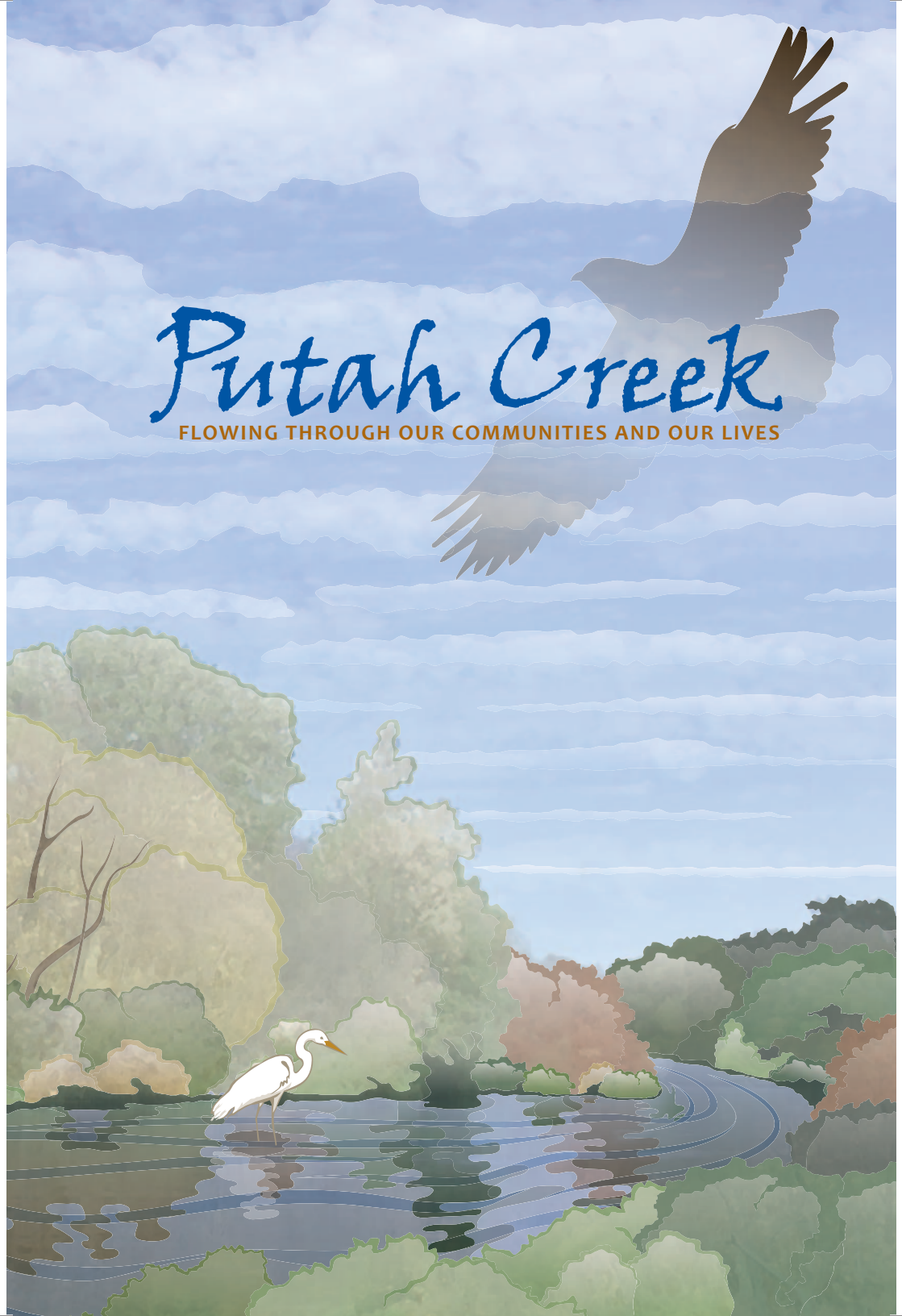
Putah Creek
FLOWING THROUGH OUR COMMUNITIES AND OUR LIVES

Putah Creek

FLOWING THROUGH OUR COMMUNITIES AND OUR LIVES

Published by: Putah Creek Council

Putah Creek Council is a nonprofit organization dedicated to the protection and enhancement of Putah Creek and its tributaries through advocacy, education, and community-based stewardship.

To join PCC, please send contributions to Putah Creek Council, P.O. Box 743, Davis, CA 95617. Membership levels are $15 student/senior, $25 friend, $35 family, $50 supporter, $100 contributor, $250 sponsor, $500 patron. Persons donating $50 or more receive a Putah Creek Council T-shirt (please specify size).

Prepared by: EDAW | AECOM

Published 2008

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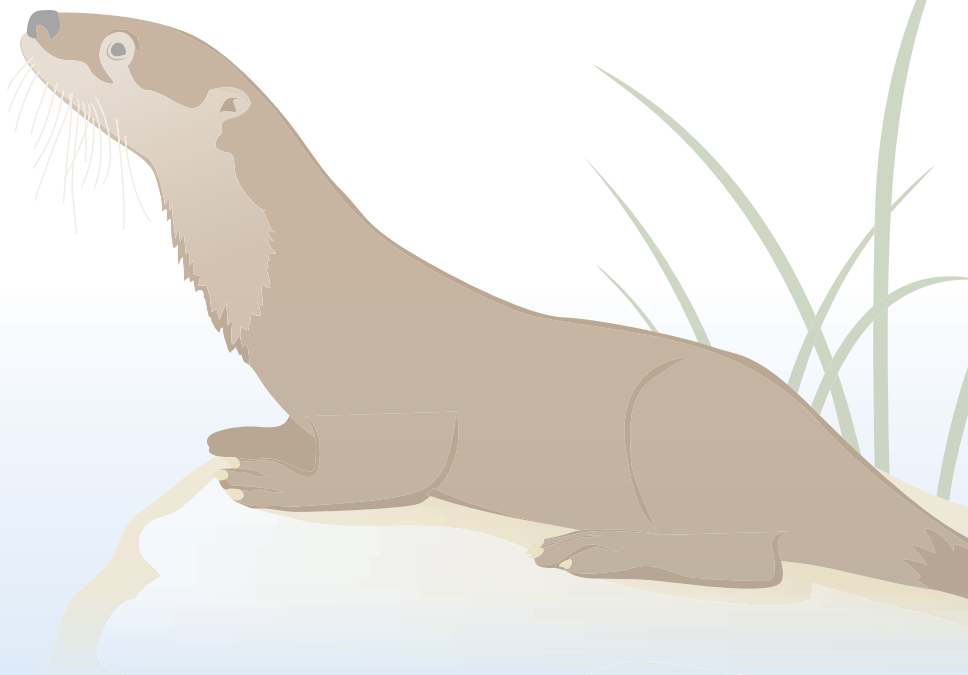
CALFED BAY-DELTA PROGRAM

LPCCC LOWER PUTAH CREEK COORDINATING COMMITTEE

CALIFORNIA Water Boards

ARE THESE LOGOS CORRECT?



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Preface

Who hears the rippling of rivers will not utterly despair of anything. We go to the river's edge for comfort, spiritual renewal, meditation, solitude: we go to the river to feel and know the continuance of life.

Henry David Thoreau

Streams have a life and spirit of their own. They've fed and nourished countless lives of all species for millions of years. Many of us, in growing up, had the good fortune at one time or another to discover a creek or wilderness. For some of us growing up in cities, it might have been the open lot next door. Others grew up on farms or, if lucky, near a state or national park or forest. The moment of discovery of the natural world leaves an impression on most of us that is never forgotten, even if the details erode over time. When John Fogerty of Creedence Clearwater Revival wrote "Green River" in 1962, he captured wondrous experiences he had with his family going to Putah Creek as a child. Yet we live in a time where the opportunities to experience the natural world that many of us had as children are rare or no longer sought.

More of us are sharing the earth now, putting pressures on basic resources—not only the land on which to grow our food and build our houses, but even the water that sustains us. As we demand more of earth's resources worldwide, our wilderness areas have diminished and, with them, we've lost habitat for the multitude of species with which we share our planet.

The story we are telling about Putah Creek is not unlike that of most of our waterways across America and the world. In our need for water and other resources, and our joy in living near water while not being flooded out, we have narrowed, leveed, dammed, and rerouted nearly all creeks and rivers. Yet they remain, crossing our landscapes as narrow bands of water and trees, still providing critical sustenance for so many species.

Just as we've altered our streams and rivers, so too have many of us lost our connection to them. There are countless technologies to engage and distract us, more then ever before—to the point that children growing up today can explore virtual worlds without ever exploring their local outdoors. But, with the realization that humans are now effecting environmental changes on a global scale,

Courtesy LPCCC, Photography by Rich Marovich

Construction of W-weirs reduces bank erosion and improves habitat for fish.

© Putah Creek Council

Bird boxes provide important nesting spaces for many species.

we are also now realizing how much our health and well-being depend on interactions with the natural world.

In response, people everywhere are beginning to recognize their role in the global community and to change their attitudes about their nearby creeks, rivers, and wilderness areas. Those who restore creeks also restore themselves and their communities. Life-changing discoveries await all who explore and tend their local and regional waterways. Stewards of their watersheds, they are also stewards of a healing planet.

We hope this book will provide a glimpse of the wonderful world of Putah Creek—past, present, and future—and inspire new generations of streamkeepers and stewards to protect their own Green Rivers.

Courtesy LPCCC, Photography by Rich Marovich

Putah Creek: water that sustains up all

A Connecting Flow

Water is everything.

Peter Moyle, fisheries biologist

Oh, the joy of dropping down from the hot, dusty flatlands of the Sacramento Valley and into a cool, green glade. Here the cottonwood leaves flutter merrily overhead and the creek sparkles and gurgles beside you. This magical mystery world of sound, color, and movement is Putah Creek, and it reveals much. Find a seat on a nearby log, soften your gaze, and wait for the denizens of the creek to show themselves to you.

A downy woodpecker whinnies overhead, a jaunty little acrobat in black-and-white tuxedo, while a Bewick's wren sulks furtively within a dark tangle of blackberry brambles. Before long, however, his ego gets the better of him and he jumps up into the light to sing an aria—all buzzes and trills—to spring, to his lady love, and to the other skulking suitors waiting to steal her. A wheezy cry wafts in over the levee and two Swainson's hawks soar lazily into view, a light-phase female and her smaller dark-phase mate. They circle in wide arcs, then race in toward each other, feinting and dodging in an aerial courtship dance. Gliding off down the creek corridor, they land at the edge of a bulky stick nest near the top of a large cottonwood tree.

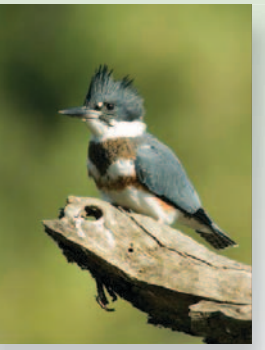
Swainson's hawk

As you relax in the sun and soft breezes, you realize you are not alone on your log as a small reptilian face emerges above the woody horizon. The western fence lizard strikes a dashing pose and begins a series of "pushups," his brilliant blue sides flashing a warning that this is his log and you are an unwelcome intruder. Ignoring him, you bend over and peer down into a micro-world of beetles, ants, springtails, and spiders, all going about their buggy business.

Soon, you begin to notice other subtle sounds amid the score of wind, water, and hawk cry. Bees and flies buzz excitedly about a buttonbush, drunk with nectar and pollen. Nuttall's woodpecker trills from the treetops, while a yellow warbler sings "sweet sweet sweet" from the branches of a large black willow tree.

From a distance, the rattling call of a belted kingfisher echoes up the creek, drawing nearer, until suddenly, in a rush of blue and white, the bird sweeps by, her chestnut breast band glowing in the afternoon sun. Landing on a branch just upstream, she surveys a series of small riffles. Diving headfirst into the shallow water, she emerges with a silver fingerling-size trout in her bill. A couple of well-placed "thwacks" against the branch knock the fish unconscious. The kingfisher tosses it deftly to reposition it in her bill, then flies to an oblong hole in the bank, disappearing inside to a chorus of baby kingfisher cries.

As you wait for the kingfisher to emerge, you notice a large brown gopher snake making its way slowly up the face of the bank, finding purchase on whatever snake-sized nook or cranny it can find. Deliberately, patiently, the snake makes its way higher and higher, using its strong abdominal muscles to grip the steep surface. Then, only a few feet from the burrow, it slips and free-falls to the base of the bank, landing with a soft thud in the grass. It pauses for a moment, then slides away into the underbrush to seek supper somewhere else.



Belted kingfisher

Damselfly

Chinook fry

There's something hidden about Putah Creek. It takes time to see what's really here. Those who have looked closely, whether scientists, kayakers, longtime residents, or just friends, have found an intricate web here. Through migrating birds, Putah Creek is connected to the Arctic and to South America. Through chinook salmon, steelhead, and Pacific lamprey, all fish that spawn in the creek and migrate to the ocean and back, the creek is connected to the Pacific Ocean. The history of the people who have lived here is entangled with the larger movements of California's history.

Though the creek hardly looks like a wilderness as it runs through the fields of the Central Valley, its waters and the ribbon of trees along it support an astonishing array of birds and insects, fish, mammals, amphibians, reptiles, crustaceans, and so on. Yet the zone of trees and shrubs, Putah Creek's riparian forest, was once far wider. Today, only about 5 percent of California's riparian forests survive. That makes any shred of riparian forest rare and valuable.

" Many of the activities that we engage in because we live in an urban environment have profound effects on our creek.... Yet we often don't make the connection between these mundane activities and the quality and quantity of the water in our watershed.... I want the people of our watershed to know what happens to a drop of water in its journey from the sky to the stream."

