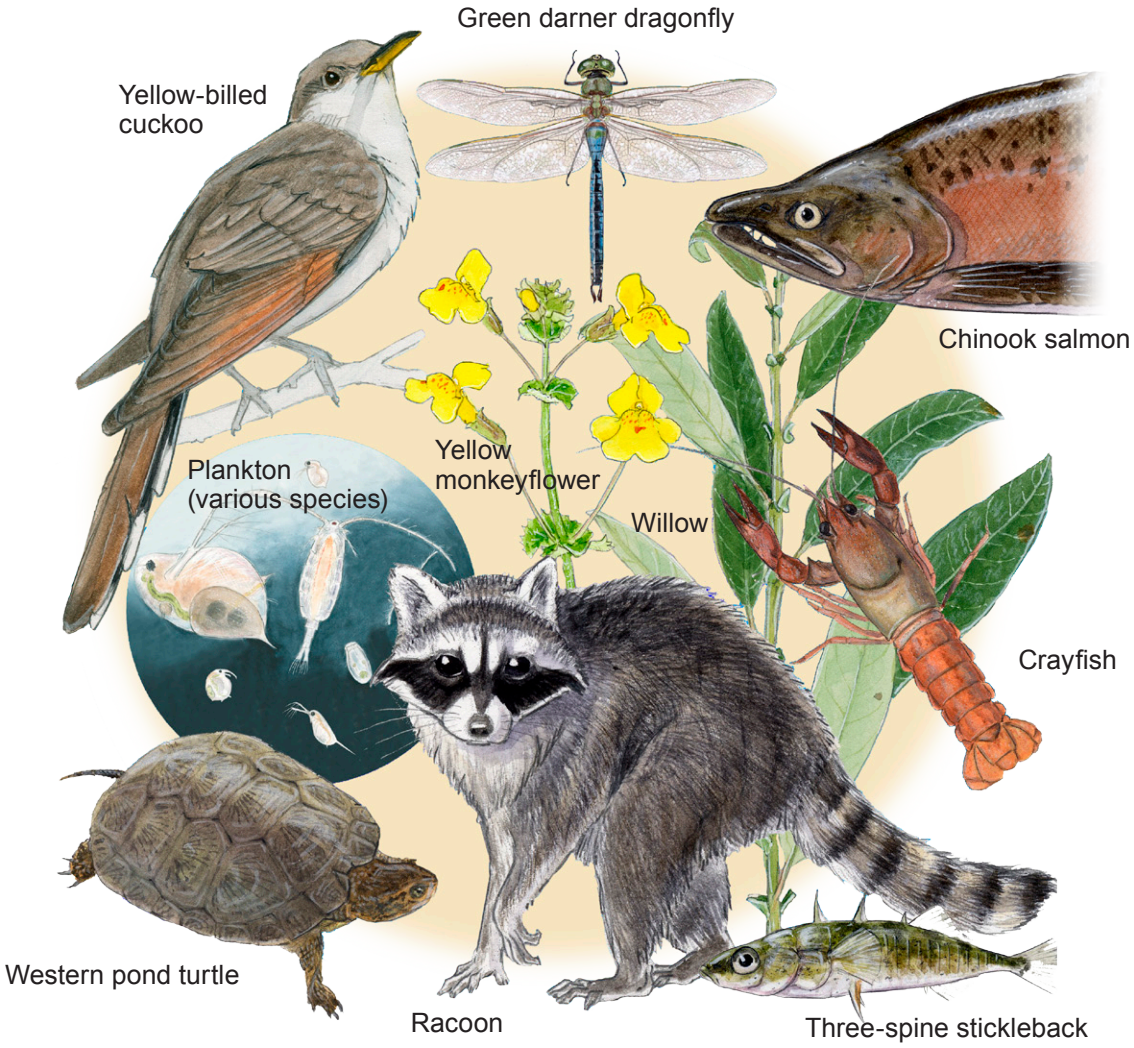
Humans have lived in the low desert for thousands of years. At first, they hunted for food. They gathered desert plants for food and clothing. Soon, the people began to plant and grow crops. Later, miners came to the desert. They found other rich resources. Salt and potash were mined from the floor of the desert. Gold and silver were mined in the canyons. Today, farmers grow dates, citrus fruits, vegetables, and other crops around the Salton Sea.

