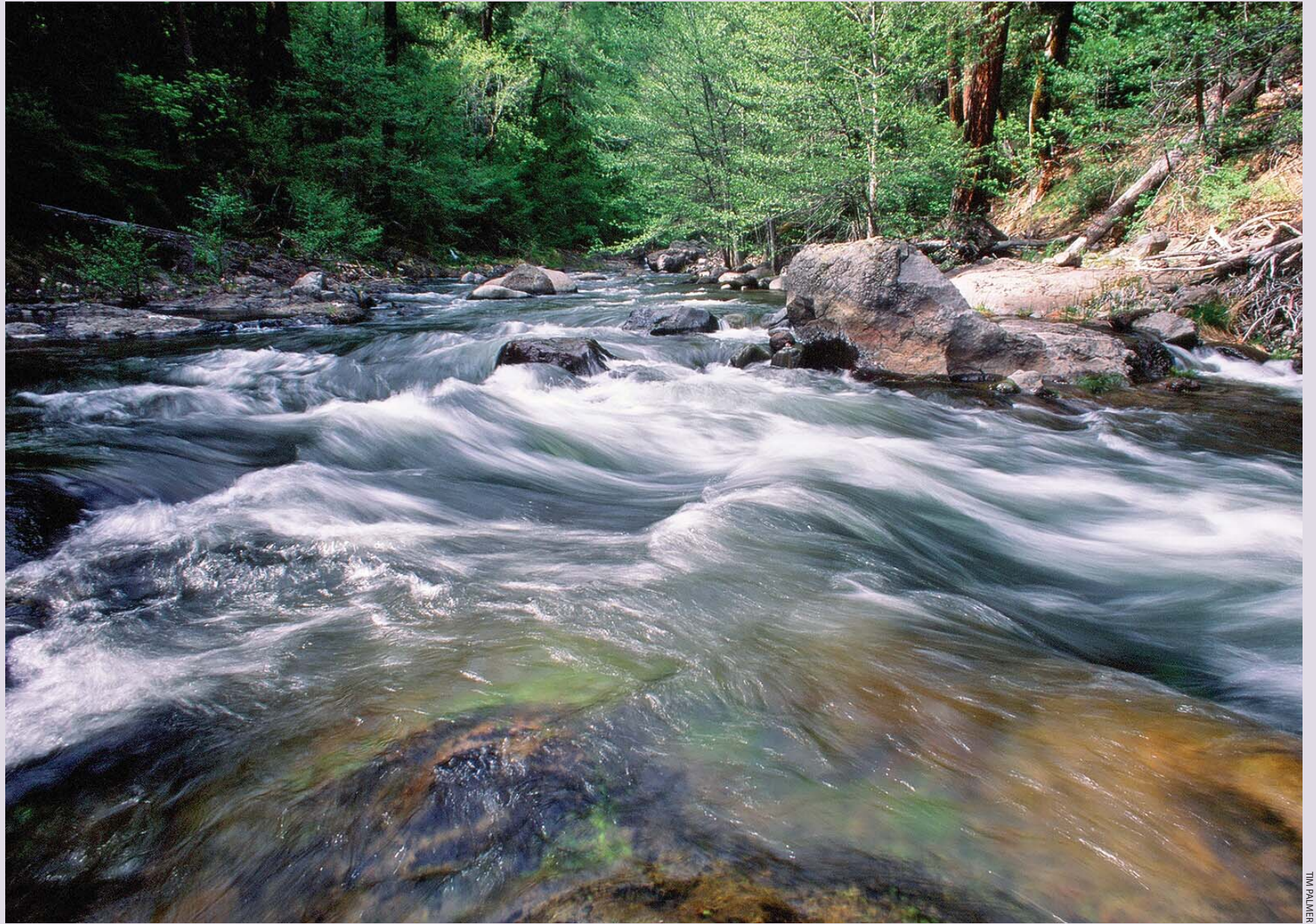


Great Rivers of the West: **CALIFORNIA**



WESTERN RIVERS
CONSERVANCY

Report prepared by Tim Palmer and Ann Vileisis



TIM PALMER

Mill Creek. Cover: Tuolumne River.

Letter from the President

Rivers are the great treasury of biological diversity in the western United States. As evidence mounts that climate is changing even faster than we feared, it becomes essential that we create sanctuaries on our best, most natural rivers that will harbor viable populations of at-risk species—not only charismatic species like salmon, but a broad range of aquatic and terrestrial species.



That is what we do at Western Rivers Conservancy. We buy land to create sanctuaries along the most outstanding rivers in the West – places where fish, wildlife and people can flourish.

With a talented team in place, combining more than 150 years of land acquisition experience and offices in Oregon, Colorado, California, and Washington, Western Rivers Conservancy is well positioned to fulfill its mission in 11 western states.

Yet if we are to conserve the great rivers of the West, we need to know which rivers these are. To develop an inventory of the highest quality rivers, we turned to Tim Palmer—a noted author and photographer with 35 years of experience exploring hundreds of streams throughout the West.

The principal goal of the survey was to develop a list of the most outstanding natural rivers—the great rivers of the West. Criteria included free-flowing length, natural flow regime, water quality, biological health and habitat, ecological and regional diversity and recreational suitability, among other attributes. A committee of

noted scientists and other experts reviewed the survey design, and state-specific experts reviewed the results for each state.

The result is a state-by-state list of more than 250 of the West's outstanding streams, some protected, some still vulnerable. The Great Rivers of the West is a new type of inventory to serve the modern needs of river conservation—a list that Western Rivers Conservancy can use to strategically inform its work.

This is one of 11 state chapters in the report. Also available are a summary of the entire report, as well as the full report text.

With the right tools in hand, Western Rivers Conservancy is seizing once-in-a-lifetime opportunities to acquire and protect precious streamside lands on some of America's finest rivers.

This is a time when investment in conservation can yield huge dividends for the future. We invite you to join forces with us as we work to buy and conserve high-quality lands on the Great Rivers of the West. Please visit our website at www.westernrivers.org, or you may contact me at sdoroff@westernrivers.org or 503-241-0151 to learn more.

For Our Rivers,

A handwritten signature in blue ink, appearing to read 'Sue Doroff'. The signature is stylized with large, flowing loops.

Sue Doroff
President

Introduction

Great Land, Great Rivers

Rivers and streams may be the most valuable of all natural resources in the western United States. They provide for a wide range of human needs—everything from drinking water and recreation to hydroelectricity and agriculture. At the same time, they offer crucial habitat and migration routes for fish and wildlife—often in otherwise arid landscapes. Even more fundamentally, they sustain vital natural processes—the hydrologic cycle, the flow of groundwater, and the growth of forests—that nourish all of life.

An extraordinary network of rivers flows from mountaintops to deserts, lowlands, and seashores. Among thousands of streams, several hundred remain as exemplary natural waterways.

Bound for the Pacific Ocean, rivers of the coastal states flow through remarkably varied terrain—from high elevations to sea level, and through drylands as well as the greatest temperate rainforests on earth. In California, the Smith River is the only sizable undammed river in the state and still supports runs of wild salmon. In the Sierra Nevada, the Kings, North Fork of the Kern, and other streams flow magnificently from alpine headwaters to lower foothill elevations. In Oregon, the Elk and Illinois are criterion natural rivers of the Pacific Coast Range, and the Rogue is one of few rivers that winds without development or roads as it cuts through these far-western mountains. In Washington, an incomparable suite of still-wild rivers drops from towering Mount Olympus, and in the glacier-carved North Cascades, the Skagit and Sauk River systems are among the finest for salmon, steelhead, and deep forest frontage with long, free-flowing mileage.

In the Rocky Mountains, a few rivers remain with exceptionally long reaches of undammed, watery pathways through the rugged terrain, and others are critical to fish and wildlife even though they are shorter. The Salmon of Idaho, perhaps America's premier river



Goose Creek

for combined length and natural mileage, runs for more than 400 miles through a geographic maze of eight major mountain ranges and still supports one of the West's most notable runs of salmon. The Selway is even wilder, pulsing down from its headwaters in the Bitterroot Mountains. Montana has the forks of the Flathead—each remarkable for its clarity, beauty, and habitat of rare bull trout and wildlife including grizzly bears and wolves. The Yellowstone flows for more than 600 miles without large dams, its nature still largely intact from Rocky Mountain heights to the heart of the Great Plains. In Wyoming, rivers of the renowned Greater Yellowstone Ecosystem include outstanding tributaries to the upper Snake and its incomparable riparian corridor beneath the craggy peaks of the Tetons. In Colorado, the Yampa has one of the finest cottonwood forests in the West and still supports endangered warm-water fishes of the Colorado River basin.



Eel River, Middle Fork

The drylands and deserts also have their riverine highlights. The Green of Utah flows for nearly 400 miles with native fish habitat through spectacular canyonlands, and the Virgin River is centerpiece to Zion National Park and a greater region of redrock canyons. Nevada has mountain streams where the rare Bonneville and Lahontan cutthroat trout survive. New Mexico has the fabled Rio Grande and the still-wild upper Gila; Arizona has the biologically rich Verde and the one-and-only Grand Canyon of the Colorado River.

These are just a few of the rivers and tributaries that still flow with exceptional natural assets throughout the American West. Much of value remains, yet much of natural worth has been lost during the past two hundred years, and even some of the best-protected waterways are threatened by mismanagement, development, or pollution from near or distant sources.

To protect and restore the finest rivers that remain are goals of top importance for the future of the West, yet no recent comprehensive survey has been completed to identify the best natural rivers that

remain. That is the intent of this report prepared by the Western Rivers Conservancy.

Great Rivers of the West: The Western Rivers Conservancy Survey of Eleven States

Western Rivers Conservancy (WRC) is dedicated to protecting the outstanding rivers of the western United States. Based in Portland, Oregon, but working throughout an eleven-state region, this nonprofit, private organization purchases riverfront property from willing, private landowners and assures that the land will be conserved as open space. In this way, the group has successfully protected dozens of critical riverfront tracts along streams such as the Sandy, Illinois, Chetco, and Willamette Rivers in Oregon; the Hoh River and Icicle Creek in Washington; the Snake River in Hells Canyon of Idaho and Oregon; the Sun River in Montana; the Smith River and Chico Creek in California. However, both the need and the opportunity to protect rivers far exceed the ability of this—or any organization—to accomplish all that should be done. Many rivers and their landscapes must be safeguarded so that natural ecosystems can continue to function and provide for people's needs in the future.

To clarify its mission and focus its efforts, the WRC in 2005 adopted a strategic plan to “protect outstanding river ecosystems in the western United States” and to “conserve the great rivers of the West.” These are described as “healthy, natural rivers where ecological functions are still intact.” The plan emphasized “whole ecosystem protection” and recognized the importance of headwaters, riparian lands, estuaries, and regions that have “a high density of high-quality rivers.” To plot this ambitious course, the WRC recognized the need to complete a survey to identify the highest quality rivers. Simply stated, if the organization is to save the “great rivers of the West,” it needs to know which rivers these are.

To develop the survey, the WRC hired Tim Palmer—a noted author of ten books about rivers and river conservation, a planner trained in landscape architecture, a photographer, and an inveterate rivers

enthusiast with thirty-five years of experience exploring hundreds of rivers throughout the West. A committee of noted river scientists and other western river experts reviewed the survey design as it was being developed, and state-specific experts reviewed the results for each state.

The survey examined rivers of Washington, Oregon, California, Idaho, Montana, Wyoming, Utah, Colorado, Nevada, Arizona, and New Mexico. For pragmatic reasons, Hawaii and Alaska were excluded.

Rather than start from scratch, the WRC survey built on past river inventories. These include significant studies following the National Wild and Scenic Rivers Act of 1968, such as the Nationwide Rivers Inventory (NRI), and a wide variety of other more recent studies, inventory lists, articles, and research papers. Typically, for each state, 15 to 20 such sources were consulted. Each of these had its own “take” on the definition of quality (e.g. native fish abundance, water quality, recreation values), and some lists addressed only specific regions within a state. None told the whole story, but in aggregate, these earlier efforts all pointed the way or offered useful evidence. If a particular river was identified as excellent by half a dozen different sources, for example, it was considered likely to be a “better” natural river than one that was identified only once. To specifically consider rivers’ biological values, several experts—usually fisheries biologists or ecologists—were interviewed for each state. Their perspective and firsthand knowledge of local rivers provided essential insights for this survey’s analysis.

The Great Rivers of the West does not include of all rivers deserving protection. That would be a far larger list. To state this important point another way, if a river does not appear in this report, it implies no agreement that dams, pollution, new roads, or development can occur without significant public losses in river qualities and ecosystem functions. This survey, however, is the WRC’s attempt to identify the very best rivers that remain with outstanding natural values. Furthermore, restoration efforts for rivers that are not even mentioned in this survey might someday reinstate their natural qualities so that they, too, will again become “great rivers of the West.”



Blue Creek, a tributary to the lower Klamath River

CINDY DIAZ

Based on this survey, the Western Rivers Conservancy will be able to better identify prime opportunities for its involvement. However, no land will be acquired for open space simply because a river appears on our list. And in cases where open space may eventually be bought to conserve the rivers, acquisition would be only from willing sellers who voluntarily agree upon all terms. The work of the Western Rivers Conservancy and of other conservancies and land trusts simply gives property owners an opportunity to have their land protected if they want to do so.

The need for river protection is becoming more urgent as western streams are increasingly affected by pressures of a rapidly growing population; of the 10 fastest growing states in the nation on a percentage basis, seven are in the West. Such growth intensifies needs for water and energy and spurs suburban development of farm and ranchlands. The urgency of conserving rivers is also heightened by the aggravating effects of global warming and by neglect of problems that have been accumulating for many years across the watersheds of the West. In this challenging context, it is the aim of this survey to inform the conservation of the best remaining rivers of the West.

Surveying California's Great Rivers

Stretching from the Pacific Northwest to Mexico with an unequalled breadth of climate and habitat, California has the most diverse system of rivers in the West. Scores of major streams and thousands of small ones carry runoff in rainforests receiving 100 and more inches of precipitation per year and in intermittent washes through our driest deserts. Streams flow from the ultimate height of Mount Whitney, and hundreds flow through sea level estuaries as they disgorge into the ocean. Plentiful runoff along with a variety of mountain landscapes guarantee that rivers take interesting and distinctive routes from the high country to the sea.

The rivers system here can be pictured in four parts. First, thousands of tributaries drain magnificent mountain slopes of the Sierra Nevada's western flanks, and these meet fewer and markedly smaller streams winding off the east side of the Coast Range, altogether forming the Sacramento and San Joaquin Rivers, running south and north respectively through much of the length of the state to their junction in nation's largest inland delta before easing out to San Francisco Bay. Eleven major rivers flow from the west slopes of the Sierra Nevada—the 400-mile-long unbroken mountain range that includes the highest peak outside Alaska and a fabulous array of whitewater crashing down gleaming granite slopes.

Second, waters of the north, with its wetter winters and deeply forested masses of mountains, flow west via the massive Klamath and Eel, but also in dozens of other Pacific-bound streams. The Klamath and other adjacent mountain ranges of the northern state spawn a spectacular suite of rivers through woodlands ranging from sunny oak savannas to the perpetually mossy depths of redwoods, dripping much of the time with fog if not rain.

Next, rivers of the south coast and south are small and subject to very low summer flows, and take relatively short routes to the ocean from the Coast Range and also from the Transverse and Peninsular Ranges of southern California. This complex maze of seismic topography gives rise to seasonal flows in dozens of streams within



California Redwoods

forest, chaparral, and desert, much of it lying at the doorstep of the largest megalopolis in America.

Finally, rivers of the far east tumble down off the Sierra and flow to landlocked basins and to heavily diverted fates in the drylands of the Nevada and California deserts.