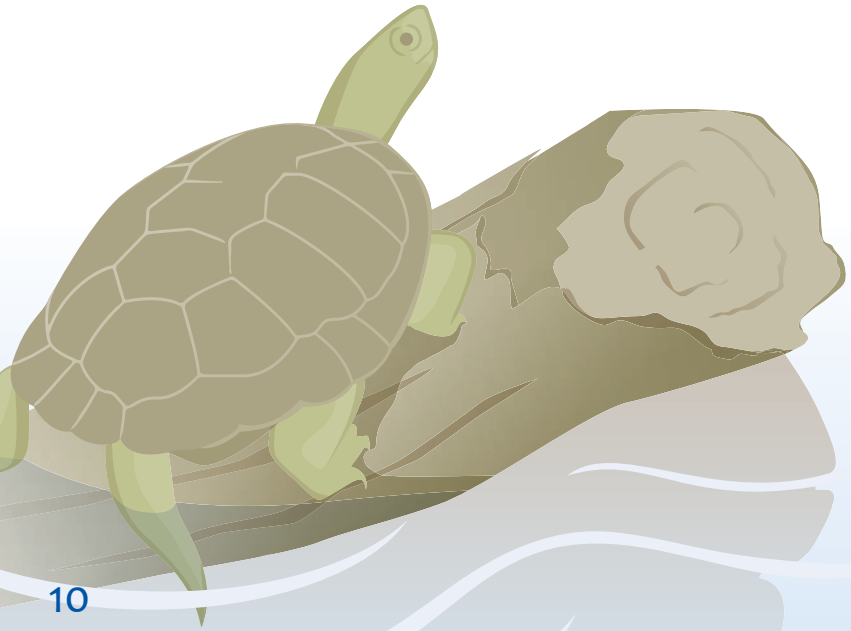
Ruth Williams, Executive Director of Tree Davis and Putah Creek Council Board Member

RESPECTING PRIVATE PROPERTY

About three-quarters of the land along lower Putah Creek is privately owned, making respect for private property the most important issue along the creek. Please respect the private property along Putah Creek by enjoying the creek at public access points only; do not trespass. See the public access map at the back of the book for the variety of locations and activities available.

It turns out that Putah Creek is an especially valuable shred. The waters of the creek support one of the most complete communities of native California fish anywhere. The trees along the creek are home or stopover for more than 200 species of birds. Beaver and river otter make their homes here. So does the threatened western pond turtle. And the endangered giant garter snake has been seen in the Yolo Bypass Wildlife Area, where the creek empties into the wetlands of the Yolo Bypass.

One of the most important reasons that Putah Creek is so valuable is that people care about it. People have long affected it and the land around it. The Patwin who first lived here carefully tended the landscape to enhance its extraordinary diversity and abundance. The agriculturalists who came next saw the creek and the land around it as a means of producing unusually large harvests, and this water and this land continue to help feed the world. The people who now inhabit the Putah



Creek watershed are making it a model for far larger waterways, such as the San Joaquin River.

Scientists at the University of California, Davis, have studied the creek and established that it supports a web of life that stretches far beyond the bounds of the creek. The Putah Creek Council fought hard to make sure that the creek gets water year round, and now the Lower Putah Creek Coordinating Committee and the Solano County Water Agency employ a streamkeeper and support biological monitoring (biomonitoring) and restoration projects. Farmers are experimenting with techniques that boost yields while protecting the creek and attracting wildlife. The townspeople of Winters and Davis have organized to help protect and restore the creek. The CALFED Watershed and Ecosystem Restoration Programs and state and local agencies have invested millions of dollars in the vision of the creek as a living stream whose ability to support life is protected and enhanced over the long term.

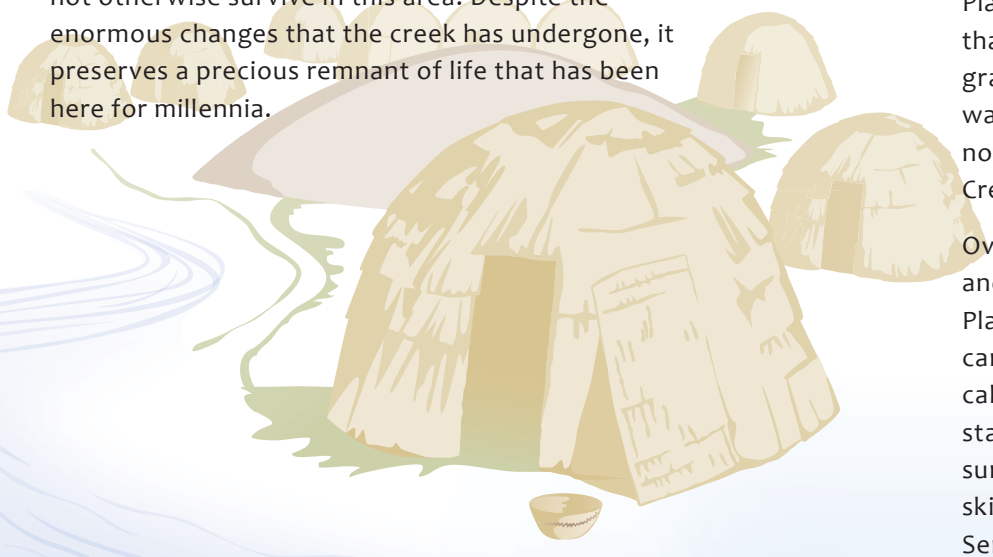
So much depends on the creek, and the creek depends so much on us. Not only birds and fish, but mammals, amphibians, reptiles, pollinators, and others all benefit from our careful choices. We can and do make a difference to the life around us. The next chapters will journey through the creek's past, take a snapshot of the creek's present, and show how the people of the creek are working to secure its future. Our hope is that this book will show you how complex Putah Creek's web of life is and how valuable this slim thread of water is, and inspire you to give something back to the creek.

Putah Creek in my opinion is a treasure. It is a home for birds, for wildlife, for waterfowl, fishes, trees, and vegetation. It's an entire ecosystem in the middle of a heavily farmed, agricultural environment. It's a place for people to watch birds, [to] fish, to canoe, to kick back and enjoy the sights, sounds, and the smells.

Judge Richard Park, ruling to require water to sustain the Putah Creek ecosystem

Constant Changes:
An Ecological History of Putah Creek

Putah Creek runs deep through time as well as the landscape. To walk along Putah Creek is to walk on gravels that are the remains of old sea floor; to walk where mammoths once walked; to walk where Native American traders packed obsidian from Coast Ranges volcanoes into the Central Valley. The Putah Creek of today has been strongly shaped by its history, first by geological forces and then by the people around the creek. At the same time, it has shaped the landscape through which it flows and made possible an abundance that could not otherwise survive in this area. Despite the enormous changes that the creek has undergone, it preserves a precious remnant of life that has been here for millennia.



Putah Rocks

Putah Creek probably existed before the Coast Ranges rose.

Eldridge Moores, geologist

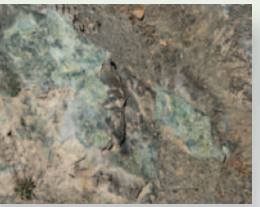
The hills and rocks of the Putah Creek watershed tell a complicated tale of the massive forces of plate tectonics. The story begins with three enormous pieces of the earth's crust, called the North American Plate, the Farallon Plate, and the Pacific Plate. The heat and friction produced by the Farallon Plate sliding beneath the North American Plate (a process called subduction) melted rock that rose and cooled to became the Sierra Nevada granite. During this time, the edge of the continent was where the Sierra Nevada foothills are now. The ocean lay to the west; neither Putah Creek nor the Central Valley yet existed.

Over millennia, subduction scraped islands and the sea floor onto the North American Plate. Along Knoxville-Berryessa Road, you can see some of the deep seafloor rock, called serpentine. Serpentine, California's state rock, got its name from its mottled surface, which is as scaly as a serpent's skin, often green but sometimes brown. Serpentine is very high in magnesium and iron, low in silica and calcium, and therefore toxic to most plants. Some plants have evolved special adaptations to grow in

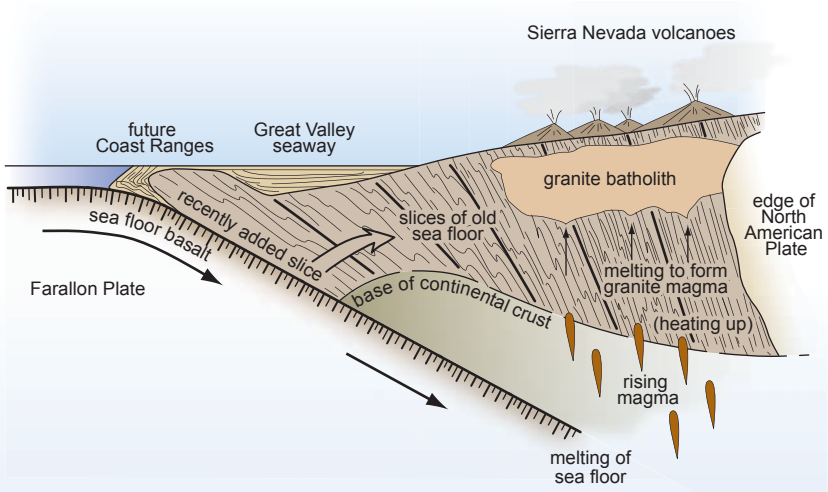
Creekside landowner Harvey Olander displaying mammoth tooth found on his property

serpentine soils. Those plants that have evolved locally are endemic to this region, which means that they occur nowhere else on earth. Serpentine sediments that washed down from the Coast Ranges influence Putah Creek's soils, which, in turn, influence the plants that grow here.

Meanwhile, rivers carried sediment such as sand, gravel, and silt from the young Sierra Nevada westward into the ocean. About 3 million years ago, subduction stopped. The edge of the North American Plate, which had been pulled downward, came back up to sea level. The sediment from the Sierra Nevada that had been carried out to sea and laid down in neat horizontal layers was bent upward, and the undersea pile of mixed-up rock that had been scraped onto the edge of the North American Plate rose up to become the California Coast Ranges. At Monticello Dam, State Route



Serpentine outcrop at Lake Berryessa



Subduction process about 130 million years ago (vertical scale exaggerated)

Adapted from Alt and Hyndman, Roadside Geology of Northern and Central California , 1975

128 cuts through these sandstone and mudstone layers (the Great Valley sequence), which are now nearly vertical, their roots lying deep beneath the Sacramento Valley.

Today the edge of the Pacific Plate grinds northwest along the San Andreas Fault and takes the edge of the North American Plate along with it. As a result, the Sierra Nevada microplate (the Great Valley and the Sierra Nevada) is developing. The irregular boundary between the Sierra Nevada microplate and the Pacific Plate creates both "pull-apart" basins and folds: valleys and hills of the Coast Ranges. Lake Berryessa is in one of those valleys. Where the crust was pulled apart, it sometimes thinned enough to allow magma to rise and produce volcanoes, including Mt. Konocti, a volcano so young—only 10,000 years old—that people lived in the Coast Ranges before Mt. Konocti existed.

As the edge of the North American Plate rose up, streams formed and began eroding the newly exposed hills into the deep trench to the east that would become the great Central Valley we know today. Putah Creek was likely one of those early streams. Its headwaters emerge as springs on Cobb Mountain, near the edge of the Napa Valley and about 20 miles south of Mt. Konocti.

The Great Valley Sequence of sedimentary rock at Monticello Dam

Floods that Built a Valley

The Coast Ranges are still rising, and their hills are steep. Rainfall runs off quickly, and a dry wash in summer may be a raging river in a winter storm. Historically Putah Creek carried enormous volumes of water after storms, up to 80,000 cubic feet per second (cfs). That's enough to fill about four and a half Olympic-size swimming pools each second. The water carried the rocks, gravel, sand, silt, and clay of the Coast Ranges into the Sacramento Valley.

As Putah Creek rushed into the valley, it would overtop its banks, flooding the surrounding areas, sometimes even carving a new channel for itself. Where the water first slowed, near the tops of the banks, sand and gravel dropped out, forming natural levees. The floodwaters carried silt, clay, and organic matter farther, forming broad floodplains of rich soil that gently slope away from the creek and often end in wetland basins.

The water in the basins slowly infiltrated the earth, recharging the groundwater. During the summers, Putah Creek would dwindle, but in some reaches the surrounding water table was high enough for groundwater to seep into the creek. One such reach, near today's Stevenson Bridge, flowed all summer long for several miles.

Toward the eastern end of Putah Creek, it forked, becoming not one channel but several. It had its own delta at the Putah Creek Sink, a maze of interconnected sloughs in what is now the Yolo Basin. There Putah Creek joined the Sacramento and American Rivers to form a winter lake, an "inland sea" a hundred miles long that usually lasted well into summer.

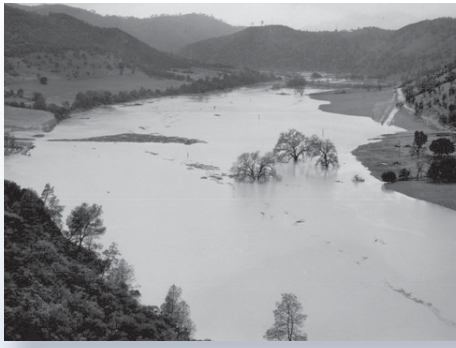
Over the millennia, rivers and creeks have brought so much rich alluvial soil into the valley, both from the Coast Ranges and the Sierra Nevada, that the alluvium (sediments deposited by a river or creek) is a mile deep in places. The top layer of this alluvium is the basis of the Valley's famous agricultural fertility and productivity.

The waters and alluvium of the creek supported dense, 1- to 2-mile-wide riparian forests and thickets of tules, cottonwood, and willows near the inland sea. The forests and thickets were home to an extraordinary diversity of life: grizzly bears, mountain lions, mule deer, hundreds of species of songbirds, shoals of fish. Millions of migrating birds darkened the sky in clamorous flocks. In grasslands between the riparian forests, vast herds of tule elk and antelope roamed.

For millennia, the life along the creek has included humanity. How people have interacted with the creek has had tremendous impact on it and the creatures that depend on it.