If enough rain falls during the winter months, wildflowers pop up everywhere in the spring. Desert marigold and brittlebush spread a yellow carpet between the dark creosote bushes. Sand verbena flows like a purple stream in sandy desert washes. White desert lilies spring up from the sandy soil. Many, many people drive out to the desert in spring to see all the beautiful flowers.

Millipede

Brittlebush

Rivers and Lakes



Water's Journey

It is hard to imagine just how much water there is on Earth. In fact, 70 percent of Earth is covered by water. Most of this water is salt water. This water is always moving. Clouds drop snow on the mountains in the winter. In spring, the weather warms and melts the snow. Tiny creeks begin to swell with water.

At first, the water is often just a trickle. As the snow melts, streams begin to flow. Soon, the streams will join rivers. These rivers follow the curve of the land. Their long journey ends at the Pacific Ocean.

Land drains the water from rain and snow into the streams and rivers. Picture the way water drains down your kitchen sink. It's a little like that. The land that feeds a certain stream or river is called a watershed. Watersheds give us fresh water to drink. They provide homes and water for plants and animals.

Many rivers drain water from the Sierra Nevada Range. The Tuolumne River and the Merced River are two rivers that begin their journey in Yosemite National Park. Both rivers split into smaller rivers called "forks." In some places, the water races over "rapids." There are also deep pools and long stretches of calm water along the way.

Along the Bank of a River

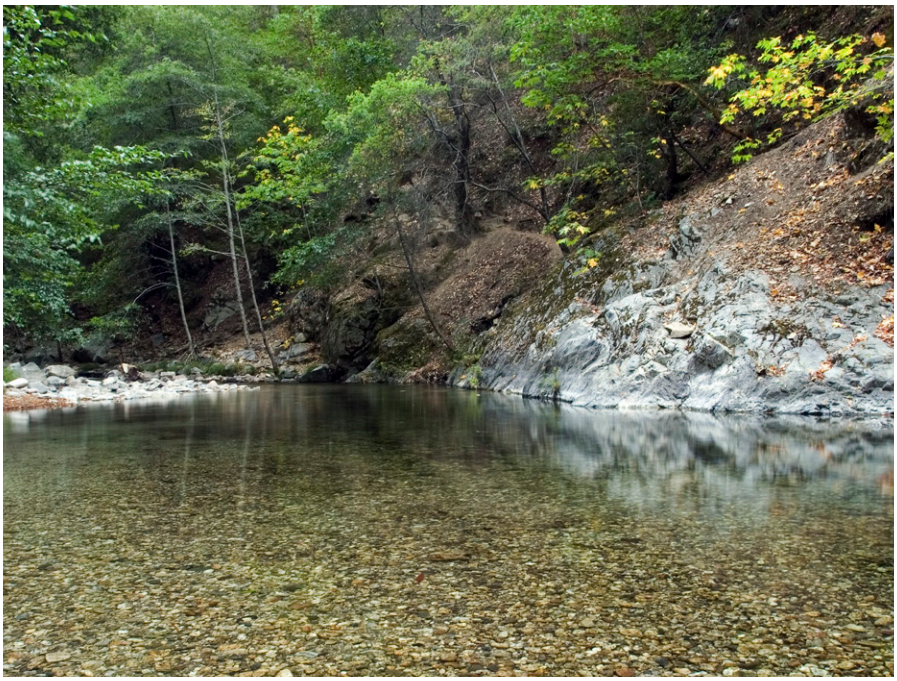
Cottonwood trees live on the banks of many rivers. Their leafy branches grow high above the water. Willows have long leafy branches that often touch the water. Both of these trees grow where water flows quietly. In some places, cattails grow on the riverbanks. Their long brown flower heads bend in the wind. Reeds and rushes grow beside them. Pink jewel flowers bring bright color to the banks of the river. Monkeyflowers turn their yellow, orange, or red blossoms towards the Sun.

Animals live near these rivers as well. The western yellow-billed cuckoo makes its nest under plants near the river. The red-shouldered hawk flies high above the river, looking for food. Larger animals, like black bear, bobcat, and mountain lion also call the river's edge their home.