The great majority of natural rivers in California occur in just one among the state's seven ecoregions. This is the single province called the Sierran Steppe-Mixed Forest—Coniferous Forest-Alpine Meadow. It includes all of the Sierra Nevada and its foothills, plus the mountainous and forested country throughout the northern third of the state. Nearly all of California's water originates in these two areas, and most of the wildest country—except for the desert—is there. Varied rivers of this ecoregion dominate the lotic list of the Golden State, with very few semi-natural rivers remaining in the other regions, which are the coastal edge, the Central Valley, the southern mountains, and the desert. These other regions house most of the state's population and also account for most of the agriculture. Even so, we have found at least one river in each ecoregion that still retains significant natural value and is worth



Upper Sacramento River

protecting.

California has the second-and third-largest rivers on the West Coast: the Sacramento and Klamath (ranking in volume only

behind the Columbia among the streams entering the Pacific). The free-flowing mileages of these and also the Middle Fork Eel/Eel are among the longest in the coastal states, however, the Klamath and Sacramento are both heavily dammed in their upper reaches, and the Sacramento is constrained by levees for much of its length.

Superlatives claimed by California rivers seem to be endless. Here is one of the best protected rivers from source to mouth—the Smith. Though it has serious problems, the Klamath is the most intact large watershed on the West Coast, with less population density than Idaho or Montana and large areas that have not been logged (though much has been, as well). The Klamath is the only large river on the West Coast with a completely natural mouth—no jetties, dredged harbors, or channelization. Though much smaller, the Mattole is spectacular in this regard as well. The Middle Fork Eel combined with the main stem Eel is the longest river protected in the National Wild and Scenic Rivers system from source to mouth and source to ocean. The American has one of the finest urban river greenways in the country, and its South Fork is one of the most used whitewater rivers in the nation. The Merced has an incomparable collection of waterfalls on its main stem and tributaries. The Tuolumne is a premier whitewater run in the West and the site of John Muir’s pioneering battle to stop the building of a dam (he lost, and Hetch Hetchy Valley—the twin to Yosemite—was flooded). The Kings has the greatest undammed vertical drop in America and the deepest canyon.

Recent and on-going tectonic and volcanic activity has created a young and changing landscape with varieties of rivers unheard of elsewhere. The McCloud is born in copious springflows. The Amargosa disappears after flowing for 20 miles in the desert. The Eel, Mad, Klamath, and others were blocked by tectonic plates that repeatedly docked against the evolving California shoreline and forced the rivers to bend northward; they now flow behind the new plate aggregations before arriving at the ocean. The Kings begins higher than any other river in America amid glacier outflow, as do a number of streams in this era of receding and disappearing glaciers. The Cosumnes and other Central Valley streams pond into wetlands that are still biological bonanzas of wildlife, though 90 percent

KELLY WILLIAMS

of those lush marshes have been lost to drainage, diversions, and filling. The Tuolumne flows through its own “Grand Canyon” with a blizzard of waterfalls that is awesome to behold at the height of early-summer runoff, or, for that matter, anytime.

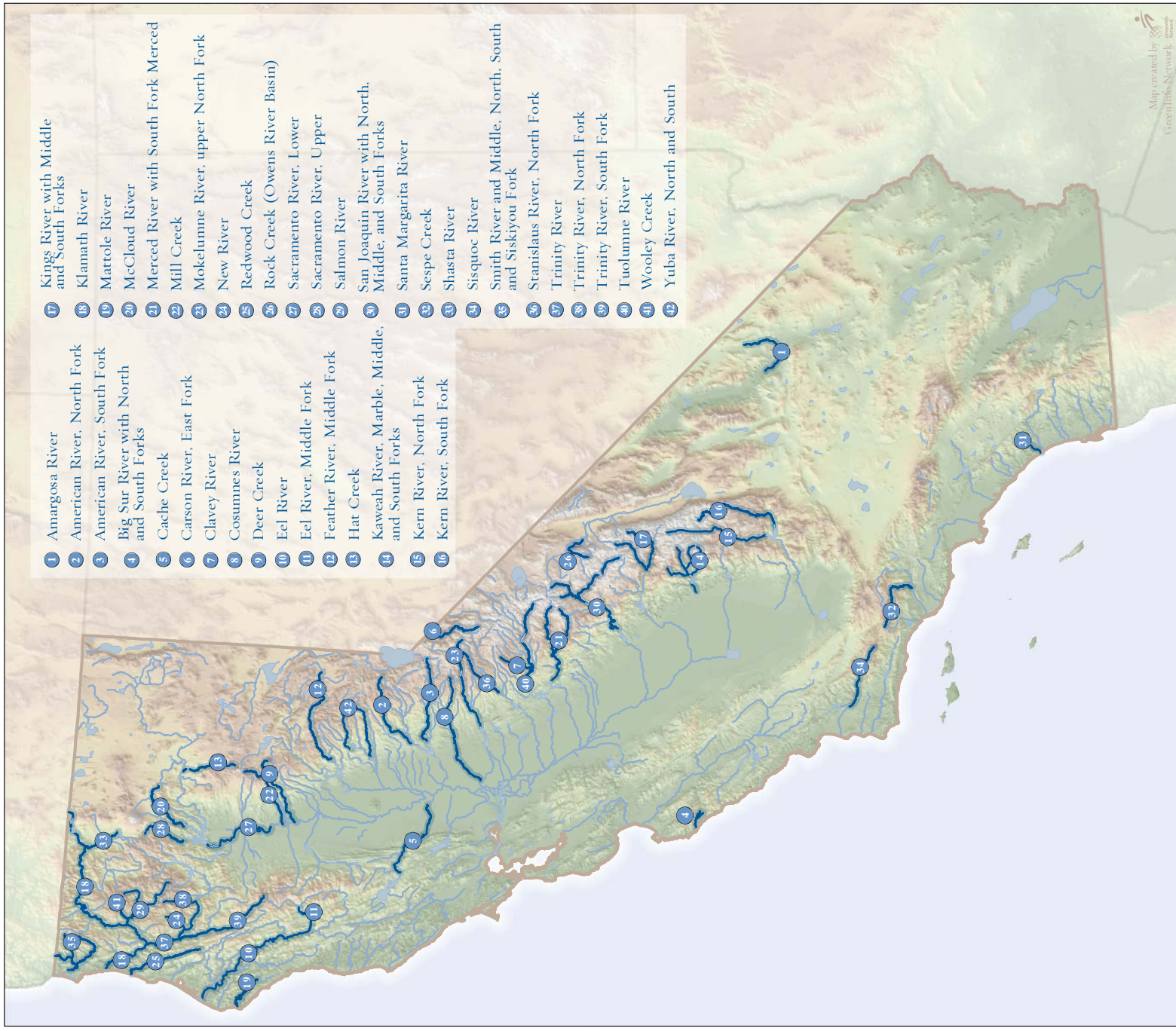
Owing largely to the work of Friends of the River throughout a 30-year period and to the foresight of Governor Jerry Brown in 1980, California has the largest number of rivers and tributaries designated in the National Wild and Scenic Rivers system and the second-largest mileage (only Alaska has more). Furthermore—and unlike many of the other national river designations in other states—many of these rivers were protected amid intense controversy and in the face of proposals that would have eliminated long reaches as natural waterways. The Tuolumne, Merced, Kings, Kern, Middle Fork Eel, North Fork American, and others fall into this category. Simple designation, however, does not mean that the problems facing these streams are over. Even on some of these “protected” rivers, additional challenges remain regarding development of private land and degradation from influences far away, such as air pollution and global warming. In the “A” list of our WRC survey, all rivers except the Clavey, East Fork Carson, and Deer Creek have been included in the national rivers system.

The California rivers deliver the water used in two among the four largest urban areas in America. These rivers provide for a large share of the nation’s food. They nourish one of the most important but stressed fisheries offshore. They transport and deposit sand needed to prevent immensely destructive erosion of ocean beaches. They make possible one of the most diverse assemblages of birds and wildlife found anywhere. They offer recreation to unprecedented numbers of people. Finally, they serve as ecological conduits used by salmon and many other forms of life. Of course, amazing as they are, the rivers can’t do all of this in adequate shares, and so the specter of collapse in virtually every one of these support systems is on the horizon if not imminent

Degradation of waterways is extreme in a state where industrial agriculture, hydroelectric power, urban growth, and the invasion of exotic species have all taken an enormous toll. The state already has 1,400 sizable dams. More people live here than in the rest of the West

combined, and the population is growing more rapidly than ever in history and is slated to double in only 37 years. Nearly 100 percent of that growth owes to immigration, which Congress, thus far, shows little inclination to reduce. Additional people mean greater demand for water, food, electricity, and housing. As more people move into the large cities, people there move out to the suburbs and the smaller towns throughout the Sierra foothills and elsewhere. In Bulletin 160, the state Department of Water Resources reported that improved efficiency and lower consumption by agriculture can accommodate new water needs for 30 years. But that is not long in the life of a river, and the current and projected population growth assures that existing supplies will ultimately run short unless population growth is addressed. New forces to dam and divert rivers will gain strength. On top of these problems, global warming is expected to reduce the Sierra snowpack by up to 80 percent in the coming century. This will severely aggravate problems of water supply for cities, farms, and ecosystems. Conservation of every form, in every basin, is essential if the magnificent rivers of California are to survive the demands of the future and be available for the next generation to appreciate, admire, and use. ■

California's Great Rivers: List



Great Rivers of California



Other Rivers and Streams



WESTERN RIVERS
CONSERVANCY

California's Great Rivers:

River Narratives

CALIFORNIA "A" RIVERS

Carson River, East Fork

The East Fork Carson has the longest, wildest, undammed section of river on the east side of the Sierra Nevada, harbors the imperiled Lahontan cutthroat trout and the Paiute cutthroat trout, and passes through wilderness and lightly roaded sections popular among anglers and canoeists.

Beginning on the northeast slope of Sonora Pass, the East Fork Carson flows dam-free for nearly 60 miles north to Highway 395 in Nevada, where diversions dams begin to shunt water into irrigation canals, greatly depleting the river by the time it enters Carson Sink.

In an unusual alignment, the river flows north from the Sonora Pass area, paralleling the Sierra Crest for about 35 miles through roadless terrain. The upper river cuts into both volcanic rock and granite canyons, and flows past high-country meadows where the Pacific Crest Trail follows closely for 5 miles. It then begins to drop into forests of Jeffrey and lodgepole pine and a robust riparian belt of willows and cottonwoods. The river picks up Wolf and Noble Creeks, major tributaries that contribute prodigious spring snowmelt. Upper reaches are designated as a Wild Trout stream, and the headwaters is habitat of the threatened Lahontan cutthroat trout. Lower reaches are considered a trophy fishery for non-native rainbow trout and brown trout.

Downstream of Silver Creek, Highway 4 parallels the river through a deep canyon for eight miles, popular among whitewater boaters and anglers. Then the East Fork flows for another 20 miles through roadless mountains that slope down into the dry lands of Nevada's



East Fork Carson River

Great Basin. In this reach, the river quickly drops from the eastern Sierra Jeffrey-pine plant community to semi-arid sagebrush slopes with pinyon pine. The section offers a popular two-day whitewater canoe trip—one of few routes in the Sierra where an overnight river trip is possible without big whitewater. A popular hot springs lies near the river in this reach.

Much of the upper East Fork Carson basin qualifies as a wilderness area, and the Forest Service has found the entire reach to be eligible for National Wild and Scenic River designation.

While most of the watershed is publicly owned, significant tracts along the middle river and scattered parcels on the lower river are private.



Deer Creek

Clavey River

The Clavey is recognized as one of the top three rivers in the Sierra with a healthy suite of aquatic life (the others, Deer and Mill Creeks, are in the far northern Sierra). This wild, undammed, and undeveloped stream is one of few Sierra rivers that supports a full complement of native fish species and has no non-native fish.

A major tributary to the Tuolumne River, the Clavey runs for 47 miles southwest from headwaters in the Emigrant Wilderness. The river passes undammed through most of the Sierra's ecological zones, from upper reaches with meadows and aspen groves, through old-growth forests, and into dry chaparral canyons. The California spotted owl, fisher, and other wildlife thrive in the wildness of this river and its steep canyons. It also offers habitat for imperiled native frogs.

With unimproved road access at only a few remote sites, the river is used only by trout anglers, hardy hikers, and a select group of Class-V kayakers each year.

The Clavey is managed as a Wild Trout Stream along with its

tributaries, Bell and Lily Creeks. Nearly all the river frontage is public land in the Stanislaus National Forest, and according to Forest Service studies, is eligible for National Wild and Scenic status.

Deer Creek

With no dams, nominal development, and little watershed disturbance, Deer Creek is one of the Sierra's top three streams in conditions for aquatic life and a rare California waterway with healthy runs of spring chinook and steelhead.

In the transition zone between the Cascade Mountains and the Sierra Nevada, Deer Creek flows for more than 50 dam-free miles from its source west of Almanor Reservoir to the Sacramento River north of Chico. The upper creek begins with hot springs and drops through a deepening volcanic canyon shared with Highway 32. In its mid-section, the creek flows through a wilderness course, winding among chaparral, some of the finest blue oak groves in California, and then grass-blanketed foothills at the northern end of the Sierra. Its final eight miles cross the northeastern edge of the Central Valley.

The remote river supports salmon and other rare fish, and the upper reaches include old-growth forests and habitat for the California spotted owl, black bears, and other wildlife. This stream and Mill Creek, just to the north, are excellent examples of high quality waters draining the Sierra-Cascade interface.

The Forest Service has recommended that 30 miles of Deer Creek be designated as a National Wild and Scenic River. Most of the stream's mileage below Lassen National Forest flows through private land.

Just to the north, Mill Creek, along with the adjacent basins of Antelope, Paynes, and Battle Creeks farther north, make an excellent complex of Sacramento River tributaries, each having accessible salmon and steelhead spawning grounds. This cluster of streams offers some of the finest potential for habitat protection and stream restoration in California. Large portions of each of these basins are privately owned.



Feather River

Feather River, Middle Fork

With 108 undammed miles designated in the original National Wild and Scenic Rivers Act of 1968, the Middle Fork Feather is the longest free-flowing reaches of stream in the Sierra Nevada and one of the range's quintessential natural rivers.

The Middle Fork Feather begins at Beckwourth Pass in the northern Sierra Nevada near Quincy and flows west to the massive Oroville Reservoir. The first 14 miles of the river upstream from the town of Beckwourth meander in braided channels through a high headwaters basin that once flowed east from the Sierra crest. With mostly private land fronting the upper river, the Middle Fork gains volume and begins to cut increasingly steep rapids. West of Sloat, the road leaves the river, which then cuts a wild and rugged canyon having tumultuous Class V rapids and virtually no road access. In this 34-mile section, fine white gravel bars and deep green forests border the lucid water. At Bald Rock Gorge, granite walls rise up 2,000 feet. One of the least accessible river reaches in the state, the lower Middle Fork Feather features some of the clearest water,

largest rapids, and wildest riverfronts found in the West.

Recognized as one of California's finest wild trout fisheries and premier expert whitewater runs, the river is accessible by only a few trails and unimproved access roads. However, several isolated mining claims and tracts of private land border the lower river, especially in the six miles below the primitive Milsap Bar Road and bridge.

Kern River, North Fork

Extraordinary for its wilderness, range of habitat, free-flowing length, and whitewater, the North Fork Kern makes its epic descent from the western flanks of Mount Whitney to low elevations in the Sierra foothills.

Located in the far southern Sierra Nevada, and confined within the depths of the mountains by massive subranges of the greater mountain chain, the North Fork of the Kern flows directly southward for 82 miles from Mount Whitney to Isabella Reservoir. More than any other Sierra stream—and unusual for mountain rivers anywhere—the North Fork flows not directly away from the mountains where it begins, but entirely within a mountain fastness of high peaks that parallel the crest of the range.

The river begins as an exquisite stream of the high Sierra, flowing over immense slabs of granite. It picks up Whitney Creek, which drains the west side of the highest peak in 49 states, and then churns through a 4,000-foot-deep canyon that follows a one-of-a-kind, relentlessly straight fault line for 30 miles.