Courtesy Solano County Water Agency, Photography by C.B. Hertzog

1950 Putah Creek flood plain, an extensive alluvial deposit, now Lake Solano



Courtesy Solano County Water Agency, Photography by E.S. Ensor

Flooded Putah Creek, December 19, 1955, looking upstream from partially completed Monticello Dam

The First People of the Creek

She said we had many relatives and ... we all had to live together; so we'd better learn how to get along with each other.... I found out later by my older sister that mother wasn't just talking about Indians, but the plants, animals, birds—everything on this earth. They are our relatives and we better know how to act around them or they'll get after us.

Lucy Smith, Mihilakawna Pomo elder

The first fall storm was a few days ago, and the creek that was nearly dry is now full. Now called Kapa Liwai, the creek will one day be called Putah, after the village Putah-toi in the broad valley through which it flows.

A bald eagle flies far above another village, called Liwai like the creek, near the edge of the valley. The village is on a bench above the creek, close but not too close. When the creek rises, it rises swiftly and dangerously, and every year or two it roars with the water racing down it, brown with mud and rattling its gravels.

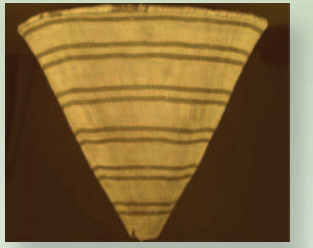
Women on a boulder by the water are grinding acorn meal, which they will leach in sandy, leaf-lined hollows in the creek for tomorrow's meal.

© Petra Unger

Tule hut

© Lorrie Jo Williams

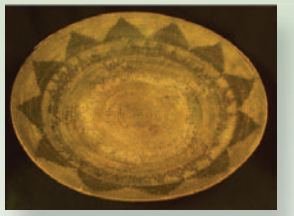
California Native Americans continue the basketweaving tradition



Courtesy California State Indian Museum

Patwin burden basket

These baskets were made of peeled and unpeeled redbud, creating a two-color pattern.



Courtesy California State Indian Museum

Patwin parching basket

One old woman is weaving an intricate basket with sedge roots gathered along the creek. Men discuss the fires they need to set under the oaks to clear underbrush and prevent acorn weevils. The recent rains mean the fire won't burn too quickly or too hot. All the people are waiting. A few miles downstream a grizzly bear drinking from the creek is waiting. Still farther downstream, in the village Putah-toi, near where the creek dissipates into the tule reeds, more people are waiting.

And then splashing announces the big, old silvery fish, exhausted from their journey up the river into the narrow gravelly creek, where they will make their redds (a nest of fish eggs covered with gravel) and lay their eggs and die in the shallows. The salmon are here! And with them comes good food for the people, the eagle, and the grizzlies. Even the deer will nibble the carcasses, a little extra protein, a little extra fat, returned from the sea.

© Lorrie Jo Williams

Chinook salmon

The people who first lived here, collectively called the Patwin, contributed to the tremendous biodiversity around the creek. Other factors included the variation in conditions from dry serpentine in the hills to the seasonal inland sea in the middle of the Sacramento Valley, and disturbances from fire and floods, constantly renewing the land and clearing open space.

Putah Creek's valley oak groves and flower-filled savannas and grasslands probably depended on the Patwin's tending. Every year or so, they would set low-intensity fires to clear thatch and underbrush, return nutrients to the soil, reduce insect pests and diseases, and protect their villages and food sources from high-intensity fires that otherwise would have occurred.

The Patwin burned tule marshes as well, reducing congestion so new shoots could come up. They tended sedge beds, willows, and redbud along the creek in ways that reduced erosion, produced straight roots and shoots for baskets, and rejuvenated the plants. They harvested the bulbs and corms of lilies, brodiaeas, soap plant, and others in ways that ensured abundance, leaving some of the plants undisturbed and distributing the tiny bulblets that clung to the larger bulb.

Soap plant

Harvest brodiaea

The Patwin used their environment extensively and managed it intensively. They thought of these practices as caring for those they tended and harvested. The plants thrived from their tending and animals such as deer benefitted from the improved vegetation. Putah Creek, with its shaded stream, full of insects feeding on leaves dropped from the trees, was immensely productive, and fed the Patwin with salmon, thicktail chub, and Sacramento perch. Indeed, from about 12,000 years ago to the early 1800s, California supported the highest density of Native Americans in all of North America.

Western redbud

When Spanish explorers and Russian fur traders came to California, things quickly changed. New diseases such as smallpox and malaria were fatal to many Native Americans, and an epidemic in 1833 emptied the village of Putah-toi. The Spaniards forced many of the remaining Patwin onto the Solano mission. There, disease and deprivation took a heavy toll. When the missions were secularized in the 1830s, the number of remaining Indians was less than one-third that of the Indians who had been pushed there.

By the 1920s no Patwin remained along the creek and few were left in the area. Native American ecological knowledge was lost and continues to be lost, along with the tending that fostered the growth of many California plants. However, efforts are being made to bring Native Americans and their understanding back into the management of California land. Despite obstacles, Patwin descendants still know the plants of this area and still tend them.

1873: Farms and Floods Make New Channels for Putah Creek

Before many years, levees will be constructed ... and the vast tract known as the 'Tulares' will be cultivated.

Editor, California Star, 1848

Courtesy LPCCC

By 1860, the riparian forest had already been cut down as in this Putah Creek photograph (date unknown).

Winter storms are here, and the creek is nearly at flood stage. As it rumbles out of the foothills, it courses between levees built by farmers and past Theodore Winters's two horse-racing tracks, one on either side of the creek.

A red-tailed hawk is hovering over a pasture where grazing has reduced cover for the mice below. To the east the straight line of a railroad slants past the little town of Davisville, where the village of Putah-toi used to stand. The new people eat wheat rather than acorns.

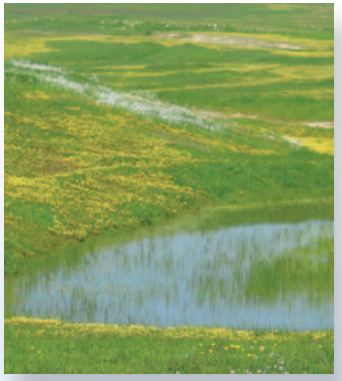
Below the hawk, a group of bearded men are eyeing a barrier of lumber and mud that separates the main channel of the creek, which flows toward Davis, from a secondary channel dug by the creek itself when it broke through a levee in 1871. "Think it'll hold?" one of them asks. They plan to scrape the secondary channel deep enough to permanently route the creek through it, south of Davisville and away from the farms struggling to establish themselves in the Putah Sink.

"It held last year, didn't it?" says another. He will rebuild the levees around his Putah Sink fields five times before giving up in despair.

In 1842 John Wolfskill established Rancho de los Putos near present-day Winters. He was the first of an enormous influx of American settlers, drawn and then disillusioned by the Gold Rush. Few Patwin remained, so the valley must have seemed nearly uninhabited to the first settlers.

Early harvesting used mule teams.

The new people acted to reshape the creek and its landscape in the image of the familiar farmlands they had left behind. The forest along Putah Creek was nearly gone by 1854, cut down for fence posts and firewood. The hummocks (mounds) and swales (seasonal wetlands) of the valley floor, which John Muir called "one smooth, continuous bed of honeybloom," were fenced for pasture or levelled for grain



In spring, much of the Great Valley of the 1800s looked like this modern-day vernal pool.

fields. The settlers hunted the tule elk for meat and the grizzly bear for self-protection; by 1873 there were few or no tule elk along Putah Creek. By 1878 water from Putah Creek irrigated vineyards. The extraordinarily fertile fields the farmers tilled helped feed Europe and made the farmers prosper.

The settlers also brought new species. In the creek, new fish were introduced: carp, catfish, and smallmouth bass. Quick-growing, quick-dying annuals like wild oats crowded out perennial grasses, turning the hills brown in summer. John Wolfskill imported hundreds of olive slips, giving them to farmers who planted them throughout the area. In the 1890s, eucalyptus was brought in for lumber. The settlers even brought new insects—honeybees to pollinate the orchards that were widely planted in the 1880s.

Courtesy Solano County Water Agency. Photography by D. K. McNaugton

Historically, Putah Creek often flooded roads.

The creek's natural levees were replaced by human-made ones, built with tremendous effort to protect fields and towns. The settlers even drained the tule swamps along the lower part of the creek, which had been uninhabited up until then; At least they tried to, but they were beaten back for decades by the Sacramento River's spectacular, destructive floods.

Putah Creek continued to burst its levees on a regular basis, overflowing into Winters and Davisville. But it began to flow into the secondary channel as the farmers wanted. Running in a straighter channel, it flowed faster, beginning to downcut within its banks.

© Amy J. Boyer

Olive trees at the site of John Wolfskill's rancho

1955: The Dam Generation

It is the solemn duty of our generation to plan wisely for the best use for all purposes of every drop of water.

Earl Warren, Governor of California, 1948

Winters is bustling this spring, full of construction workers and engineers. Just upstream a new dam is being built, a great concrete arch spanning Devil's Gap, the narrow notch in the Coast Ranges through which Putah Creek flows. Monticello Dam promises many things: water for farms, factories, and suburbs, and flood protection for the bridges and businesses of Winters.

Upstream in the Berryessa Valley, a Swainson's hawk hovers above broad old oak trees and orchards in bloom. Next year they will be cut down and burned so they don't clog the dam intakes or snag boats in the lake that will rise behind the dam.

A woman is visiting the cemetery of the town of Monticello with her family. "That's great-grandma's grave," she tells her children as they read the grave stone. She points to a westward hill. "They're moving it up there. The whole cemetery. Next year, they say."

In the nearby creek, tiny salmon spawned last year are making their way downstream. When the survivors return, they will have to spawn far downstream—if they can find a place to spawn at all.

Courtesy Solano County Water Agency

Historic view of Devil's Gap before construction of Monticello Dam

Courtesy Solano County Water Agency, Photography by E.S. Ensor

Monticello Dam under construction in 1955

Courtesy Solano County Water Agency, Photography by E.S. Ensor

Monticello Dam near completion in 1956

In the mid 1900s, people acted to engineer the creek into its current form. By 1928 the Yolo Bypass had largely been built, giving the Sacramento River a big, wide floodplain to move high flows out to San Francisco Bay. Today Putah Creek connects with the Sacramento River via the Toe Drain, a 50-foot wide channel that runs along the east side of the Bypass and eventually into the river.

Courtesy Solano County Water Agency, Photography by E.S. Ensor

Putah Creek Diversion Dam spillway under construction

In the 1940s, the U.S. Army Corps of Engineers put the finishing touches on the South Fork of Putah Creek, completing the work begun by the farmers in 1873. This gives Putah Creek a straight, permanent channel that keeps Putah Creek water out of Davis. Today the North Fork, the old main channel, winds through the UC Davis campus and the greenbelt in south Davis, dry except for local runoff and the water in the Arboretum.

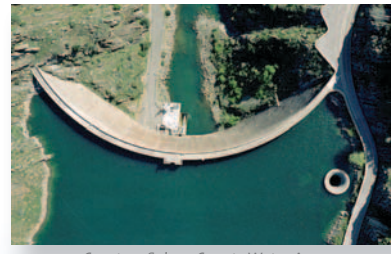
Meanwhile, Solano County's development was hampered by a lack of readily available water, while Yolo County had long been using Cache Creek water. So in the 1940s and 1950s, the Solano Project came into being, consisting of Monticello Dam, Putah Diversion Dam, and the Putah South Canal.

In 1957, Monticello Dam was completed and, the beautiful Berryessa Valley filled, and Lake Berryessa, the third largest reservoir in California, was born. A small hydropower plant at the base produces electricity. Putah Diversion Dam retains

Lake Solano and diverts the water released from Lake Berryessa to Solano County via the Putah South Canal.

For the last 50 years, the Solano Project has done its job, providing water for irrigation, industry, and Solano County gardens. Although Monticello Dam does not guarantee flood protection, it has evened out the flow in Putah Creek, preventing Winters from being inundated. Even the highest flows from Lake Berryessa, after the biggest storms, are no more than 20,000 cfs and stay within the banks of Putah Creek. Much costlier dams have been built with much less benefit.

Damming completely changed the creek. Monticello Dam separates the creek into two subbasins: the upper watershed, a 50-mile reach above the dam; and lower Putah Creek, the 30-mile stretch below the dam. Summer flows may now be higher than winter flows. High, channel-scouring floods occur more rarely, so the creek bed tends to be more silty; the dams keep back the gravels of the hills. Starved of coarse sediment, the creek has carved itself deeper into the soft alluvial soils. In many places, the creek has downcut more than 40 feet.



Courtesy Solano County Water Agency

Monticello Dam

The dam has also affected tributaries of Putah Creek below the dam: Thompson Creek, Cold Canyon Creek, Bray Creek, Pleasants Creek, and Dry Creek, entering from the north just upstream of Winters. Because Dry Creek is the only tributary below the dams, it is an important source of gravel for lower Putah Creek.

During floods, Putah Creek historically backed up into these streams, slowing tributary flows as they joined the creek. Because these tributaries remain undammed, during floods they run as high as ever, but Monticello Dam now keeps Putah Creek flows relatively low. Therefore, these tributaries flow faster, with a steeper slope, leading to increased downcutting and streambank erosion, which sometimes threatens buildings and roads.

Fish passage is completely blocked at Monticello Dam, so some of the fish species below the dam are different from those above the dam. Until 1998, salmon no longer came up the creek, because the flows were so different from historic flows and a checkdam (a small dam to decrease flow velocity and minimize erosion) blocked passage.

Other changes affect the creek. The riparian forest is a narrow remnant of its former self. The groundwater that used to replenish the lower creek is largely absent. The population of both Yolo and Solano Counties has grown, as has demand for water.