As rivers race down mountain canyons, they grind rock into fine sand. Plants and leaves fall in the river or are washed off the land. Soon they begin to decay. They turn into rich food for the insects and fish that live along the river bottom.

The Carving of Lake Basins

Thousands of years ago, the climate was much cooler. The snow piled up until it was very deep. It was so deep and heavy that the snow turned into ice.



Big Sur River, California

Red-shouldered hawk

Many glaciers were formed. They moved slowly downhill, picking up rocks and scouring the land as they went. The glaciers carved out U-shaped basins. When the ice finally melted, these basins held water. They became high mountain lakes.

In some places, the land broke along deep faults (cracks) in Earth's crust. On one side of the fault, the land was pushed up and became mountains. On the other side, the land sank into deep valleys. Some of these valleys filled with water and became lakes. Lake Tahoe is one of these lakes. It is the largest mountain lake in California.

Volcanoes can also cause lakes to form. When a volcano erupts, lava flows can build up and make a dam. The water spreads out behind the dam and becomes a lake. Many of the lakes in Lassen National Park were formed when volcanoes erupted.

Some lakes look natural but were made by people. They are called reservoirs. They are used to store water. People make them by building walls made of concrete or huge piles of rocks. These walls across the river are called dams. They hold back the water. Some of these lakes are used to store drinking water or to water crops. Others are used to make electricity for towns or cities. Still others are used for boating, fishing, and water sports.

Life in the Water

The water in lakes and rivers is rich with life. Some of the tiniest animals and plants, called plankton, are so small you can only see them through a microscope. Small fish and insects that live in water eat them. The small fish are food for larger fish in the food chain.

Brine shrimp live in ponds and salty lakes in the desert. Their eggs hatch even if the water is very warm. Brine shrimp are not like the shrimp you eat. They are much smaller. They swim on their backs. These small animals eat tiny bits of plankton floating in the water. Brine shrimp are food for gulls and other birds.

Crayfish look a little like lobsters. They can grow up to eight inches. They eat worms, insect larvae, and small fish. Crayfish are called scavengers because they eat dead fish and other animals. Raccoons eat crayfish. So do large fish.

California has many fish in its inland waters. They are found everywhere from alpine lakes to mountain streams. Slender minnows swim in river currents. Suckers eat off the bottom of streams and lakes. Trout shine like rainbows in deep, cool pools. Even salmon are found in the state's northern rivers. They spend part of their life in the ocean and part of it in a river. Salmon travel upstream against the current to lay their eggs.

If you like to fish, you will remember trout! Golden trout, for example, are found in high mountain streams and rivers. They need clear, cold water to live. The males are bright gold on their sides, and bright red on their stomachs. Golden trout are beautiful. They are California's state freshwater fish.

People, Rivers, and Lakes

Many people live near rivers and lakes. They provide water and food.

California Indians lived by rivers for thousands of years. The Yokuts, for example, lived near the Kern River. They hunted tule elk, deer, fish, and game birds for food. They also grew crops. It was a good place to live because the soil around the river is very rich. There was plenty of water!

In the 1800s, miners found gold in California's streams and rivers. They built their towns and cities along these stream banks.

Today, people like to visit their favorite lake or fishing hole. Rivers can be exciting too. Try running the rapids in a raft! Larger rivers, like the Sacramento and San Joaquin, are used to ship rice, vegetables, and other goods to the coast. From there, they are sent all over the world.