The upper 48 miles flow within Sequoia National Park and the Golden Trout Wilderness. Then the river flows onward past granite domes, cliffs, and ponderosa pine and fir groves of Sequoia National Forest. From the west, the North Fork is joined by the Little Kern River, which likewise tumbles for 23 spectacular miles from the lofty peaks of the Great Western Divide. Below the Johnsondale bridge, the North Fork Kern becomes road accessible and is used intensively for fishing, Class IV whitewater boating, and camping. Finally, near Kernville, the river's gradient eases to Class II and III

rapids. Just below town the river enters the backwater of Isabella Reservoir, where—now impounded—it joins the South Fork to form the main stem Kern.

The North Fork of the Kern's extraordinary descent through a variety of elevations has resulted in 15 different plant communities along the river and habitat for at least six endangered or rare species. The river hosts an excellent trout fishery, and a trail offers superb backpacking from Johnsondale up to the river's headwaters, especially in the spring when Sierra high country is still snowed-in, and also in the fall when the summer heat at low elevations subsides. The "Forks of the Kern" is a 17-mile raft and kayak run from the mouth of the Little Kern through pristine wilderness that *California White Water* calls "one of the finest stretches of expert whitewater on earth."

The entire reach from source to the Kern County boundary, three miles above Kernville, is in the National Wild and Scenic Rivers system. The river flows dam-free for about 80 miles—the second-longest free-flowing length in the Sierra. However, Wild and Scenic designation in 1987 allowed for the continued use of a small hydroelectric dam and diversion on the lower North Fork. Nearly all the river frontage is publicly owned.

Kern River, South Fork

Occupying an unusual place in the geography of the Sierra Nevada, the South Fork Kern flows through inaccessible wild canyons with native fisheries and nourishes California's largest cottonwood forest where yellow-billed cuckoos and other unusual birds thrive.

Rising in the southern Sierra south of Mount Whitney and east of the North Fork Canyon, this river flows due south for 73 miles and then southwest for another 15 miles into the backwaters of Isabella Reservoir east of Kernville.

Collecting its waters from the Boreal Plateau and 11,000-foot-peaks on the North Kern-South Kern divide, the upper river flows almost entirely through national forest land, including the Golden

Trout Wilderness, home of California's official but rare state fish. Though they have been introduced elsewhere in the southern Sierra, the South Fork Kern is the "type locality"—the stream where this imperiled fish originated. Kennedy Meadows is a popular recreation area on the upper river, and the Pacific Crest Trail parallels the stream for nine miles.

In mid-sections, the river cuts through deep gorges, granite outcroppings, and scattered meadows reached only by remote, unimproved roads and trails. Then it flows for 13 miles through the Domeland Wilderness, virtually inaccessible with gorges, rock walls, and bouldered terrain.

Even though the river ultimately flows off the west side of the Sierra, it runs for most of its length on the eastern side of the highest peaks and therefore lies in a rain shadow that receives less runoff than other rivers on the west slope. It also flows through a pivotal transition zone between high and low elevations and the high Sierra and Mojave Desert ecosystems. As a result, the South Fork Kern features exceptionally diverse plant life.

The lower river corridor is mostly in private ownership, and Highway 178 parallels much of the river's course. Meandering through nearly flat country before the main stem of the Kern drops precipitously through its great foothills canyon, the South Fork nourishes the largest and most intact cottonwood forest in California. The National Audubon Society has a major preserve along the lower river, where the yellow-billed cuckoo—rare in California—can be found.

Nearly 72 miles—all but the lower reach—are included in the National Wild and Scenic Rivers system.

Kings River, and Middle and South Forks

Truly a river of superlatives, the Kings has the greatest undammed vertical drop in America and flows through the deepest canyon.

The river begins at the base of Muir Pass in Kings Canyon National Park, flows westward down the steep incline of the Sierra Nevada, and enters Pine Flat Reservoir at elevation 950 feet west of Fresno.

Most of the Middle and South Fork basins lie in Kings Canyon National Park. With tributaries including Palisade Creek, Cartridge Creek, Bubbs Creek, and Roaring River, the Middle and South Forks flow from some of the most spectacular high-mountain country in America and then tumble through hundreds of rapids and over dozens of waterfalls beneath granite walls rising thousands of feet. Groves of cottonwoods, willows, and lodgepole pines shade the shorelines that are not paved with gleaming granite. The Middle Fork flows through Tehipite Valley with its spectacular, narrow, granite dome, 3,600 feet high. Footpaths in this basin, including the Pacific Crest and John Muir Trails, offer some of the finest wilderness backpacking in America.

Below the national park boundary, the Middle and South Forks join to become an extraordinary whitewater river suited only to expert paddlers. Tributary streams pour in over waterfalls, and the river carves its tumultuous path beneath Spanish Peak—8,300 feet directly above. At Garnet Dike, the river opens into a gentler foothills valley with lyrically beautiful oak savannas, grassy slopes that rise thousands of feet, a fine trout fishery and one of the most popular whitewater rafting runs in the state. Nine miles later the river enters



Kings River

the backwater of Pine Flat Reservoir.

From its source, the Kings drops 10,650 vertical feet without a dam—the largest free-flowing drop in the country (the high peaks of Alaska are engulfed in ice down to low elevations, and other rivers of the southern Sierra have reservoirs at higher elevations). Sierra peaks rise 8,000 feet above both sides of the river—more than Hells Canyon of the Snake River or the Grand Canyon of the Colorado. With a basin almost wholly composed of granite, and with almost all the upper watershed protected as wilderness, the water of the Kings is among the clearest anywhere—perhaps the clearest in America. The foothills canyon is often regarded as the finest large-river trout fishery in the state. The South Fork and main stem flow for a combined dam-free length of 59 miles.

Congress designated the entire Middle and South Forks as National Wild and Scenic Rivers, along with the upper six miles of the main stem. The remaining 11 miles of the main stem to Pine Flat Reservoir are designated as a Special Management Area, where new dams are prohibited unless Congress acts specifically to approve them—a unique classification that arose from opposition in 1987 to a proposed dam at Roger's Crossing, two miles above Pine Flat Reservoir.

The North Fork of the Kings, which enters a mile above Pine Flat Reservoir, is heavily dammed and diverted for hydropower, however, the 30-mile-long Dinkey Creek is nearly as large as the North Fork where the two join above the main stem Kings. The creek is free-flowing, with popular recreation sites, and in its upper reaches includes an astonishing complex of granite pools and waterfalls. The Dinkey Creek basin is mostly national forest, except for several private tracts that border the middle section.

The lower Kings River below Pine Flat Dam flows through intensively farmed and developing land, where it is diverted for irrigation. Ultimately, the river is completely dried up before it reaches its historic terminus in the now-dry Tulare Lake, which was once among the greatest of western wetlands and a robust commercial fishery.



HIGH COUNTRY EXPEDITIONS

Salmon River

Salmon River with Wooley Creek

With wilderness, crystal-clear water, and steep rapids, the Salmon is one of the finest remaining salmon streams in the state and an exceptional river with big whitewater.

A major tributary to the Klamath River, the “Cal” Salmon flows from the Marble Mountain and Trinity Alps Wilderness areas west to its confluence with the Klamath at Somes Bar.

The upper North Fork flows for about 15 miles through the Marble Mountain Wilderness. A narrow road then parallels the river down to the South Fork, which flows from the Trinity Alps and also has minor road access. The main stem then flows for 21 miles to the Klamath. The remarkably wild Wooley Creek—with a trail along much of its length—flows for about 20 miles through wilderness and joins the Salmon four miles upstream from the Klamath.

The Salmon’s headwaters collect meltwater from the only glacier in the Coast Range south of the Olympic Mountains. Vividly green-and-white waters plunge through gorge-bound rapids interspersed

at low flows with dark green pools. Lush riparian vegetation thrives on 80 inches of rain per year. Salmon, steelhead, and trout are important species; Wooley Creek is especially critical to spring-run salmon and steelhead. White sturgeon have also been found in the lower main stem. Nearly all the watershed is national forest, though scattered private land lies along parts of the river as a result of mining claims.

The North Fork, South Fork, and main stem are among California’s prized trout, steelhead, and salmon rivers, and the main stem is also considered one of the premier Class V whitewater runs in the nation with three Class V and eight Class IV rapids.

The main stem is entirely included in the National Wild and Scenic Rivers system, as are the lower eight miles of Wooley Creek, the North Fork from the Marble Mountain Wilderness boundary to its mouth, and the South Fork from Cecilville to its mouth. A contiguous 100-mile reach counting the wilderness section of the North Fork and the North Fork-Salmon-Klamath combination is the second-longest reach of river in the National Wild and Scenic Rivers system that is protected from source to mouth (the Middle Fork Eel-Eel is the longest).

This extraordinary river is one of the highlights of the California rivers estate. Along with the Smith, it is the outstanding river of the northern area and the Coast Ranges. The Salmon is also centerpiece to one of the greatest regions of wild or natural rivers in the West, spanning from the Siskiyou Mountain rivers of Oregon southward through the Eel River basin.

Sespe Creek

The last remaining completely undammed river in southern California, Sespe Creek is a trout stream flowing through a wilderness of rugged, chaparral-covered mountains.

The Creek follows a convoluted route through the Santa Ynez Range east of Santa Barbara, flowing east and south to meet the Santa Clara River east of Ventura.

Upper reaches of this small stream are paralleled by Highway



Smith River

33, and then the creek cuts a deep, forbidding canyon through the highly erodible amalgam of rocks that comprise the Santa Ynez—the westernmost of the five transverse ranges that angle east-west across southern California. The Sespe finally cuts southward and flows out through a mountain gap just north of Fillmore.

The Sespe runs through one of the nation's largest roadless and wilderness areas that lie near a large metropolitan area. It flows mostly through the Los Padres National Forest, including eight miles through the Sespe Condor Sanctuary, a vital habitat area for reintroduction of the nearly extinct California condor. Sandstone cliffs rise 500 feet above the river, and prehistoric settlements and rock art sites abound. Flows vary radically with winter storms and summer drought; the Sespe can fluctuate from 70,000 cfs to a trickle of 1.5 cfs. Sediment carried by the river is essential to prevent coastal beach erosion south of Point Mugu.

The California Department of Fish and Game has designated 25 miles of the Sespe as a Wild Trout Stream, and it is considered the finest trout water south of Monterey. The Sespe also hosts some steelhead and is one of few streams in southern California with the potential to restore these fish, whose migration is currently affected

by diversions downstream from the national forest.

The river and its wild canyons are used extensively by backpackers, campers, horseback riders, mountain bikers, anglers, and occasional expert whitewater boaters.

National Wild and Scenic River designation protects 32 miles of the river, but excludes the headwaters, a mid-river section where a dam has been proposed between Chorro Grade Canyon and Bear Canyon, and the lower eight miles, which run through farmland and urbanizing property where levees have been built.

Smith River, and Middle, North, South, and Siskiyou Forks and tributaries

The largest undammed river in the state, the Smith is one of the best-protected and most exceptional river systems on the Pacific Coast.

Collecting its North, Middle, and South Forks, the Smith drains the far northwestern corner of California and flows into the ocean just three miles south of the Oregon border. The main stem is 16 miles long while the North Fork is 27 miles long, the Middle Fork is 32 miles long, and the South Fork is 38 miles long.

Extraordinary in its own right, the North Fork begins in Oregon (see Oregon narrative) and flows with superb whitewater south through unroaded, rugged terrain. After the Middle Fork joins the river in the community of Gasquet, Highway 199 parallels the North Fork to its confluence with the South Fork. The main stem then runs through Jedediah Smith Redwoods State Park and turns northward, its final 12 miles flowing through rolling terrain and a broad coastal plain to a spectacular, natural river mouth at the Pacific. Highway 199 follows the Middle Fork from its headwaters on the Illinois-Smith River divide. The upper half of the South Fork flows through unroaded wild areas while the lightly traveled South Fork Road parallels the lower half.

Deeply forested, the many tributaries of the Smith drop through shaded canyons and beneath verdant mountainsides where 100 inches of rain a year create one of California's wettest watersheds.

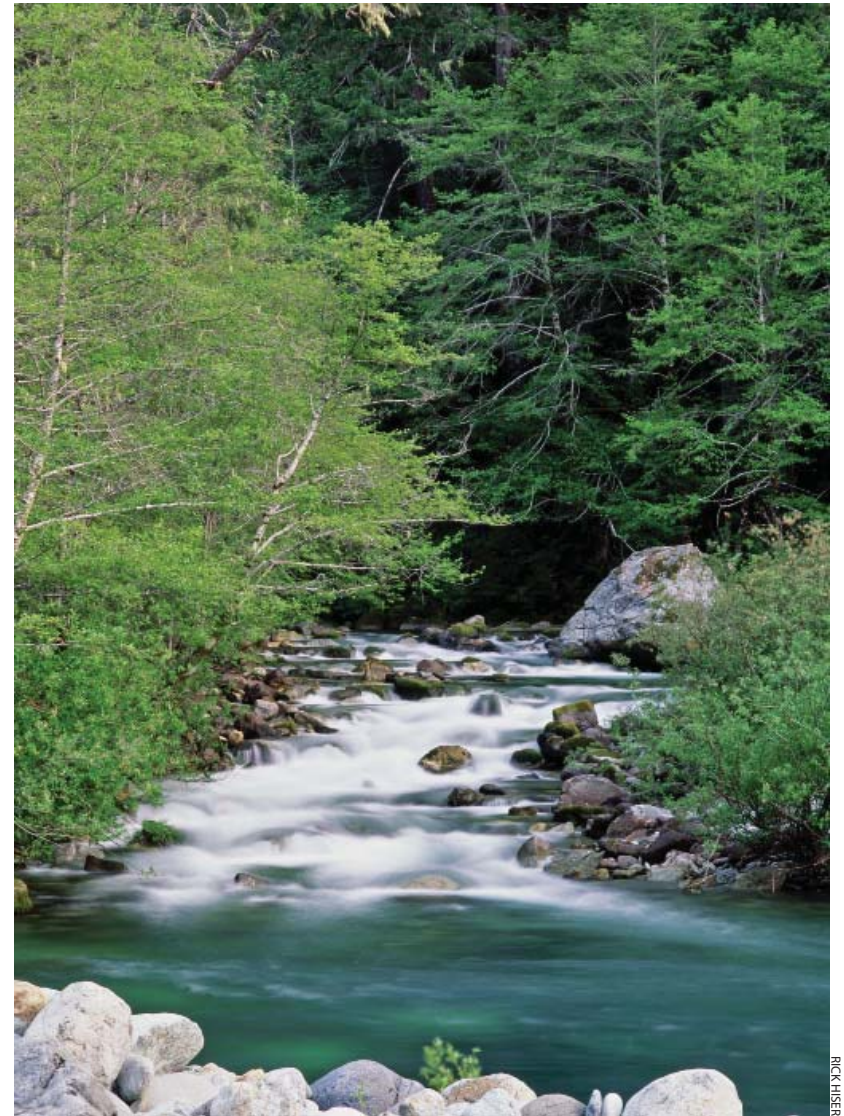
With a variety of soils including the sparsely nourished peridotite, the basin supports at least 27 species of rare or endangered plants, some in specially designated tracts such as the Myrtle Creek Botanical Area adjoining the North Fork. The basin is entirely within the Siskiyou Mountain Range, which includes the most diverse collection of conifers on the planet. Jedediah Smith Redwoods State Park, which flanks both sides of the main stem, includes some of the finest redwood groves anywhere.

One of the cleanest streams on the West Coast, the Smith's waters run crystal-clear except during floods. An excellent trout river, the Smith also hosts the finest remaining steelhead and salmon runs in the state. Roadless areas cover one-third of the basin, which is largely in public ownership except for some river frontage on lower reaches of tributaries. Most of these are scattered mining claims. In its final 12 miles, the river flows through privately owned agricultural land where further land development is likely to occur unless open space is acquired for protection.

