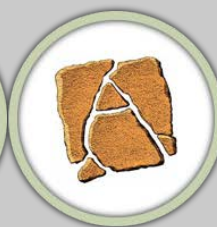


# Volcan Mountain

## WATERSHED EXPLORERS



Photo: Janice Smith



# Contents

OVERVIEW .....	2
Objectives .....	2
California Performance Expectations & Dimensions.....	2
INTRODUCTION .....	3
The San Dieguito River Watershed .....	3
Volcan Mountain.....	5
Mixed Oak Conifer Forest Habitat .....	5
Chaparral Habitat .....	6
Coastal Sage Scrub Habitat .....	6
Riparian Habitat.....	6
Water Quality .....	7
ACTIVITIES .....	8
1. Volcan Mountain Watershed Round Robin (1 hour) .....	8
a. Watershed Model (30 minutes).....	8
b. Water Quality Testing (30 minutes) .....	8
2. Hike the Sky Island Trail (1.5 hours) .....	8
Pre- and Post-Field Trip Watershed Activities.....	8
VOCABULARY .....	10
REFERENCES & SUGGESTED READINGS .....	12
ACKNOWLEDGEMENTS .....	13



# VOLCAN MOUNTAIN WATERSHED EXPLORERS

## OVERVIEW

Led by the Volcan Mountain Foundation, students travel through mature conifer and oak forest to take a guided hike to the top of the Sky Island Trail where they observe the San Dieguito Watershed from a mile above sea level. They then head back down to VMF's Volcan Mountain Nature Center stopping at the year-round spring that feeds the San Dieguito River. Along the way they explore the riparian habitat and its inhabitants and test the water for its ability to support life in the watershed. At the nature center, students participate in a hands-on demonstration of how watersheds function by creating a spray bottle "rainstorm" over a 3D relief map of the Volcan Mountain Range.

## Objectives

Students will:

- understand they live in a watershed, what it is, how it works, and its relevance to their lives;
- explore and experience the biodiversity of a watershed through observations;
- conduct water quality tests to assess the health of the watershed; and
- commit to watershed conservation and encourage others to do the same.

## California Performance Expectations & Dimensions

Note: This program can assist with meeting the following Performance Expectations and Dimensions from [California's Next Generation Science Standards \(NGSS\)](#).

**Grade 5:** 5-PS3-1; 5-LS1-1; 5-LS2-1; 5-ESS2-1; 5-ESS2-2; 5-ESS3-1.

**Grades 6-8:** MS-LS1-4; MS-LS1-5; MS-LS1-6; MS-LS1-7; MS-LS1-8; MS-LS2-1; S-LS2-2; MS-LS2-3; MS-LS2-4; MS-LS2-5; MS-ESS2-1; MS-ESS2-2; MS-ESS2-3; MS-ESS2-4; MS-ESS2-5; MS-ESS2-6; MS-ESS3-1; MS-ESS3-2; MS-ESS3-3; MS-ESS3-4; MS-ESS3-5.

**Grades 9-12:** HS-LS2-6; HS-LS2-8; HS-LS4-6; HS-ESS1-5; HS-ESS1-6; HS-ESS2-1; HS-ESS2-4; HS-ESS2-5; HS-ESS3-1; HS-ESS3-4; HS-ESS3-5; HS-ESS3-6.



# INTRODUCTION

## The San Dieguito River Watershed

When it rains, the falling water runs downhill off the land into nearby creeks, rivers, and lakes. If you were to follow a raindrop from the mountains to the ocean, you would be following the raindrop through a watershed. A watershed is the area of land and waterbodies that collect rainwater. A watershed includes the mountains, valleys, and flatlands, as well as water flowing above ground and underground (groundwater) in creeks, rivers, and aquifers. Most watersheds eventually end at the coast, often at an estuary open to the ocean. Flowing water connects all of the communities in a watershed, and what happens upstream affects those living downstream.

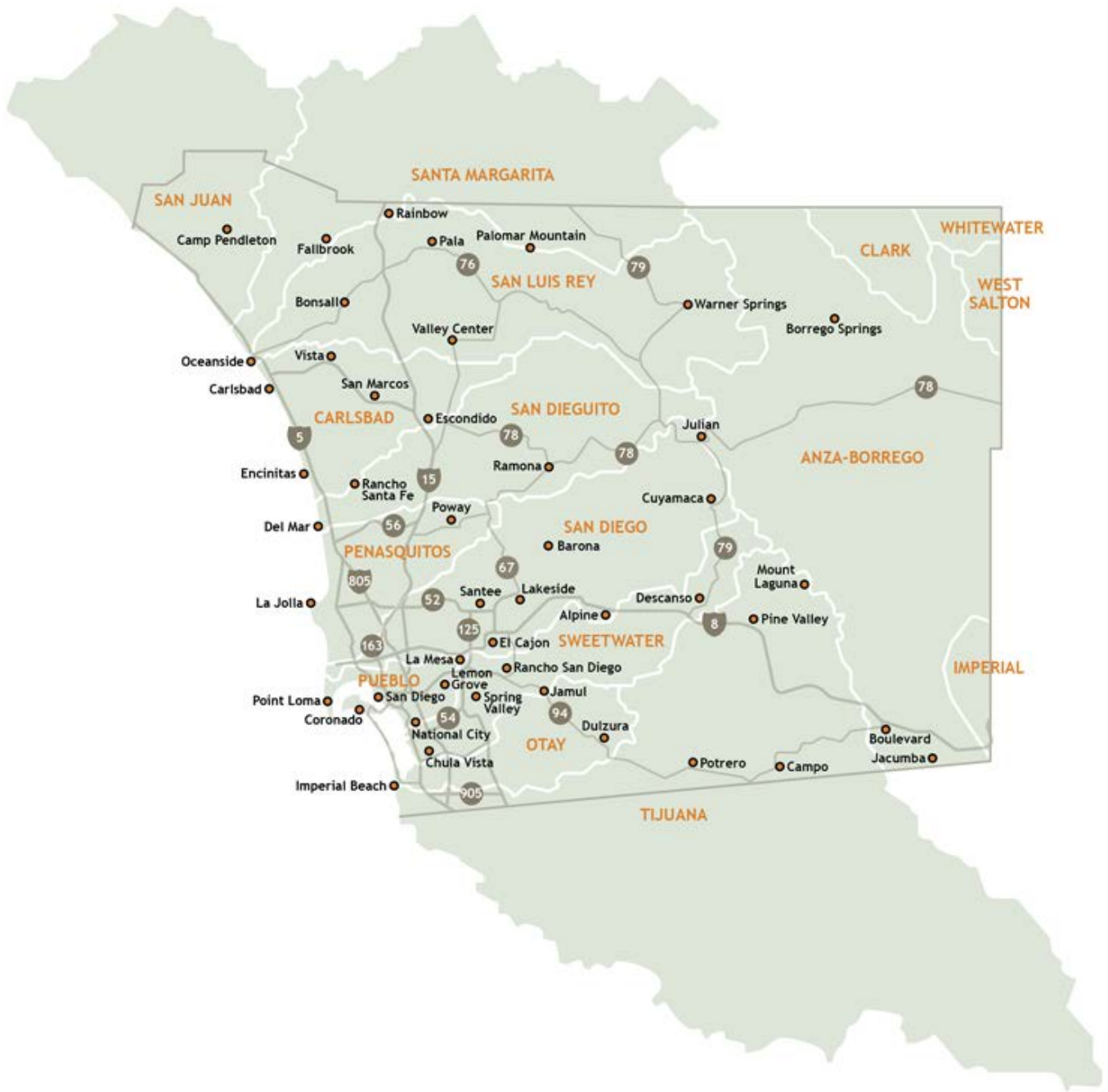
Did you know that you live in a watershed? We all do. Do you know which one you live in? If you live between Julian and Del Mar you probably live in the San Dieguito River Watershed. This watershed starts at Volcan Mountain near Julian and stretches 55 miles through portions of Julian, Wynola, Santa Ysabel, Ramona, Poway, Rancho Bernardo, Escondido, Del Dios, Santa Fe Valley, Rancho Santa Fe, Fairbanks Ranch, San Diego and Del Mar through the San Dieguito Lagoon to the Pacific Ocean.

In terms of land area, the majority of the watershed (79.8%) is within the unincorporated area of San Diego County. The San Dieguito River Watershed is presently divided into vacant/undeveloped (54%), parks/open space (29 %), and urban (18%) land uses. Nearly half of the vacant land area is open to future development, most of which is zoned for residential use. The current watershed population is approximately 125,000; however, this level is projected increase to over 210,000 residents by 2020.

There are several important natural areas within the watershed that sustain a number of threatened and endangered species. Among these are the 92,000-acre San Dieguito River Park Focused Planning Area, the 150-acre San Dieguito Lagoon, and five water storage reservoirs including Lake Hodges, Lake Sutherland, and Lake Poway.

This curriculum focuses on the San Dieguito River Watershed; however, the environmental and water-quality issues found there are pertinent to most coastal California watersheds. Click on this [link](#) to find out information on other watersheds in San Diego County. Note: See the watershed map below for the location of these watersheds.





## Volcan Mountain<sup>1</sup>

The Volcan Mountain Range is a main contributor to quenching San Diego's thirst! It is a vital regional resource. In San Diego County, water from the range feeds three of the largest watersheds in the San Diego Basin (water that flows west from the Range directly into the Pacific Ocean). San Felipe Creek starts high atop the Volcan Mountain Range and drops sharply east to the desert, feeding the Anza-Borrego Watershed and Colorado Basin that flows east to the Salton Sea and into the Gulf of California.

An average of 30+ inches of precipitation a year contribute to the pristine and abundant source waters such as Ironside and Catfish Springs, that feed the San Luis Rey, San Dieguito and San Diego River Watersheds, flowing 55-60 miles to San Diego's metropolitan communities and coastline, and comprising 1,366 square miles out of the total 2,951 square miles of coastal flowing watersheds in San Diego County.

*Hahachepang* means 'Where the waters come from', and refers to several abundant springs. It's the traditional Native American name for the Volcan Mountain Range. For thousands of years, human and animal communities have known that Volcan Mountain is a source of life and energy.

Protecting headwater areas is the single most effective way of maintaining downstream water quality and hydrologic functions of watersheds. Loss of natural watershed processes in headwater streams can cascade to areas far downstream of the source of the impact itself, so water quality on Volcan is extremely important. Conservation efforts like fuel reduction and management ensure that wild fire severity is kept in check, minimizing erosion and soil contamination in water bodies to protect habitat and water resources downstream.

## Mixed Oak Conifer Forest Habitat

Mixed conifer forests are found in the mountain ranges above 4,500 feet elevation. Mixed conifer forests range from dense forests of pine, cedar, and fir species to more open forests with oak trees and an understory of chaparral shrubs and pineland herbaceous species. The forest has multiple 'layers' of vegetation: the top layer is called the canopy, and is made up of the tallest pine trees. Below the canopy is a shorter tree layer, then a shrub layer, and finally a ground layer of grasses, ferns and other herbs. Characteristic plants

---

<sup>1</sup> <http://www.volcanmt.org/water>



include Coulter Pine, Jeffrey Pine, White Fir, Bigcone Douglas-fir, Incense Cedar, Black Oak, and Canyon Live Oak.

A noteworthy species that makes this habitat its home is the Bigcone Douglas-fir. The southern-most occurrence of this species is found in the Volcan Mountains. Mature stands of Bigcone Douglas-fir provide habitat for the California Spotted Owl, which is a candidate for endangered or threatened species listing.

## Chaparral Habitat

Chaparral is California's most common plant community, found in every county in the state. It is characterized by mild, wet winters and hot, dry summers (called a Mediterranean climate and found in only a few places on Earth). The average annual rainfall can vary between 9 and 30 inches, usually increasing with elevation. Most plants are dense, woody, evergreen shrubs with thick, leathery leaves to hold in moisture. Plants in this community are also adapted to dry-season fires, and the ability to regenerate from a stump after fire is a characteristic of chaparral plants. A noteworthy species that makes this habitat its home is the endangered Quino Checkerspot Butterfly.

## Coastal Sage Scrub Habitat

Coastal sage scrub is another dry habitat of rocky slopes and flatlands, receiving an average of about 10 to 20 inches of rainfall per year. Most plants are drought-resistant, deciduous shrubs. They tend to be shorter (about 3 feet) and less dense than those of the chaparral. Sage scrub plants are also typically softer in texture. A noteworthy species that makes this habitat its home is the threatened California Gnatcatcher.

## Riparian Habitat

Along the banks of Santa Ysabel Creek and other small creeks throughout the watershed is riparian habitat (a streamside freshwater wetland). The fairly consistent water source (above and below ground) supports a dense thicket of vegetation that's typically taller and lusher than those in the drier chaparral or coastal sage scrub habitats. Flowing streams and drainages create washes that support trees and smaller herb-like plants. Cool, shaded, and wet riparian habitat attracts many species. Noteworthy species that make this habitat their home are the Least Bell's Vireo, Southwestern Willow Flycatcher, and Arroyo Southwestern Toad.



## Water Quality

Human population growth and development throughout San Diego County has led to significant habitat loss and a reduction in watershed ecosystem services. As water flows through our neighborhoods, it picks up pollution from yards (fertilizers and pesticides), streets (oil and grease), and walkways (trash and pet poop), and carries the pollutants throughout the watershed.

Today's polluted water no longer encounters the cleaning services that wetlands used to provide. Over the past 200 years, nearly 85% of Southern California's wetlands have been destroyed. With fewer wetlands, the job for those that remain is bigger and more challenging. Too much pollution and trash can overwhelm wetlands' cleansing abilities and destroy their usefulness. This disrupts the lives of the plants and animals living there, and ultimately affects the health of habitats throughout the watershed.

Ecosystem health is crucial to ecosystem services. Scientists and technicians use different tests to measure a watershed's health, just like doctors use different tests to measure your health. One way to determine the health of a watershed is to monitor the water quality.

Almost everything we do affects water quality. When the physical, chemical and biological components of water are altered, it causes the watershed to become unhealthy. There are a number of different measureable characteristics of water that can give us clues to a watershed's health including ambient measurements (temperature, pH and dissolved oxygen) and pollutants (nitrate and phosphate). As you visit the different sites included in this program, you will observe and record these measurements to determine water quality and overall health of the San Dieguito Watershed.

Since everyone lives in a watershed, everyone affects the quality of the water. We all have a responsibility to protect our limited freshwater resources and the ecosystem services they provide. By caring for and protecting our watershed, we're helping care for the ocean as well. It's critical that we keep the water in our watersheds flowing clean and healthy.





## ACTIVITIES

### 1. Volcan Mountain Watershed Round Robin (1 hour)

#### a. Watershed Model (30 minutes)

The watershed model demonstrates that Volcan Mountain feeds four large watersheds in San Diego County, including the San Dieguito, San Diego, San Luis Rey and Anza-Borrego watersheds. It also demonstrates how the canyons and ridges of the mountains funnel the water from natural springs and rainstorms downhill to the valleys below and out to the ocean. It gives an overall understanding of how watersheds work and filters pollutants that occur upstream.

#### b. Water Quality Testing (30 minutes)

Students will learn about different factors that affect water quality and the health of our watershed. Working in small groups, students will collect and test water samples for dissolved oxygen, nitrates, phosphates and pH and rank the water quality on site.

### 2. Hike the Sky Island Trail (1.5 hours)

This hike gives students the experience of hiking in a mountain conifer-oak forest at an altitude of 5000-5200 feet, where they will learn about the plants and animals that live there, what they need to survive, especially water! They will do an experiment on transpiration with the local trees and reinforce what they know about the water cycle. They will look for evidence of animals and places where water is evident. They will also view and learn about the relationship between fire and how plants and animals recover from wildfires.

At the top of the mountain they will be able to view the watershed from the “macro view” and use binoculars and the sky scope to locate the tallest mountaintops in San Diego County, the Pacific Ocean, Mexico, and the Anza-Borrego Desert.

### Pre- and Post-Field Trip Watershed Activities

Excellent pre-and post-field trip watershed activities were developed by the San Elijo Lagoon Conservancy for its education program. These activities can be adapted for use in the Watershed Explorers Program and are found at:



**Grade 5:**

<http://www.sanelijo.org/sites/sanelijo.org/files/Publications/TGwater-wetlandsv07.pdf>

**Grades 6-8:**

[http://www.sanelijo.org/sites/sanelijo.org/files/images/education/Biodiversity\\_MS\\_Teacher%20Guide.pdf](http://www.sanelijo.org/sites/sanelijo.org/files/images/education/Biodiversity_MS_Teacher%20Guide.pdf)



## VOCABULARY

**altitude:** the height of an object or point in relation to sea level or ground level.

**aquifer:** an underground layer of rock or soil that contains water from which groundwater can be extracted.

**chaparral:** a habitat with dense, small evergreen shrubs that grow where summers are hot and dry and winters are cool and moist

**coastal sage scrub:** a habitat on drier coastal slopes that consists of drought-resistant, deciduous shrubs and other plants.

**conifers:** mostly evergreen trees and shrubs having usually needle-shaped or scale-like leaves and including forms (as pines) with true cones and others (as yews) with an arillate fruit.

**culvert:** a drainage or channel, such as a flood control channel, that crosses under a road or railway.

**cumulonimbus cloud:** a cloud forming a towering mass with a flat base at fairly low altitude and often a flat top, as in thunderstorms.

**deciduous:** plants that lose their leaves during certain seasons; in California, usually the dry summer-fall season.

**endemic:** native to and confined to a certain place or region.

**erosion:** the process by which water, wind, or other means wears away land.

**fault line:** a line on a rock surface or the ground that traces a geological fault.

**groundwater:** water that is in underground streams or aquifers.

**headwater:** a tributary stream of a river close to or forming part of its source.

**nitrates:** nutrients needed by all aquatic plants and animals that come from decomposing dead plants and animals and the excretions of living animals.

**pesticide:** a substance used to kill harmful or undesirable plants or animals



**pH:** a measure of acidity (acid) or alkalinity (base) of water or other solution indicating hydrogen ion concentration on a scale of 0 (acidic) to 14 (basic), with 7 being neutral; pH is an abbreviation for “power of Hydrogen”

**pollution:** the presence or introduction into the environment of a substance (pollutant), usually produced by humans, that causes harm to a natural environment.

**reservoir:** a large natural or artificial lake used as a source of water supply.

**riparian:** a type of wetland near or along the banks of a river, stream or lake; a streamside or riverside habitat.

**runoff water:** water that doesn't soak into the soil, and instead runs off the land into storm drains, creeks, rivers, etc.

**sky-islands:** isolated mountains surrounded by radically different lowland environments.

**transpiration:** is the process where plants absorb water through the roots and then give off water vapor through pores in their leaves.

**water quality:** a measure of several factors (e.g., dissolved oxygen, nitrates, phosphates, and pH) in water relating to a particular purpose of the water (e.g., drinking).

**watershed:** an area of land that drains the rain falling onto it (or water flowing through it) into a common body of water, such as a creek or stream, which flows into a larger body of water, such as a river or lake, which eventually flows into an estuary and out to the ocean



## REFERENCES & SUGGESTED READINGS

### General

San Dieguito River Park: <http://www.sdrp.org>

Volcan Mountain Foundation: <http://www.volcanmt.org/>

### Watersheds (General)

Benefits of Healthy Watersheds: <http://watershedcheckup.ca/benefits-of-healthy-watersheds>

Healthy Watersheds, Healthy people:

<https://fortress.wa.gov/ecy/publications/publications/0801018.pdf>

How Watersheds Work (5 short kid friendly explanations):

<http://science.howstuffworks.com/environmental/conservation/issues/watershed.htm>

Why Watersheds are Important to Protect:

<http://des.nh.gov/organization/commissioner/pip/factsheets/wmb/documents/wmb-19.pdf>

### San Dieguito Watershed

The San Dieguito River Watershed:

[http://www.projectcleanwater.org/index.php?option=com\\_content&view=article&id=36&Itemid=45](http://www.projectcleanwater.org/index.php?option=com_content&view=article&id=36&Itemid=45)

San Diego Coastkeeper. San Diego Watersheds. Interactive map of water quality along watersheds, including San Dieguito:

<http://www.sdcoastkeeper.org/learn/swimmable/san-diego-water-quality.html>

### Water Quality Monitoring

U.S. Environmental Protection Agency (EPA). How's My Waterway? (searchable by location): <https://www.epa.gov/waterdata/how-s-my-waterway> .

Water quality indicators: Biological, chemical and physical parameters.

Adapted from Healthy Water, Healthy People: Water Quality Educators Guide (www.projectwet.org). Available at:

[https://riverexchange.files.wordpress.com/2015/09/water\\_quality\\_indicators\\_final.pdf](https://riverexchange.files.wordpress.com/2015/09/water_quality_indicators_final.pdf)



## ACKNOWLEDGEMENTS

Made possible by a grant from The San Diego Foundation



Material compiled by:

The San Dieguito River Valley Conservancy  
The San Dieguito River Park Joint Powers Authority  
The Volcan Mountain Foundation  
San Diego Archaeological Center

Material generously contributed by:

The San Elijo Lagoon Conservancy  
<http://www.sanelijo.org/ForTeachers>

[www.watershedexplorers.org](http://www.watershedexplorers.org) • email [weadmin@sdrvc.org](mailto:weadmin@sdrvc.org) • call 858-755-6956