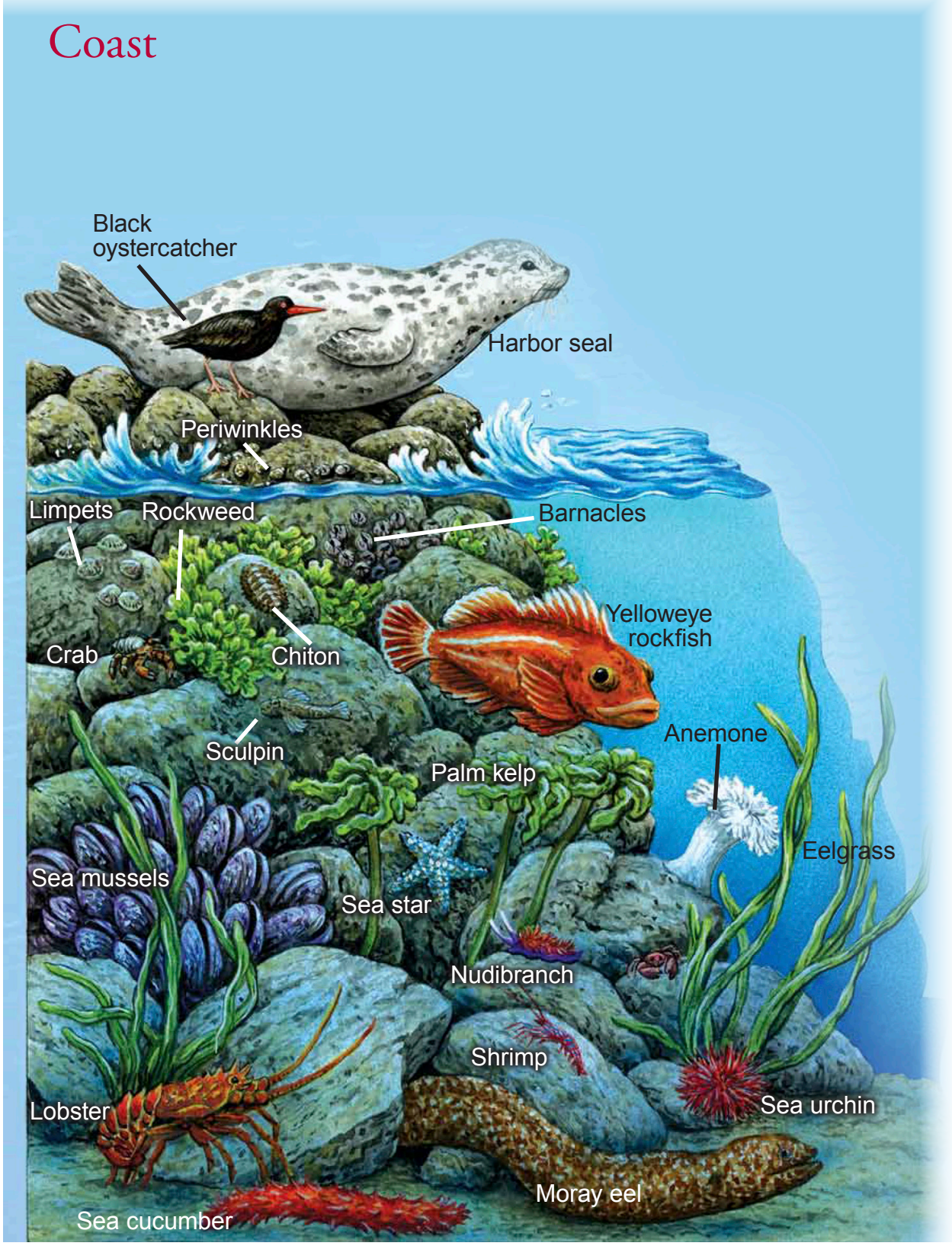
Rivers and lakes bring us our water. They water our growing crops. They flow through dams to make electricity. Rivers give us fish to eat. Both the water and water's edge provide homes for wildlife and plants. Rivers and lakes support life, including our own.

The climate near rivers and lakes depends on where they are. In northern California and in the mountains, the climate is cool and moist. In South California, it is warmer and drier.

River otter

Ocean and Coast

Coast



A Day at the Beach

It is early morning on the coast of California. Waves crash loudly on the shore and pull back with a sigh. Gulls dip and soar against the wind. The beach is empty. Soon, the people will arrive. They will lay their towels on the sand and run into the surf. Some people will set up their fishing rods on the beach, waiting for surf perch and corbina to bite.

California is a very long state. From end to end, its coast is 1,100 miles long. This long stretch of water, sand, and rock has many kinds of weather. The northern coast, for example, is cooler and wetter than the southern coast.

Ocean currents keep the temperatures on land from being too hot or too cold. In the winter, the temperature stays around 50º F. In the summer it is warmer. Fog forms when breezes warmed by the land meet the cooler ocean water. Fog carries a lot of water. Drippy foggy days help coastal plants live through the dry summer.

