Sacramento River[1]

Sacramento River Basin

"The future of California is joined at the hip with the Sacramento River."

— University of California geologist Jeff Mount, Ph.D.

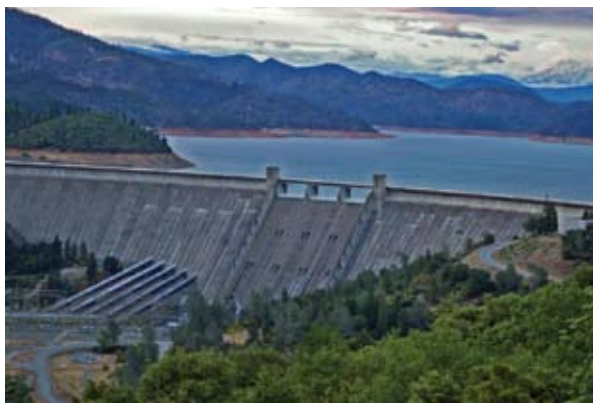
Sacramento Valley agriculture[2]

The Sacramento River is the largest river and watershed system in California (by discharge, it is the second largest U.S. river draining into the Pacific, after the Columbia River). This 27,000–square mile basin drains the eastern slopes of the Coast Range, Mount Shasta, the western slopes of the southernmost region of the Cascades, and the northern portion of the Sierra Nevada. The Sacramento River carries 31% of the state's total surface water runoff. Primary tributaries to the Sacramento River are the Pit, Feather, and American Rivers.

The Sacramento River Basin provides drinking water for residents of northern and southern California, supplies farmers with the lifeblood of California's agricultural industry, and is a vital organ for hundreds of wildlife species, including four separate runs of Chinook salmon. It is also the home of more than 2 million northern Californians. From the mountains, to the valley, to the small towns and cities, it is the place where we live, work, and play.

Mount Shasta

Sacramento River flowing through the city of Sacramento



Shasta Dam

Hydrology

The Sacramento River Basin lies between the Sierra Nevada and Cascade Range in the east and the Coast Range and Klamath Mountains in the west. Its source waters rise in the volcanic plateaus and ranges of northern California as three rivers: the Upper Sacramento, McCloud, and Pit. These three rivers join in the waters of Lake Shasta, a 4.5 million acre-foot reservoir formed by Shasta Dam. From the dam the Sacramento River winds approximately 30 miles south through the foothills between Redding and Red Bluff. Many small and moderate-sized tributaries join the river from both east and west, including Clear, Cottonwood, Cow, and Battle Creeks. At Red Bluff a large portion of its flow is diverted into canals that deliver irrigation water to agriculture south in the Sacramento Valley. The Sacramento River continues to meander south, where it is joined by Antelope, Mill, and Deer Creeks in eastern Tehama County, and by Stony and Big Chico Creeks south of Chico. Butte Creek merges

Hydrology in the Sacramento River Basin

Hydrology, continued

with the Sacramento River near Colusa and the Sutter Buttes, a group of isolated volcanic hills in the middle of the Sacramento Valley. The Sacramento River is joined by its largest tributary, the Feather River, at Verona. About 10 miles downstream, the Sacramento River flows through the city of Sacramento and receives the American River, its second largest tributary. Here the river divides into the mainstem and the Sacramento Deep Water Ship Channel, constructed for navigation by cargo ships. Both waterways eventually rejoin in the estuary of the Delta near Rio Vista. The mouth of the Sacramento River is at Suisun Bay near Antioch, where it combines with the San Joaquin River. The Sacramento River, now nearly a mile wide at its mouth, flows into San Francisco Bay and finally joins the Pacific Ocean under the Golden Gate Bridge in San Francisco.

The Sacramento River and the city of Sacramento[1]

Sacramento River levee break[2]

Water quality in the Sacramento River Basin is generally considered very good

Red Bluff Diversion Dam[3]

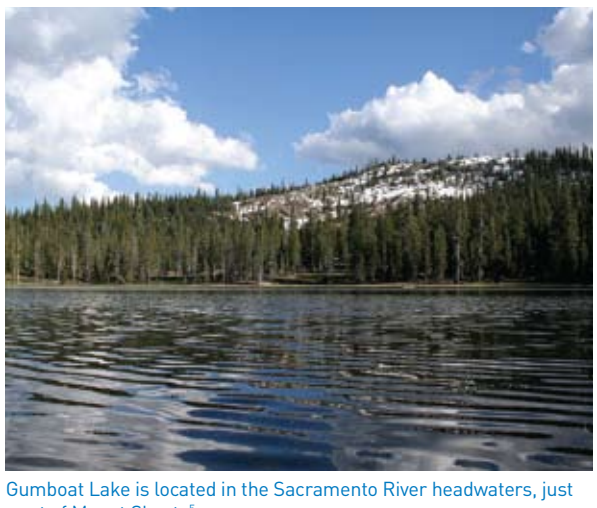
Water Quality

Water quality protection and improvement are principal management issues throughout the Sacramento River Basin. While each individual watershed area has its own set of water quality concerns, priority issues for the basin overall can be summarized as:

- potential for aquatic life toxicity and domestic supply impacts resulting largely from agricultural chemical use in the Sacramento Valley;
- mercury and methylmercury levels that are absorbed into and accumulate in the aquatic food chain;
- accelerated erosion of stream channels and uplands that affects sediment transport rates and causes problems from sediment deposition; and
- temperature impacts on coldwater species resulting from loss of riparian cover canopy, streamflow diversion, and waste discharges.

The Sacramento River itself is considered to have relatively clean water that supports a wide variety of beneficial uses. However, in the Sacramento River Basin are numerous lakes, rivers, and streams (including the Sacramento River) that are state and federally listed (Clean Water Act Section 303(d) list) as impaired water bodies.

Oxbow Lake on the Sacramento River[4]



Gumboat Lake is located in the Sacramento River headwaters, just west of Mount Shasta[5]

Mercury: A California Gold Rush Legacy

Hydraulic gold mining in the Sierra Nevada

Throughout the Sacramento River Basin there are numerous lakes, rivers, and streams currently on the Clean Water Act Section 303(d) list of impaired water bodies for mercury. Mercury enters waterways when soils erode, atmospheric dust falls to the ground, and mineral springs discharge. Another significant source is cinnabar ore (mercury sulfide) that was mined in the Inner Coast Ranges for elemental mercury (quicksilver). This liquid form of mercury was transported from the Coast Ranges to the Sierra Nevada for gold recovery where several million pounds of mercury were lost to the environment during the gold rush.