Courtesy Solano County Water Agency, Photography by Roland Sanford

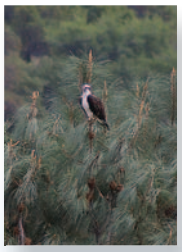
Sediment deposits at Pleasants Creek following a major storm in mid 1990s

The lower flows of the creek make it easier for invasive species such as Himalayan blackberry, tamarisk, and arundo to gain a foothold. These invasive species displace native plants such as wild rose and California blackberry, which provide food and shelter to local wildlife. Many native

species are adapted to lie flat under rushing water, while the invasive species often grow in dense clumps that slow water. Sediment settles there and build mounds of soil, which reduce channel capacity and deflect the water into streambanks, thus causing further erosion.

And yet this shred of riparian forest and the greatly changed creek still support wildlife. More native fish species remain in lower Putah Creek than in most Sacramento Valley creeks. Migrating birds still rely on the creek for food and rest during their long flights. River otters still slide down its banks and beavers still build on it. Very rarely mountain lions and black bears travel along it as a corridor down from the hills into the valley and back.

Arundo grows in clumps along the creek, slowing flows and capturing sediment.



Osprey

Yellow-headed blackbirds

1989: A Creek in Crisis

The lower 6 miles of Putah Creek have been dry for over 2 weeks. Countless fish and aquatic life have been lost, cottonwood and willow trees are beginning to die out, and numerous species of wildlife have abandoned the riparian and wetland habitat they rely on for survival.

Putah Creek News, July/August 1989

A Swainson's hawk is patrolling a research field near the creek, on the campus of UC Davis. Between the creek and the field is a narrow strip of oak and elderberry, eucalyptus and blackberry, the much-invaded remnant of the riparian forest. The creek is in a deep channel below the field; it has been decades since creek water spilled over onto the field.

"Eww!" "Gross!" A gaggle of children at Camp Putah day camp are gazing into the gravel of the creekbed. "What happened to the fish?" one of the children asks a counselor, and the young woman, who is just as shocked as the children at the fish carcasses clumped in the dry basin that was once a deep pool, shakes her head in dismay.

In 1989, in the midst of a 7-year drought, Putah Creek went dry from just downstream of Winters to the Yolo Bypass. Lake Berryessa was low and getting lower. So much water was being diverted from the creek that there was none left in it, and there was no provision for releases from Lake Berryessa to keep water in the creek. Meanwhile urban and agricultural pumping lowered the water table, so no groundwater was seeping into the creek. Suddenly, there was a realization that if people did not take care of the creek, it was in danger of dying.

Shocked townspeople and landowners along the creek rolled up their sleeves and got to work. Putah Creek Council, an offshoot of the Yolo Audubon Society, went into overdrive, resolving to ensure that Putah Creek would henceforth be a living stream, with water in it year round. Putah Creek Council and its partners, the City of Davis and UC Davis, spent 10 years gathering data and raising money for a lawsuit that ended with a historic water accord with the Solano County Water Agency, Solano Irrigation District, and other water interests.

Fish kills during the drought of 1989

© Janet Krovoza

Signing the precedent-setting Putah Creek Accord, May 23, 2000

The Yolo Basin is the perfect place to restore another link in the Pacific Flyway. Its potential is as limitless as the vast flocks of waterfowl that return each winter.

Dave Feliz, Area Manager, Yolo Bypass Wildlife Area

On May 23, 2000, the Putah Creek Accord was signed, guaranteeing permanent surface water flows for the 23 miles of Putah Creek below Putah Diversion Dam. The accord requires carefully timed flows, with brief high pulses in fall for salmon and steelhead trout migrating upstream and high flows in spring for all the native fish that live there. Along with a startup grant of $250,000, it provides permanent funding to restore and monitor the creek to maintain and improve habitat for the flora, fish, and fauna that exist there. A streamkeeper watches over the creek and works to pull people together for the health of the creek. Meanwhile, a grassroots effort headed by the Yolo Basin Foundation helped to create the Yolo Bypass Wildlife Area, bringing wetlands and huge flocks of migrating birds back to what was once the Yolo Basin.

Nearly 20 years later, the creek depends even more on the people who live along it. Judge Richard Park, who made the historic ruling that mandated sufficient flows to sustain the creek's native fish,

called Putah Creek a treasure. It is so because of the incredible life that it nurtures. How can *we* nurture the creek? That is the question we need to ask as participants in the life around the creek. Our answers determine what kind of life we as a human community can have along the creek, what other creatures can live with us in the ecological communities of the creek, and what will live on into the future.

© Ron Unger

May 23, 2000 accord ceremony: water for people, water for nature

From the beginning we believed that efforts on behalf of the creek should be based on good science and working cooperatively with the creek side landowners, the City of Davis, and the University of California. The Putah Creek Council represented a new kind of environmentalism that stressed positive and practical solutions over negative debate. It is an honor to have worked with such a knowledgeable and dedicated group of people. Those of us who worked on the events that led up to the Putah Creek Accord earned the experience of a lifetime—the opportunity to set up a positive future for the fish, birds, and people of the Putah Creek community. The story of the Putah Creek Accord is that a small group of people with a vision, the willingness to listen and learn, and a disciplined focus on the essential issues can repair the world.

Robin Kulakow, founding member of Putah Creek Council and executive director of the Yolo Basin Foundation

The Incredible Life of Putah Creek

"... he sat on the bank, while the river still chattered on to him, a babbling procession of the best stories in the world, sent from the heart of the earth to be told at last to the insatiable sea"

Kenneth Grahame, The Wind in the Willows

Like the river in *The Wind in the Willows*, Putah Creek is home to a wide array of plants and animals. The creek supports one of the few remaining streamside habitats in the Central Valley today. Most have been drained and cleared for agriculture and homes. Those that remain—tendrils of shredded riparian forest penetrating deep into the heart of a dry, even more modified landscape—serve as home, haven, hunting ground, and highway for a variety of organisms as they make their living and amid a constantly changing environment.

The incredible life along Putah Creek shifts with the seasons. Spring brings a quickening. Hibernators wake, turtles and snakes bask, and migrating birds return from their southern wintering grounds to breed. The feathered migrants come in waves, each week bringing new species that add movement and splashes of color to the newly leafed-out branches and new voices to the dawn chorus. Birdwatching opportunities abound, especially before new leaves appear on the trees and shrubs.

Summer begins with a frenzy of feasting and breeding, but soon settles down to a quiet rhythm of slack water and long, lazy afternoons. Birds fledge, baby mammals leave the nest, and family groups begin moving about together. Summer turns up the heat on insect development too, and soon the number of insects and their attendant predators in riparian areas grows rapidly. In California's Mediterranean climate, summer is the

Spring brings new life.

Summer: slack water and lazy afternoons

off-season. Heat and drought send plants into dormancy and animals into estivation, a summer torpor akin to hibernation. But along streams, the availability of water keeps life thrumming along. In fact, Central Valley riparian habitats are especially important to wildlife in the summer and fall months, because they offer a permanent source of water during the driest time of the year.

Hanging out by Putah Creek with Younger Poets

Sitting on the dusty
dry-leaf crackly ground,
freeway rumble south,
black walnut shade,
crosslegged, hot,
exchanging little poems

Gary Snyder

Summer merges imperceptibly into fall, the season of abundance, when acorns ripen and seeds and berries become plentiful. During so-called mast years, when acorns are especially bountiful, squirrels, jays, and acorn woodpeckers work diligently, stockpiling their harvest to get them through the lean times. Bronzed trees, cast amid the long, golden rays of a waning sun, are once again alive with southbound migrants: black and gold Townsend's warblers and crimson-headed western tanagers return from the northern coniferous (cone-bearing) forests in which they breed before heading south to tropical wintering grounds. A far cry from their exuberant spring selves, they slip in quietly, saying little, alert for predators and for opportunities to fatten up for the journey ahead. As temperatures continue to drop, leaves fall, frogs and turtles burrow into streambanks, and lizards and snakes crawl away into rock and root crevices to spend the winter.

Winter brings drama: winter storms and raging floods, bone-chilling blankets of morning tule fog, and crystal-clear nights ablaze with stars. In winter, wildlife species subsist largely on seeds and berries produced the previous summer, the

abundance of which helps to ensure their survival and reproductive success in the following year.

Putah Creek's character shifts spatially as well. As the creek leaves the higher elevations of the inner Coast Ranges and passes through rolling foothills and into the wide open flats of the Yolo Basin, it flows through varied plant communities that provide habitat for different wildlife groups. Communities also change as one moves away from the creek. Aquatic plants like rushes and sedges, tolerant of waterlogged soils and the frequent scouring that occurs along the channel, give way to the cottonwoods, willows, and box elders of the mixed riparian woodland, which in turn transition to oaks and walnuts on the upper terraces.

Within the floodplain, which is now within the creek banks, fine-scale disturbances caused by variations in flow create microhabitats. Trees border on grassy meadows where voles build their runways and butterflies sip the nectar of sun-loving wildflowers. Oxbows and backwater channels create stable, nutrient-rich habitats and a profusion of thickets and copses that shelter breeding birds and other vulnerable organisms. In the stream, gravel-bed nurseries cradle salmon eggs, while trout wait patiently in quiet shaded pools for mayflies, or perhaps fishermen's lures, to alight on the surface. Farther down, a pair of beavers raise their family in the pool that they have widened and deepened with their dam of sticks and brush.

Fall gilds the foliage.

Winter, with beaver dam

The Instream Community

If there is magic on the planet, it is contained in the water.

Loren Eisley

The plants of the instream community are perfectly adapted for life in this ever-changing environment. Their roots anchored securely in the saturated soil, they simply bend over under the rush of high flows during the rainy season, then spring back with renewed vigor when the waters subside. They also have special adaptations, like air sacs in their stems and roots, to help them thrive in oxygen-depleted, waterlogged soils. Plants growing within the stream include the delicate white lady's thumb and the floating water primrose with its bright yellow flowers.

Water hyacinth

Water milfoil

Primrose, both native and nonnative, and the nonnative plants water milfoil and water hyacinth, can all be invasive. Water milfoil's feathery leaves float below the surface, and water hyacinth's lush leaves float above the surface. All these plants may grow in dense colonies that can block sunlight, crowd out native species, clog water intake structures, and degrade fish habitat, not only in Putah Creek but also in downstream locations in the Sacramento-San Joaquin Delta.

Along the creek's edge, clumping sedges squat like something out of Dr. Seuss. In the places where wetlands occur, the cigar-shaped seed heads of cattails sway gently in the breeze.

Each cattail seed head is packed with some 250,000 seeds, each equipped with a fluffy parachute to catch the wind and send it sailing downstream. Cattail roots are a favorite food of muskrats, and their tall stems provide nesting habitat for a variety of waterbirds.

Cattails

Sedge roots help stabilize streambanks and offer food and cover to wildlife.

Macroinvertebrates

Aquatic macroinvertebrates are freshwater "bugs" that humans can see without a microscope. They are critical links in the riparian food chain and serve as important indicators of creek health and productivity. Macroinvertebrates commonly found in Putah Creek include caddisflies, mayflies, blackflies, and aquatic moths. Other important aquatic macroinvertebrates are crayfish, native aquatic snails, Asian clams, and dragonfly and damselfly larvae.

Caddisflies are small moth-like insects whose adults have two pairs of hairy membranous wings. Their larvae are aquatic. Some species have predatory larvae that feed on other insects; others are vegetarian, shredding leaves or grazing on algae, and still others are opportunistic fishers of particles from the water column and stream bottom. At least three species of caddisfly have been found in Putah Creek. *Hydropsyche* larvae spin silk nets, which they use to strain food items from the water column. *Brachycentrus* and *Glossosoma* are builders, creating shelters out of sticks or rocks. Like many caddisflies, they have very short adult life stages, so they must all emerge synchronously (during the same period) to ensure a timely encounter with a member of the opposite sex. Fish take advantage of these synchronous hatches, as do anglers, who match their artificial flies to the fly flavor of the day in an attempt to fool the fish.

Mayfly nymph

Hydropsyche caddisfly larva

Another important macroinvertebrate, the mayfly, is sensitive to pollution and so serves as a reliable indicator of water quality. Immature mayflies reside in the stream for a year, hiding in the sediment, under rocks, and in decaying vegetation before emerging in adult swarms. *Baetis* and *Callibaetis* are two of the more common mayfly species found in Putah Creek.

In California, the most common aquatic moths belongs to the genus *Paragyractis*. Their aquatic caterpillars, studded with spiny gills, eat algae while protected from currents by silken tents attached to rocks. Their adult, above-water lives last just long enough for them to reproduce. Amazingly, female moths may dive several feet underwater to lay eggs on rocks, using two hind pairs of legs as oars.

Three species of crayfish, all introduced, patrol Putah Creek's waters. In the coldest water, the signal crayfish dominates, feeding on everything from algae to insects to dead fish. In the warmer downstream reaches, red swamp crayfish and northern crayfish hold sway. River otters feed on all three species, diving under banks to pick them out of their hiding places and chomping them down, claws and all.

Amphibians and Reptiles

Lower Putah Creek used to have two species of native frogs, the foothill yellow-legged frog, which still occurs above Monticello Dam, and the red-legged frog of Mark Twain's "The Celebrated Jumping Frog of Calaveras County." Today, however, predatory bullfrogs and their huge tadpoles dominate the lower creek.

The western pond turtle is California's only native turtle. Often seen basking on logs or rocks—sometimes in teetering piles of turtles—pond turtles can be distinguished from introduced turtles by their blunt noses and black blotches on a light-colored head. They spend most of their lives in low-elevation ponds and streams, consuming a wide variety of prey and carrion (meat of dead animals). Females must often travel long distances to find suitable areas of well-drained silty soil in

Western pond turtle

which to lay their eggs. Their shallow nests of 1 to 13 eggs are highly susceptible to trampling and to predation. After hatching, the baby turtles must run a gauntlet of hungry birds and other predators on their way back to the creek. Once in the water, baby turtles face a variety of other dangers, including introduced bullfrogs and largemouth bass.

In winter, western pond turtles may also leave the stream to find sheltered places to hibernate, avoiding the big scouring floods that typically follow heavy winter storms. Although still relatively common in Putah Creek, they are declining elsewhere and have been classified as a species of special concern by the California Department of Fish and Game.