Shifting Sand

Rivers flow from the Sierra Nevada and Coast Ranges. Their journeys end at the ocean. These rivers carry rocks and soil from the mountains with them. As they move along, the rocks and soil are broken into smaller and smaller pieces.

Ocean and coast habitat

California beach hopper

When the rivers reach the ocean, they wash these tiny stones out into the water. The pounding waves break them into even smaller grains of sand. This sand becomes the beach.

The waves move the sand from the shore to the water and back again. Behind the place where the waves begin to break, there is a current, or flow of water. It carries some of the sand down the coast as it moves south. Sometimes the sand is washed down a steep canyon under the water. Other times it is dropped near the mouth of a bay.

When the sand builds up, it keeps the bay safe from the action of the waves. The sand forms a natural sand bar. Morro Bay is a good example. People built a small harbor behind the sand bar there. Boats are anchored in this bay.

Going with the Flow

When the tide is out at a beach, there is flat wet sand as far as you can see. The pull of the Moon and Sun causes the tides to go in and out. The Moon affects the tides more than the Sun because it is closer to Earth. In California, there are two high tides and two low tides every day.

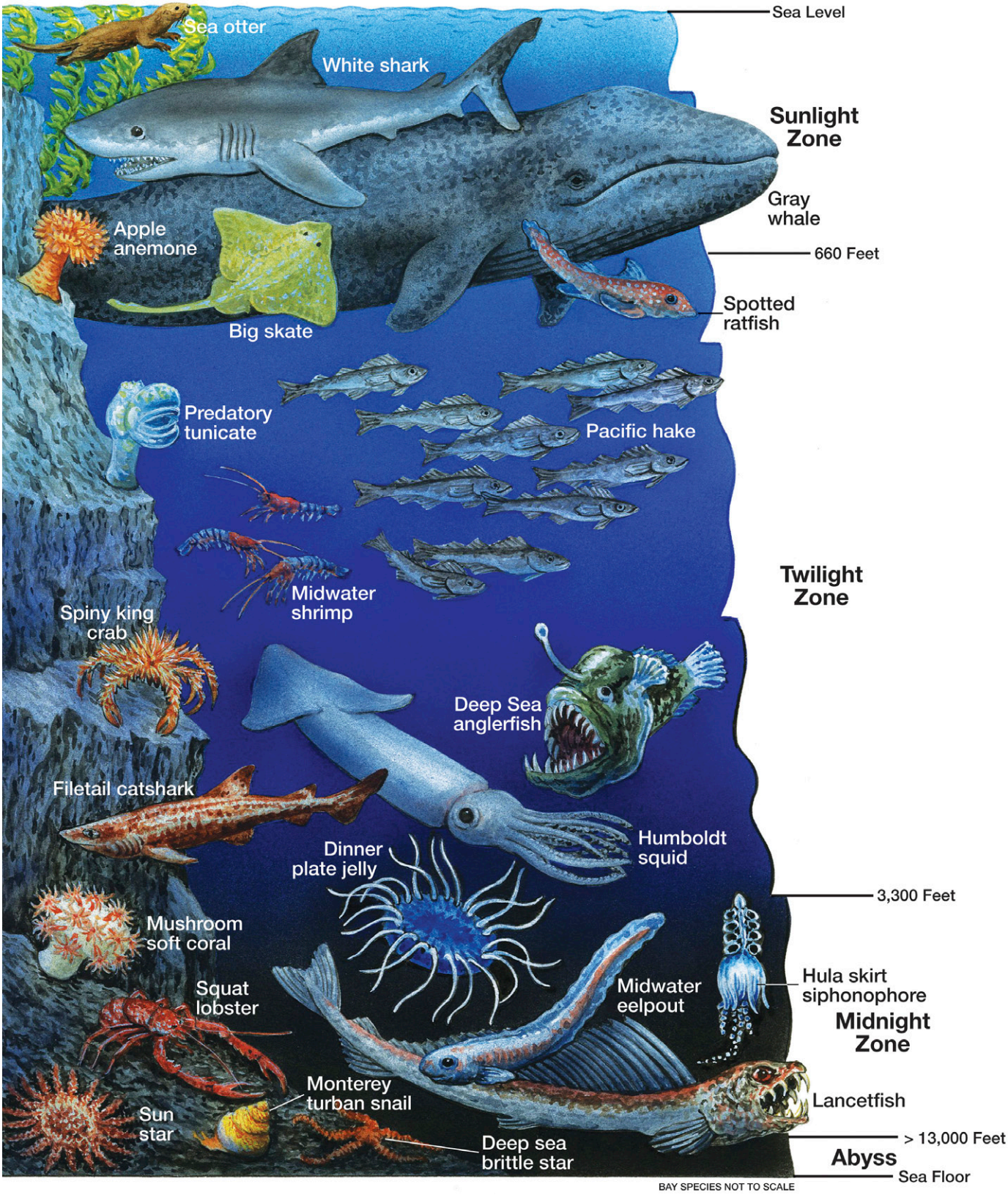
The sand is home to many different animals. When the tide comes in, these animals must be able to live in water. When the tide goes out, they must live without it. Animals like the western sand crab live in the sand. They use their legs to swim when the tide is in. When the tide is out, the crabs dig backward into the wet sand.