While the main stem flows with gentle rapids, the three forks of the Smith all feature extreme whitewater. Oregon Hole Gorge, on the lower North Fork and visible from Highway 199, is a non-stop series of sharp drops and pools with steep walls and enormous boulders blocking the flow. The upper North Fork is considered one of the most beautiful whitewater runs in the West. The South Fork is the longest branch and likewise has challenging whitewater and also trail access along remote sections of the stream.

The entire length of the three forks and main stem of the Smith are designated in the National Wild and Scenic Rivers system. In addition, many tributaries to the main forks are designated, making the Smith the most completely designated watershed in the national system. (Designated Middle Fork tributaries include Griffin Creek, Kelly Creek, Knopki Creek, Hardscrabble Creek, Little Jones Creek, Monkey Creek, Myrtle Creek, Packsaddle Creek, Patrick Creek including East and West Forks, and Shelly Creek. Designated North Fork tributaries include Bear Creek, Diamond Creek and North Fork, High Plateau Creek, Peridotite Creek, Still Creek, and Stony Creek. Designated South Fork tributaries include Blackhawk Creek, Buck Creek, Canthook Creek, Coon Creek, Craigs Creek, Eightmile Creek,

Goose Creek and East Fork, Gordon Creek, Harrington Creek, Hurdy Gurdy Creek, Jones Creek, Muzzleloader Creek, Prescott Fork of the Smith, Quartz Creek, Rock Creek, and Williams Creek.) To deter



RICK HISER

Goose Creek, a tributary of Smith River

logging and mining proposals in the highly erodible basin, much of the watershed was also designated as the Smith River National Recreation Area.

For all its protected status, critical parcels of private land remain, and mining proposals continue to resurface. The lower river is also vulnerable to development pressures.

The Smith is centerpiece to a much larger region of contiguous wild-and-scenic river basins including the Illinois and Rogue to the north and the Klamath and other California rivers to the south. For its combined qualities of water quality, fisheries, undammed length, wildness, unusual plantlife, old-growth trees, and recreation use, the Smith is a superlative river of California and the West.

CALIFORNIA "B" RIVERS

American River, North Fork

Dropping steeply through narrow wilderness canyons, the North Fork American has excellent trout waters, a wide range of habitat from high elevation to low, and spectacular whitewater.

From its Sierra Nevada headwaters just south of Donner Pass, the river flows west to its confluence with the South Fork in the backwaters of Folsom Dam, east of Sacramento. Beginning with the deep snow pack on the western flanks of Silver Peak, the upper North Fork drops precipitously through Sierra granite and forests and cuts 3,500-foot deep canyons at Royal Gorge and Giant Gap. Here the gradient reaches 180 feet per mile. Downstream from the Iowa Hill Bridge, the gradient lessens, but rugged and remote canyon country continues until the river reaches the backwaters of Clementine Reservoir. Downstream from that silted-in, five-mile-long pool, the lower North Fork flows past the Auburn Dam site, where one of America's largest dams was begun but then stopped after the Oroville earthquake raised serious safety concerns. Cutting through chaparral-covered foothills, the river is joined by the Middle Fork of the American, and then finally enters the slackwater behind



American River

Folsom Dam.

With wilderness through much of its watershed, the North Fork American's remote canyons provide excellent habitat for 238 birds, 47 mammals, and a wide variety of amphibians and reptiles, including several imperiled species, such as the foothill yellow-legged frog. The river also provides high quality habitat for native fish, with 36 miles designated as a wild trout fishery.

The North Fork's remote river canyons attract many hikers,

anglers, mountain bikers, and river runners, who enjoy a range of whitewater from the upper river's challenging Giant Gap run to the lower river's easier reaches. From Folsom Dam to the Sacramento River in the city of Sacramento, the main stem of the American flows through one of the finest urban river greenways in the nation and is heavily used by walkers, bicyclists, anglers, and boaters.

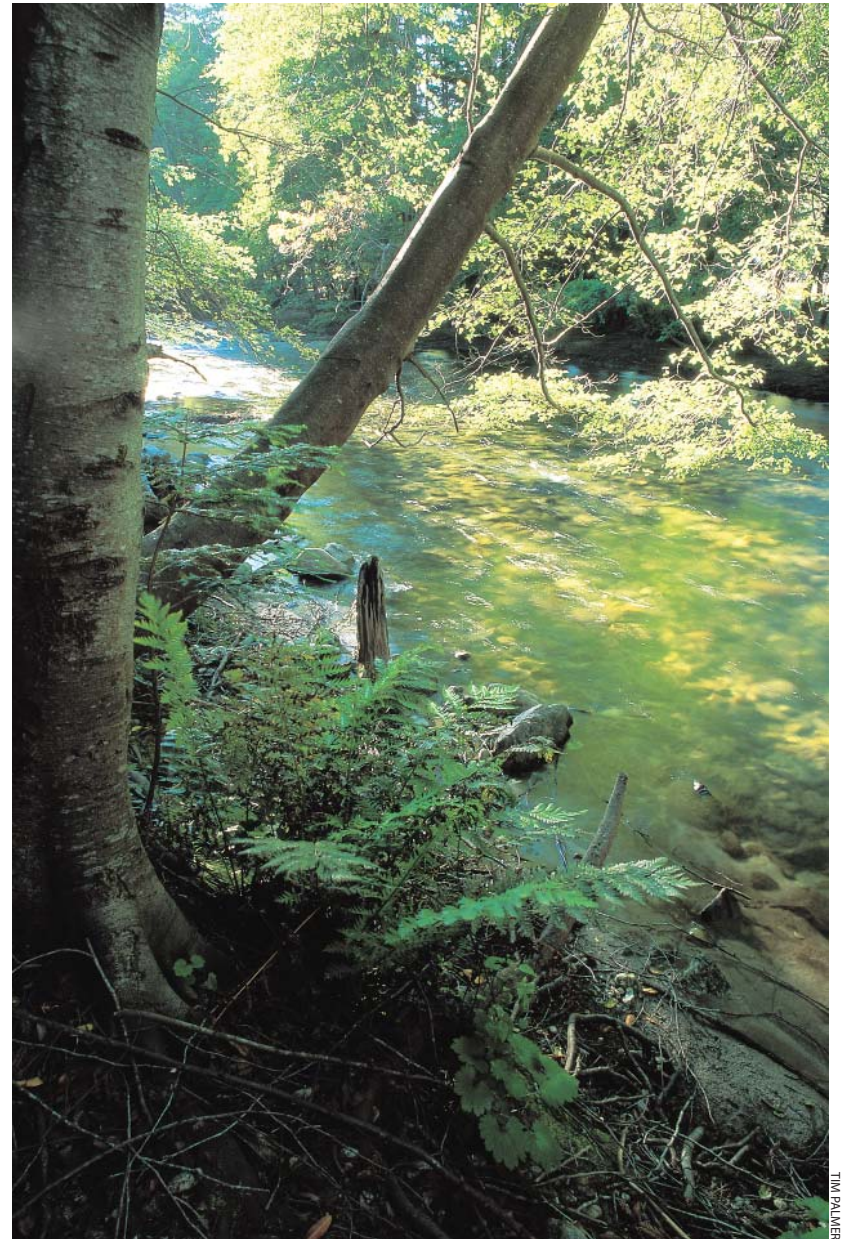
In 1972, 48 miles of the North Fork were designated in the California Scenic Rivers system, stopping a dam that had been planned at Giant Gap. In 1978, 38 miles from The Cedars to the Iowa Hill Bridge were protected in the National Wild and Scenic Rivers system. This reach notably excluded the section from the Iowa Hill Bridge downstream to Auburn, where the massive Auburn Dam had been proposed. Though perennially rejected as uneconomic and unfeasible, the dam continues to be championed by the local congressman.

Although most of the North Fork's riverfront is publicly owned as Tahoe National Forest or as the Auburn State Recreation Area, blocks of private land dating back to railroad land grants lay scattered in a checkerboard pattern in the upper river basin.

Big Sur River with North and South Forks

Flowing from the central or southern Coast Range, the Big Sur River drops through some of the southernmost redwood groves, thick chaparral, and riparian forests to a wild beach at the Pacific, and is perhaps the finest natural river on the West Coast south of San Francisco.

Rising in the Santa Lucia Mountains of the Big Sur Coast, south of Carmel, the river runs to the ocean at Andrew Molera State Park. The Big Sur is the largest river flowing from the west side of the Santa Lucia Mountains and through the coast redwood's southern range. The river's North and South Forks gather on the Santa Lucia's rugged slopes, where a mix of chaparral, tanoak, and bay intermingle with redwoods that grow in clustered groves on the cooler north-facing slopes of the deep canyon. The river then ripples out through redwood forests in Pfeiffer Big Sur State Park, flows alongside Highway 101, enters Andrew Molera State Park, and finally curves



Big Sur River

TIM PALMER

through riparian sycamore forests and coastal scrub habitat to a spectacular wild beach at the Pacific surf.

From its North Fork source, the river runs 21 miles to the sea. Steep trails reach the main stem and its tributaries in several places. Three sulfur hot springs bubble up in the canyon, and a rainbow trout fishery benefits from the cool, foggy microclimate of the canyon and from the rugged terrain that limits access to anglers. The Big Sur River also hosts one of the southernmost steelhead runs on the West Coast, and the lower river is one of few in its region that can be canoed in the high runoff season of winter.

Both North and South Forks and seven miles of the main stem flow through the Ventana Wilderness and are also designated in the National Wild and Scenic Rivers system. A lower seven-mile reach of the river flows through private land, with numerous recreational resorts and campgrounds, before entering the state park near its mouth.

Though Sespe Creek and the Sisquoc River are longer, they each encounter major diversions before reaching the ocean, and so the Big Sur River is perhaps the finest natural river remaining on the central and southern California coast.

Eel River, Middle Fork and main stem

The Eel and its Middle Fork form a long, continuous, free-flowing river running through terrain that is wild or only lightly developed from mountain headwaters to a natural estuary at the Pacific. The river still serves surviving salmon and steelhead runs.

The vast river system drains the coastal mountains of northern California, flowing west and north to the river's mouth near Eureka. The Middle Fork collects its headwaters north of Mendocino Pass, where the first six miles flow through wilderness. Then the river drops through a beautiful 54-mile-long canyon with ponderosa pine, scattered oaks, and vast sweeps of grassland in steep, erodible terrain. Unstable soils here can result in huge landslides, and silt-loads at peak flows have reached 15 times those of the Mississippi per unit of water. The river still offers excellent habitat for summer



Eel River Estuary

steelhead and supports winter steelhead, winter and spring chinook, and rainbow trout, though all the anadromous runs are greatly reduced from historic levels and there is some hatchery influence on wild fish. Bald eagles winter and peregrine falcons nest in the canyon.

Several trails reach to the river, and a 30-mile whitewater run from Black Butte River to Dos Rios is popular in the spring with plentiful Class II-III rapids, sandbars, and deep pools. Coal Mine Falls is a boulder-choked, nearly unrunnable rapid for rafts. Though the river flows through Mendocino National Forest, much of the riverfront in the canyon is privately owned.

From the wilderness boundary at the upper river to its confluence at the main Eel at Dos Rios, the Middle Fork is included in the National Wild and Scenic Rivers system. Designation precluded a major dam that had been planned at Dos Rios.

The main stem of the Eel below the Middle Fork confluence flows

in a broadening valley with oak savanna and grasslands on steep mountainsides. A superb 46-mile reach of Class II-III whitewater runs from Dos Rios to Alderpoint. Below there, the Eel becomes wide and shallow, with immense gravel and sand bars in the summer. The lower river winds through redwood groves in Humboldt State Park and then issues past farms, small communities, pastures, and marshes before entering the Pacific at a wide, natural, sandy mouth where acres of driftwood collect.

The Eel system has a distinctive, human-altered hydrologic regime. Enormous winter and springtime flows recede after the rainy season ends, leaving the summertime river to carry only 1 percent of the river's annual volume. Low natural flows are exacerbated by large diversions of water southward from dams near the main stem Eel's headwaters. These affect water quality and temperature downstream.

In spite of this, the Eel still supports coho and chinook salmon, American shad, Pacific lamprey, and California's largest run of spring steelhead. Bald eagles, peregrine falcons, and brown pelicans find habitat along this river.

The main stem Eel is included in the National Wild and Scenic Rivers system for 157 miles from Van Arsdale Dam, at its headwaters, to the Pacific. It is unusual in the national rivers system because it is a large river, averaging 7,600 cfs (though summer flows are low), and because 80 percent of its riverfront is privately owned. The Forest Service has found 26 tributaries of the Eel to be eligible for the National Wild and Scenic Rivers system (the same number as in the Klamath basin). Though most main stem frontage is sparsely settled ranchland today, the river corridor is likely to see great development pressures in the future.

Counting the upper wilderness reach, the Middle Fork Eel-Eel combination is the longest free flowing stream protected in the national wild and scenic system from source to mouth and from source to ocean. With its upper tributary, Rattlesnake Creek, the Middle Fork-main stem Eel combination flows for 167 dam-free miles to the Pacific, making it the second-longest free flowing reach in California.



Eel River, Middle Fork

Hat Creek

Starting on the east flanks of Lassen Peak in Lassen Volcanic National Park, Hat Creek flows 53 miles north to meet the Pit River.

From headwaters just below timberline, the West Fork of Hat Creek tumbles down Lassen Peak, joins the East Fork below a



Hat Creek

highway crossing, and then continues north past a series of low volcanic cones remaining from past eruptions. Flowing through forests of lodgepole pine and past the edge of broad meadowlands, the remarkably clear Hat Creek is continuously augmented by cold spring flows prevalent in this porous landscape of lava.

With unusually regular flows that are relatively unaffected by floods, droughts, and diversions, Hat Creek hosts a renowned trout fishery and is popular among anglers despite its remoteness. Endemic species include the rough sculpin and the Shasta crawfish. Highway 89 passes through much of the length of the valley, but it is not a major traffic route. The river flows through forest and some ranchland but has very little development in its remote setting, far from California cities and towns.

Kaweah River, Marble, Middle, and South Forks

Making spectacular drops from Sierra high country to low elevation in the foothills, the Kaweah River system remains mostly wild and natural, and continues to provide habitat to native fishes.

The Marble, Middle, North, East, and South Forks of the Kaweah lie almost entirely within Sequoia National Park. Collecting headwaters from the Great Western Divide of the southern Sierra, these forks drop generally westward through an wide range of habitats from 10,800 feet in elevation to 694 feet at Kaweah Reservoir below Three Rivers—nearly as great a dam-free drop as the Kings River.

Except for the lowest eight miles of the North Fork, six miles of the Middle Fork, and 10 miles of the South Fork, the basins are almost completely in public ownership, and much of the watershed is wilderness.

The Marble Fork drains the extraordinary granite high country of Sequoia National Park and flows near the largest groves of giant sequoias. The Middle Fork begins at the Great Western Divide and flows west through deep, wild canyons. The East Fork flows from the popular recreational high-country trailhead of Mineral King. The North and South Forks include wild canyons but drain lower-elevation basins. The South Fork has the best native fish habitat, hosting more robust populations and a greater diversity of species, though its lower reaches flow through private land with some development.

Below Kaweah Reservoir, the river is heavily diverted for agriculture and is ultimately dried up.

Klamath River

An epic river in the geography of the West, the Klamath is the third-largest stream flowing into the Pacific south of Canada, it has one of the longest free-flowing lengths, and it has more intact forests, fisheries, and wild tributaries than any other major West Coast stream.

Beginning in south-central Oregon, the Klamath River flows into California, is impounded by Iron Gate Dam, then flows dam-free for 188 miles to the Pacific. This is the second-largest California river, and on the entire West Coast south of Canada, the Klamath ranks third in free-flowing length behind only the Umpqua of Oregon, which is much more developed, and the Sacramento, which is

severely constrained by levees and industrial farmland.

After an initial 15 miles below Iron Gate Dam where the Klamath flows through a valley linking the Cascade Mountain range with the Klamath and Coast Ranges, the remainder of the river's eventful course to the Pacific flows through deep valleys and steep sided canyons of the coastal mountain complex—subranges of the Klamaths called the Scott Bar, Marble, Siskiyou, Salmon, and Coast Ranges. The Klamath is one of only three rivers that begins east of the Cascade crest and flows through both that range and the Coast Range to reach the ocean (the others are the Columbia and the Pit-Sacramento).