This is a species, one of many, that you can help in a number of ways. Watch from a distance to avoid scaring them from their basking areas. Try not to create new paths to the water's edge since raccoons, skunks, cats and other predators will use your trail to hunt for nest sites. Do not release pet turtles into local waterways.

Fishes

© 2008 EDAW
California roach

© Ken Davis
A Putah Creek sculpin

Putah Creek's fishes are remarkable for their diversity. Like terrestrial organisms, fish partition their watery world into niches based on differences in their life history strategies. Some live in cold, fast-moving reaches of the creek while others thrive in warm sluggish pools and backwaters. Some like open, sunlit waters, others prefer quiet, shady nooks. Each species finds its own niche, which prevents it from competing with its neighbors. Clearly, a niche is an important thing to have.

Introduced species often displace native species because they share the same niches. Many nonnative fishes, like carp, catfish, bass, and sunfish, were introduced to California by the settlers who wanted to catch the same species they knew back home. These species adapted well to the changed conditions brought on by gravel mining, dams, and diversions: warmer water, deeper pools, and decreased flows. Aggressive species of sunfish like crappie and bluegill brought on the local demise of the mild-mannered Sacramento perch, California's only native sunfish, which also preferred these warm-water areas.

Native species were better able to retain a fin-hold in the foothills and upstream reaches of the creek where changes were less drastic. One of these is the speckled dace, a busy little fish that spends its life

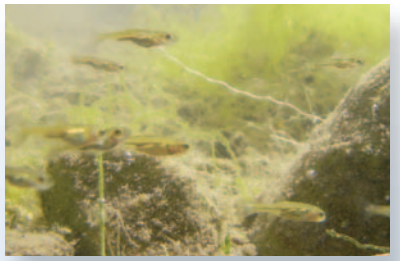
hiding under rocks and zipping along the bottom in fast-moving reaches above Lake Berryessa, often at night. The California roach inhabits some of the smallest, most remote, and warmest tributary streams, such as Pleasants Valley Creek, where the fish will nibble on your toes if you stick them in the water. The tiny threespine stickleback is found mainly in cool, clear water with lush beds of aquatic plants like those found in Lake Solano. Riffle sculpins and prickly sculpins linger beady-eyed among the rocks in fast-moving water, waiting to ambush small insects. The prickly sculpin is one of the few native fish that has managed to adapt well to altered habitats and the presence of nonnative species.

© 2008 Jupiter Images Corporation
Rainbow trout

Sacramento tule perch are found from Putah Diversion Dam all the way down to Pedrick Road in areas of dense cover. Here, they hang out in beds of aquatic vegetation or under overhanging bushes, feeding on the insects and crustaceans that crawl over the bottom. Unlike most fish that produce eggs, tule perch bear live young. Pregnant females must seek dense cover in which to hide from predators and give birth to their 20–30 young, each a tiny replica of its adult form.

© 2008 EDAW
Speckled dace

The Sacramento sucker has fleshy lips that can protrude to vacuum insects and algae



© 2008 EDAW, Photography by Chris Fitzer
A school of immature speckled dace

off the creek bottom. It was an important staple of the Patwin people, as was the Sacramento blackfish. Today, suckers are once again one of the most abundant fish in the creek, splashing and spawning in the shallow riffles of early spring.

With fog-chilled hands
I grab a squirming blackfish
Thinking of Patwin.

Peter Moyle

Indeed, many native fishes are returning as a more natural flow regime is being restored following the Putah Creek Accord. In the lowermost reaches, however, where warm sluggish conditions still prevail, nonnative species such as largemouth bass and bluegills reign supreme, allowing only the largest native species, such as pikeminnows and suckers, to coexist with them. In addition, disturbance-tolerant "aquatic cockroaches" like fathead minnows and red shiners, brought in as bait by anglers, are always poised to take over the creek if flows and water quality deteriorate.

Before construction of Monticello Dam, small runs of salmon and steelhead, andromous fish (species that migrate from freshwater to the ocean and back), were able to reach their traditional spawning grounds in the Berryessa Valley and beyond. Today, Monticello Dam not only prevents anadromous fish from reaching their preferred upstream spawning areas, it has created artificial headwater conditions many miles farther downstream than previously existed. Here, cold summer flows from the dam and a smorgasbord of invertebrates create a very productive trout stream. Rainbow trout, likely a remnant of a population of the now-threatened Central Valley steelhead, still spawn in tributaries to Lake Berryessa, using the reservoir rather than the ocean as their feeding grounds.

Of the three historic species of anadromous lamprey, only the Pacific lamprey still frequents the creek. Lampreys once ascended the rivers of California in such numbers that the Eel River was named for them. Today their numbers have dwindled, perhaps because one of their principal prey, the salmon, has also declined.

Courtesy LPCCC,
Photography by Rich Marovich
Chinook salmon below Putah Diversion Dam

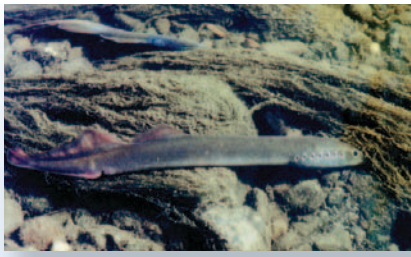
© Lorrie Jo Williams
Chinook salmon from the American River

[Along Putah Creek, we] saw three Pacific lampreys, 14–18 inches in length, about 1,000 feet downstream of Dry Creek confluence. Two were holding in a shallow riffle area and a third was upstream about 30 feet at the pool tail out constructing a nest under a small limb in the stream. The lamprey was actually picking up the large gravels (4–5 inches) and moving them out of the nest to form the circular "pot." Very interesting to watch. It was amazing how industrious the lamprey was and quite "single-minded" as it continued its nest building despite our presence and movement near its nest.

Tim Salamunovich, fisheries biologist

Hey you old lamprey
Eeling up our backyard creek
Welcome home

Peter Moyle



© Need Source
Pacific lamprey

Have you noticed how
Otters smack their lips
While crunching crayfish?

Peter Moyle

River otter

Banksiders

Crayfish caught during biomonitoring

The creatures of the bankside community live as much in the water as out of it. Otters, beavers, and muskrats make their homes in burrows in the muddy banks, and minks patrol the narrow streamside ledges, preying on any creature unlucky enough to cross their path. All of these species have webbed or partially webbed feet and other adaptations that help them make their living in and out of the water.

River otters have a fast metabolism and must eat up to four times a day. If you look carefully, you may see streaks of bubbles moving along the surface of the water as an otter swims just below, searching for its next meal. Otters also nose along the muddy bottom in search of crayfish and frogs, feeling with their long, sensitive whiskers. Onshore, they raid bird, rabbit, and turtle nests, and will even follow a muskrat into its burrow to

kill it. These intelligent predators have even been known to puncture beaver dams, sauntering in to collect the frogs and fish left stranded by the draining water. But such efficient hunters still have plenty of time for play; and play they do, chasing each other around, juggling pebbles with their paws, and sliding headfirst down steep banks into deep pools.

Beavers, on the other hand, have little time for play. Working mainly at night, these industrious engineers fell trees to feed on the tender foliage and to obtain logs for dam-building. A pair of beavers can build a 2-foot-high, 12-foot-long dam in 2 nights, piling brush and tree limbs in the stream and cementing them together with mud, leaves, and rocks. Their dams create important wetland and backwater habitats and provide convenient stream crossings for many animals (whose scat you can see on the dams). Putah Creek's beavers do not construct lodges. Instead they live in burrows in the banks. Look for beavers at dawn or dusk and listen for the resounding slap of their tails on the water, announcing your presence to the rest of the family.

Never in his life had he seen a river before—this sleek, sinuous, full-bodied animal, chasing and chuckling, gripping things with a gurgle and leaving them with a laugh, to fling itself on fresh playmates that shook themselves free, and were caught and held again. All was a-shake and a-shiver—glints and gleams and sparkles, rustle and swirl, chatter and bubble.

Kenneth Grahame, The Wind in the Willows

In Putah Creek, beavers present a mixed blessing. Their dams create important wetland habitats, but they also block paths of fish migration. Beavers often damage restoration plantings since they prefer to gnaw on native riparian plants, such as willows and cottonwoods, rather than nonnative plants such as tamarisk, arundo, and eucalyptus.

Tamarisk

U.S. Fish and Wildlife Service, Photography by R. Town

Muskrat

© 2008 Jupiter Images Corporation

Beaver

Muskrats resemble beavers but are much smaller and use their laterally compressed tails as rudders while swimming. This nonnative species is seldom found far from water except when searching for new feeding grounds, which must feature plenty of cattails and rushes. Like beavers, the muskrats of Putah Creek live in holes in banks and levees, dug with their entrances under water.

© Lorrie Jo Williams

White alder female catkins in fruit

Courtesy Saint Mary's College

White alder male catkins

The bankside community also provides ideal conditions for plant species that like to get their feet wet. Buttonbush grows only along undisturbed banks and is easily distinguished by its round, white flower "buttons" borne at the tips of its branches. Bees use buttonbush nectar to make honey. Wood ducks hide beneath the bush's overhanging foliage. Another important but rather uncommon bankside plant is white alder, which grows in dense clusters along the bank and in saturated backwater areas. The female flowerheads, or catkins, resemble miniature pine cones, and pollen is produced in hanging male catkins. Alders also have nodules on their roots that contain nitrogen-fixing bacteria that help them acquire this important nutrient directly from the air.

Mixed Riparian Forest

In the mixed riparian forest, water flowing year round provides moisture and creates increased air movement and more stable temperatures than in the surrounding environment. This entices deer and other large herbivores (plant eating animals), as well as scores of smaller mammals looking for food, water, and cover. The abundant prey provide ample food for raptors, mink, fox, coyote, and other carnivores (those that feed on animal tissue), making the mixed riparian forest one of the most diverse habitats in California.

Riparian habitats also provide valuable shaded riverine aquatic habitat (overhanging or instream trees and branches) for aquatic organisms. This cover maintains cool water temperatures; supplies fallen leaves, twigs, and insects into the aquatic food web; and provides a variety of instream microhabitats characterized by variations in flow, depth, and cover.

Streamside forests are laden with insects and other invertebrates. Flying insects breed in the swampy water, and herbivorous insects have

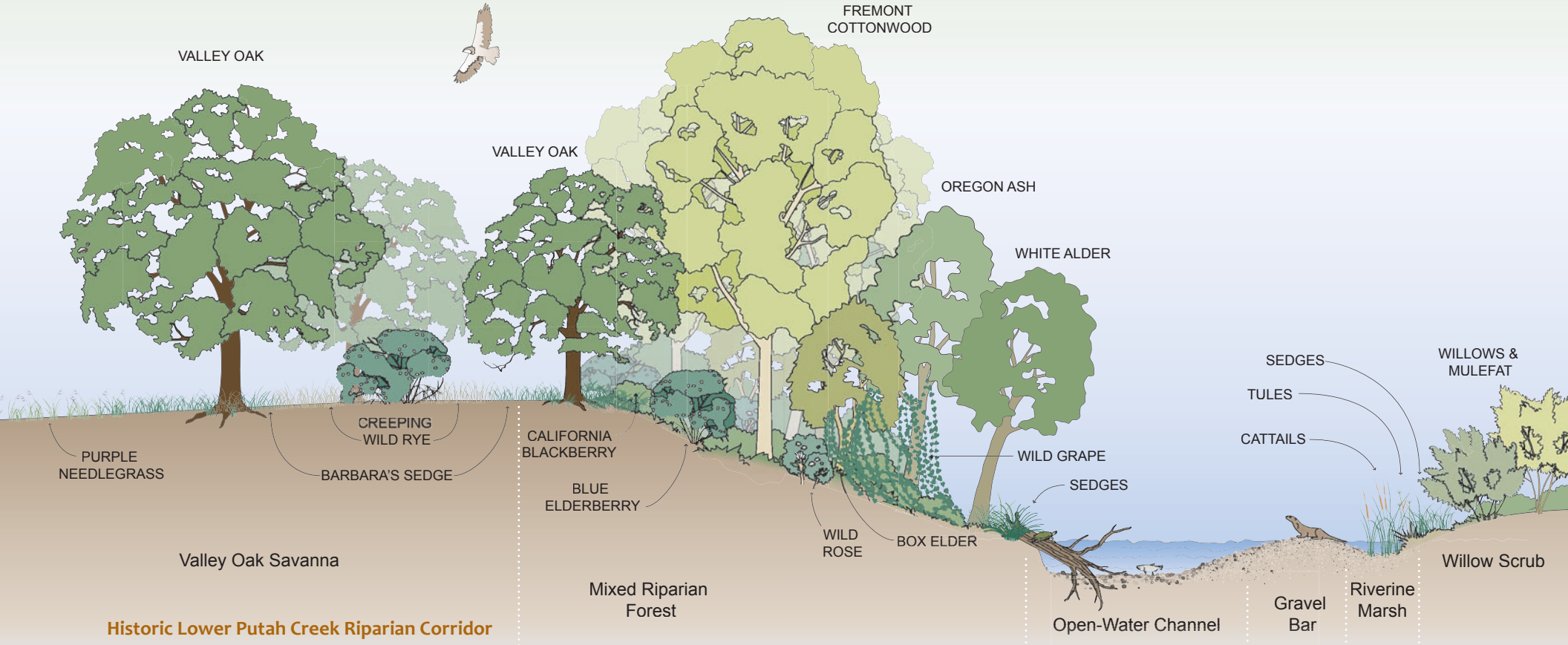
© 2007 Dee E. Warenycia

Buttonbush

© 2006 EDAW, Photography by Vance Howard

Mixed riparian forest

acres of leaf surfaces on which to hide and feed. Jewel-like dragonflies and damselflies cruise along the water, feeding on smaller insects. This insect wealth supports dense flocks of insectivorous songbirds, such as flycatchers, warblers, wrens, vireos, and swallows. As the songbirds return to the trees in the evenings to roost, bats emerge, zigzagging above the water surface, using sonar to track down the rising hordes of emerging insects. Shiny black carabid beetles scuttle about the forest floor, annoying ground spiders and sending springtails—a very ancient form of insect—springing. Tarantulas of the genus Aphonopelma, of which there are many species in California, are scary-looking but essentially harmless. (They do have barbed hairs that they can kick off their abdomens, directing them toward potential attackers.) Tarantulas hide out in bird boxes and other dark crannies during the day, emerging at night to hunt. Stretched across gaps between trees and bushes like so many hammocks, the swaying webs of orb-weaving spiders sparkle in



Historic Lower Putah Creek Riparian Corridor

the sunshine, their occupants quick to race out and snag whatever hapless victim gets entangled there. In late summer, spider webs are so numerous that one can hardly avoid walking into them, rather disconcerting, but attesting to the incredible insect productivity of the creek.