Life in a Kelp Forest

Seaweed grows in the ocean. Kelp is a kind of seaweed. Kelp forests provide homes for many marine animals. Rockfish and sea urchins live in the kelp. Leopard sharks swim between their long graceful strands.

Sometimes strands of kelp break off and wash up on the beach. The strands bake in the Sun and start to decay. This decaying seaweed is the home of California beach hoppers. During the day, the hoppers burrow under the sand to keep cool and to avoid being eaten by gulls and other birds, like sanderlings. At night, they come out to feed on the salty leaves and bulbs.

Ocean


Sea Level
Sea otter
White shark
Sunlight Zone
Gray whale
Apple anemone
660 Feet
Spotted ratfish
Big skate
Predatory tunicate
Pacific hake
Twilight Zone
Midwater shrimp
Spiny king crab
Deep Sea anglerfish
Filetail catshark
Humboldt squid
Dinner plate jelly
3,300 Feet
Mushroom soft coral
Hula skirt siphonophore
Midwater eelpout
Squat lobster
Midnight Zone
Monterey turban snail
Lancetfish
Sun star
> 13,000 Feet
Deep sea brittle star
Abyss
Sea Floor
BAY SPECIES NOT TO SCALE

Living in the Ocean

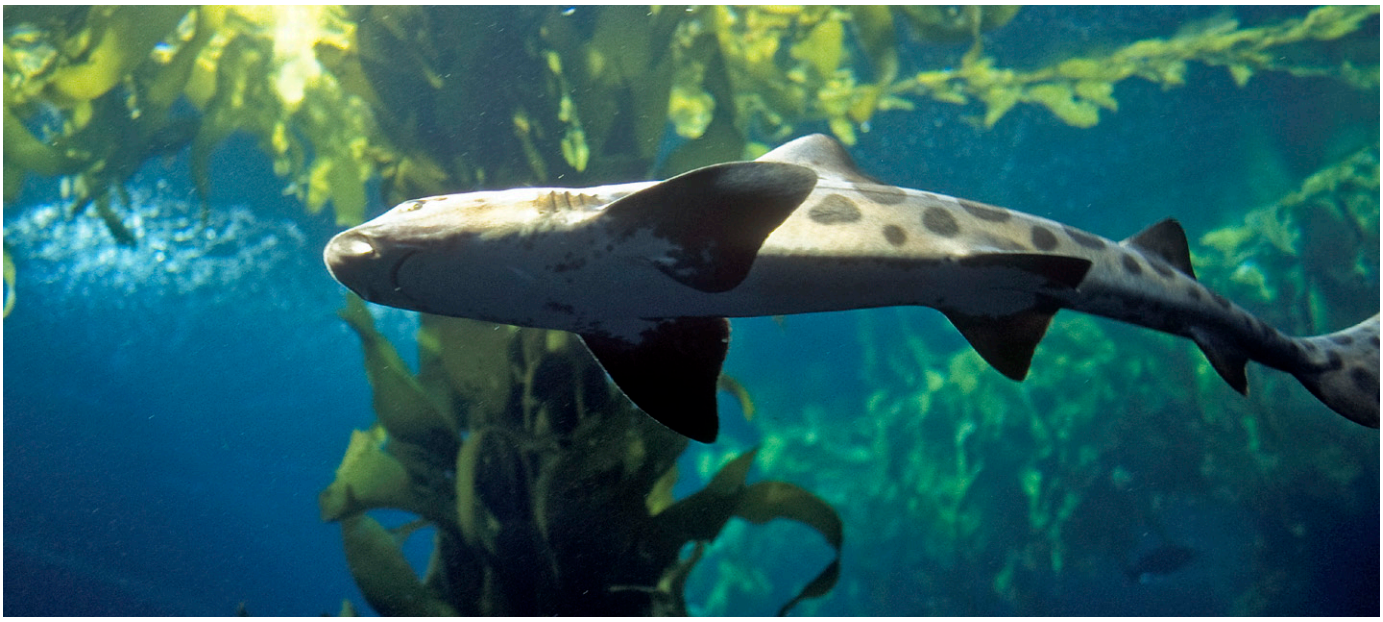
Seals, sea lions, and sea otters are marine mammals. Seals and sea lions swim in the sea, but they come back to land to have their babies. Sea otters are playful animals that live in the ocean. They need to eat a lot of food to keep warm in the cold water. Sea otters float on their backs while eating and sleeping. They carry a small rock with them, so they can crush the shells of abalone and crabs and eat the meat.