Today, contaminated mine sites, riverbanks, and debris basins are a legacy source of mercury, and the scale is daunting, with more than 47,000 abandoned mines in California. Liquid mercury is encountered today by large- and small-scale dredging operations in the rivers and streams once used to wash away unwanted waste from historical mine operations. In urban areas, municipal stormwater and sewage also contain mercury from various consumer products.

Why Mercury Is a Problem

Methylmercury is a potent neurotoxin, and thousands of people eat fish and shellfish from mercury-contaminated waterways in the Sacramento River Basin. Methylmercury is readily absorbed from water and food, and therefore concentrations multiply greatly between water and top predators of aquatic food chains. The cumulative result of this bioaccumulation is more than million-fold increases in concentrations of methylmercury in predatory fish such as bass and fish-eating wildlife such as terns and eagles.

State regulators recently listed 100 water bodies throughout the Central Valley as impaired by mercury. Mercury contamination affects aquatic life and wildlife habitat; sport, subsistence, and commercial fishing; and rare and endangered species habitat. State health managers have posted dozens of fish consumption advisories.

Addressing the Mercury Problem

Government and land management agencies are tasked with cleaning up mercury-contaminated areas on public lands. Meanwhile, there are few incentives for voluntary private lands cleanup, and regulations regarding assessment and cleanup target levels are not always consistent or understandable. Reducing methylmercury levels in fish will require local, waterway-specific solutions because each waterway has its own unique set of mercury sources, land ownership patterns, and available resources. Both sources and the process of converting elemental mercury into methylmercury must be addressed. It takes less than half of a measuring cup of methylmercury to contaminate 3 million fish to levels above consumption advisories. That amount is a small fraction of the 1,500 pounds (which would fill 25 two-liter bottles) of all the mercury carried by the Sacramento River annually, which in turn is a minuscule portion of the 3 million tons (which would fill 40,000 truckloads) of sediment delivered by the river contaminated by that mercury.

Helen Mercury Mine

Transformation of various kinds of mercury into methylmercury is a crucial step in the bioaccumulation process. An unfortunate irony is that more productive ecosystems such as wetlands and flooded agriculture tend to generate more methylmercury. A national survey by the USGS of 21 large watersheds across the U.S. demonstrated that methylmercury levels in fish were determined largely by methylmercury concentration in water, and that the percentage of wetlands in these watersheds was an important factor influencing methylmercury concentrations in water. The CALFED Program provided more than $30 million for scientific research into the status of mercury in the Delta and the mechanisms that control the formation of methylmercury. Now actions are needed to implement control measures. Proponents of projects—to rehabilitate land, restore riparian habitat, and manage sediment and water—need tools and incentives to encourage environmentally sound removal techniques that minimize the transport of mercury and its transformation to methylmercury. Regulators need to measure current conditions and to monitor over time the effectiveness of their policies on project outcomes. Health officials need to convey accurate, relevant public messages.

Vegetation

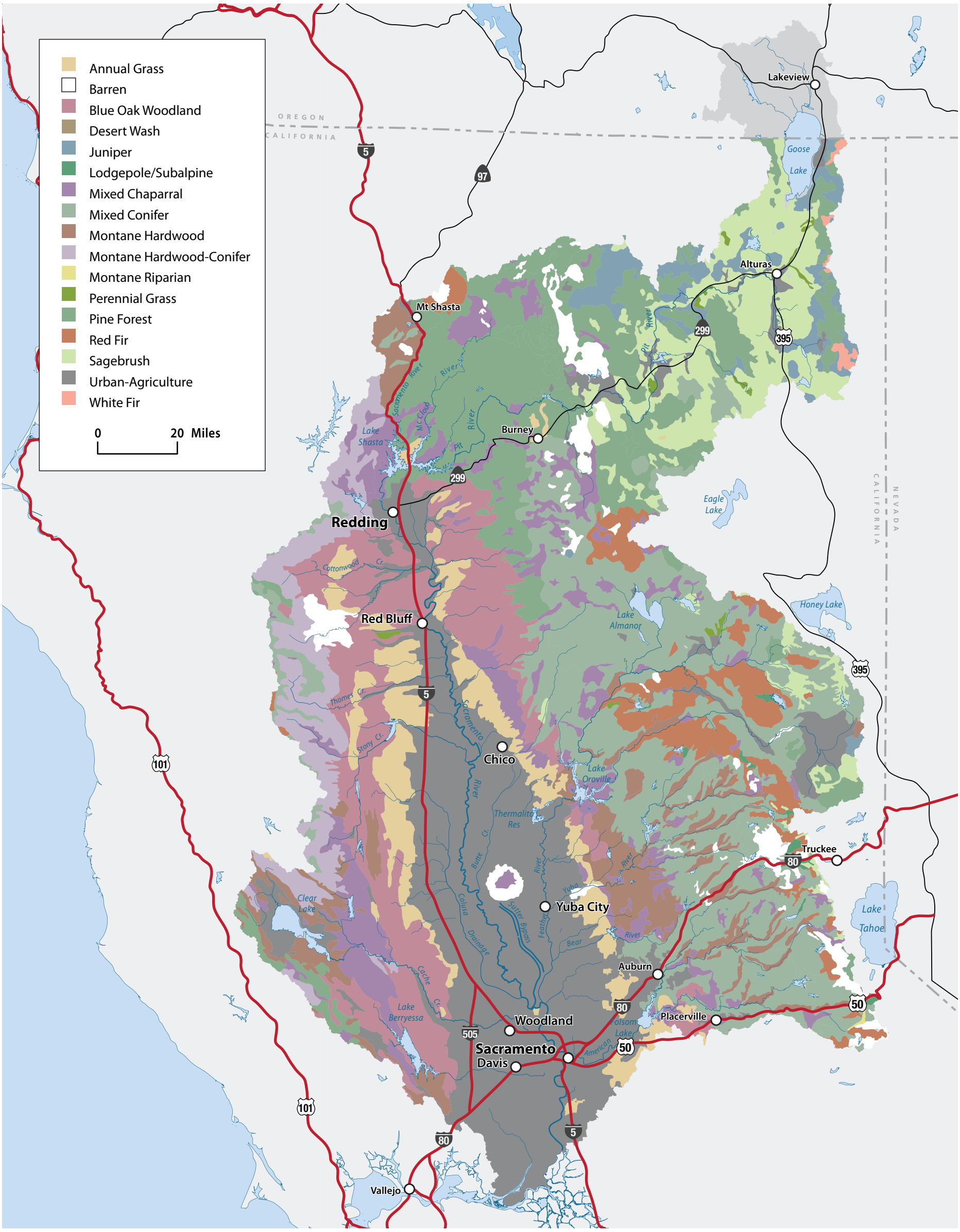
The Sacramento River Basin includes several distinct ecosystems. The Sacramento Valley floor consists largely of a mosaic of irrigated agriculture, wetlands, and riparian habitats. East and west of the valley, the foothills are primarily annual grasslands and oak woodland. Particularly on the west side of the valley, there are large tracts dominated by chaparral (brush species) that is overly thick and decadent as a result of the many years of fire suppression policy. With increasing elevation, the landscape consists predominantly of mixed conifer species such as pine, fir, and cedar.

