



California Project WET Gazette

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GROUNDHOG DAY!

I can already sense the hackles rising with the tone of disgust escaping the lips of the most hardcore science advocates among us at the mere sight of the article title. What a ridiculous concept; the idea that one can predict future weather by dragging a hibernating rodent out of its lair and observing its reaction to the current above ground conditions... as the late Tom Magliozzi of the NPR 'Car Talk' program would say, 'Boooooogus!' However, it is not as crazy as the media spectacle around Punxsutawney Phil, nor as scientifically invalid as the scoffers opine – in fact, the observation and study of organisms and their interrelationships in the environment have been and continue to be used to monitor and deepen our understanding of ecosystems – a field of study known as phenology.

Macroinvertebrates are routinely used in stream monitoring programs to assess water quality. Many of us have used the Project WET Guide 2.0 activities '[Macroinvertebrate Mayhem](#)' (p: 343) or '[Water Quality? Ask the Bugs!](#)' (p: 421) to introduce students to the concepts and skills involved in using macroinvertebrates as indicators of water quality at a given point in time. The characteristics of an organism are key to its value as an indicator species in any research. Thus, external gills and a diet dependent on the vegetation in and around a stream creates a category of organisms that are very sensitive to changes in water temperature, dissolved oxygen level and or other chemical imbalances resulting from events in and around the stream. Internal breathing mechanisms and an ability to prey upon other organisms or thrive on the dead, decomposing muck at the bottom of a stream are adaptations that place other members of the aquatic community into categories that allow us to assess the severity of the damage to water quality. Organisms are also studied in order to assess longer term ecosystems trends through time – and the quantity, state and quality of water available through time is a key factor in all of these relationships.

California is a global 'hot spot' of phenological research due to the wealth of endemic species and biodiversity of habitat types generated by the convoluted geography and Mediterranean climate. California condor are a poster child for research into the effects of lead in the environment, but a feeding system reliant on large, dead animals also brings research questions regarding a species in decline and past climate change events. Plants like coyote bush and manzanita grow in ecosystems throughout the state and each has the ability to morph its growth form in response to light, wind and soil properties. California quail occupy many of the same ecosystems, eating seeds and invertebrates and locating the necessary shelter in accordance with

their adaptations – and providing an additional layer of knowledge to deepen our knowledge of shared ecosystems through time.

Using the adaptations of an organism to identify the habitat it needs is the focus of the Project WET activity *'Water Address' (Guide 1.0)*. It engages students in a clue card activity to 'identify plants and animals and their habitats by analyzing clues that describe water-related adaptations of aquatic and terrestrial organisms' – concepts and skills at the very core of phenology research. The organisms included in the activity as written were chosen to allow use across the nation, but this should not stop one from using local examples as suggested in the Assessment section of the activity. California clue cards have been developed to allow you to focus on our state from the get-go, including the California organisms mentioned above and a dozen others. You'll need to adjust the activity point system, as the California clue cards have 6 instead of 4 questions to provide added heft to the activity.

The California cards include a shell-less, gastropod that produces lots of mucus to help it slide across the floor of damp temperate forest floors and a plant with grooved needles that helps channel fog to the ground – a source of water that can provide up to 40% of the hundreds of gallons it needs per day. The first is named for the cylindrical shape and bright yellow color reminding people of a certain fruit; the latter is the tallest organism on the planet, named for the deep red of its heartwood and thick, shaggy bark. Banana slugs play a key role as decomposers in our coastal forests, cleaning up rotting plant and animal material and feasting on lichen, algae and fungi. Coast redwoods and banana slugs are both sensitive to extended cold or dry conditions, with banana slugs used as indicators of environmental parameters within the forest, while the trees are studied as indicators of environmental change throughout their range from Monterey County north to just inside Oregon.

Students will discover adaptations to hoard water and conserve its use in the extreme are common among desert plants and animals. Cacti, Joshua trees and desert tortoise all have internal structures to store large quantities of water. The tortoise gets most of its water through the vegetation it eats and has flattened, claw-like scales allowing it to dig underground, where it spends a large portion of its life to avoid temperatures that range from freezing to 140 Fahrenheit. Cacti and Joshua trees also share the adaptation of wide, shallow root systems to capture water, spines to keep animals at bay and the ability to stop daytime water loss by disengaging the photosynthesis process. Solid adaptations to the desert environment make each an obvious candidate for phenology studies, but so do other factors affecting each: A number of issues have afflicted the desert tortoise population for years, but it suffered one of its most severe declines in the past year of multi-year drought and above average annual temperatures. Cacti are expanding in range in response to a warming California climate; while evidence indicates Shasta ground sloth were the primary disperser of Joshua tree fruit. The sloth went extinct 13,000 years ago, which gives a rather disturbing thought to the limbs looking like upraised arms that led to naming the plant after a biblical prophet.

A slick, glistening black predator with yellowish spots and stripes is a key species of study in the vernal pools and grasslands of the Central Valley. It may sound like a large cat, but this organism preys on earthworms, snails, insects, fish and the rare small mammal – and its tail will fall off to keep you distracted as it runs away! Its reliance on seasonal ponds and vernal pools, moist estivation quarters to avoid arid summers and role as a predator make the tiger salamander a candidate for research. Ringing the Central Valley is the population of a true California endemic species. A whitish barked tree sporting bluish green, drought deciduous leaves – designed to drop when conditions become too arid – and allowing the tree to go dormant during the worst of droughts, while sipping what water it can pull in with roots that can extend 80 feet into the rocky terrain of its foothill domain. Blue oak and tiger salamanders occupy areas in transition, as rural landscapes give way to urban expansion and expected to undergo a biological upheaval as entire ecological life zones migrate in response to changing precipitation patterns and temperatures.

A hamster-like member of the rabbit family with big ears, a high-pitched squeak is one 'face' of the alpine ecosystems of California. Pikas scurry about the rocky slopes of their habitat storing harvested plant material in "hay piles" to sustain a high metabolic rate – instead of hibernating, pika survive frigid winters by maintaining a high internal temperature. Another 'face' of cold environments is a broad head with short furry

ears that comes with a thick-bushy coat, teeth that can chew through bone and frozen meat, a ferocious temper and curved, semi-retractile claws. Wolverine are very real animals, but are as reclusive and transient as the X-Men character with the one known animal in California as an example – its DNA indicates it came from the northern U.S. Rocky Mountains. Wolverine are studied as indicator species for the cold environments they inhabit, a range that spans North America and Eurasia; the pika on the other hand cannot survive temperatures above 25°C for more than a few hours and can only travel upslope to stay ahead of rising temperatures – which is a problem when one already lives at the top of the mountain.

Aquatic environments of California are represented by beaver, California sea lion and Pacific salmon. Beaver are studied not only for their interrelationships in fresh water habitats, but also the potential to use their ability to engineer wetlands to rebuild mountain meadows damaged by past human actions and slow the flow of water from the mountains as a counter to declining annual snowpack. California sea lions are master predators of the California coast, which makes them sensitive to changes in water temperature that force food sources to move to colder waters and polluted water runoff that can create toxic algae blooms that poison their food supply. Kids love sea lions, but fishing enthusiasts generally do not as sea lion take over docking facilities and compete with them for a favorite catch – salmon. Salmon are battle-hardened survivors of past climate change, including Pleistocene California – a time period punctuated by mass disturbance over entire watersheds as glaciers advanced and retreated multiple times. As an anadromous species, Pacific salmon link fresh water environments of inland California with the salt water environments of our bays, estuary and ocean habitats and are studied as indicators of health throughout the environments they inhabit.

[‘Water Address’](#) wraps-up with a student discussion on how adaptations in the clue cards enable organisms to live in their habitat. Doing this after the directions to categorize and analyze adaptations in the clue cards for similarities and differences between organisms and environments will enhance this discussion – and allow students to back-up their statements with evidence teased from their own analysis in good Common Core practice. A suggested Extension in the [‘Water Address’](#) activity has ‘students create a new organism in an environment of the future.’ An added twist on this extension for older students would be to use the information they have learned about one of the organisms in [‘Water Address’](#) and predict how the organism may react to a warmer, drier future – and how one might design a study to investigate this. [‘Water Address’](#) has not been correlated to the new standards, it is hoped this article highlights the Common Core and NGSS potential in this activity – and the California specific cards will make the activity even more useful!

It is also hoped readers may think again on the actual science that led to Groundhog Day before dismissing it as pure ‘hog wash.’ Are there adaptations of groundhogs (and the badgers originally used in Europe) that could correlate with local weather patterns – i.e., factors affecting groundhog hibernation? The agrarian societies originating the tradition usually celebrated the start of spring when new life begins to emerge in early February. Our modern spring ‘officially’ begins with the Vernal Equinox in March, well after the new life of the year has burst forth; it ends in June with the Summer Solstice, long after much of the plant life not irrigated in the West has died in the heat of summer – a season many of our ancestors celebrated the start of in early May. Something to think about as we watch the geese and whales head north, await the return of the swallows to San Juan Capistrano and peruse the [‘Websites of Interest,’](#) [‘Grants and Student Opportunities’](#) and [‘Events’](#) in this Gazette. Please also check out the list of upcoming Project WET Workshops and Special Events – and the Supplemental Materials section on this website to view and download the California cards for use with the [‘Water Address’](#) activity!

WEBSITES OF INTEREST

[Project WET Portal](#)

Guide 2.0 educators can download a copy of the '[Water Address](#)' activity from the portal. Click on the '**GUIDE 2.0**' tab after logging in – You'll find all of the '**Guide 1.0 Activities**' available for download under the tab of the same name. You'll also find additional materials for a number of activities, courtesy of Project WET Coordinators across the country! The Portal also includes the Common Core Standard correlations for each activity and we are in the process of updating our draft NGSS correlations.

[USA National Phenology Network](#)

The USA National Phenology Network serves science and society by promoting broad understanding of plant and animal phenology and its relationship with environmental change. The Network encourages people of all ages and backgrounds to observe and record phenology as a way to discover and explore the nature and pace of our dynamic world. We bring together citizen scientists of all ages to monitor the impacts of climate change on plants and animals in the United States. Help advance the field by working with a [program in California](#).

[Journey North](#)

Seasonal change is all around us. We see it in the length of a day, in the appearance of a flower, in the flight of a butterfly. Journey North engages students and citizen scientists around the globe in tracking wildlife migration and seasonal change. Participants share field observations across the northern hemisphere, exploring the interrelated aspects of seasonal change. Engage in citizen science anywhere by downloading a free [Journey North app](#)!

[Article: 'Climate change projected to drive species northward'](#)

Anticipated changes in climate will push West Coast marine species from sharks to salmon northward an average of 30 kilometers per decade, according to a new study published in *Progress in Oceanography*. The study suggests that shifting species will likely move into the habitats of other marine life to the north, especially in the Gulf of Alaska and Bering Sea. Some will simultaneously disappear from areas at the southern end of their ranges, especially off Oregon and California.

[Citizen Science Central](#)

Citizen science, volunteer monitoring, participatory action research... this site supports organizers of all initiatives where public participants are involved in scientific research (PPSR). You can find information on current projects throughout the country. The site is administered by the Cornell Lab of Ornithology and includes a great, kid-friendly overview of [California quail](#), [California condor](#) and many other species.

[National Geographic Society: Animal Facts](#)

The National Geographic Society has been inspiring people to care about the planet since 1888. It is one of the largest nonprofit scientific and educational institutions in the world. Its interests include geography, archaeology, natural science, and the promotion of environmental and historical conservation – including a kid-friendly web page on animal facts!

[California Wildlife Habitat Relationships \(CWHR\)](#)

California Wildlife Habitat Relationships (CWHR) is a state-of-the-art information system for California's wildlife. CWHR contains life history, geographic range and habitat relationships information on 694 species of amphibians, reptiles, birds, and mammals known to occur in the state. The site also includes a great information on [California habitats](#).

[Calflora](#)

The Calflora database provides information about California's wild plants, including habitat descriptions, photographs, observations, nomenclature, and distribution maps. Through Calflora, researchers, scientists, students, environmental consultants, landscapers, and amateur enthusiasts have quick and easy access to data they need for analyzing species distributions, modeling spread of invasive species, or identifying consequences of habitat loss - and gives all users an opportunity to learn about the beauty and diversity of California plant life.

[California Pika Survey](#)

We're recruiting hikers, mountain climbers and others in the northern Sierra Nevada to survey the sites where scientists believe pikas may be in trouble in the next 10-20 years. By recording data related to pika, volunteers will help compile baseline data, allowing future studies to assess changes. Please review the map on this website and if you plan to explore these areas, we need you! Read more about pike as [climate indicators](#).

[The Wolverine Foundation](#)

The Wolverine Foundation, Inc. (TWF) is an international non-profit foundation comprised of leading wildlife scientists knowledgeable in the life history, ecology, and management of one of the least understood and most fascinating creatures on earth. TWF recognizes the need for a coordinated science-based effort to elevate the wolverine's management status through support and initiation of research, and to develop an information network for professional and public education. Read about the [wolverine in California](#).

[Redwood Watch](#)

As you walk through the forest, *Redwood Watch* encourages you to submit observations of plants and animals that live in the redwood forest. Observing trees, shrubs, wildflowers, ferns, insects and other animals makes a big difference in understanding species distribution. When we know where redwoods forests and their inhabitants do well today, we will be better able to predict where the redwood forests of tomorrow will thrive. Read more about [redwoods as climate change indicators](#).

[Article: 'UC effort to study effects of climate change on ecosystems'](#)

Researchers at the University of California, Davis have developed an ambitious plan to use the UC Natural Reserve System to detect and forecast the ecological impacts of climate change in California. The NRS is the world's largest system of university-administered natural reserves, offering a powerful opportunity for scientists to study how climate change will affect California ecosystems and the ecosystem services that people rely on.

[Article: 'Blue Oaks Shine New Light on California's Past Climate'](#)

Blue oak is a tough, drought-resistant tree that can shed its leaves when necessary. It also grows very slowly and doesn't reach much more than 50 feet in height. Blue oaks are sensitive to rainfall, putting on thick rings of wood in good years and thin ones during droughts. Data from the study concludes in a [recent article](#) that California's current drought is pretty exceptional — like the driest in about a millennium.

[Article: 'Struggle for Survival'](#)

"The question is: Is the tortoise going to be able to survive under a warming climate in those low California desert habitats?" That same question is increasingly being asked by scientists about a wide variety of animals across the desert Southwest. Many desert creatures have survived for millennia by withstanding long periods without water, and some have adapted to extreme heat by spending much of their lives underground in burrows. Hotter temperatures and multiyear droughts, though, could push some animals to their limits.

[Article: 'Joshua trees losing ground'](#)

Some scientists have estimated that if global temperatures continue to warm as predicted due to rising levels of greenhouse gases in the atmosphere, Joshua trees could vanish from up to 90 percent of their range in the park by the end of the century. These changes in desert plants offer glimpses of profound transformations that hotter global temperatures are likely to bring for wildlife, water supplies, and people in a region that is already the hottest and driest in the nation.

[Article: 'Groundhog Day: History and Facts '](#)

This morning, Pennsylvania's Punxsutawney Phil—arguably the world's most famous groundhog—emerged from his burrow to see his shadow, a harbinger of six more wintry weeks. Why do Americans, Canadians and others around the world turn to these furry rodents for weather predictions in the first place? Explore Groundhog Day's shadowy history as well as interesting facts about the custom.

[USGS: Science In Your Backyard: California](#)

A great resource for connecting with USGS California research and partner projects in all areas of work under the US Geological Survey umbrella from wildlife and climate change studies to earthquake and water research. Check-out the California Water Science Center's [California Drought page](#) for up to date information on our water conditions.

[Water Facts & Fun](#)

Lots of free materials for California educators, including '[The California Water Works](#)' that has a colorful comic book character, Professor Goodwater, leading students through the water cycle, showing them how water is delivered through California's built and natural water systems to the end users. Guidelines for water conservation are provided as well.

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 to review the full Gazette and all linkages to websites in this edition and/or contact us for updates!