Once among the greatest steelhead and salmon rivers on the continent, the Klamath is plagued by irrigation diversions and polluted return flows at its headwaters and by diversions to southern California from the Trinity—its largest tributary, which joins the lower river. Nonetheless, the river remains an important steelhead, coho, and chinook fishery for three major Indian tribes along the shores, for commercial fleets extending hundreds of miles along the California and Oregon coasts, and for sport anglers.

The enormous basin still has large uncut tracts of old-growth forest and an exceptional diversity of plantlife at the intersection of several distinct ecosystems. A major upper river tributary, the Scott, is heavily diverted for irrigation but still has the best coho run in the basin. Fine Klamath tributaries include Seiad Creek, Grider Creek, Thompson Creek, Indian Creek, Elk Creek, Ukonom Creek, the Salmon River, Swillip Creek, Rock Creek, Camp Creek, Boise Creek, Red Cap Creek, Bluff Creek, and Blue Creek. In all, 26 tributaries have been found eligible for designation in the National Wild and Scenic River System by the Forest Service. The Eel is the only other river nationwide with so many eligible but not designated tributaries.

The Klamath's entire 188-mile free-flowing stretch from Iron Gate Dam to the ocean is designated in the National Wild and Scenic Rivers system, as are its tributaries the Salmon, Scott, and Trinity.

With several major rapids and hundreds of minor ones, the Klamath offers the longest whitewater rafting trip on the West Coast—188 miles with one mandatory portage at Ishi Pishi Falls



Klamath River

above the mouth of the Salmon River. The Klamath has one of the highest densities of osprey nests in the West; black bears are seen here more frequently than on perhaps any other river; and other types of wildlife are common.

The lower river flows through the Yurok Indian Reservation and Redwood National Park, where redwood forests are recovering from past clearcutting. The Klamath has the largest natural river mouth on the West Coast south of Canada; no jetty or harbor has been built.

With its size, scale, geographic span, and diversity of plantlife, the Klamath is one-of-a-kind on the West Coast and in the West. Though it has been damaged by water diversions and logging, it is perhaps the most significant restorable river in California and the West. If the water quality problems related to upriver diversions and dams were solved, the Klamath would clearly be at the top of the list of high-quality rivers in California and the West.

Proposals to eliminate Iron Gate Dam could further enhance restoration possibilities, as would correction of the agricultural and impoundment-related water quality problems at the headwaters



McCloud River

and diversion problems on the Trinity. Long stretches of river frontage are privately owned but lightly developed. Some of this is threatened by further development, and throughout the river's length selected tracts may be available for open space protection.

Mattole River

Isolated like no other major river on the California coast, the Mattole flows dam-free through a rain-soaked fastness of recovering redwoods and other conifers to a rare, natural outlet at the Pacific, and it still has surviving runs of chinook salmon, coho salmon, and steelhead.

On the north coast California, northwest of Garberville, the Mattole River begins less than a mile from the Pacific Ocean but then runs parallel to the coastline for 85 miles, separated by a high barrier of forested mountains—likely the result of a separate terrain “docking” against the proto-coastline. With up to 200 inches of rain a year, this watershed includes the wettest terrain in the state.

Much of the river's course is inaccessible by road. The lower river loops through an open valley with idyllic scattered ranches and secluded homesteads before braiding out to a remote, completely natural beach south of Cape Mendocino—famous for the “triple junction” where three continental plates come together in a chaos of seismic activity.

The coastal mountains in the Mattole basin once supported an extensive old-growth forest of redwoods and Douglas-firs, but only scattered uncut groves remain. The river continues to support chinook, coho, and steelhead runs with high species diversity, good habitat, and no hatcheries, though the anadromous fish are not abundant. Strong local efforts have been made to restore coho salmon.

The Mattole is California's finest example of a river flowing from source to ocean through a remote valley, isolated by mountains and tortuously curving roads in steep terrain. With little development, no dams or diversions, and enormous amounts of rainfall, the basin presents an exceptional opportunity for restoration of a once-remarkable river system.

McCloud River

With clear water, healthy spring flows, good trout habitat, and two fine wild reaches, the McCloud is the finest example of a Cascade Mountains river in California.

Starting with headwaters in the lava fields of the Modoc Plateau in northeastern California, the river flows west and south through the southern Cascade Mountains and meets the Sacramento in the reservoir behind Shasta Dam.

The upper McCloud meanders through a broad valley shared by Highway 89 and a railroad line. At Falls of the McCloud, the river drops over a spectacular three-part waterfall in a sheer-walled gorge and enters a 10-mile reach of turbulent whitewater before hitting the slackwater of a four-mile-long reservoir called Lake McCloud. Below the dam, the river begins another remarkable descent through deep woodlands, basalt-sided gorges, swift Class-



Merced River

IV and V rapids, and resounding wildness. The final 14 miles of the McCloud are flooded by backwaters of the massive Shasta Dam on the Sacramento River, and would be further flooded if the dam were to be raised, as has been proposed.

The McCloud has a unique hydrologic regime. Prodigious runoff from storms dropping rain and snow in the Mount Shasta region sink quickly into the cracked and porous lava. The water then reemerges as spring flows, giving the McCloud a far steadier flow than most other rivers. It rarely floods and rarely drops to low levels. As a result, ferns, Indian rhubarb, bigleaf maples, and coniferous forests grow in lush thickness right to the water's edge. The water is some of the clearest in California. An aqueduct diverts a portion of the upper river above Falls of the McCloud, but the small flow is augmented below the Falls by springs continually discharging 500 to 1,000 cfs. Hydroelectric projects then diminish flows of the lower river by diverting water to the Pit River. Nevertheless, the McCloud remains a superb trout stream and is designated in the state scenic rivers system.

Merced River with South Fork Merced

A classic gem of the Sierra Nevada, the Merced boasts the most spectacular collection of waterfalls in America, is the lifeline and scenic masterpiece of Yosemite Valley, and sustains a good fishery from high elevations to foothills.

From the high country of Yosemite National Park, the Merced River drops with extreme gradient, pauses briefly as it winds quietly through the exquisite Yosemite Valley, and then plunges again through lower elevation canyons until it hits the backwater of McClure Reservoir, east of Turlock.

Like the Tuolumne, Kings, and Kern, the Merced collects its headwaters from an extravaganza of snowcapped peaks that reach up to 13,114 feet, vast expanses of granite, and magnificent groves of pines, firs, and cedars. Absolutely clear water drops over dozens of falls and cascades, including the 594-foot Nevada Fall and Vernal Fall. The river then flows as centerpiece to the famed Yosemite Valley—one of America's most stunning scenic attractions—where

DREAMSTIME



Mill Creek, Sacramento River Basin

it picks up tributaries such as Yosemite Creek. This stream free-falls 1,430 feet—one of the tallest waterfalls in the world. Below the Valley, the river plunges in a narrow canyon, dropping through

turbulent rapids having massive boulder gardens and bus-sized rocks.

At the town of El Portal, the Merced's gradient eases somewhat and becomes a prime Class-V paddling run and then a popular Class III-IV rafting reach. In this section, the river flows through a foothill canyon of oaks, chaparral, and grassland until it reaches the flatwater of McClure Reservoir below Halls Gulch. Downstream from the reservoir, the river drifts through the lower foothills and into the intensively farmed flats of the Central Valley, where it eventually meets the San Joaquin.

The Merced attracts legions of paddlers both to the gentle current of Yosemite Valley and to the exciting whitewater below El Portal. Trails along an abandoned railroad grade below El Portal, through Yosemite Valley, and throughout the high country along the river's upper tributaries offer some of the most popular hiking in America. From Yosemite National Park downstream, the river's fishery is heavily affected by the introduction of exotic bass.

The waterfalls and scenery of Yosemite Valley put the Merced in a class by itself. Its middle reaches, however, have far more road access than the Tuolumne River to the north or the Kings and Kern to the south. Most of the corridor upstream from McClure Reservoir is publicly owned, however pockets of private land are found from El Portal down.

The South Fork of the Merced flows from the forested mid-elevations at the southern end of Yosemite National Park and joins the Merced in the canyon below El Portal. Roadless except for its source near the Wawona resort and campground, the river drops for 43 miles through forests, meadows, and inaccessible canyons. A trail leads upriver from the mouth for four miles to Hites Cove, where exceptional springtime wildflower blooms can be seen. An excellent fishery, the South Fork is one of few Sierra streams with self-sustaining rainbow, brook, and introduced brown trout.

The Merced is included in the National Wild and Scenic Rivers system for 52 miles from its source to Halls Gulch below Briceburg. Four upper basin tributaries are also designated, as is the entire South Fork, which is one of the more significant rivers that's

protected in the national system from source to mouth.

Mill Creek

Mill Creek is an important salmon, steelhead, and trout stream. It is rated among the top three Sierra Nevada waterways for aquatic life and flows nearly dam-free through wild country at the interface of the Sierra and Cascade Ranges.

The creek flows for 55 spectacular miles from the southwest flanks of Mount Lassen to the Sacramento River south of Red Bluff. The only dam is a diversion structure five miles above the Sacramento River.

Headwaters begin with snowfields and hot springs of Lassen—the southernmost of the Cascade volcanic peaks. South of Highway 36, the creek enters a wild, steep, narrow canyon that runs for 16 miles with basalt cliffs. About 10 miles of this section flow through the Ishi Wilderness, and a trail parallels the creek through the entire reach. After a minor bridge crossing, the canyon extends for another 19 roadless miles in gentler, rolling terrain as the creek enters foothills and then the Central Valley. Upper reaches have one of the largest stands of old-growth forest remaining in the northern Sierra, and support California spotted owls, Pacific fishers, and wolverines. Lower reaches host some of the finest blue oak savanna, chaparral, and grassland.

This is one of the last streams in the northern Sierra that continue to support threatened spring run chinook salmon and winter steelhead, and it's the longest Sacramento basin tributary that the chinook ascend on their spawning run. The creek also hosts an excellent rainbow trout fishery.

An outstanding trail system makes the creek accessible to hikers. The Forest Service has recommended designation of 32 miles in the National Wild and Scenic Rivers system, but for now, Mill Creek remains one of the most extraordinary unprotected rivers in California.

San Joaquin River with North, Middle, and South Forks

The second largest river in California, the San Joaquin boasts an exquisite complex of high-country tributaries draining wilderness and national park areas in the central Sierra Nevada.

Nearly the whole lengths of the North Fork, Middle Fork, South Fork, Evolution Creek, and other tributaries flow through the Minarets, John Muir, and Ansel Adams Wilderness areas. These streams include some of the most extraordinary high mountain scenery in America. One dam is located on the South Fork.

The North Fork begins at the border of Yosemite National Park and flows south to meet the Middle Fork at the edge of the Ansel Adams Wilderness. A trail follows the river's route for 10 miles in upper reaches; the lower 10 miles flows through inaccessible wilderness.

The Middle Fork begins in the scenic extravaganza of Thousand Island Lake, beneath the central Sierra landmarks of Banner Peak and Mount Ritter. The Pacific Crest and John Muir Trails roughly



San Joaquin River

DREAMSTIME

parallel the river's southeastward course to Devil's Postpile National Monument—perhaps the finest example of columnar basalt anywhere. Below the Monument, the river drops over the cataract of Rainbow Falls and continues through inaccessible granite canyons for 11 miles to the North Fork confluence, where the main stem begins, and then for another 12 miles of free-flow until the river hits the backwater of Mammoth Pool Reservoir.

The longer South Fork begins in the sublime Goddard Canyon, beneath the LeConte Divide in Kings Canyon National Park, and flows north, picking up Evolution Creek, which flows from 13,000-foot peaks that ring Muir Pass. Seven miles northwest of the Kings Canyon National Park boundary, the South Fork is dammed in Florence Lake, where water is diverted west for hydroelectric power. The river continues on northwest for about 25 miles to its confluence with the main stem at Balloon Dome—a granite monolith surrounded by forest. The only roads that reach the South Fork are at Florence Lake (reservoir) and Mono Hot Springs, six miles below the reservoir.

At Mammoth Pool Reservoir the main stem San Joaquin is stopped by the first in a series of dams culminating with Friant Dam, northeast of Fresno. The lower river through the Central Valley is diverted for irrigation, leaving little or no flow in the channel, and is severely polluted by return agricultural wastewater. Nonetheless, some salmon migrate up the lower river, and long-sought restoration plans to reinstate flows for anadromous fish gained traction with a court decision in 2006 that requires that more water be returned to the lower river.

Tuolumne River

The Tuolumne flows through high meadows and an exquisite canyon that is a highlight to mountain-river scenery in America, followed by one of the West's premier whitewater rafting and kayaking runs.

With its source on Mount Lyell of Yosemite National Park, the Tuolumne River drops westward for 83 miles from the Sierra Nevada



Tuolumne River

crest to the foothills of the range in New Don Pedro Reservoir. Beginning among the stunning high granite and snowcapped peaks, the upper river winds through Tuolumne Meadows—the largest meadow in the entire range. Then the river drops over waterfalls and through deep granite chasms, brilliant whitewater rapids, and groves of ponderosa pine, incense cedar, and Douglas-fir in the Grand Canyon of the Tuolumne—one of the superlative scenic canyons of the West.

Below the canyon, the river hits the slackwater of Hetch Hetchy Reservoir. Here, John Muir waged the seminal battle over the protection of wilderness, national parks, and wild rivers when he tried unsuccessfully to save the valley from damming.

While upper reaches of the river offer premier hiking and backpacking opportunities along the river, the lower reach offers one of the most famous whitewater runs in America. At Lumsden Campground, about 15 miles below O'Shaughnessy (Hetch Hetchy) dam, rafters and kayakers embark on one of the West's most outstanding Class-IV whitewater runs, which continues for 18 miles to the backwater of New Don Pedro Dam. This reach features

a 2,000-foot-deep canyon of cliffs, ponderosa pines, oak savanna, chaparral, and grassland.

A sizable tributary, Cherry Creek, enters the river above Lumsden and offers one of the most challenging Class-V whitewater runs in the nation. Another notable tributary, the Clavey River, enters the Tuolumne in the lower canyon and is one of few free-flowing rivers left in California with no dams on its entire length (see California A list, above). The entire main stem Tuolumne corridor, from source to New Don Pedro Reservoir, is publicly owned as Yosemite National Park, Stanislaus National Forest, or Bureau of Land Management property.

The biology of the Tuolumne is heavily affected by introduced trout and by severe manipulations of flow for hydropower and water supply. The native fishes of the undammed South Fork of the Tuolumne are in much better condition than those of the main stem.

Below the sprawling New Don Pedro reservoir, the river winds through the lower foothills, past intensively farmed agricultural land, and through the city of Modesto before meandering across flats of the Central Valley and joining the lower San Joaquin River.

CALIFORNIA “C” RIVERS

Amargosa River

The Amargosa lies within the most arid desert in America and still flows perennially in one section. It supports rare native fish and is regarded as one of the best of the small desert rivers in the West.

With its source in Nevada, the river runs for about 150 miles through the Mojave Desert, first flowing south, then west, then north to its terminus in Badwater Basin—a sandy, landlocked sink in Death Valley National Park at 282 feet below sea level and the lowest elevation in the United States. As with nearly all other rivers whose watershed is limited to deserts, much of the Amargosa is dried up most of the time. However, a 26 mile segment near Tecopa

flows year round through Bureau of Land Management property. That agency has found this section to be eligible for National Wild and Scenic River designation.

In a rugged canyon with cliffs and colorful, fossil-studded rock formations, the spring-fed BLM reach includes wetlands and a riparian corridor of willows and other plant life.

The river also has most of its suite of native animal species intact. A veritable oasis, this reach supports 260 kinds of birds including the imperiled willow fly catcher, yellow-billed cuckoo, and Bell’s vireo. Pools here also support the rare Amargosa pupfish and speckled dace. Though some non-native fish have been introduced, biologist Phil Pister calls the Amargosa “as pristine a river as you can get in the desert regions of the American Southwest in the year 2006.”

American River, South Fork

Though the biology of this scenic river has largely been sacrificed to hydroelectric power, the South Fork American has become a tremendous recreation area with one of the nation’s most popular whitewater runs. Hiking and general recreation are likewise important along the river and throughout its headwaters.

Beginning in Johnson Pass, where Highway 50 crosses the Sierra Nevada, the South Fork American flows west to Folsom Reservoir, just east of Sacramento.

Headwaters drop from granite bedrock and coniferous forests, and are joined by the spectacular tributary, Pyramid Creek, which drains the Desolation Wilderness and drops over Horsetail Falls—one of the more spectacular waterfalls in the northern Sierra.

Highway 50 parallels the upper river, which tumbles through a continuous chain of rapids and clear pools. The scenic Silver Fork joins from the south after flowing through remote and sparsely roaded country from a headwaters reservoir.

In its mid-sections, the South Fork is heavily diverted for hydroelectric power. Then at Chili Bar Dam, north of Placerville, water is returned to the river during hydropower production,

yielding afternoon flows of high water throughout the summer in the 20-mile-long reach to the backwaters of Folsom Dam. This may be the most popular and accessible whitewater in the West, with crowds of rafters and kayakers from northern California's metropolitan areas paddling throughout the spring, summer, and autumn months. Because of fluctuations in flow for hydropower, the river has few fish of any species; however, a new dam-operations agreement in 2007 will result in more consistent releases and better water for both fish and rafting.

Though its flows are heavily diverted and manipulated for power production, and though roads parallel the river for significant lengths, the South Fork American remains an important river because of the recreational qualities it offers and its outstanding Pyramid Creek and Silver Fork tributaries.

Cache Creek

The highest-volume river flowing from the east side of the Coast Range in California, Cache Creek hosts the largest wintering population of bald eagles in the state, a good fishery, and excellent recreational values near both Sacramento and the San Francisco Bay area.

Flowing from the outlet of Clear Lake, Cache Creek runs southeast to lowlands of the Central Valley near Woodland. The upper river drops through an 18-mile-long roadless reach with Class II-III whitewater. Below there, Highway 16 parallels the river through a rugged canyon, which ends when the river enters the Capay Valley near Rumsey. The lower river is heavily diverted into irrigation canals and ditches before reaching the Sacramento River.

Cache Creek is the largest stream draining the east side of the California Coast Range. Grassy hills, chaparral, and oak trees predominate in this low elevation area of temperate winters and hot, dry summers. A few of Cache Creek's wintering bald eagles are beginning to nest in riverfront trees. One of the state's largest herds of tule elk also inhabits the basin, and black bears are common. The river and its tributary Bear Creek also host strong populations of

native fish.

Much of the canyon is in public ownership and administered by the Bureau of Land Management, which has found 32 miles of the creek eligible for the National Wild and Scenic Rivers system

Cosumnes River

One of the least-dammed of all Sierra Nevada rivers, the Cosumnes flows through a mostly wild basin and retains its natural flow regime, which supports a valuable network of wetlands near the river's mouth in the Central Valley.

From a broad ridge lying west of Carson Pass in the central Sierra Nevada, the river drops west to its confluence with the lower Mokelumne River in the midst of the Sacramento-San Joaquin Delta.

Unlike the major Sierra rivers, the Cosumnes' watershed does not reach to the high crest of the mountains, which are drained by the American to the north and the Mokelumne to the south. Collecting



Cache Creek



Redwood Creek Estuary

its headwaters instead from the 6,500-foot Iron Mountain Ridge, the North and South Forks of the Cosumnes flow down through mid-elevation forests to a largely undeveloped foothills landscape. At lower elevations the river winds through one of the largest remaining savannas of immense valley oaks before entering the Central Valley, where the lower river supports an extensive system of marsh lands and flooded riparian habitat at its confluence with the Mokelumne River near sea level.

The Cosumnes has only an eight-foot-high dam at Michigan Bar and one dam on tributary Sly Creek. Unaffected by flood control, the river's natural flow regime remains intact, which enables it to nourish wetlands of the Central Valley much like the other Sierra rivers did before widespread damming.

Wetlands and floodplains of the lower river offer excellent habitat and are critical for large populations of migrating waterfowl and sandhill cranes. A small run of chinook salmon survives here—another rarity among Sierra rivers. However, much of the lower river is dominated by exotic redeye bass, and the flow nearly dries up in late summer.

A Nature Conservancy preserve protects wetlands near the river's mouth, but most of the river's low lying floodplains and wetlands are privately owned.

Mokelumne River, upper North Fork

This small river flows through a nearly untouched wilderness canyon with granite boulders and tall cliffs rising up to high peaks of the northern Sierra.

The upper North Fork of the Mokelumne flows 25 miles from Highland Lakes, south of Ebbetts Pass on Highway 4, west to the slackwater of Salt Springs Reservoir. Rugged, forested country beneath volcanic peaks of the central Sierra yield heavy snowmelt to the upper river, which winds through the meadows and forests of Hermit Valley before dropping into a deep canyon of waterfalls and cascades. This spectacular wild reach has limited trail access for seven miles. At lower elevations, a trail follows the canyon for nine miles to the inlet of the reservoir.

The corridor above Salt Springs is all in the Eldorado National Forest, and much of the upper basin lies in the Mokelumne Wilderness Area.

The North Mokelumne is a rare example of a central or northern Sierra stream that does not have dams and hydroelectric diversions at high elevations, and it is one of the most significant wild Sierra streams that is not protected in the National Wild and Scenic Rivers system.

Downstream from Salt Springs Reservoir, another 18-mile canyon reach continues past Devils Nose to Tiger Creek Reservoir. This is a fine reach for whitewater boating and trout fishing, and releases from Salt Springs Reservoir have recently been improved for fish and recreation. Below Tiger Creek Dam, the river enters foothills terrain and its gradient lessens. This reach also offers a popular whitewater boating run before entering Pardee Reservoir in the lower foothills.

Redwood Creek

Undammed and undeveloped except for its lowest reaches,

Redwood Creek passes some of the tallest redwood trees and offers a rare opportunity to restore a sizable coastal stream to its native, natural abundance.

This 60-mile-long stream flows from the crest of the Coast Range westward through Redwood National Park to Orick and the Pacific Ocean. Though many reaches have been heavily logged and the upper basin has many unimproved roads, the lower 18 miles flow through Redwood National Park. Much of this mileage has been logged as well, but uncut sections include some of the tallest trees on earth in the Grove of the Giants, and remote side-canyons hide other very large trees. Much of the national park frontage is accessible only by trail.

The river's estuary has been heavily ripped and leveed for three and a half miles near the town of Orick, but efforts are underway to consider restoration of the once-rich wetlands here. Despite these limitations, this completely undammed stream still provides for chinook and steelhead, and has one of the better coho runs in the state. Entering the lower reach, Prairie Creek is a fine tributary draining Prairie Creek State Park and some of the most magnificent of all redwood groves. These are easily reached by a trail system along the creek and through the park.

Redwood Creek offers one of the more challenging but significant opportunities to restore a key river of the redwood belt and an undeveloped and undammed waterway on the West Coast.

Rock Creek (Owens River tributary)

The premier stream of the southeastern Sierra Nevada, Rock Creek flows from high peaks and through a stunningly beautiful valley surrounded by high-country, meadows, and Sierra forests.

The creek runs for 15 miles from the heights of the range northward to the Owens River. Beginning in glacial cirques on the north side of Bear Creek Spire—a central Sierra landmark that rises to 13,713 feet—Rock Creek's headwaters gather in a cluster of pristine tarns and lakes. The stream cascades over waterfalls notched into solid granite and then courses onward. Unlike most

other east-side streams that plunge directly off the escarpment, Rock Creek flows north between the towering Sierra crest to the west and the massive north-south barrier of Wheeler Ridge to the east. After the upper six miles, the stream is road-accessible to the mouth of the canyon at Tom's Place, east of Lake Crowley, with many campgrounds and picnic areas.

Popular for its introduced trout fishery, Rock Creek canyon also offers remarkable backpacking opportunities with a network of trails that run the length of the stream and also climb to high country on the west and east sides. The entire corridor lies in the Inyo National Forest.

The only other sizable stream flowing from the southern Sierra's escarpment is Bishop Creek, which has been intensively developed for hydroelectric power.

Sacramento River, upper and middle as two separate sections

This largest river in California has a semi-wild section of outstanding whitewater and trout habitat above Shasta Dam and an exceptional low-elevation, big-channel, healthy riparian reach between Redding and Red Bluff.

As the second-largest river on the West Coast, the Sacramento carries one-third of all the runoff in California and flows south from Mount Shasta to tidewater at the city of Sacramento, then finally wends westward through the Delta to San Francisco Bay. The river is 377 miles long in all.

The upper Sacramento begins with runoff from the Trinity Alps to the west and Mount Shasta to the east and is soon impounded at Box Canyon Dam. Below this it flows through 36 miles of splendid Class III and IV rapids. This reach is a biologically productive and popular trout fishery, but its otherwise wild character is compromised by Interstate 5, cutting through the mountains nearby, and by a busy railroad that was built within the canyon. The upper river plunges through this deep, forested pathway to the backwaters of the largest reservoir in the state, impounded by the 600-foot-high Shasta Dam.

Below it, a fine 56-mile-long reach flows from Redding to Red Bluff—the second outstanding section of this major California artery.

The first 31 miles downstream from Redding have a healthy riparian corridor of cottonwoods and willows. In this reach, 15,000 acres of the entire Sacramento's 800,000 acres of original riparian forest remains (nearly all the rest has been lost). Much of the land is privately owned. Then a 25-mile long reach ending at Red Bluff flows past volcanic cliffs and natural shorelines unaffected by levees. Vernal pools in this corridor support rare plant species, and the riverfront is heavily used by waterfowl and sandhill cranes. Much of this section is owned by the Bureau of Land Management, which plans to acquire more acreage from willing sellers as it becomes available.

A series of fine tributaries enters the middle Sacramento, including Battle Creek, where a 15-mile stretch north of Red Bluff features calm water flowing through healthy riparian habitat. South of Battle Creek, Paynes Creek flows through an undeveloped seven-mile gorge before joining the Sacramento. Antelope, Mill, and Deer Creeks follow consecutively to the south (see A and B sections), entering the Sacramento below the Red Bluff diversion dam. From the west, Clear and Cottonwood Creeks enter the Sacramento north of Red Bluff and have surviving salmon runs that are benefiting from ongoing restoration efforts. Farther south, Big Chico Creek enters the Sacramento from the east, followed by Butte Creek. Both have chinook salmon runs that are benefiting from restoration efforts.

The entire Redding to Red Bluff reach of 56 miles constitutes the only section of the Sacramento below Shasta Dam remaining in a relatively natural condition. With its ample flows, low elevation, and mild climate, this middle Sacramento gem offers an important riparian refuge for wildlife. Threatened or endangered runs of salmon and steelhead migrate up the river, which continues to support all four runs of chinook salmon and most of the other native fish species. Bald eagles, ospreys, and river otters are also present. The middle Sacramento also offers an outstanding canoeing route with fine campsites, year-long flows, and no major rapids—a rare combination in the West.

Below the Red Bluff Diversion Dam, levees line the river but a



Sacramento River

riparian corridor can still be found along some of the mileage, with occasional oak savanna grasslands above the floodplain where farmlands don't directly encroach. On this lower river, levees constrain the river for 69 miles as it flows toward the city of Sacramento. Below there, the tidal river winds through its delta for 83 miles to California's largest estuary—San Francisco Bay.

Santa Margarita River

With no dams on its main stem, the Santa Margarita is one of the last free-flowing rivers in southern California and has great biological diversity in its channel, floodplain, and watershed.

Just north of Fallbrook, the 27-mile-long river is formed by the confluence of Temecula and Murrieta Creeks. Cutting through the foothills of the Santa Margarita Mountains, the stream enters a rugged gorge and then crosses the coastal plain at the Pendleton Marine Corps base before entering the Pacific.

Widely recognized for its biological diversity in a region

where little undisturbed native habitat can be found, the river corridor supports a multitude of species: 500 plants, 236 birds, 52 mammals, 43 reptiles, 26 fishes, and 24 aquatic invertebrates. This is considered the highest density and diversity of bird species along the south coast of California. The riparian edge also supports a large share of the nation's entire population of endangered Least Bell's vireos. Coastal wetlands along the lower river support imperiled bird species including the light-footed clapper rail, Belding's savannah sparrow, and California least tern. The estuary still has the largest native population of arroyo chubs—a fish once abundant throughout southern California but now rare. Much of the stream, however, is dominated by exotic redeye bass.

The Bureau of Land Management has found a small segment of the river eligible for National Wild and Scenic River designation, and the 4,000-acre Santa Margarita Ecological Reserve connects two parcels of BLM land lying upstream from the Pendleton base. Much of the river is closed to public access because of military use.

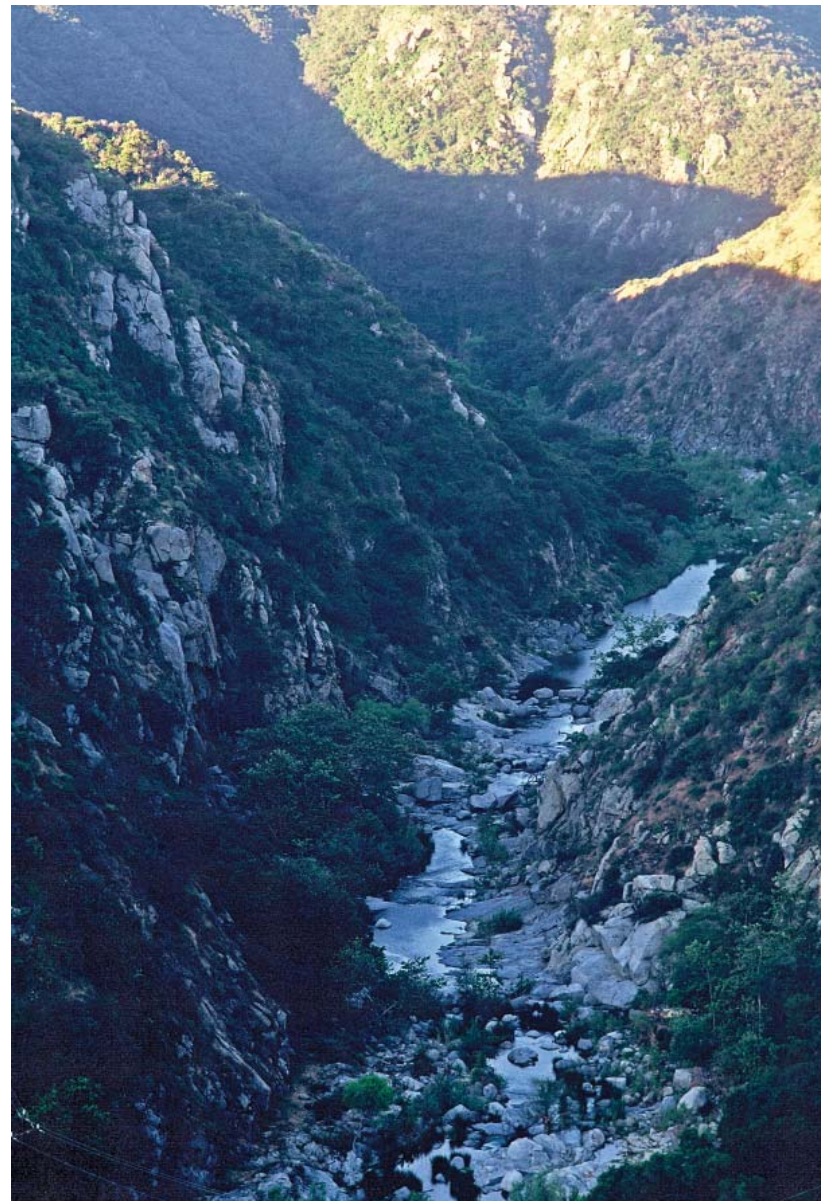
The Santa Margarita's relatively healthy flows may be threatened by massive suburban development occurring in the headwaters.

Shasta River

Owing to its critical location draining the north face of Mount Shasta, this small river may be important as a cold-water refuge for fish and other aquatic life in the coming age of warming climate.

Collecting snowmelt, rainfall, and ample spring flows from the northwestern slopes of Mount Shasta, this little-known river flows north to the Klamath. The 14,162-foot Mount Shasta—once thought to be the highest mountain in the United States—is the second-loftiest peak in the entire Cascade Range and the highest peak in California north of the Palisades in the southern Sierra Nevada. Because of its great height and its alignment with the path of wet storms that arrive from the north Pacific throughout the winter months, Shasta is the only mountain in the state where snowfall is increasing and glaciers are advancing. While global warming poses dire conditions for streams throughout the California and the West,

the Shasta River may stay relatively cold because of the snowmelt and glacial runoff that are predicted to continue. This small and



Santa Margarita River

little-known river may become a critical refuge for fish and aquatic life needing cold water in the future.

Beginning a few miles south of the town of Weed, the river collects streams flowing westward from Shasta and also eastward from the Scott Mountains. Augmented with major spring flows, the river drops north to Lake Shastina—a three-mile-long reservoir for irrigation supplies. Then the stream meanders in tight bends through pastures, hayfields, dry lands covered with sage, riparian thickets of willows, and lava beds until it pitches more steeply down to the Klamath River just west of Interstate 5.

Unlike most other rivers with great natural values, the Shasta is almost wholly owned by private landowners. Most of the stream corridor is open ranchland rather than the forests that characterize much of the Klamath watershed. Yet very little of the land is developed, and development pressure is not likely to be great in the future. Salmon still migrate here from the ocean; the Nationwide

Rivers Inventory states that the Shasta River is the most important spawning tributary in the entire Klamath drainage.

If this stream could be restored to more natural conditions, its rare and irreplaceable cold-water refuge would be secured in the coming age of global warming. In recent years the Nature Conservancy has acquired nearly five miles of river frontage—a significant tract but a small portion of the whole river.

Sisquoc River

A rare wild river in the coast ranges of southern California, the Sisquoc flows in a remote, rugged canyon and valley of dense forest and chaparral hidden by high ridgelines on both sides.

The Sisquoc gathers its headwaters on the flanks of the 6,828-foot Big Pine Mountain, which marks the junction of three major coastal mountain ranges, and runs northwest 33 miles between the high paralleling ridges of the Sierra Madre Mountains to the northeast and the San Rafael Mountains to the southwest, eventually reaching the boundary of Los Padres National Forest. This entire upper reach lies within the massive San Rafael Wilderness—second-largest on the southern California coast.

Trout are found in the river and its tributaries though the main stem is largely overrun by exotic redeye bass. The entire upper basin offers prime habitat for the endangered California condor. Mountain lions, bears, ring-tailed cats, and other wildlife are also found in this mountainous terrain. A complex mix of plant life includes Coulter pine, big-cone Douglas-fir, Jeffrey pine, ponderosa pine, California white oak, Freemont cottonwood, California sycamore, and the southernmost stand of rare Sargent cypress.

Downstream from the national forest boundary, on private land, the river is heavily diverted for agriculture and flows intermittently. For much of its lower 20 miles, however, the Sisquoc's riverbed winds through a striking landscape of cottonwood and sycamore trees, oak savanna, and rolling pasture to the confluence with the Cuyama River. This also dries up in the summer before reaching the Pacific west of Santa Maria.



TIM PALMER

Sisquoc River Basin

Stanislaus River, North Fork

As it flows through a spectacular, middle-elevation reach with green forests and granite bedrock into an impassable lower canyon, the North Fork Stanislaus offers the best remaining, dam-free section of the extensive Stanislaus River basin.

Beginning at the Sierra crest near Ebbetts Pass, the North Fork of the Stanislaus flows west to its confluence with the Middle Fork, which it reaches 2 miles above the backwater of New Melones Reservoir.

Headwaters tumble out of the Carson-Iceberg Wilderness but are then impounded behind Spicer and Utica Dams. Though downstream flows are manipulated by these reservoirs, the next 30 miles flow dam-free through wild reaches of the middle-elevation Sierra, including low domes of granite, great cliffs, and deep forests of fir and pine. Several bridges cross the river, but no roads parallel the shores. Steep and complex rapids make this reach a favorite among expert kayakers.

The North Fork flows through Calaveras Big Trees State Park—the finest northern grove of giant sequoias—and then drops into deeper canyons of mixed forest and chaparral with house-sized boulders and long chains of waterfalls before meeting the Middle Fork Stanislaus.

The Forest Service has recommended designation of the remaining free-flowing section of the North Fork Stanislaus in the National Wild and Scenic River system.

Trinity River, with North and South Forks and New River

As the Klamath's largest tributary, the Trinity flows for many miles downstream from its large, upper basin reservoirs, supports residual runs of salmon and steelhead, and has several exceptional wild tributaries.

The river begins in the Trinity Alps west of Mount Shasta and flows west and north to the lower Klamath at Weitchpec. The upper river



Trinity River

is blocked by Trinity Dam, which forms the third largest reservoir in California. Lewiston Dam, built just downstream, diverts more than half of the river's flow southward. Below these dams, however, the Trinity flows free for 111 miles to the Klamath, which then continues unimpeded to the ocean.

Above the North Fork, intensive gold mining created enormous piles of waste debris, but with the North Fork's significant flow, the Trinity becomes much wilder. Entering not far downstream, the New River is a mostly wild tributary that flows from the Trinity Alps Wilderness. Both the North Fork and New River have runs of summer steelhead, an indication of good water quality. The Trinity next drops through the eight-mile long Class V Burnt Ranch Gorge before easing into 39 miles of gentler water.

Joining the main stem in this reach, about five miles upstream from the town of Willow Creek, is the South Fork, the Trinity's largest tributary. Gathering its headwaters in the Yolla Bolly Wilderness, the South Fork flows 26 miles west and then north, mostly through national forest land to Highway 36. Below there, 55 miles are designated in the National Wild and Scenic Rivers system. Though

much of the riverfront land is publicly owned, there are occasional tracts of private land, especially along the lower river.

The South Fork Trinity hosts steelhead, chinook, and coho. Though the basin has seen heavy logging, burning, and debris flows, it is recovering and has great potential as a refuge for native fish.

The South Fork National Recreation Trail, several other trails, and occasional unimproved roads provide access for anglers, hikers, and residents. Completely undammed, the South Fork flows through deep coniferous and mixed forests in steep canyons with boulders and exposed bedrock.

The main stem Trinity below Lewiston Dam, the North Fork, and lower South Fork are all designated in the National Wild and Scenic Rivers system. Most of the basin lies in the Trinity National Forest, but many private tracts and mining claims border the river.

Yuba River, North and South

Though impounded twice and depleted by diversions, the South Yuba remains a magnificent small river of the northern Sierra with wild reaches, excellent whitewater, and superb pools for swimming in the hot foothills zone near Nevada City. Restoration efforts could someday make this an important river for salmon and steelhead.

Beginning in Yuba Pass, the North Yuba River flows west for 45 undammed miles to Bullard's Bar Reservoir. With wooded shorelines, class III –V whitewater, and a good trout fishery, the river retains a surprisingly wild character even though Highway 49 follows the route closely.

The South Yuba River rises in Donner Pass and flows 64 miles down the western slope of the Sierra Nevada to its confluence with the Middle Yuba at the head of Englebright Reservoir. In upper reaches, Interstate 80 follows the river, but then the highway bends south and the South Yuba is left to tumble in a more remote course. The river is dammed high in its basin; Spaulding Reservoir catches massive snowmelt runoff for hydroelectric generation and for diversion south through tunnels to the Bear and North Fork

American basins.

Despite the diversion, the river downstream from Spaulding drops through spectacular, rugged, roadless canyons 1,200 feet deep. Several bridges cross the river, and trails parallel much of its length. In middle reaches near Nevada City, the river is heavily used by swimmers, anglers, and whitewater boaters in the springtime.

The 39-mile-long reach from Spaulding to Englebright Reservoir was protected in the California State Scenic Rivers system after a concerted campaign by the South Yuba River Citizens League, which opposed plans to dam parts of this reach for hydropower and water supply. Half the river frontage in this section is publicly owned and managed as Tahoe National Forest, Bureau of Land Management property, or state parks. Since 1984, the California Department of Parks and Recreation has been actively acquiring important riverfront tracts in the 21-mile stretch upstream from the river's mouth, aiming to link existing park units and create a larger river-centered state park. Private land and industrial forest property remain through this reach.

The main stem of the Yuba still has residual but surviving runs of fall and spring chinook—one of few Sierra rivers that retains this vital foundation of its ecosystem. If efforts of the South Yuba River Citizens League and other groups are someday successful and the low-head Daguerre Dam on the main stem and the 261-foot-high Englebright Dam (built only for the collection of silt resulting from gold mining) are removed, the Yuba could offer prime opportunities for restoration of salmon and steelhead habitat. ■

Conclusion

With its unparalleled diversity of geography and biology, its vast regions of lightly populated landscape, and its high degree of protection owing to one hundred years of path-breaking conservation work, California still has an extraordinary estate of natural rivers.

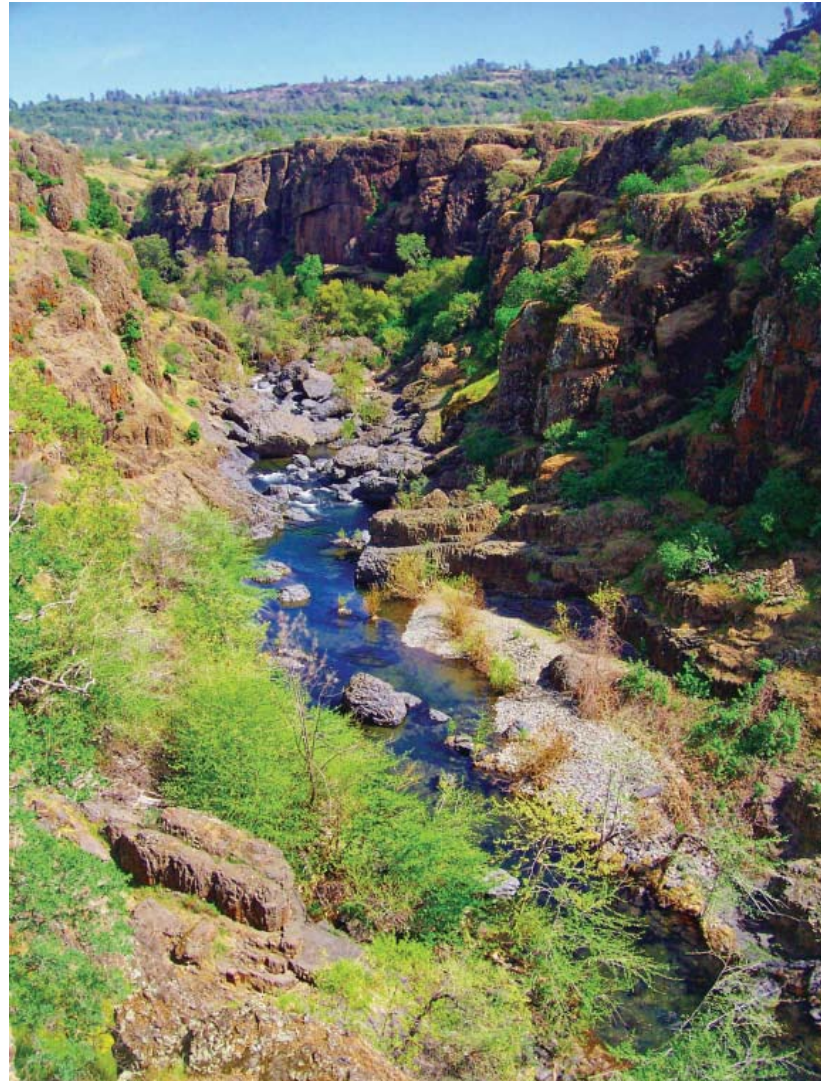
Using eighteen lists of rivers compiled by other organizations or by agencies, plus several interviews with experts familiar with the biology of California's rivers, we have listed 198 rivers with notable natural qualities and then selected 56 of these as exceptional. We sorted these into an "A" category of 17 rivers plus several small Smith River tributaries, a "B" list of 21 rivers, and a "C" list of 18.

The best rivers are concentrated in two large regions: the North Coast in the northwestern quarter of the state, and the Sierra Nevada. To a lesser degree, the middle Sacramento, from Redding to Red Bluff, along with a suite of tributaries still hold important natural values in spite of many problems, and restoration efforts raise the possibility that this cluster of waterways could be the basis of a recovering salmon and steelhead fishery. A discussion of these three "regions" of high quality rivers follows.

North Coast Rivers

With rugged mountains, heavy precipitation, dense forests, low-population, and surviving salmon runs, the North Coast's rivers are a particularly remarkable set.

California's northernmost river—the Smith—is the most intact and the most protected sizeable stream in the state, with no dams and little development. It forms an ideal basis for a vast region of natural rivers. Just to its south, the enormous basin of the Klamath has many qualities remaining, and the possibilities for restoration to outstanding natural conditions are feasible and promising,



Big Chico Creek

though significant challenges exist. Along with the Salmon and Trinity Rivers, a number of smaller Klamath tributaries remain in pristine condition and can be protected at relative little political and economic cost.

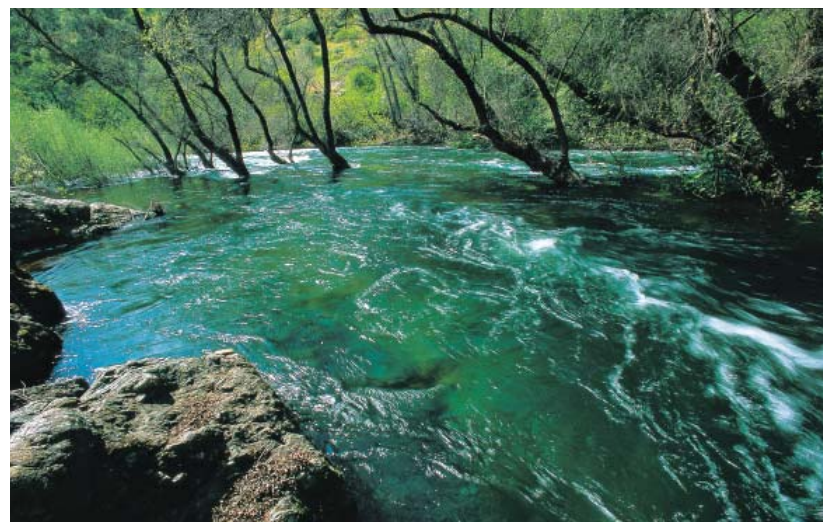
South of the Klamath, Redwood Creek offers additional restoration potential, flowing through some of the tallest groves of trees on earth. Farther south, the Eel basin, and especially its Middle Fork, retain vital natural functions and could be further protected before development pressures grow larger. Immediately south and west of the Eel, the Mattole River offers a unique opportunity to protect a river flowing in an isolated valley to the edge of the Pacific.

Together, these rivers of the North Coast constitute one of the single greatest concentrations of natural or semi-natural rivers in the West and in America. The region also joins seamlessly with the exquisite Siskiyou complex of rivers in southwestern Oregon, including the Chetco, Illinois, Rogue, South Fork Coquille, and Elk. With few dams, much land already in public ownership, good water quality, surviving runs of anadromous fish, and less development pressure than almost any other area similarly endowed with rainfall and runoff, this region clearly offers one of the most important opportunities for the conservation of natural rivers nationwide. Thanks to National Wild and Scenic River designations, most of the rivers here are already protected from future damming. Much, however, remains to be done: restoration of degraded riparian areas, reinstatement of flows, timber harvest reforms, and acquisition of private land or easements to protect sensitive watersheds and prevent damaging development.

Sierra Nevada Rivers

The second stellar region of natural rivers in California is the Sierra Nevada—especially the southern Sierra.

Though dams block the flow of virtually all Sierra rivers in foothill elevations and thereby truncate the historic runs of salmon and steelhead, the upper reaches of many streams remain breathtaking in their beauty and valuable for their natural qualities of clean, abundant water, and wild, forested shorelines. Most of the upper



TIM PALMER

Stanislaus River

basins of the Sierra streams are publicly owned as national forests or national parks, and many of the finest reaches are protected within wilderness areas.

Rivers of the northern Sierra from the Feather through the Stanislaus are exquisitely beautiful, but many have dams at middle and even at high elevations. Roads are also more prevalent here, with seven of nine major roaded passes over the 400-mile-long mountain chain crossing in the north. For this reason, private lands are also mixed with public property, frequently dating to railroad land grants across a few broad swaths in these watersheds and also to mining claims staked decades ago on public land. The opportunity and the need to protect these lands through acquisition of private property—usually owned by forest industries—are great in the northern Sierra.

While the Middle Fork of the Feather is the flagship river of quality in the northern half of the range, outstanding streams in consecutive order to the south are the North Yuba, South Yuba, North Fork American, South Fork American, lower Cosumnes, upper North Fork Mokelumne, and the North Fork Stanislaus along with its Middle and South Forks to a lesser degree. Back-to-back, the upper

basins of these rivers constitute one of the most contiguous masses of semi-wild land, pristine headwaters, and beautiful mountain terrain in America.

For its intrinsic mountain qualities, the northern Sierra is outdone only by the southern Sierra. From the Tuolumne River southward, no highways cross the formidable fault-block of mountains for 140 miles. Most of the high terrain through this reach is designated wilderness. The Tuolumne, Merced, San Joaquin, Kings, Kaweah, and Kern constitute a unique and unrepeatable collection of wild, high-mountain rivers. Nearly all this river mileage is now protected against further damming, and most of the land is publicly owned. However, as these rivers flow through the biologically rich, lower-elevation foothills zone, they are heavily degraded and vulnerable to further development threats.

Middle Sacramento Streams

The 56-mile-long reach of the Sacramento between Redding and Red Bluff is the only remaining reach of this great Central Valley waterway lacking levees. A fine riparian corridor of cottonwoods and willows remain—rare for low-elevation rivers in the West. Below the low diversion dam at Red Bluff, additional mileage offers good riparian habitat, though the influence of levees and nearby farming is greater. Throughout the lower and middle Sacramento, four runs of chinook salmon still migrate upstream to spawning grounds. These constitute a fraction of the historical numbers but represent viable populations that are critical to the survival of these species.

Several tributaries within the Redding-Red Bluff reach and also joining the Sacramento not far downstream from this section still retain natural qualities, provide salmon spawning habitat, and are largely undammed. Lower elevations of these basins are mostly privately owned, and all these streams have restoration needs. Nonetheless, as a group, these waterways present an intriguing opportunity to save the last semi-natural habitat of the Sacramento River system lying within and near the Central Valley. It may be possible to restore this group of streams so that they can function



American River at sunset

again as robust contributors to a once-great riparian ecosystem.

Rating highest in fishery and natural values, Deer Creek, entering the Sacramento from the east between Red Bluff and Chico, might be regarded as the core of this tributary cluster. The next major stream to its north, Mill Creek, is likewise rated as an excellent stream. Consecutive major basins to the north are Antelope, Paynes, and Battle Creeks—all with high ratings from sources used in this survey. Flowing from the Yolla Bolly Mountains on the west side of the Central Valley and joining the Sacramento north of Red Bluff, Cottonwood Creek is a major tributary with high values identified by the Nationwide Rivers Inventory, Bureau of Land Management, and State Department of Fish and Game. Farther to the south, Big Chico Creek is a fine west-side tributary of the Sacramento and has been the subject of a Western Rivers Conservancy protection and restoration project, and Butte Creek lies just to its south.

Unlike the other clusters of natural rivers in California on the North Coast and in the Sierra Nevada, this nexus of streams includes large expanses of privately owned land.

Taken singly or together, these Sacramento tributaries present

a challenging but promising opportunity to restore salmon and waterfront habitat in a once-rich region that has been heavily affected by intensive farming and ranching. However, any restoration efforts for anadromous fish are also dependent on water diversion, pollution, and other problems based downstream in the Sacramento-San Joaquin Delta, which the fish must pass through to reach the middle river and its tributaries. How these problems will be resolved is difficult to predict given the massive growth in population projected for California over the next 40 years.

Beyond the North Coast, Sierra, and middle Sacramento clusters of outstanding streams, the rivers of greatest natural value in California are relatively isolated from each other. Some streams do have adjacent rivers of quality, such as the Big Sur River with the Little Sur River, and Sespe Creek with Piru Creek, but overall, the regional connections have been lost. Hat Creek, McCloud River, Cache Creek, Big Sur River, Sisquoc River, Sespe Creek, Santa Margarita Creek, and Amargosa River are all of exceptional value—especially biologically—though they are not part of large, contiguous regions of rivers. This isolation makes their protection even more critical, as the other rivers in their regions have been degraded to a degree that they do not appear on this list. ■

SOURCES FOR THE SURVEY

Over 100 California Rivers were evaluated, using the following sources. Please see Appendix 1 for criteria.

1. Existing Inventories Of High-Quality Rivers

- National Wild and Scenic Rivers
- National Wild and Scenic Study Rivers
- National Wild and Scenic Study Rivers
- State-designated wild and scenic rivers
- Nationwide Rivers Inventory (National Wild and Scenic Rivers Act)
- U.S. Forest Service rivers recommended for protection
- Bureau of Land Management rivers recommended for protection
- Bureau of Outdoor Recreation, Western U.S. Water Plan
- Columbia Interior Basin Ecosystem Management Plan

2. Interviews with biologists and local experts

- Ron Remple, consultant, formerly with CA Dept. of Fish & Game (DFG)
- Phil Pister, fish biologist, Desert Fishes Council, formerly with CA Dept. of Fish & Game
- Malin Pinsky, Wild Salmon Center, Science and Conservation Program
- Peter Moyle, fish biologist, University of CA- Davis, Dept. of Fish, Wildlife and Conservation Biology
- Jerry Meral, former director of the Planning and Conservation League (PCL)
- Grant Werschull, conservation consultant

3. California Department of Fish and Game (CF). Designated wild trout and trophy trout waters, taken from American Rivers' 1991 Outstanding Rivers List.

4. Friends of the River (FR). This statewide river conservation group has been working since 1973 to protect the finest California streams. Rivers noted here are mainly taken from FOR's publication, *River Gems: A Guide to Free-Flowing Rivers in California* (Steve Evans, Friends of the River, Sacramento, 2002), which describes a select list of the most valuable but largely unprotected rivers. A few other streams were taken from FOR's *Rivers of Life: Saving The Last Free Flowing Rivers In Southern California* (Sacramento, FOR, about 2004), and from *Potential Wild & Scenic Rivers in California: A Statewide Inventory* (Sacramento, FOR, 2001). In addition, FOR published *National Wild & Scenic Rivers in California: A Status Report*, in 1998. This includes a list of rivers declared "eligible" for National Wild and Scenic River designation by the Forest Service or the Bureau of Land Management as of 1998 (others have been added to the list since then). The list of eligible rivers is far more extensive than the initial Forest Service and BLM eligible lists that appear in *American Rivers Outstanding Rivers List* of 1991. However, the 1998 list includes many short reaches (frequently less than 5 miles long) and small as well

as larger streams—324 in all—and is not copied in our WRC survey.

5. California Natural Areas Program (CN). Taken from the Outstanding Rivers List, these are rivers itemized by the state as high priority for natural diversity conservation.

6. Sierra Nevada Ecosystems Project Report (SN1). These are the highest-ranking Sierra Nevada rivers (scores of 70 and above, which apply to 13 streams) as determined by an Index of Biological Integrity (IBI) that identified healthy aquatic conditions (Status of the Sierra Nevada: Volume II, "Biotic Integrity of Watersheds," Peter B. Moyle and Paul J. Randall, Center for Water and Wildland Resources, University of California at Davis, 1996, p. 978 and supplemental table). The code SNI is followed by the IBI rating (scale of 1-100).

7. Sierra Nevada Ecosystems Project Report (SN2). This is a list of streams of 20-mile length or greater that are still used by chinook salmon (Status of the Sierra Nevada: Volume II, "Status of Fish and Fisheries," Peter B. Moyle, et al. Center for Water and Wildland Resources, University of California at Davis, 1996, p. 962).

8. Sierra Nevada Ecosystems Project (SN3). This list is recommended for special management because of outstanding aquatic diversity (Status of the Sierra Nevada, Vol. III, "Potential Aquatic Diversity Management Areas in the Sierra Nevada," Peter B. Moyle et al, Center for Wildland Resources, University of California at Davis, 1996, p. 411-412).

Appendix 1: Assessing the Quality of Rivers

To assess the qualities of rivers, the WRC survey used two sets of criteria. The first set were minimum requirements to be considered for a base-list of the best natural rivers. The second set addressed quality indicators—the specific values that indicated which rivers were the very best.

MINIMUM CRITERIA

Five minimum criteria were considered:

1. Free-flowing current. Free-flowing reaches of rivers are those that remain with their currents, riverbeds, shorelines, valleys, and canyons unblocked by dams. These reaches continue to benefit from floods' scouring and replenishment, they lack dams as barriers to fish migration, and they are more likely to retain ecological functions. Dams are so ubiquitous throughout the West that in many states only limited free-flowing reaches of rivers remain.
2. Reasonably natural flow regime. Natural flow regimes permit the full complement of native flora and fauna to thrive. Reaches that are de-watered or heavily diverted usually lack much of their native fish and wildlife and were not included in this survey, though rivers with minor diversions were considered. The more-natural the flow regime, the better.
3. Good water quality. High water quality is a foundation for much of the life in rivers. Heavily polluted reaches were not considered.
4. Non-urbanized shorelines. Most urban riverfronts no longer have intact corridors of riparian plant life; rather they are encased by impervious surfaces that contribute to extreme flow fluctuations and tend to aggravate problems of sedimentation and pollution. Conversely, undeveloped and undisturbed shorelines with their green band of riparian vegetation provide shade, temper flow and temperature, filter sediments, and offer habitat for wildlife. For this reason, urban rivers—though extremely important to society—were not included in this survey of the best natural streams. But occasional small towns and rural development did not bar a river from inclusion.
5. Outstanding natural features. One or more of these should be present. These include superlative scenic, geologic, hydrologic, fish, and wildlife qualities. (Historic and cultural values were excluded because they are an indicator of human activity and do not necessarily represent natural values.)

QUALITY CRITERIA

Beyond the minimum requirements (which yielded a very long list of rivers), the following four quality criteria were used to determine which rivers best retain their natural values:

1. Biological health. In keeping with the strategic plan of the WRC, this was the most important criterion. The best rivers should have intact and functioning ecosystems, with most of the native fish and wildlife species present. This survey identified rivers with exceptional biological diversity, healthy fisheries, and natural riparian corridors.

To date, no uniform or comprehensive evaluation of the biologically healthiest rivers has ever been compiled for the West, though the Environmental Protection Agency is currently

working on this goal, and some states have inventoried at least small (wadeable) streams for biological integrity. Even at state or regional levels, there is little information that indicates cumulative biological values of all rivers. To make determinations in this regard, the survey consulted with biologists working for state fish and wildlife departments, state natural heritage programs, and federal agencies including the U.S. Geological Survey, Fish and Wildlife Service, and Forest Service. We also consulted some of the Nature Conservancy's ongoing ecoregion planning programs. These local experts often provided the best judgments available regarding biological values.

In evaluating rivers' biological health, the survey considered high value fisheries as ranked by state agencies and the American Fisheries Society, valuable fisheries listed by the organization Trout Unlimited, inventories of riparian conditions, and other biological data. Rivers with intact native assemblages of fish were favored over rivers where introduced species, such as pike, brown trout, and rainbow trout have become dominant (even though these fish may be popular with many anglers).

Wildlife and plantlife are also important indicators for biological health. The survey considered keystone species such as cottonwoods, healthy populations of rare species otherwise in danger throughout much of their ranges, and other fauna and flora of special interest. Federal and state endangered and threatened species and species of special concern were also considered.

2. Wildness and roadless areas. Rivers with the least development generally rank highest in natural quality. For this reason, the survey noted rivers flowing through designated wilderness, through roadless areas, and through publicly owned land. For some states, the survey consulted comprehensive proposals for wildland protection that identified large blocks of undeveloped and roadless terrain. For some states (generally those lacking other lists indicative of wildness), we conducted our own survey of roadless conditions by consulting with DeLorme atlases.

3. Recreation suitability. Though not necessarily an indicator of natural quality, river-based recreation often depends on high natural values. Thus the survey includes recreation as an additional and related category of interest and consideration. Three river-based recreation activities that depend on natural qualities were noted: fishing, river running, and backpacking.

4. Length. Though short rivers or river segments may have great natural values, rivers and tributaries with long free-flowing reaches provide the greatest range of interconnected aquatic habitat. Connectivity is especially important for migratory fishes that depend on a range of habitat conditions for different phases of their life history. In some cases, connectivity is also important for the transfer of nutrients within river systems and from oceans to rivers. For these reasons, the survey considered longer free-flowing reaches better and focused on rivers 25-miles or more in length but did not necessarily exclude short streams.

Threats to the qualities of a river were not considered criteria for selection. This is not a list of the "most endangered" rivers. The survey, however, does note some threats to specific rivers. Consideration of these problems may be important in conservation strategies that will follow.

In addition to these specific criteria, the survey set out to include rivers that represented the full diversity of the West's biology and terrain. Recognizing the importance of biological and natural diversity, we included at least one river from each ecoregion, based on vegetation and shown on the U.S. Forest Service's map, Ecoregions of North America.

RATING THE RIVERS

To analyze these criteria for rivers West-wide, data were obtained and tabulated for hundreds of rivers on a state-by-state basis. The resulting state-by-state tables became the integral foundation for evaluating and ranking waterways for the WRC survey. Each table lists a large number of high-quality rivers considered for the survey (100-300 for each state), the sources that have identified the river for its exemplary natural qualities, the types of qualities that are recognized, and the ecoregion that the river flows through.

Sources consulted include the National Wild and Scenic Rivers system, National Wild and Scenic study rivers, state-designated wild and scenic rivers, the Nationwide Rivers Inventory conducted by the National Park Service, rivers recommended for protection by the U.S. Forest Service and Bureau of Land Management, and streams identified in other regional planning efforts, such as the Columbia Interior Basin Ecosystem Management Plan. Additional sources were used for specific states, ranging from articles in the American Fisheries Society journal to state lists of the best water quality, top fisheries, and other natural features. Of comparable importance, the survey consulted on-the-ground experts from natural resource agencies and western universities to supplement and corroborate information about the biological values of the rivers.

The tables also list the final rankings given to streams on the basis of comparative analysis. In these rankings, A represents the most valuable natural rivers. B applies to rivers of very high value but that might occur in the same region as an A river and that have somewhat less quality or significance. C rivers lack the superlative qualities of A and B rivers or represent the second- or third-highest ranking stream in their particular region, or they have valuable qualities but also one or more significant problems.

In the main body of this report, state-by-state chapters include narrative sections that begin with an overview of the state's river system, one-page profiles of each A-, B, and C-listed river, and a description of notable river "regions" where clusters of high-quality streams are found. In this regard, advantages can be gained by protecting identifiable clusters of streams in order to safeguard continuous aquatic habitat, to conserve landscape-scale wildlife habitat in adjoining basins, and to minimize "edge" effects that can damage rivers even when the source of degradation might be distant.

California's Great Rivers: List