With regard to vegetation and watershed management, two dominant themes emerge for the basin overall:

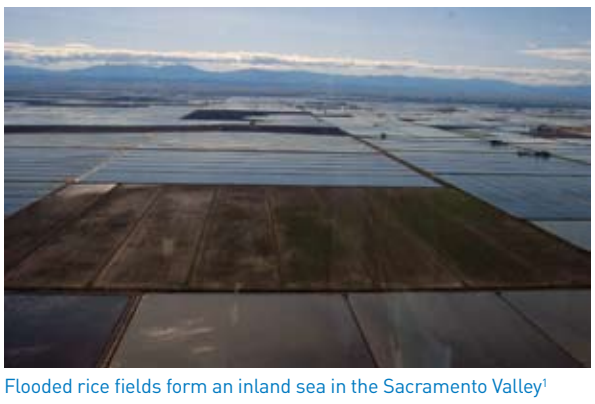
- reducing forest fuel loads to decrease potential for catastrophic wildfire, and
- eradicating noxious and invasive plant species that are competing with native plant communities.

Sacramento River at Castle Crags

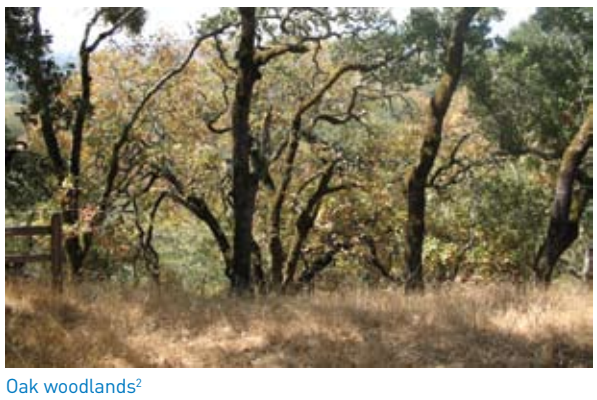
Conifer forest and Upper American River



Vegetation in the Sacramento River Basin



Flooded rice fields form an inland sea in the Sacramento Valley[1]



Oak woodlands[2]

Sacramento River and riparian forest, near Woodson Bridge[3]

Fish and Wildlife

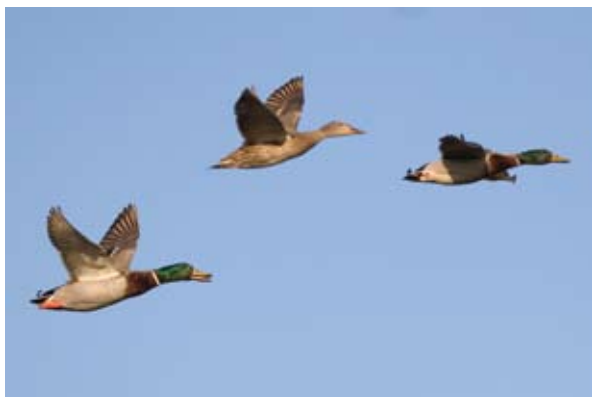
The Sacramento River Basin was originally rich with a multitude of avian and aquatic species. Modern-day development has reduced the populations of many species (especially those dependent on riverine habitat), while some species have flourished under the changes in land and water use. Along the Sacramento River, the once-ample stretches of riparian and wetlands, supported by flooding and wide variations in flow, mostly have been replaced by agricultural lands and expanding urbanization. Fish and wildlife populations in the basin have been affected by water diversions for agriculture and urban areas, and pollution from a variety of sources.

Today, the Sacramento River Basin continues to support a diversity of fish and wildlife species, although the numbers are not as robust as they were with historical conditions. The health of the Sacramento River and its tributaries is critical to anadromous fish species such as Chinook salmon, steelhead, and sturgeon. Rivers and streams in the upper watersheds are vital for coldwater fish such as native trout. Located along the Pacific Flyway, the marshlands in the Sacramento Valley continue to be an important stop for migrating waterfowl. Both migratory and resident species rely on the complex of state and federal wildlife refuges that exist throughout the basin and on the vast acreage of irrigated agricultural land.

Deer Creek Chinook salmon

Fishing on Sacramento River[1]

River trout[2]



Waterfowl in flight

Pacific Salmon: King of California Fish

For hundreds of years, Pacific salmon have been part of California's natural landscape. Resilient and ever-determined, they face huge odds to travel from their inland birthplace to the open ocean, where they mature for several years before making the journey back home to spawn at the end of their lives. But salmon numbers have been dropping. In 2008 and 2009, the population of California's Chinook salmon was so low the state had to close sport and commercial salmon fisheries for the first time in history. Businesses failed, traditions were lost, and anglers were frustrated.

The Sacramento River represents by far the largest population of returning Pacific Chinook salmon. There are four distinct runs; fall, late-fall, winter, and spring, giving the Sacramento River the unique distinction of having some salmon in its waters year-round. Historically (1900s) maximum spawning runs in the Central Valley approached 2 million salmon, including 100,000 late-fall, 200,000 winter, 700,000 spring, and 900,000 fall run. Currently, Sacramento River salmon populations are at a historic low. In 2009, total Chinook populations were fewer than 69,000 salmon, including 50,000 fall, 10,000 late-fall, 3,800 spring, and 4,700 winter run. While numbers of all populations (called stocks) have been in serious decline, winter-run Chinook salmon are federally listed as endangered, and spring-run Chinook are listed as threatened. In terms of numbers and value to sport and commercial fisheries, fall-run Chinook salmon are most important and currently are listed as species of special concern.

Many factors have contributed to the decline over the past two decades, including predation by competing native and nonnative species, water quality and water exports in the Delta, commercial and sport harvest, and changing ocean conditions. Currently, state and federal fishery agencies are increasing monitoring efforts, undertaking restoration projects, and promoting management practices to protect core habitats and maintain genetic diversity. A recent DFG publication listed the following practices to benefit salmon in light of predicted habitat and climate changes in the years to come:

- maintain genetic diversity;
- protect coldwater sources;
- maintain habitat complexity;
- connect rivers/streams and floodplains;
- protect alpine meadows, springs, and riparian areas;
- limit interaction between hatchery and wild fish;
- temper extreme high and low flows; and
- restore estuaries, sloughs, and marshes.

The locally directed watershed management programs discussed in this Roadmap document are making major contributions toward most of the practices recommended.

The Anadromous Fish Restoration Program is a major program currently underway in the Sacramento River and throughout the Central Valley. It is part of the 1992 enactment of the Central Valley Project Improvement Act, which directed the Secretary of the Interior to implement a program that makes all reasonable efforts to at least double natural production of anadromous fish in California's Central Valley. The major resulting program became known as the Anadromous Fish Restoration Program, and since 1995 the program has implemented more than 195 projects to restore natural production of anadromous fish. Only time will tell whether these efforts, together with those of the many partner watershed organizations working throughout the Sacramento River Basin, will result in restoring Pacific salmon populations to their desired prominence.

Canada geese

Boat docked on Sacramento River[1]

Life in the Watershed

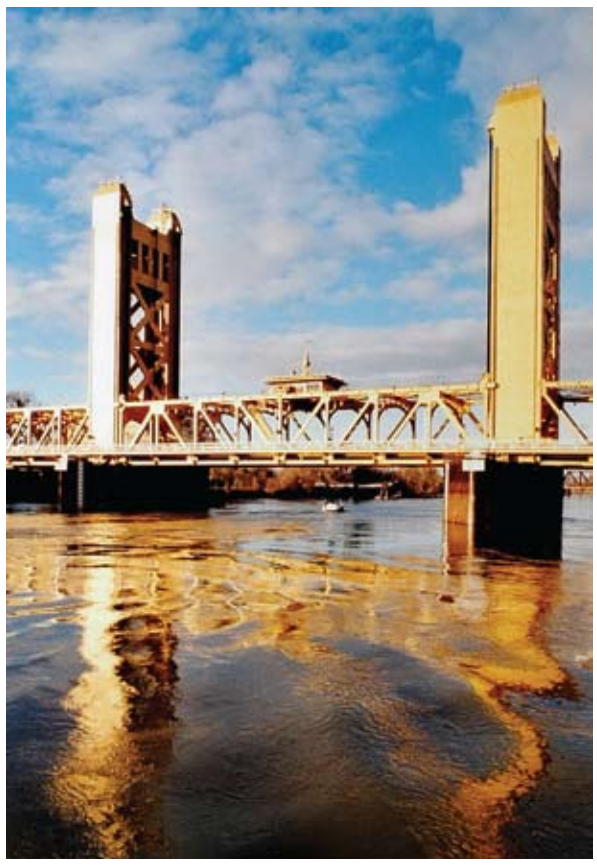
In the upper watershed, much of the land area is managed by the U.S. Forest Service for multiple uses such as timber production, grazing, and recreation. Large tracts of mixed conifer forest are privately owned and used for commercial timber production. Particularly in the more arid north and east portions of the basin, high desert forest and sagebrush lands are managed by the Bureau of Land Management. Alluvial valleys in the upper watershed are mostly privately owned and used for irrigated agriculture and cattle ranching. Most of the Sacramento Valley is intensely cultivated, with some 2 million acres of irrigated farmland growing crops that include rice, wheat, orchard fruits and olives, corn, alfalfa, tomatoes, and vegetables. Along with the agrarian base, the basin is home to about 2.2 million people, almost half of whom live in the Sacramento metropolitan area. Other larger cities are Redding, Chico and Yuba City/Marysville. The Sacramento River Basin covers all or most of nine counties and extends into portions of 11 other counties.

The Sacramento River Basin includes large areas of forests such as the Mendocino and Trinity National Forests in the Coast Range, Shasta and Lassen National Forests in the southern Cascades, and the Plumas, Tahoe and Eldorado National Forests on the western slopes of the Sierra Nevada. The basin is also home to Lassen Volcanic Park, which covers 106,000 acres centered around Lassen Peak, the southernmost Cascade volcano. Whiskeytown-Shasta-Trinity National Recreation Area, which is over 200,000 acres in size, straddles much of the upper Sacramento and Trinity Rivers, centering around three popular human-made lakes—Shasta Lake, Trinity Lake, and Whiskeytown Lake. Many other state parks and recreation areas lie within the watershed.

Key Management Issues

The Sacramento River Basin includes a variety of habitats, landscapes, and cultures; however, management issues common throughout the basin can be summarized as follows:

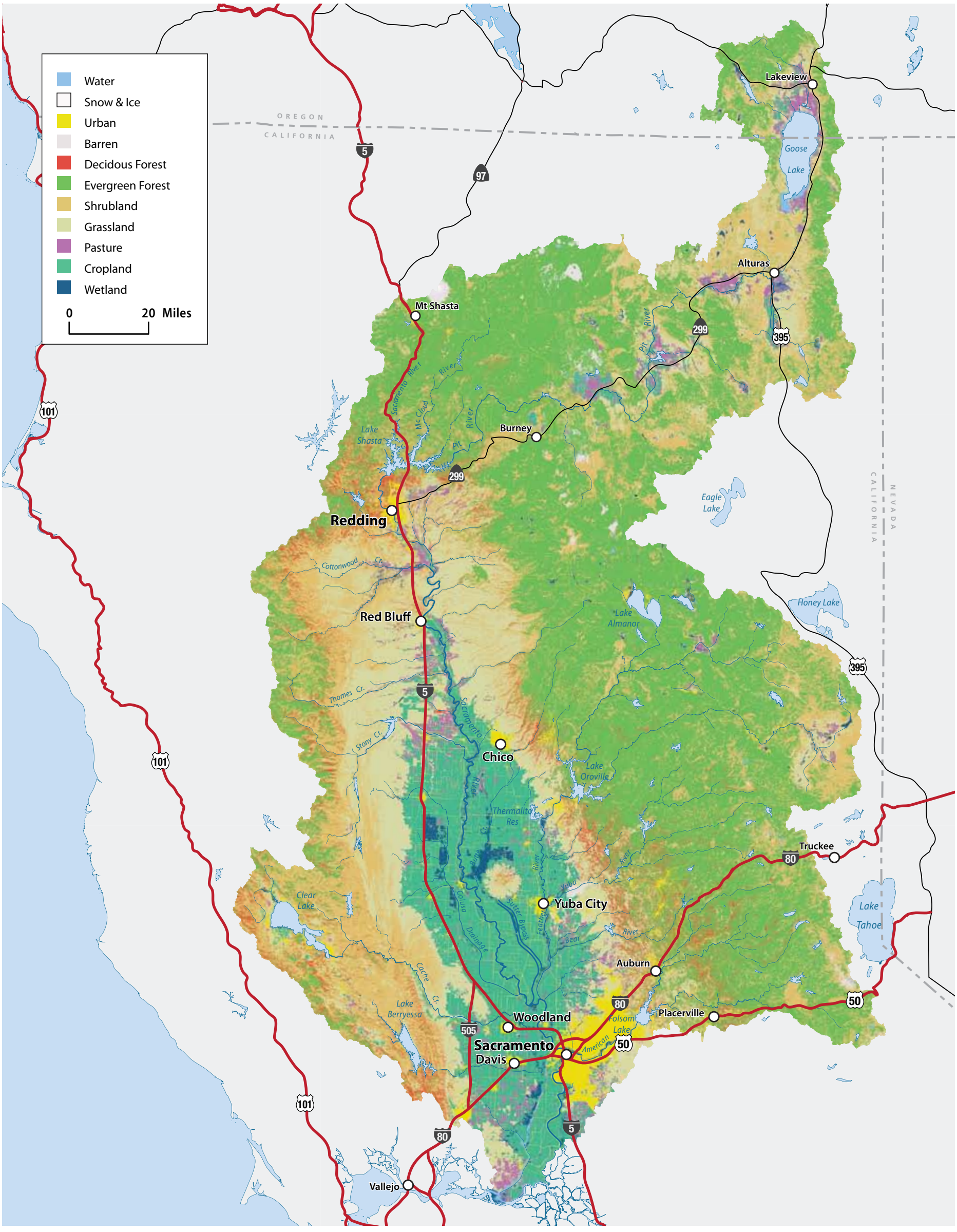
- salmon/steelhead passage and habitat;
- wild trout, native fish;
- forest health and fire risk;
- aquatic and riparian habitat ;
- water quality;
- water supply;
- flood management;
- open space and land conservation;
- erosion and natural stream function; and
- noxious and invasive species.



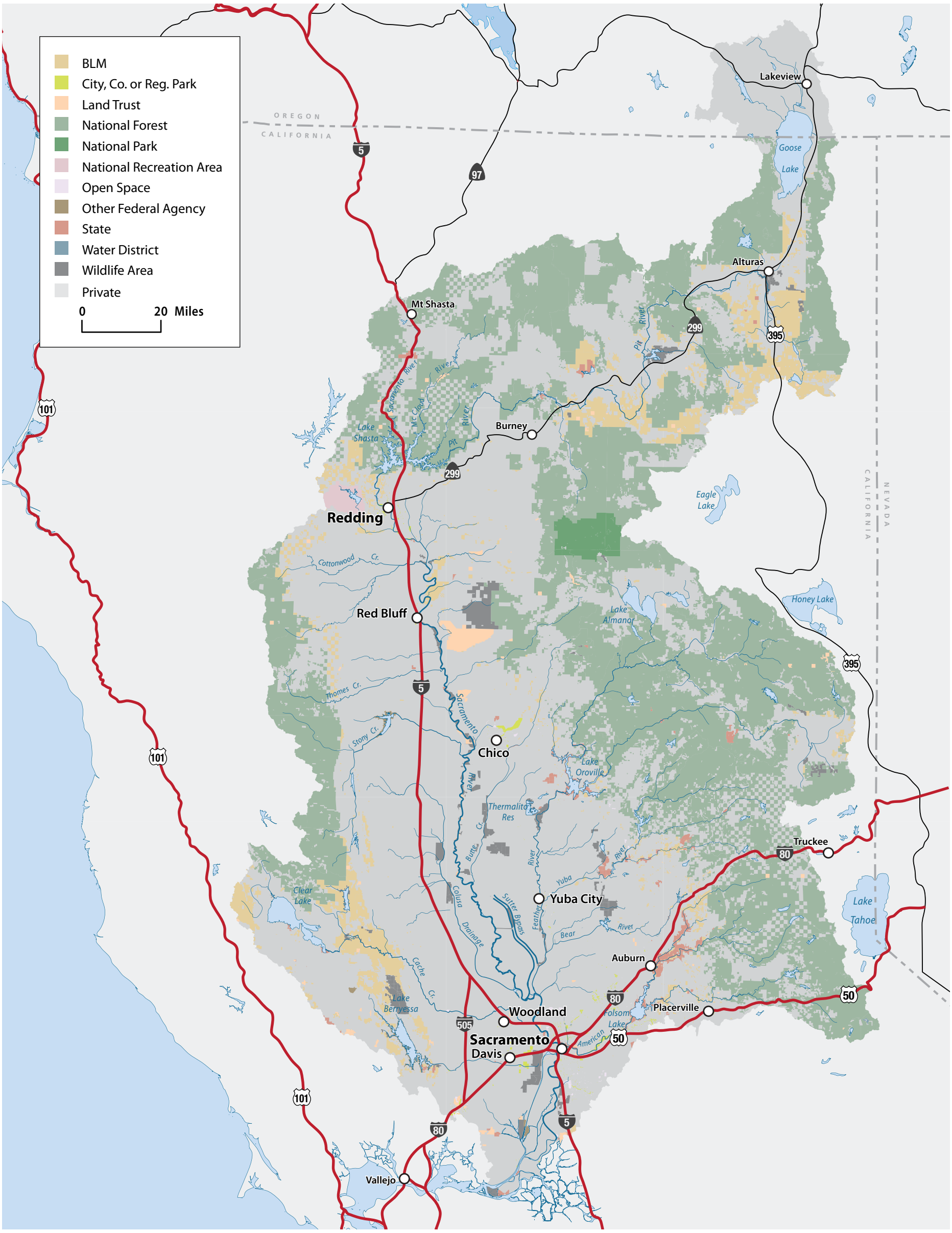
City of Sacramento's Tower Bridge[2]

Rafting on the American[3]

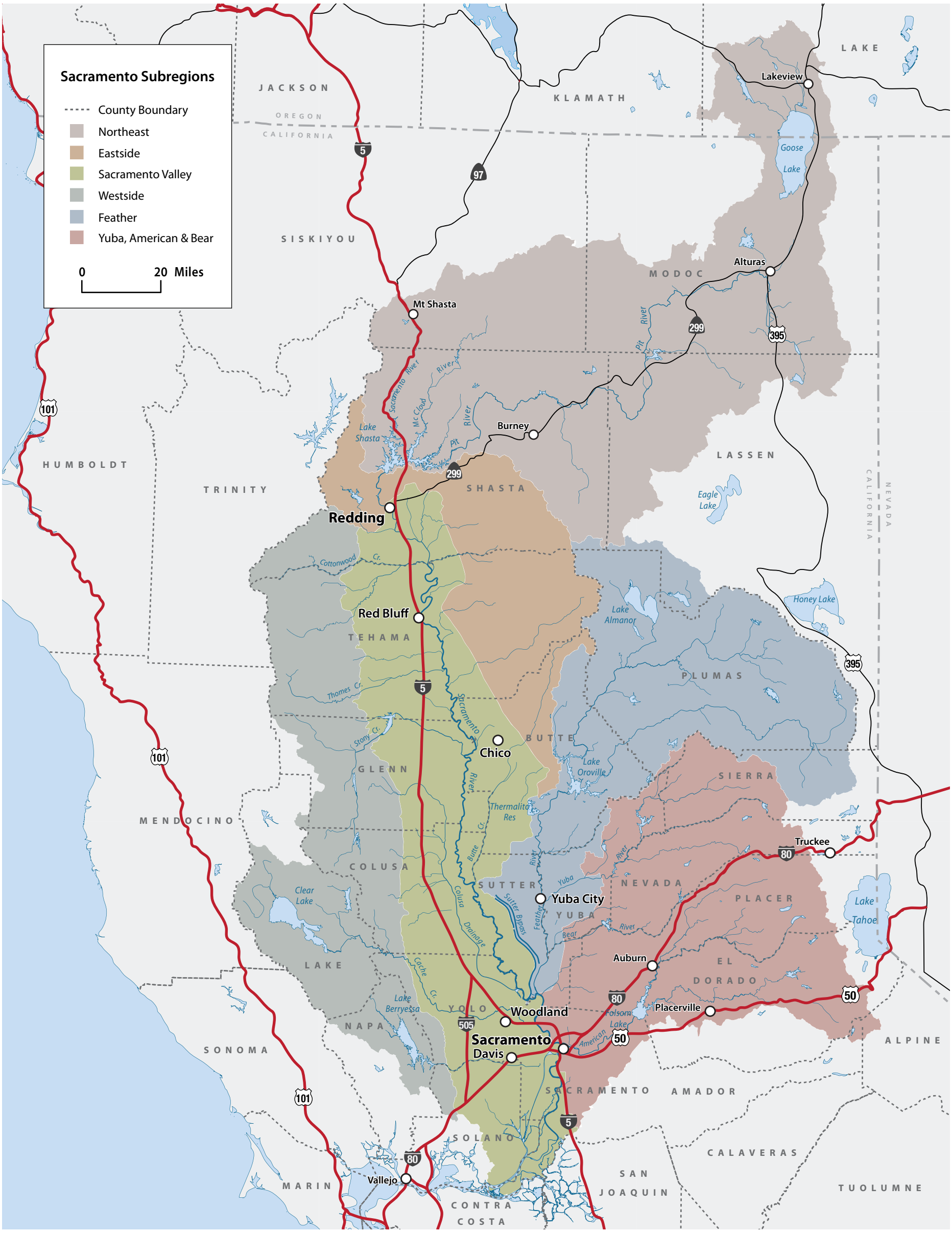
SUBREGION	WATERSHED	KEY MANAGEMENT ISSUES									
		Salmon / Steelhead	Wild Trout	Forest Health / Fuels Management	Aquatic / Riparian Habitat	Water Quality	Water Supply	Flood Management	Open Space / Land Conservation	Erosion / Natural Stream Function	Invasive Species
Northeast	Upper Sacramento River		■	■	■	■					
	McCloud River		■	■	■	■					
	Pit River		■	■	■	■	■			■	■
Westside	Clear Creek	■	■	■	■					■	
	Cottonwood Creek	■		■	■				■	■	
	Tehama West			■	■				■	■	■
	Stony Creek	■		■	■					■	■
	Cache Creek			■	■	■	■	■		■	■
	Putah Creek			■	■	■				■	■
Eastside	Tehama East	■		■	■				■		
	Stillwater/Churn Creeks			■	■	■			■		■
	Cow Creek	■		■	■	■			■		
	Bear Creek	■		■	■				■		
	Battle Creek	■		■	■	■			■	■	
	Mill Creek	■		■	■				■	■	
	Deer Creek	■		■	■			■		■	
	Big Chico Creek	■		■	■	■			■		
	Butte Creek	■		■	■	■	■	■			
Feather	Upper Feather River		■	■	■	■				■	
	Lower Feather River	■			■	■	■	■	■	■	
American	Upper American River		■	■	■	■					
	Lower American River	■			■		■	■			
	Yuba River	■	■	■	■	■		■			
	Bear River	■		■	■	■					
Sacramento Valley	Sacramento River Mainstem	■			■	■	■	■	■		



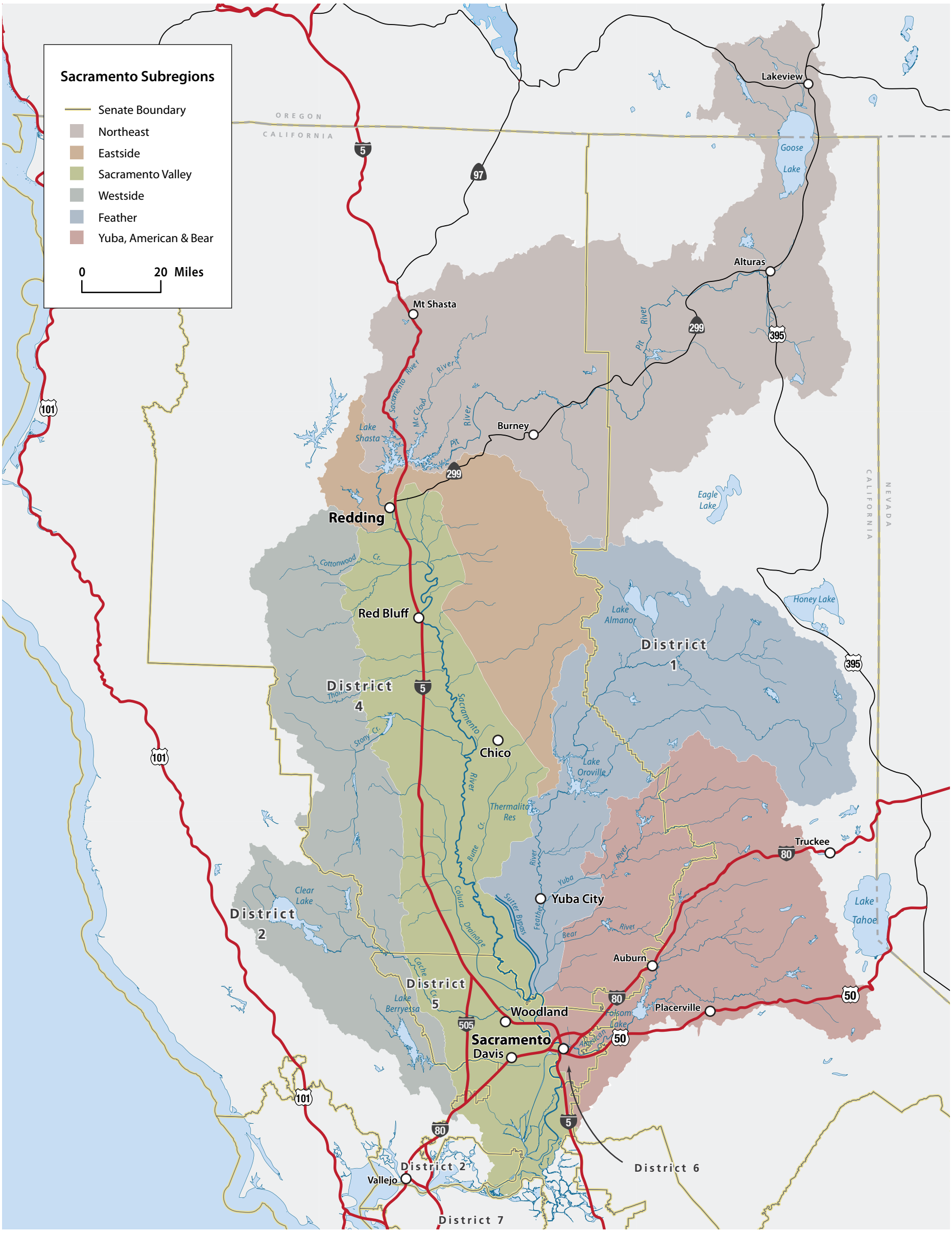
Land use in the Sacramento River Basin



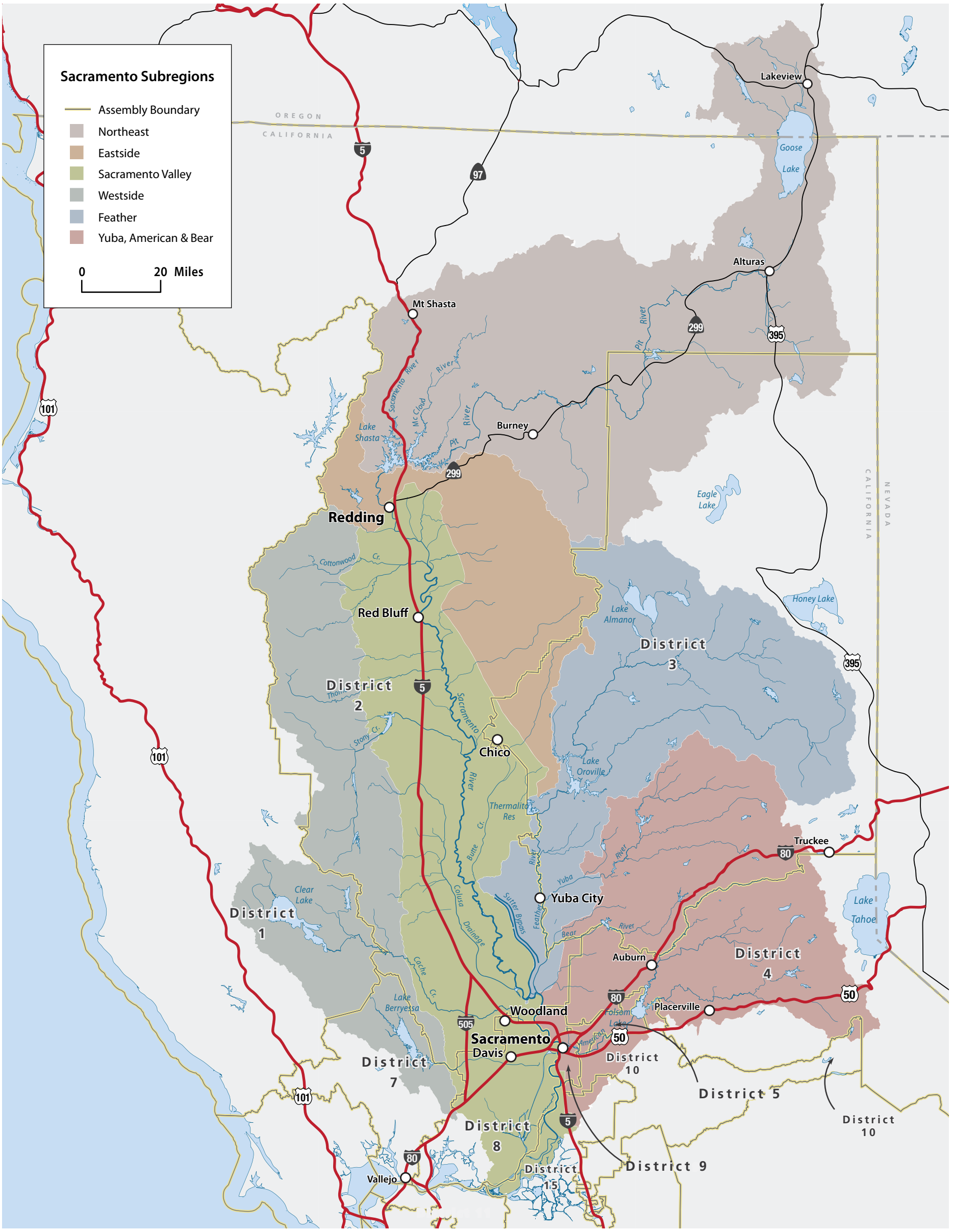
Land ownership in the Sacramento River Basin



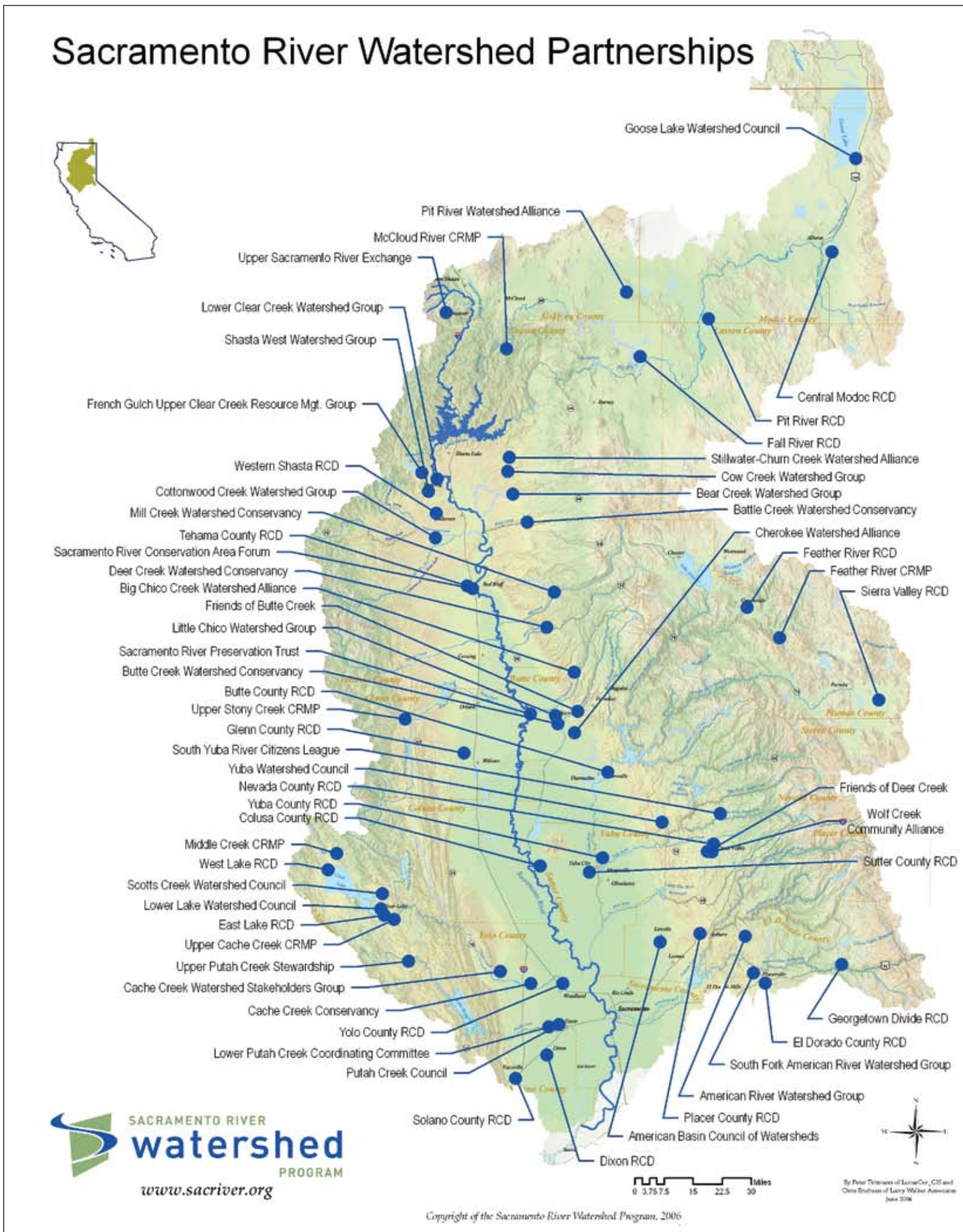
County boundaries in the Sacramento River Basin



Senate boundaries in the Sacramento River Basin



Assembly boundaries in the Sacramento River Basin



Map of Sacramento River Basin partners

Sacramento River Basin Partners

In recent years locally directed watershed management in the Sacramento River Basin has grown to more than 60 individual programs (RCDs, watershed groups, CRMPs, etc.) covering virtually all tributary watershed areas in the basin. These programs work independently to protect and improve watershed conditions within their area of responsibility. SRWP provides a forum for this dynamic network of watershed programs and works with these partners to maintain a shared vision for the Sacramento River Basin. Collectively, these local management programs are making a vital contribution toward watershed protection and improvement and are assisting local, state, and federal resource agencies in achieving their individual program objectives. The Reference sectionprovides contact information for these Sacramento River Basin Partners.

Kayaking in the Delta[1]

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