Wood-boring insects tunnel in large, decaying trees that also provide habitat for Nuttall's and downy woodpeckers, northern flickers, great horned owls, raccoons, western gray squirrels, opossums, wood ducks, and common mergansers. Branches of living trees support the bulky platform nests of red-shouldered hawks and the pendulous "purse" nests of bushtits and Bullock's orioles.

Fremont cottonwood

Fremont cottonwood leaves

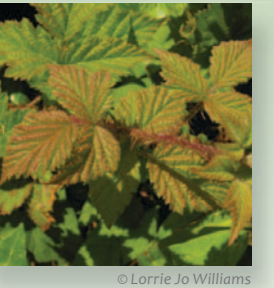
Many riparian plants are relicts (remnants) of a deciduous flora that once extended across all of North America before receding to riparian strongholds as the climate warmed and dried over the last 2 million years. As descendants of this flora, riparian trees still lose their leaves in the fall and grow new ones in the spring, a process that requires large amounts of energy and water, a luxury that few other than riparian species can afford in the Central Valley's dry Mediterranean climate. Since the distribution of streams in the larger landscape is patchy, the seeds of riparian plants are often well-equipped for airborne or waterborne dispersal. Putah Creek's common riparian trees include Fremont cottonwood, box elder, valley oak, and five species of willow: Goodding's black willow, red willow, arroyo willow, narrow-leaved willow, and shining willow. The leaves, twigs, and buds of willows have high nutritional value for animals and insects. Their

roots help stabilize streambanks and the larger species provide canopy cover and hiding places for insects in their furrowed bark.

Fremont cottonwood is the tallest native tree in the community. It is easily distinguished by its heart-shaped leaves and furrowed, light-colored bark. The tree gets its name from the cotton-like coat surrounding its light, windborne seeds. Cottonwood buds and catkins are valuable winter and spring food for wildlife, especially game birds. Beavers and other herbivores relish its tender twigs, foliage, and bark. Its soft bark is easy for woodpeckers to chisel into. Goodding's black willow is nearly as tall as cottonwood and has slender, serrated leaves that are dark green on both sides. All other Central Valley willows are shrubs less than 15 feet tall. Young willows and cottonwoods need areas of moist sediment to germinate in, so they often become scarce along deeply incised streams like Putah Creek.

Box elder

The box elder is a member of the maple family, those icons of eastern North American forests. The box elder is tolerant of poor conditions so it is adept at naturalizing disturbed sites. Its seeds are an important winter food for birds, and small mammals and deer browse on the young plants. Largely gone from the vicinity of Putah Creek, though still present elsewhere in the Central Valley, is the majestic western sycamore, a giant that once stood toe to toe with the equally imposing valley oak.



© Lorrie Jo Williams

Native California blackberry has fine, closely spaced thorns. Its leaves are green below.

© Lorrie Jo Williams

The Himalayan blackberry has an octagonal stem with large, widely spaced thorns. Its leaves are white below.

Can't tell poison oak from blackberry? This rhyme may help.

"Leaves of three, let it be, but if it's hairy, it's a berry."

Riparian shrubs, vines, grasses, and forbs are extremely important to wildlife because they provide cover and fruit, especially valuable during the winter months. They are often lacking in the riparian forest because they are sensitive to trampling and changes in groundwater availability.

Poison oak and California wild grape produce nutritious fruit that is eaten by many different animals, especially birds. The least Bell's vireo, which is on the federal endangered species list, nests in poison oak. California wild grape vines hang from trees in dense curtains. Grape bark is used in nest building and the clusters of dried fruit are consumed by many animals in fall and winter.

All types of blackberries rank at the very top of preferred summer foods for wildlife, especially birds. The thorny brambles also serve as effective cover, but can hinder movements of medium to large mammals. The highly invasive, introduced Himalayan blackberry is being removed by restoration efforts along the creek and replaced by the equally fruity but less aggressive California blackberry.

© Lorrie Jo Williams

Poison oak

Creeping wildrye is a native perennial grass often found with sedges. Both plants provide cover for waterfowl and game birds and produce materials used by

Native Americans for basket weaving. Creeping wildrye and sedges spread via rhizomes (hoizontal plant stems that can produce roots and shoots) forming dense mats of vegetation that help stabilize streambanks.

The valley elderberry longhorn beetle, which is on the federal list of threatened species, depends on blue elderberry to complete its life cycle. Putah Creek is considered an important area for the beetle.

A number of butterflies are common in the riparian zone. The western tiger swallowtail is often seen cruising along the Putah Creek corridor. Tiger swallowtail larvae feed on many riparian species, including willows, cottonwoods, alders, and sycamores.

Riparian woodlands are legendary for their bird diversity. More than 200 species of birds have been reported from Putah Creek alone. Many of them are of conservation concern because of declining populations and habitat loss. The western yellow-billed cuckoo, on California's endangered species list, has been seen recently along the creek. The yellow-breasted chat, the largest of California's wood warblers, prefers tangles of willows and other thick streamside vegetation for habitat. The chat has been better able than other native riparian songbirds, like the least Bell's vireo, to cope with nest parasitism by brown-headed cowbirds.

© Lorrie Jo Williams

California rose flower

© Lorrie Jo Williams

California wild grape leaves

© Lorrie Jo Williams

California wild grape fruit

© Lorrie Jo Williams

California rose fruit (hip)

© Lorrie Jo Williams

Blue elderberry bushes are home to valley elderberry longhorn beetles.

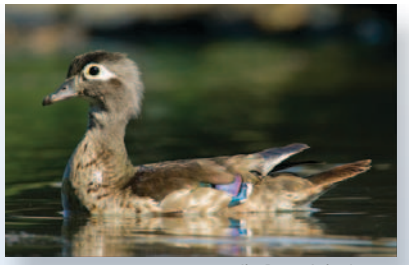
© Ron Unger

Valley elderberry longhorn beetles emerge for only a few weeks every few years to reproduce.

The wood duck, a shy bird of undisturbed riparian woodlands, was once on the verge of extinction. It is still rare in the Central Valley. On Putah Creek, however, thanks to a successful nest box project sponsored by the UC Davis Department of Wildlife, Fish, and Conservation Biology, one can often catch glimpses of this stunning bird as it floats quietly beneath overhanging vegetation, or more commonly, as it flies away, shrieking in alarm.

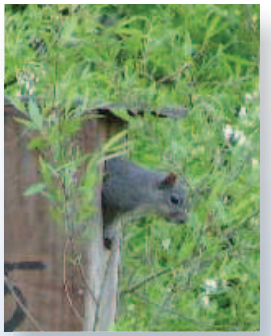
Putah Creek's raptors are truly remarkable for their diversity, attesting to the productivity of the creek and its surrounding lands. The red-shouldered hawk hunts mainly within the riparian corridor, while the red-tailed hawk is often seen perched on roadside poles or sailing over fields and woodlands. The northern harrier is frequently seen quartering low over the ground in open country, using its keen hearing to locate prey as an owl does.

The Swainson's hawk, a grassland species, finds local agricultural fields much to its liking. Swainson's hawks are generally found nesting in scattered trees or along riparian systems adjacent to agricultural fields



© Jim Dunn, Avian Images

Wood duck hen



© Melanie Allen Truan

Western gray squirrel

or pastures. While they often soar in search of prey, it is not uncommon to see several hawks foraging, together capturing insects flushed by tractors or other farm equipment. Once one of the most numerous raptors in the state, the Swainson's hawk is today threatened by loss of native nesting and foraging habitat, and by loss of suitable nesting trees, accelerated by flood control practices and bank stabilization programs.

Cooper's and sharp-shinned hawks are woodland birds with short, rounded wings and long tails that provide the maneuverability needed to capture small birds in the densely forested riparian corridor.

The white-tailed kite is one species that seems to have benefited from the introduction of a nonnative species, the European house mouse, upon which it feeds. Once considered rare and endangered, this elegant white bird is now commonly seen "kiting"—hovering on rapidly beating wings—as it hunts.

Several species of falcon are also found on the creek. The smallest, the American kestrel, is commonly seen perched on roadside wires or "kiting" over open fields in search of grasshoppers. Merlins, peregrine falcons, and prairie falcons are also seen on occasion.

© Jim Dunn, Avian Images

Red-shouldered hawk

© Lorrie Jo Williams

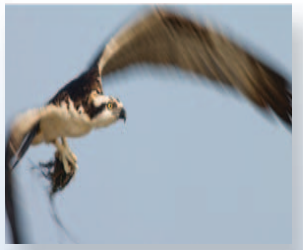
White-tailed kite

Owls are found in great abundance in and around the creek. Barn owls, those ghostly hunters of the night, fly low over open ground, watching and listening with hearing so precise that they can strike their prey in total darkness. Powerful and aggressive, great horned owls are abundant in the streamside forests. Their courtship hoots roll across the forest on midwinter nights. Western screech owls nest in old cavities. Northern pygmy owls, usually found only in the reaches of the upper foothills, hunt small birds during the daylight hours. Birders often imitate the call of the pygmy owl to draw songbirds into the open as they attempt to "mob" this predator. Burrowing owls, those long-legged, ground-dwelling clowns of open grasslands, are endearing but declining because of habitat loss. While they consume mainly insects, they also rely on ground squirrels to construct burrows for them.

Burrowing owl

Short-eared owl

Osprey are commonly seen fishing the waters of Lake Solano, plunging feet first to grab fish in their talons. Bald eagles and golden eagles have also been seen there, usually in winter. Turkey



Osprey in flight

vultures roost and nest in the riparian corridor, soaring over the countryside to forage for carrion.

Giant gartersnake

Riparian areas are not generally considered strongholds for terrestrial reptiles these species can tolerate much drier areas. However, gopher snakes are common, often found associated with ground squirrels. Recent research has found that ground squirrels smear themselves with gopher snake skin so that predators nosing around burrows will mistake them for snakes, not tasty squirrels. When disturbed, a gopher snake will hiss loudly and sometimes flatten its head and vibrate its tail in the leaves, thus mimicking the rattlesnake, which it resembles with its brown coloration and diamond-shaped markings. Rattlesnakes occur frequently along the creek, especially in the upper foothill reaches. While they generally prefer rocky, boulder-strewn areas, they are also found in grassy areas near the water. The beautiful brown and cream California kingsnake, a species that will kill rattlesnakes, has also been sighted, as have the western yellow-bellied racer and the valley gartersnake. The giant gartersnake, an endangered species, may be found in the channels and sloughs of the Yolo Bypass Wildlife Area.

California Kingsnake

Gopher snake

Living on the Edge

Because they are long and narrow, riparian corridors are inherently "edgy." In riparian areas, edges occur between instream habitats and the mixed riparian forest, and between the mixed riparian forest and the adjacent uplands. Edges also occur between different microhabitats, such as between forest and grassy meadows. Here species mingle. Edges are often good places to watch for wildlife.

© Lorrie Jo Williams

Anna's hummingbirds are often found in urban backyards feeding on wild fuchsia, Mexican sage, and other nectar-producing plants.

Unlike natural edges, edges created by humans are often abrupt and sharply defined, bounded by hard, straight features like roads or fences. The species found along hard edges are accustomed to living near humans and often gain food or shelter from them. European starlings and brown-headed cowbirds grow fat on agricultural waste products. Their populations often reach very high densities, spilling over into adjacent riparian woodlands. Starlings work together to compete with native birds for nesting cavities. Starlings usually win. Cowbirds "parasitize" other songbirds by laying eggs in their nests, leaving the host birds to raise both sets of chicks. Host chicks often do not survive.

© Lorrie Jo Williams

California ground squirrel

Carnivores like coyotes and foxes often use hard edges as handy highways to get from place to place. Here the going is relatively smooth and cover is only a few steps away, to detect the scent of carrion wafting up from the creek or the sight of rabbits foraging in the fields. Mice and rats are common along edges, as are California ground squirrels, which establish colonies in the loose soil of levee slopes and field margins.

Human development along edges often serves as a source of invasive species that thrive in riparian habitats. For example, eucalyptus trees, imported for fuel and windbreaks, have colonized riparian corridors. Eucalyptus trees suppress the growth of native plants, create fire hazards, and can suffocate foraging songbirds by clogging their bills with their sticky resins. Domestic cats kill large numbers of songbirds every year and packs of dogs often harass and kill wildlife. Residents can help prevent adverse effects on natural lands by keeping their pets at home and by carefully choosing landscape plants that are noninvasive or that provide habitat for local wildlife.

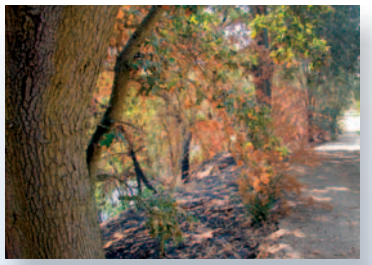
Not all edge effects created by humans are negative to all species, however. Swainson's hawks, declining elsewhere, are doing well in the Central Valley because they forage in agricultural fields adjacent to the riparian corridors in which they nest.