Scientists divide the ocean waters into three parts, or zones. The sunlight zone is the area between the ocean's surface to as far down as sunlight can reach. Plankton and kelp grow in this zone. The sunlight zone goes down to about 660 feet. Mammals like the gray whale and sea otter live in this zone. Sharks, tuna, and stingrays live there too.

It is hard to find places to hide in the sunlight zone. Some animals have darker tops and lighter bottoms. When a predator is above them, the prey are hard to see in the dark water below. If the predator is below, they blend with the sunlit water above. This gives them a little extra time to get away!

Deeper than the sunlight zone is the twilight zone. Some light reaches down to the twilight zone, but not much. Plankton and kelp cannot grow here because there is not enough light. The water is very cold. Animals that live in the twilight zone must be able to live with almost no light.

California sea lions



Leopard shark

Some animals in the twilight zone have huge eyes that help them see in the dark water. Both the Humboldt squid and midwater shrimp have special organs that cause their bodies to light up the water around them.

At the bottom of the sea, it is completely dark. This is the midnight zone. Fewer animals can survive at this deep level. In this zone, some animals do not have eyes at all. The gulper eel and the giant squid live in this very deep water. Brittle stars live on the dark ocean floor.

People, Oceans, and Coasts

The coast and ocean off California provide many things to people who live here. California Indians found plenty of food in the tidepools and shallow waters. They gathered abalone and limpets. They caught fish with nets, spears, or hooks. Later, the Spanish settled in California. They built their missions a few miles from the ocean.

Today, fishing boats troll for tuna and hake off the coast. Divers harvest lobster and abalone. A few times each year, people even cut the top of the kelp forests. They use seaweeds to make food products, like ice cream, thicker. Huge ships leave the harbors and travel across the ocean. They carry goods from California to many different countries.

The ocean and coast provide food and oxygen to people around the world. Oceans also affect the weather. They produce many storms and move cool air onto the land.

Oceans are so important that we could not live without them!

This reader is used with 3rd and 4th grade units:

History-Social Science Standards 3.1.1. and 3.1.2. The Geography of Where We Live

History-Social Science Standard 3.2.2. California Indian People: Exploring Tribal Regions

Science Standard 3.3.a. Structures for Survival in a Healthy Ecosystem

History-Social Science Standards 4.1.3. and 4.1.5. Reflections of Where We Live

History-Social Science Standard 4.2.1. California Indian Peoples and Management of Natural Resources

© Copyright 2010 By the State of California
All rights reserved.
This publication, or parts thereof, may not be used or reproduced without permission
from the Office of Education and the Environment.
These materials may be reproduced by teachers for educational purposes.

California Education and the Environment Initiative

Printed on post-consumer recycled paper