SIERRA NEVADA

Water Facts

Sierra Nevada Water Facts

This booklet was developed to show the value of water, our most precious resource, and the importance of the Sierra Nevada region in providing water for California. The information is based on the report Looking to the Source: Watersheds of the Sierra Nevada by the Water Education Foundation.

The Sierra Nevada mountain range features some of the most beautiful landscapes in the world, habitat for thousands of animal species and popular destinations for recreation activities.

The Sierra Nevada region is vital to California's overall water picture.

The region is vital to California's overall water picture. In the Sierra Nevada and a portion of the southern Cascades, on average 60 percent of the state's total annual precipitation falls in the form of rain and snow, according to the California Department of Water Resources (DWR). During spring and summer months, the snow melts and flows downstream into lakes and man-made reservoirs.

This water travels hundreds of miles to provide irrigation for farms, which produce half of the nation's fruit, nuts and vegetables, and dairies, which have made California the largest milk producer in the country. In addition, Sierra snowmelt provides a good portion of the drinking water to Sierra Nevada residents and to 23 million people living in cities stretching from the Central Valley to the Bay Area to Southern California.

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WATER EDUCATION FOUNDATION

The mission of the Water Education Foundation, an impartial, nonprofit organization, is to create a better understanding of water resources and foster public understanding and resolution of water resource issues through facilitation, education and outreach.

Sierra Nevada Background

The Sierra Nevada is one of the most diverse regions in the world because of precipitation that ranges from 10 to 90 inches a year. Towering granite cliffs give way to lush conifer forests, alpine meadows and foothill grasslands on the westside, and to stark desert landscapes on the eastside.

Tom Rassuchine

Quick Facts

- **Notable landmarks:**
  - Mount Whitney, at 14,505 feet is the highest point in the contiguous United States
  - Yosemite Falls is the highest waterfall in North America with a 2,425-foot cascade
  - Lake Tahoe is the largest alpine lake in North America and the second deepest lake in the United States at 1,645 feet
- **Sierra watersheds provide habitat for the majority of bird, mammal, reptile and amphibian species found in California.**

U.S. Fish and Wildlife Service

Mount Shasta
PIT RIVER
SHASTA DAM/RESERVOIR
Burney
Redding
Susanville
SACRAMENTO RIVER
Quincy
Chico
OROVILLE DAM/RESERVOIR
Oroville
Truckee
FEATHER RIVER
Grass Valley
YUBA RIVER
Auburn
South Lake Tahoe
MOKELUMNE RIVER
FOLSOM DAM/RESERVOIR
Placerville
AMERICAN RIVER
Jackson
COSUMNES RIVER
MONO LAKE
SACRAMENTO-SAN JOAQUIN DELTA
PARDEE DAM
Sonora
Manteca
HETCH HETCHY RESERVOIR
San Francisco
Mammoth Lakes
OWENS LAKE
TUOLUMNE RIVER
OWENS RIVER
MERCED RIVER
Bishop
Merced
FRIANT DAM
SAN JOAQUIN RIVER
KINGS RIVER
Tulare
Porterville
Lake Isabella
KERN RIVER
Mojave
SIERRA NEVADA CONSERVANCY BOUNDARY

What is a Watershed?

A watershed is the land through which runoff – snowmelt and rain – drains into lakes, streams and rivers. Watersheds may be as small as a patch of land draining into a tiny pond or as large as the Sacramento River Basin, which drains an area of about 27,000 square miles.

A watershed has many important natural functions. It collects water from precipitation; stores water in lakes and other surface water bodies as well as underground aquifers; releases water as runoff and provides habitat for plants and animals. Flowing water carries organic matter that provides food and shelter for aquatic life. The health of Sierra Nevada watersheds is directly linked to the quality and even the amount of water that flows through the region and downstream.

To protect and enhance the Sierra Nevada, in 2004 state legislation established the Sierra Nevada Conservancy (SNC) to provide a strategic direction for the region's environmental, economic and social well-being. The SNC provides state funding for local projects and offers technical assistance for projects in partnership with local governments, tribes and non-profit organizations.

The SNC's boundaries extend beyond the geographic Sierra Nevada and include the Mono Basin, Owens Valley, the Modoc Plateau and a part of the southern Cascade Range, including the Pit River watershed. This region includes all or parts of 22 counties, from Modoc County in the north to Kern County in the south.

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A Natural Reservoir

Snow serves as an enormous natural reservoir. Mountain meadows, especially in the northern Sierra, also play a critical role in the natural storage of water.

The Sierra Nevada provides so much of the state's water because the mountains "catch" eastern-moving storms before they reach Nevada, and snow accumulates at higher elevations. The mountains act like a natural reservoir that holds the snowpack until temperatures rise. During the late spring, the snow melts to provide significant runoff that supports many uses and activities.

Man-made reservoirs are carefully managed to make sure there is sufficient space available during periods of high flood risk. Then, in late spring and summer, water is allowed to fill the reservoirs. By late summer, when natural river flows are at very low levels, water releases from the reservoirs provide much of the downstream water supply to farms and homes.

Pardee Dam and Reservoir in the Sierra serves the East Bay area of California.

Water Use

Groundwater

Groundwater – the portion of water beneath the land surface – plays an important role in the state's water supply and the health of watersheds. Although Sierra Nevada groundwater makes up only about 4 percent of the state's total applied water, many Sierra residents rely on groundwater for their primary source. The most notable Sierra Nevada groundwater basins are found in the volcanic soils of the upper portion of the Feather River watershed.

Hydroelectric

As Sierra water flows downstream, it serves as the state's leading source of hydroelectric power generation, responsible for up to 55 percent of all hydroelectricity produced in California, according to DWR. That's up to 15 percent of California's total energy every year, according to the California Energy Commission (CEC).

Benefits of hydroelectric plants are: their ability to generate power during periods when demand is high, such as hot summer afternoon hours; relative low cost; and near-zero emissions, according to the CEC. But hydroelectric power plants alter stream flows, water temperature, turbidity – the amount of sediment in the water – and oxygen content, which can affect wildlife.

A Southern California Edison hydroelectric power station on Bishop Creek in the eastern Sierra.

One acre-foot equals about 326,000 gallons, or enough water to cover an acre of land, about the size of a football field, one foot deep. An average California household uses between one-half and one acre-foot of water per year for indoor and outdoor use.

A Downstream Source

In addition to providing water to local users, rivers in the Sierra Nevada region are a direct source for many downstream water districts:

- The city of San Francisco – Tuolumne River
- Alameda and Contra Costa counties – Mokelumne River
- Los Angeles Department of Water and Power – Owens River

San Francisco gets 85 percent of its water directly from the Tuolumne River.

The Delta Connection

It's been said that the Sierra Nevada is as important as the Delta, just in a different way. From the Sierra Nevada region, water flows into larger rivers, including the Sacramento (447 miles) and the San Joaquin (330 miles), which come together just south of Sacramento. Here the two rivers mingle with smaller tributaries and tidal flows to form a 700-mile maze of sloughs and waterways surrounding more than 60 leveed tracts and islands.

Sacramento-San Joaquin Delta

Outflow from the primary rivers of the Sierra Nevada region accounts for 40 to 50 percent of total water into the Delta, according to DWR.

The Delta is the hub for two massive water delivery systems:

State Water Project (SWP)

The SWP is operated by DWR, includes more than 700 miles of aqueducts from Northern to Southern California. The SWP delivers about 2.5 million acre-feet annually and serves farmers in the San Joaquin and urban users in Southern California and the Bay Area.

Central Valley Project

The federal Central Valley Project (CVP), which is operated by the Bureau of Reclamation, was built primarily to irrigate the Central Valley, and in a "normal" year delivers 7 million acre-feet of water. About 90 percent irrigates more than 3 million acres of farmland.

Ongoing Challenges

Water Quality

For the most part, Sierra Nevada streams and rivers run clear and cool. Yet many waterways have had stretches periodically closed because of pollution.

Water quality sampling by El Dorado Irrigation District

Some forms of human activity threaten Sierra Nevada water quality. Contaminants, such as oil and nitrate (from fertilizers, septic tanks and wastewater systems) have decreased water quality in some areas. As water quality deteriorates, costs increase to treat and store drinking water and address damage to fish and wildlife.

Healthy Forests and Fire

Forests are water factories. In healthy forests the canopy – tree branches, needles and leaves – intercepts rainfall and absorbs its erosive energy before it hits the ground. A continuous cover of trees and shade near streams benefits fish and wildlife. Healthy forests also add an important level of predictability for water managers through controlled peak flows and reduced flood risks as the forests are able to absorb water and slowly release it over time.

Forest land after thinning, Tahoe National Forest

Fire is a natural process, and much of the Sierra Nevada vegetation evolved as a result of low-intensity fires. As the region developed, fire suppression policies dictated that low-intensity fires be put out to avoid property damage. As a result, many forests are now overgrown. Many Sierra Nevada forests average 400-1,000 trees per acre versus 50-75 in the Gold Rush days. This leads to a build-up of fuels, an invitation for more severe, even catastrophic fires, which are occurring more frequently.

Additional factors that add to the potential for high-intensity wildfires include variation in climate, human settlement patterns and

land-use practices. These catastrophic fires can destroy forest habitat and cause soil erosion, which impacts water quality.

Recreation

The Sierra Nevada region has been called California's outdoor playground. The region's diversity attracts tens of millions of visitors each year, and nearly two-thirds of the visits occur on public lands managed by the U.S. Forest Service. Region-wide, tourism accounts for 15 percent of the total payroll according to the Sierra Business Council.

Jon Klusmire, Eastern California Museum

Many of the recreation opportunities center on water – reservoirs and lakes, streams and rivers. While most recreation is compatible with watershed protection, some recreational activities and the facilities built to support them can have impacts, such as pollution and watershed damage.

Development

Today, more than 650,000 people live in the Sierra Nevada region. Various agencies report that number could double or even triple by 2040. The challenge is proper planning to avoid significant impacts on resources, including fragmented and damaged habitats, altered stream flows, increased groundwater use, invasion of non-native plants and animals, increased wastewater and heightened risk of catastrophic fires.

Climate Change

Climate change already is having an impact on the Sierra Nevada watersheds. A long-term increase in temperature and a shift in precipitation patterns means more water is falling as rain rather than snow, and spring runoff is coming earlier, resulting in stresses to the water supply and flood control system, according to the California Climate Change Adaptation Strategy.

To prevent flooding, water managers would likely need to release water from reservoirs more frequently to protect downstream communities. Without working to capture and store this water downstream, water supply shortages could develop later in the year.

Summary

The importance of Sierra Nevada watersheds to the state's overall water picture cannot be overstated. Water from the Sierra Nevada provides irrigation for food crops, water to keep business and industry thriving, hydropower to light homes and quality drinking water to residents throughout California. Yet the Sierra source faces mounting threats. Education, investment and support need to continue so that Sierra Nevada region watersheds can function and thrive, not only for the sake of those who live in the region, but for everyone in California who depends on water from the region.

North Fork, Battle Creek

For more information:
www.aquafornia.com
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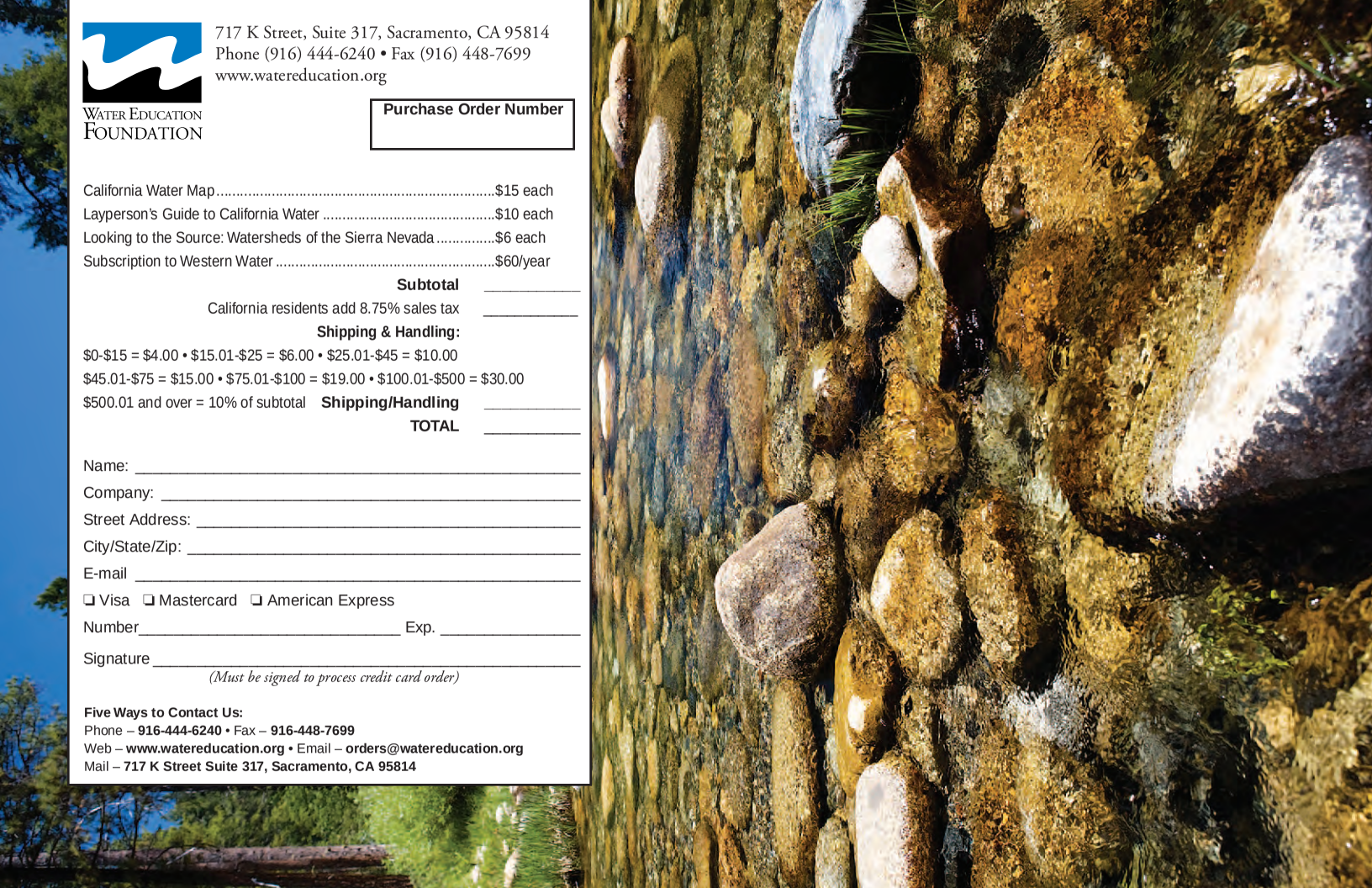

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