© Dave Feliz

Yolo Bypass

© Molly Farrell

Agricultural edge habitat



Courtesy LPCCC, Photography by Rich Marovich

Oak woodland edge habitat

Agricultural- and urban-wildland interfaces are also great places for crop-pollinating native bees. Many native bees nest in underground tunnels or tree cavities in riparian forests, but leave the forest to pollinate crops and upland plants. Native bees are tough and versatile, often active when conditions are too cold and wet for honeybees. Native bees often are more successful at pollinating species that need buzz pollination (vibration), like tomatoes. Ornamental plantings near homes and businesses also provide forage and shelter for hummingbirds, orioles, and other songbirds. One must be careful, however, to select ornamentals that are noninvasive.

© Lorrie Jo Williams

Agricultural fields adjacent to nesting habitat provide hunting grounds for raptors.

© Lorrie Jo Williams

Valley carpenter bee

© Lorrie Jo Williams

Swainson's hawk

Mighty Like an Oak

Putah Creek's oak woodlands vary with elevation. The creek's upper watershed supports a diverse array of live and deciduous oaks, complemented by foothill pines, and an equally diverse understory of shrubs, forbs, and grasses. The lower watershed was once characterized by vast streamside galleries of valley oak that stretched away from Putah Creek for a mile or more. Today, most of the local oaks exist in narrow fringes along the creek or as old, isolated individuals scattered across the landscape. Few seedlings mature into trees.

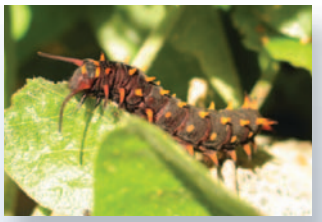
Many important plant species occur in oak woodlands. Dutchman's pipe is a perennial vine that can be found in Cold Canyon and other areas in the upper part of the watershed and is the biologically essential host plant for the larvae of the pipevine swallowtail butterfly. Understanding such interdependencies is important in managing ecosystems, since the loss of one species inevitably leads to loss of the other.

© Ron Unger

The unusual shape of the flowers give the Dutchman's pipe its name.

© Lorrie Jo Williams

Although pipevine swallowtail butterflies visit many different flowers, they return to lay their eggs on the Dutchman's pipe.



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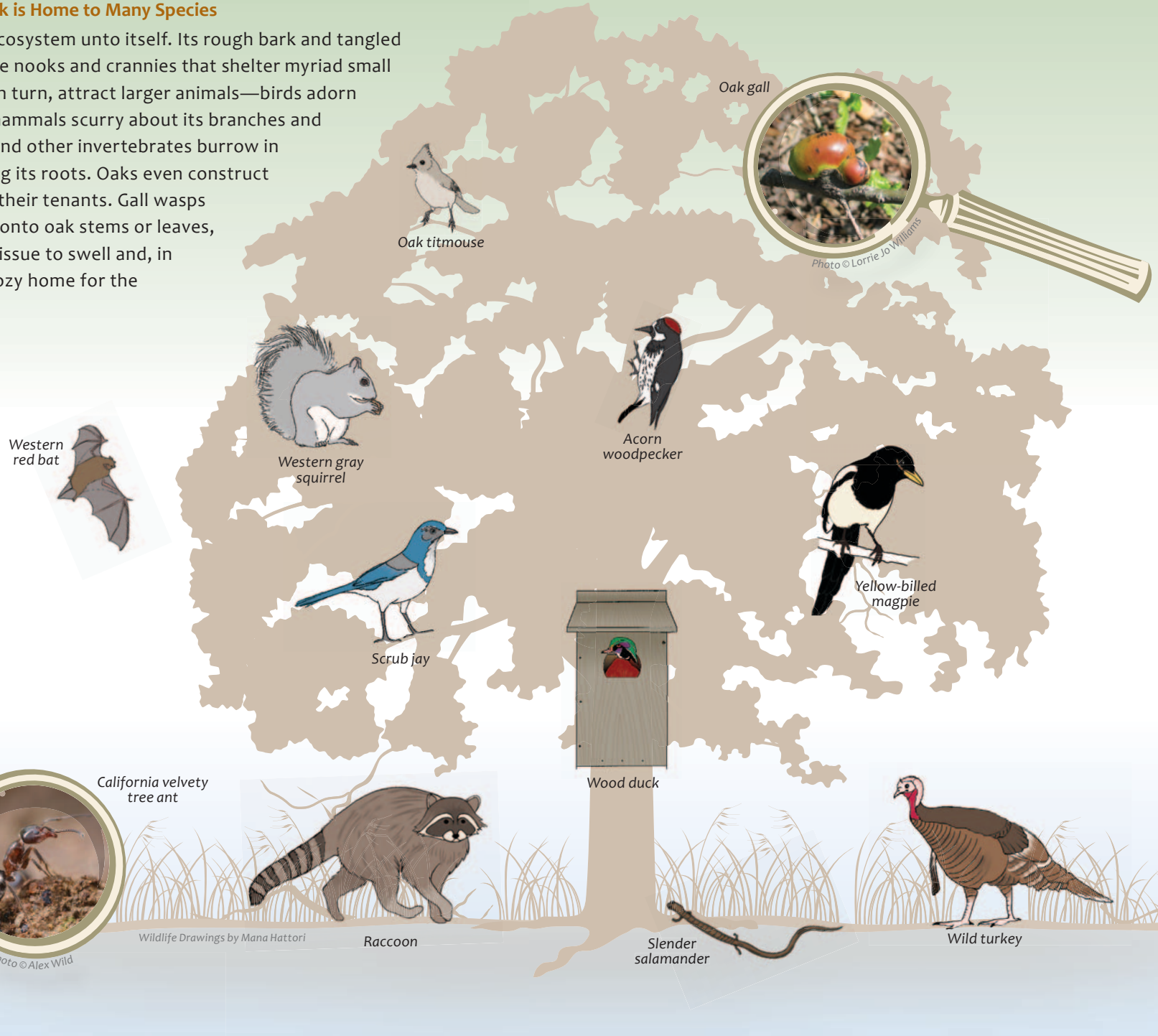
Pipevine swallowtail caterpillars feed on Dutchman's pipe each spring.

A Mature Valley Oak is Home to Many Species

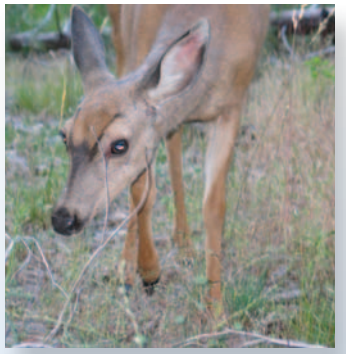
An oak tree is an ecosystem unto itself. Its rough bark and tangled root systems create nooks and crannies that shelter myriad small creatures. These, in turn, attract larger animals—birds adorn the crown, small mammals scurry about its branches and base, and insects and other invertebrates burrow in the bark and among its roots. Oaks even construct special houses for their tenants. Gall wasps deposit their eggs onto oak stems or leaves, causing the plant tissue to swell and, in time, to create a cozy home for the developing wasp.



But the greatest of the mighty oak's gifts are its acorns. There, loaded into one convenient package, is a powerhouse of energy that provides food for numerous species. Deer and wild turkey obtain the majority of their diet from oaks. Dusky-footed woodrats store acorns in their large stick nests, gray squirrels and western scrub jays bury them in the soil, and acorn woodpeckers carve out holes for them in large storage trees called granaries. By storing acorns for later use, these animals extend the harvest even when the trees and forest floor are empty. The abundant acorns also provided an important food staple for local Native American tribes.

Woodrat

Scrub jay



Mule deer

We continue to learn more about Putah Creek's incredible life and about riparian habitats and their importance to biodiversity in a changing world. As stewards of our natural environment, we need to carefully evaluate what we can do to restore, enhance, and protect our local creeks and rivers while planning for a future that enables both human and natural communities to thrive for generations to come.

Valley oak tree

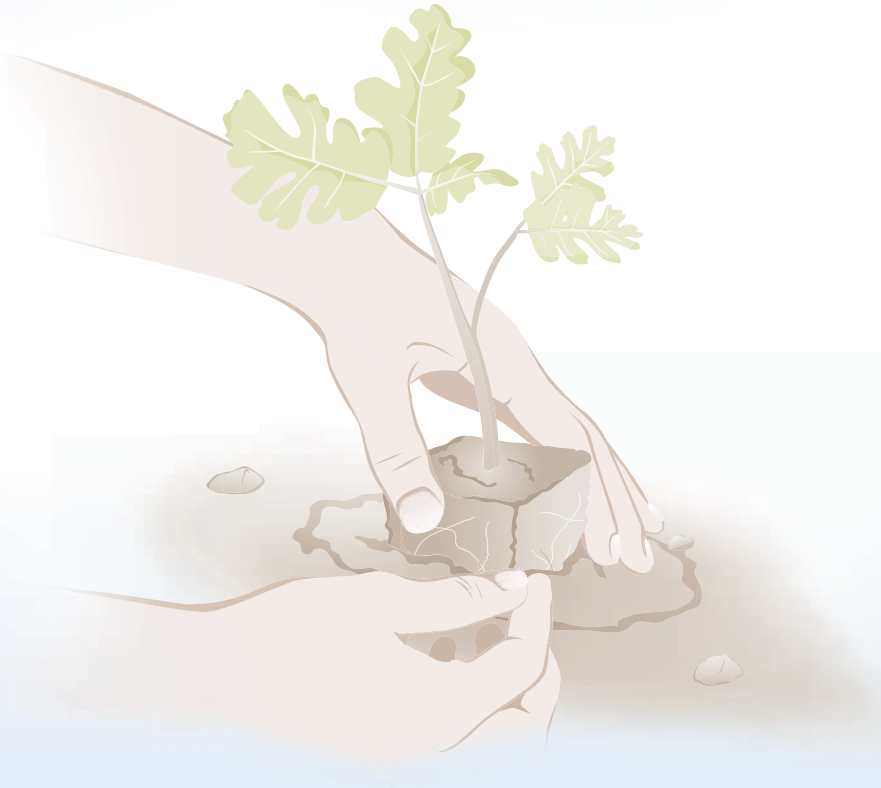
Valley oak acorn

Valley oak leaf

Creating the Future: Stewardship

Relationships are what will restore the creek.

Rich Marovich, Putah Creek Streamkeeper



Welcome to the future of the watershed, a future that depends on our actions. People all along the creek are working to help the creek and the life around it thrive. For more than a decade, volunteers have been ridding the creek of tons of trash on biannual cleanup days. Landowners have been working hard to reduce tamarisk and arundo on their properties. Farmers are experimenting with wildlife-friendly farming practices. Fishermen are learning how to prevent the spread of the New Zealand mudsnail, and a crew of citizen-scientists are monitoring the creek to see which invertebrates live there and how they are faring. Other volunteers are replanting oaks and native grasses that provide habitat and food for wildlife. Groups up and down the creek have formed to take care of the creek, and they've joined together to bring salmon back, restore native vegetation, control erosion, and educate our communities.

There are many ways to get involved with your community and with the creek. This chapter gives suggestions on how to be a steward of our unique watershed. Many local groups and resources are mentioned. You can find more information on these projects, groups, and opportunities at the end of the book in the "Community Resources" section.

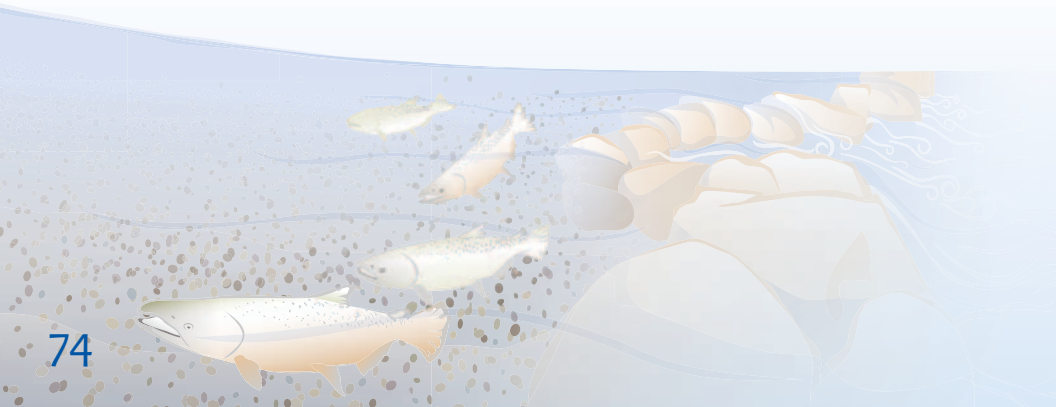
Chinook salmon

Return of the Salmon

straight through tule fog
slide upsteam, a salmon king!
called by putah-to
Michael Marchetti

It's homecoming time. The oceangoing salmon feel it, drawn instinctually back toward fresh water, through the Golden Gate and into the maze of the Sacramento-San Joaquin Delta. The smell of Putah Creek means familiar spawning grounds to some of the salmon, which swim up the Toe Drain of the Yolo Bypass. And the stewards of Putah Creek are waiting for them again.

The dam tenders for the Solano County Water Agency open the valves on Putah Diversion Dam, so higher pulses of water flow down the creek, mimicking flows after fall storms that brought chinook salmon back into the creek for millennia. At the mouth of the creek, farmers lift the boards of a checkdam that would bar the salmon's passage. The salmon gathered at the checkdam push into the creek, jump beaver dams, and search the creek bed for the right place to make a good redd, or nest, for their eggs. A few splash in the clean gravel trapped by a rocky W-weir, built by landowners with help from the creek streamkeeper.



Salmon have been returning to Putah Creek because of groups working together on a larger effort: members of the local communities of Davis and Winters, creekside landowners, the Lower Putah Creek Coordinating Committee (LPCCC), the Putah Creek Council, and many others. The Putah Creek Accord paved the way for stakeholders to cooperate on collaborative grants, restoration work, and outreach. Instream improvements to benefit native fish and other aquatic organisms are being installed; oak trees, native grasses, and other riparian vegetation are being replanted; trash and invasive plants are being removed; and habitat for birds and other wildlife is being restored.

Separating macroinvertebrates from stream debris for biomonitoring

The kind of sediment in the creek is critical to salmon, steelhead, and lamprey, which need natural gravel beds for spawning grounds. Aquatic invertebrates also need gravel for habitat. Although dams provide much-needed water to cities and farms, they greatly modify the natural flow and sediment movement patterns in Putah Creek, which were already changed by past gravel mining and flood control practices. Less gravel enters the creek, and bank erosion threatens homes and roads while increasing finer sediments that reduce light in the creek, cover leaves that feed invertebrates, and choke gravel beds.

Courtesy LPCCC, Photography by Rich Marovich

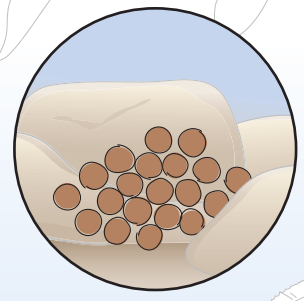
Logs and rocks are added to banks to reduce erosion and add habitat.

The creek channel is also overly wide and deep in many places. Restoring Putah Creek will require narrowing the main creek channel and reestablishing a broad floodplain where the channel is too wide. Where the channel is deeply incised, restoration involves reestablishing a low floodplain bench.

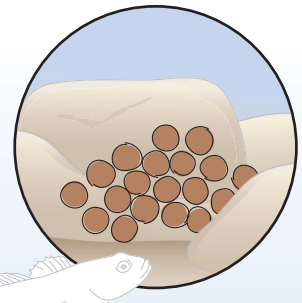
Many actions have already been taken to increase gravel, control erosion, and reshape the creek. The LPCCC, guided by stream hydrologists, geomorphologists, and fisheries experts, brought in heavy equipment to realign and reshape a section of Putah Creek. The realignment prevents Putah Creek Road from sliding into the creek and enables more efficient movement of gravel from Dry Creek, a primary natural source for gravel replenishment.

Salmon Development

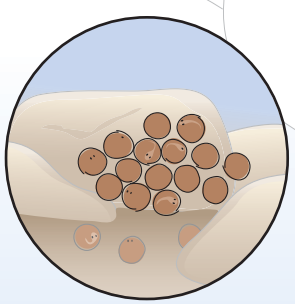
Salmon have gradually begun to return to Putah Creek, but they face many challenges in their quest to spawn. Salmon must first make the long journey up into Putah Creek to find gravel to form redds. The salmon eggs are often the victim of erosion when fine dirt covers and stifles the eggs. The eggs that manage to hatch and grow into fry and then fingerlings face high predation pressure. The salmon that survive swim to the ocean during the spring. After spending 3-4 years at sea, they will make their return trip to spawn. Then they will die and become food for many other animals.



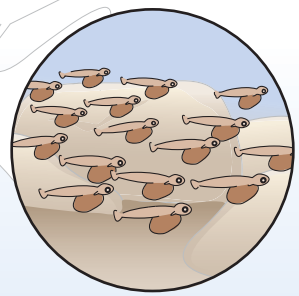
Newly laid salmon eggs nestle in the protection of the gravel in the creek bed.



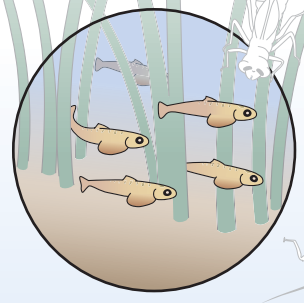
Some eggs are lost to predators such as sculpin.



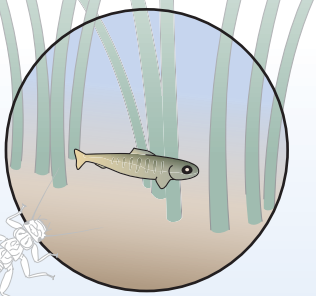
Silt from erosion can cover and smother still more eggs before they hatch.



Newly hatched salmon fry find shelter among reeds and rocks.



Many fingerlings fall prey to stonefly and dragonfly larvae as well as larger fish, egrets, and kingfishers.



Only 1 in 20 eggs matures into a fish large enough to attempt the hazardous migration to the ocean.

To anchor meander bends in the stream channel and prevent continued erosion of slopes, log and rock vanes are installed along Putah Creek and its tributaries at sites where substantial bank losses occurred and continue to threaten nearby land. Stone structures called W-weirs are built in the creek bed to reduce bank scour and to create complex flows that produce gravel beds upstream and deep pool refuges downstream. Restoring native vegetation and using farming practices like buffer strips (zones of vegetation between fields and the creek) also reduce erosion.

Salmon: What Can I Do?

- Plant native trees in the riparian area to help shade the creek to provide cooler water, preferred by native fish.
- Don't dump aquarium fish, turtles, or plants into your local creek or water body.
- Don't dump bait fish into the water after fishing.
- Help with fish surveys.

Volunteers planting a seedling

Juvenile salmon

Testing the Waters

When I started in December of 2000 ... we knew very little about biological diversity along Putah Creek. Now we have extensive inventories of wildlife, including nesting birds and aquatic invertebrates.

Rich Marovich, Putah Creek Streamkeeper

A girl dips her net into the rushing water as volunteers overturn stones upstream, washing them into the stream flow. She pulls the net from the creek and turns the contents out into a shallow white pan, where myriad tiny insects now float. Trained as a stream biomonitor helping to catalog species along lower Putah Creek, she identifies caddisfly larvae and mayflies in the pan. Great, she thinks, those only show up if the water quality is good. But what's that one? She looks more closely at the stocky insect slowly crawling along the bottom of the pan. With the help of other group members, she identifies the ungainly creature as a dragonfly larva. She marvels that it will become a beautiful, graceful dragonfly.

There are many biomonitoring efforts along the creek to observe and understand fish, bird, and insect populations. Insects are good environmental indicators because they are sensitive to pollution and their short life cycles fluctuate quickly in response to changes in the environment. For terrestrial habitats, butterflies and bees are common indicator species. For aquatic ecosystems, stream benthic macroinvertebrates (insects that live in the creek bed) are good indicators of water quality.

In 2004, the Putah Creek Biomonitoring Group began gathering baseline data on the creek's benthic macroinvertebrates to learn more about the creek's aquatic ecosystems. Once the group has completed baseline surveys, it can monitor effects of beneficial and detrimental actions over time.

Because benthic macroinvertebrates are an important food for many native fish, noting how invertebrate populations change can help predict effects on fish and other species. Invertebrate biomonitoring at restoration sites can mark the return of species to a formerly degraded area and show how restoration affects existing populations. Restored shallow gravel beds and rock weirs increase riffle-type habitat with flows and substrates that benefit benthic macroinvertebrates, so invertebrate biomonitoring can give us a better understanding of how and where to restore riffles in Putah Creek.

© Ken Davis

New Zealand mudsnail

In 2003, the invasive New Zealand mudsnail was discovered in Putah Creek. It was likely introduced through contaminated fishing or boating equipment. The Putah Creek Biomonitoring Group assists with surveys to track the mudsnail's spread and its impact on other aquatic species. This tiny aquatic mollusk is of great concern in areas outside its native Australia and New Zealand, where it is kept in check by natural controls. Dense populations of 500,000 or more individuals per square meter have been known to drive native snails to extinction and crowd out native insects that are important as food for fish and birds.

Mudsnails are indigestible and pass unharmed through digestive tracts. They tolerate a wide variety of environmental conditions and can survive for long periods out of water.

Biomonitoring: What Can I Do?

Here are some of the ways you can become involved in creek biomonitoring and help to prevent the introduction and spread of aquatic invasive species:

- Join a biomonitoring group to help perform baseline surveys of creek macroinvertebrates, local birds, or native pollinators, and to track the spread of invasive species. Contact Putah Creek Council, the Audubon Society, or the Xerces Society for information.
- Don't release unwanted pets into the local environment where they don't belong and can become invasive.
- Don't move a species from one water body to another.
- If you go hiking, boating, or fishing near a creek or river, inspect and remove aquatic plants, animals, and mud from boats and equipment, even your dog, before leaving the area.

© EDAW, Photography by Chris Fitzer

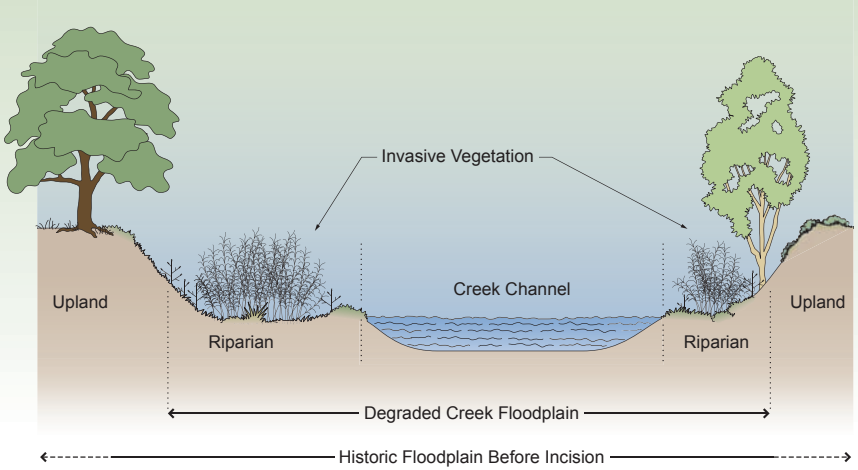
Dragonfly nymph

© Putah Creek Council

Members of the Putah Creek Biomonitoring Group sorting benthic macroinvertebrates

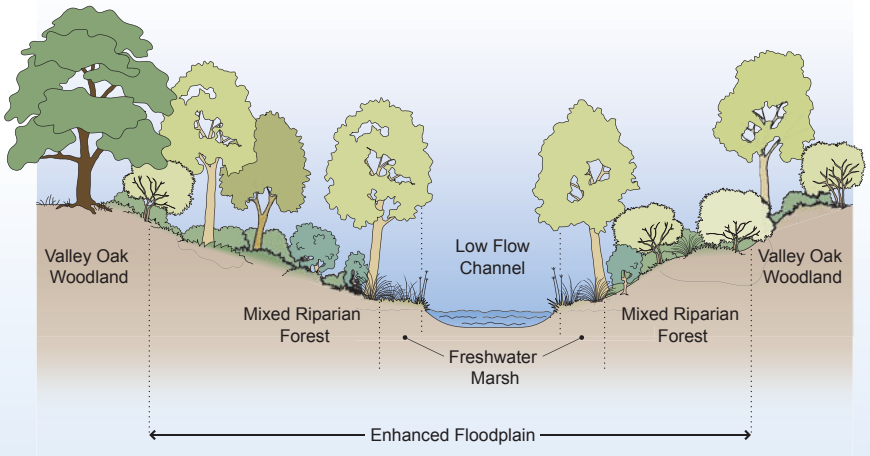
A Degraded Creek

The creek channel is too wide, and it is deeply incised, cut off from the upland that was the original floodplain. Invasive plants fill the degraded narrow floodplain, which is confined within the creek banks. In upland areas riparian plants no longer reach groundwater because of the deeply cut creek. Nonnative fish thrive in the warmer waters.



A Restored Creek

The creek channel is narrower. The creek now has a wider floodplain that accommodates different flows within the creek banks. There is a continuum of diverse, mostly native vegetation and wildlife habitat from the upland to the creek channel. Native fish dominate the creek, made cooler by more shading, faster flows, and the wider riparian forest and adjacent valley oak woodland.



Dig in to Restoration

Put the natives in—trees, shrubs, sedges, grasses.... Let them produce berries for birds, bark for beetles, leaves for aphids,.... and become the substrate for new life. Establish it, then let it become itself.

Dan Leroy, former chair of Putah Creek Council

The little girl pinches dirt around the top of the grass plug she just planted to make sure it won't dry out. Then she joins her classmates on the creek bank at the UC Davis Putah Creek Riparian Reserve. Her class grew several flats of native grasses this year to plant on creek banks that are too steep for the drill seeder. Along with planting grasses such as creeping wild rye, purple needlegrass, and blue wild rye, the class learned how those species can benefit wildlife, prevent the spread of invasive plants, and stabilize streambanks. The area surrounding her was once overgrown with invasive species like yellow starthistle, arundo, and prickly milk thistle. The University Reserve stewards, with help from the LPCCC, Putah Creek Council, and many community volunteers, have cleaned up trash, removed invasive weeds, and planted native species in their place.

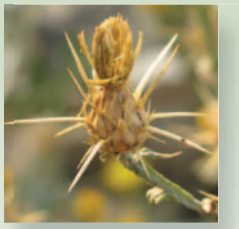
Adopt-A-Flat volunteer planting native grass plugs

Volunteers planting a red willow seedling

Native grass plugs

© Lorrie Jo Williams

Tamarisk



© Lorrie Jo Williams

Yellow starthistle

Adopt-A-Flat

The Putah Creek Council's Adopt-A-Flat program works with volunteers, including families and classes, to raise flats of native grasses for restoration projects along Putah Creek. Volunteers seed the flats, grow out the grasses for 2 months or more, and then plant the seedlings at scheduled restoration events in the spring.

What I'm interested in:

"Many of PCC's programs, especially the Adopt-A-Flat program, which works with citizens and schoolchildren to propagate and plant native grass plugs along the creek."

Katherine Holmes, Putah Creek volunteer and PCC Board Member

Disturbances from past alterations to the creek opened the way for invasive plants to dominate certain areas of the channel. Overall, about one-tenth of the creek's riparian corridor is covered by invasive plants, but in some areas the invasives almost completely dominate the corridor.

The heavy growth of weeds such as Himalayan blackberry and arundo have trapped sediments on the creek's floodplain in many locations, cutting off the floodplains from all but the highest creek flows. Although much of the weed removal on Putah Creek is done by licensed pesticide applicators and using larger equipment, volunteers can get involved with hand removal of invasive plants on smaller projects. Invasive aquatic plants like Eurasian milfoil can also have negative effects on an ecosystem. It is therefore important to try to prevent and slow their spread.

With efforts to remove arundo, tamarisk, yellow starthistle, and other invasive plants, native species can once again flourish and grow along streambanks. