



California Project WET Gazette

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The Future of Our Hydrological Bank Account

Snow is falling in the mountains of California bringing joy to skiers, but it may not necessarily ease jitters among our managers of water and other natural resources. Regardless of where we stand on the climate debate, change in natural systems is a fact and the record of even natural climate oscillations in recent centuries past does not paint a pretty picture for California. Even as the debate continues to rage in the political sphere, organizations through California are already developing management strategies to deal with varying degrees of change. Researchers are seeking a broad spectrum of data on environmental factors like prevailing weather patterns, temperature and precipitation which define climate to monitoring of streams, wildlife migration trends and plant growth cycles to quantify the expected changes. This is no small task, but it provides a wealth of opportunities for average citizens of all ages and backgrounds to engage in meaningful, 'citizen science.' The concept of 'citizen science' is not new – individuals from Thomas Jefferson and Theodore Roosevelt to all the bird enthusiasts turning out for the annual Christmas bird count – are examples of non-formally trained citizens that have provided invaluable data that researchers use to better understand the natural world. Below are a number of Project WET activities that can be used to raise student awareness of climate concerns involving water resources, develop knowledge and skills involved in the study of climate science and 'citizen science' opportunities to take the learning from awareness to action, while still addressing California Content and Common Core Standards and STEM education initiatives.

What concerns does climate change pose for managers of water and other natural resources? Historically our northern mountain ranges act as frozen bank accounts of water, building up assets throughout the winter and releasing the liquid dividends well into our long, dry Mediterranean summer. Students can investigate the range of environmental factors involved in the timing and volume of snowpack runoff by building the simple table model described in the activity *'Snow and Tell'* (p: 387). The model can be manipulated to simulate how climate change is expected to alter runoff from the Sierra snowpack and raises the very questions are surface water resource managers are investigating regarding dam and reservoir management as the area of snowpack declines and a greater amount of our precipitation falls as winter rain. Students can investigate these reservoir management scenarios in the Project WET activity *'Your Hydrological Bank Account'* (p: 223) and physically demonstrate different management scenarios using the activity *'Blue River'* (p: 135), where the students form a stream system to enact stream flow in a watershed over the course of a year and create a hydrograph of the results. California has attempted to enhance control over natural accounts by plumbing the state with a system of dams to store some of the liquid assets that would otherwise flow to the sea. 'Dams' can be integrated into the *'Blue River'* activity by giving students 3 oz. cups at key location in your class watershed. The activity can be run to demonstrate how the 'dams' can capture water during high runoff periods, then release it during late summer through fall to bolster available water resources – as was the intent of the Central Valley,

State Water and local water projects. But what could happen if weather patterns shift with climate change? This too can be demonstrated using the *'Blue River'* activity, with the student in charge of the 'dam' being responsible for determining when to meter out and when to save water. You as the teacher get to play the role of Mother (or Father) Nature and determine if an average year, drought or an atmospheric river strikes the system and use the student hydrographs of each event in the analysis of the results. Researching current methods California water and flood managers are investigating to deal with change is one extension of these activities, as is using the above activities with the [California Environmental Education Initiative \(EEI\) unit E.9.c. 'Liquid Gold: California's Water.'](#)

Climate science involves the collection and interpretation of data over a broad spectrum of space and time. A better understanding of and practice with skills involved in the study of climate and natural resources will help prepare students for the role of 'citizen scientist' before engaging in a project. Project WET activities such as *'A Snapshot in Time'* (p: 377) or *'A Grave Mistake'* (p: 315) build understanding for the value of data, its interpretation and potential limitations. The importance of standardizing procedures and careful record keeping are stressed in *'Hitting the Mark'* (p: 327) or even *'H2Olympics'* (p: 13) if one encourages student desires to rewrite the student page directions to make the activity 'more fair.' Students gain skills in geography and interpreting topographic maps in *'Seeing Watersheds'* (p: 187), which can be applied to studying watersheds ringing the Central Valley and the relationship between precipitation patterns and the location of California dams. The application of comparative math skills to analyze student journeys through the water cycle in *'The Incredible Journey'* (p: 155), use of simple statistical analysis in *'Blue Planet'* (p: 135) to estimate the percentage of water covering Earth's surface and the measurement and calculation of water volume in *'A Drop in the Bucket'* (p: 257) or *'Money Down the Drain'* (p: 351) are among the other Project WET activity skills that may be of use in preparing students before engaging in a 'citizen science' project. Plenty more can be found using the *Skills and Teaching Methods* indices on the Project WET Portal or on pages 559 and 556 – 557 in *Project WET Guide 2.0*.

Assessing climate change involves the study of environmental factors like temperature, precipitation and prevailing weather patterns. The California adaptation of *'Discover the Waters of Our National Parks'* (p: 495) helps students visualize how these factors influence the California landscape. Students are introduced to how precipitation is measured and mapped in *'The Thunderstorm'* (p: 209) – and having students describe sensory experiences they have had during a thunderstorm focuses Part I of the activity on weather observation skills and further sets the stage to introducing students to the [Community Collaborative Rain, Hail & Snow Network. CoCoRaHS](#) is a grassroots volunteer network of backyard weather observers of all ages and backgrounds who are working together to measure and map precipitation (rain, hail and snow) in their local communities. Their goal is to provide the highest quality data for natural resource, education and research applications using low-cost measurement tools. The only requirements to join are an enthusiasm for watching and reporting weather conditions and a desire to learn more about how weather can affect and impact our lives. With our annual snow surveys set to begin in January, you may also be interested to know the Project WET *'Snow and Tell'* (p: 387) activity includes a simulation of the [SNOTEL \(SNOWpack TELemetry\)](#) data collection process, which dovetails with [CoCoRaHS'](#) guide to measuring snow. The [CoCoRaHS](#) network has a website that provides the ability for network participants to see their observations mapped out in "real time" as well as providing a wealth of information for data users – including teachers looking for local data to 'localize' activities.

California is predominated by a Mediterranean climate, but the geography of our state results in many shades of this climate type. Students are introduced to how this plays out on the landscape in the California adaptation of *'Discover the Waters of Our National Parks'* (p: 495), using pictures of National Park units to observe the effect of different temperature, precipitation and growing season regimes on park ecology while also learning the characteristics of each park as a living laboratory to study natural processes. The activity also provides a wonderful way to introduce students to the California Phenology Project – a project that includes a primary focus on recruiting citizen scientists in the collection and interpretation of phenological data with the support of organizations such as the National Park Service

and U.S. Geological Survey. The California Phenology Project website describes how your class can [participate](#) and provides an overview of the [parks](#) already engaged in the study and the [species](#) being monitored – ***and your class does not need to have access to any of the parks to participate!*** Pilot studies are already being conducted in seven of the California National Park areas, with plans to eventually extend the study to 19 California National Park Service units, other public and private lands in California, and national parks in adjacent states.

The signatures of change can also be detected in the monitoring of streams. The activities *'Blue River'* (p: 135), *'A Snapshot in Time'* (377), *'Macroinvertebrate Mayhem'* (p: 143) and *'Water Quality? Ask the Bugs!'* (p: 421) each help introduce students to common water quality parameters and the [World Water Monitoring Challenge \(WWMC\)](#) makes it easy for your students to apply the knowledge in a 'snapshot day' event. The WWMC website includes ready-to-print instructions for safety at the stream, simple protocols to follow, data sheets to use and even extended activities to build greater knowledge in the classroom – including a number of the Project WET activities listed above! You can input the data your class collects and compare it to data others may have added in your watershed, but the goal of the WWMC is to basically help you get your monitoring feet wet to encourage participation in more formal citizen monitoring efforts. January is a great time to begin your planning for a Spring 'snapshot day' event, as the annual kick-off date for World Water Monitoring Challenge events is March 22 - International World Water Day.

Adaptability is the key to California's future in a changing climate and the science data gathered by an engaged citizenry will enhance the ability of scientists, natural resource and emergency response managers to predict and prepare for future events. Visit the *'Websites of Interest'* for more information on California climate change news and 'citizen science' opportunities.

WEBSITES OF INTEREST

Our Changing Climate 2012 <http://www.energy.ca.gov/2012publications/CEC-500-2012-007/CEC-500-2012-007.pdf>

The 2012 Vulnerability and Adaptation Study, the State's third major assessment on climate change, is summarized here. In contrast to the previous two assessments, this one explores local and statewide vulnerabilities to climate change, highlighting opportunities for taking concrete actions to reduce climate change impacts. This assessment examines adaptation options in regional case studies and offers insights into regulatory, legal, socioeconomic and other barriers to adaptation so that they can be addressed effectively at the local and state levels.

Climate Change Indicators in the United States <http://www.epa.gov/climatechange/science/indicators/>

The Earth's climate is changing. Temperatures are rising, snow and rainfall patterns are shifting, and more extreme climate events—like heavy rainstorms and record high temperatures—are already affecting society and ecosystems. EPA is working with many other organizations to better understand the causes and effects of climate change. With help from these partners, EPA has compiled a set of 26 indicators tracking signs of climate change.

California Phenology Network

<http://www.usanpn.org/cpp>

With funding from the National Park Service (NPS) Climate Change Response Program, the California Phenology Project (CPP) was launched in 2010 as a three-year pilot project to develop and test protocols and to create tools and infrastructure to support long-term phenological monitoring and public education activities in California. A primary focus of the effort is to recruit and to engage Citizen Scientists in the collection and interpretation of phenological data.

Nature's Notebook

<http://www.usanpn.org/participate/observe>

Welcome to Nature's Notebook, a national plant and animal phenology observation program. You can join thousands of other individuals who are providing valuable observations that scientists, educators, policy makers, and resource managers are using to understand how plants and animals are responding to climate change and other environmental changes. Observations by participants like you are already helping researchers detect early leaf-out in forests from St. Louis to Maine in response to unusually warm winters and springs.

USGS: Water Science for Schools

<http://ga.water.usgs.gov/edu/sc1.html>

What is the water content of things? Water is needed to grow not only everything we eat but also to produce almost all the products we use every day. This water is either supplied by nature as precipitation and/or added by people during the growing/production process. You can't tell by the size of a product or the appearance of a food how much water was actually used to produce the item. Is there more to add here?

ARTICLE: Tracking California's Rivers of Rain

Atmospheric rivers are concentrated bands of water vapor that form about a mile (1.6 kilometers) above the ocean, typically ahead of a cold front, and then migrate east. Satellite images have long been able to show them heading for the coast. But it's only now that forecasters are able to zero in on just how much precipitation and flooding they might cause when they arrive. <http://news.nationalgeographic.com/news/tracking-california-s-rivers-of-rain/>

Climate Change Response Program

<http://www.nps.gov/climatechange/effects.cfm>

The Climate Change Response Program works to foster communication, provide guidance, scientific information, and recommendations that support stewardship actions to preserve our natural and cultural heritage from the detrimental impacts of global climate change.

<http://www.nps.gov/climatechange/resources.cfm>

Pacific Coast Bioregion

<http://www.nps.gov/climatechange/pacificcoast.cfm>

Climate change threatens some of the most treasured natural and historic places in our nation. An example in the Pacific Coast bioregion that park managers are concerned about is the potential increase in severe flooding due to heavier early summer rains. Suggested links to learn more about climate change in this region: <http://www.nps.gov/climatechange/aridlands.cfm>

California Cooperative Snow Surveys

<http://cdec.water.ca.gov/snow>

As the successful use of snow surveys in the forecasting of runoff became known, several water agencies began independent snow survey programs. After a few years, these agencies, and the state of California, recognized both the inherent value that such information could have for water users throughout the State and the need for centralized coordination of the snow survey program. In 1929 the State Legislature established a statewide program that has continued to this day. Check-out the short video on how the surveys are conducted!

SNOTEL Data Collection Network

<http://www.wcc.nrcs.usda.gov/snow>

The Natural Resources Conservation Service (NRCS) installs, operates, and maintains an extensive, automated system to collect snowpack data in the Western United States called SNOTEL (for SNOWpack TELemetry). Climate studies, air and water quality investigations, and resource management concerns are all served by the modern SNOTEL network. The network provides important data collection opportunities to researchers, water managers, and emergency managers for natural disasters such as floods. View real-time daily snow and precipitation data in Google Maps, snow and precipitation update reports and Google Earth SNOTEL data layers on this website.

California Data Exchange Center

<http://cdec.water.ca.gov>

The California Data Exchange Center (CDEC) provides a centralized location to store and process real-time hydrologic information gathered by various cooperators throughout the state. Currently, over 140 agencies provide data to CDEC from hundreds of rain, snow, temperature, wind, atmospheric pressure, humidity, and stream stage sensors. The data enable forecasters to prepare flood forecasts and water supply forecasts; reservoir and hydroelectric operators to schedule reservoir releases; and water suppliers to anticipate water availability.

Thank You Ocean Report

<http://www.thankyouocean.org>

The Thank You Ocean Report focuses on interesting and exciting California ocean topics such as marine mammals, the latest news on ocean health, timely ocean issues and fascinating ocean facts. Stories feature interviews with ocean experts, explorers, scientists, conservationists, government and business leaders. Listeners learn about ocean activities and recreation, surfing, fishing, boating, and the many ways we all can thank the ocean through conservation and stewardship.

Watching Our Watersheds (WOW!)

The acronym “WOW!” stands for [Watching Our Watersheds](#), a name coined by local creek enthusiast Trish Mulvey, expressing her reaction on seeing the Google Earth map developed for Western Alameda County. Fans of Project WET activities such as *‘Seeing Watersheds’* (p: 187), *‘Blue River’* (p: 135), *‘Sum of the Parts’* (p: 283) or *‘Color Me a Watershed’* (p: 239) with a love maps, creeks and access to a computer able to run Google Earth are going to love this program!

WOW! is an interactive map in Google Earth format that depicts the present and historical surface water drainage of the Santa Clara Valley based on the Oakland Museum Creek & Watershed Map series. Creek networks, storm drains, creek names, artificial ponds or lakes, freshwater marshes, bay lands and watersheds come into focus in the Google Earth format as users zoom in to view detail, zoom out for an overview or do a fly-over of the watershed with 3-D topography. Information points on the map provide users with information and photographs help them find and learn about their neighborhood creeks and watersheds and inspire them toward greater understanding and stewardship.

WOW! is available to the public for free download from the Santa Clara Valley Water District website (<http://www.valleywater.org/WOW.aspx>) and Oakland Museum (<http://museumca.org/creeks>). You must first download Google Earth, free from Google to use WOW!

If you would like more information on Project WET please contact Brian Brown, California Project WET Coordinator at: projectwet@watereducation.org or (916) 444-6240.

Check our website www.watereducation.org and/or contact us for updates.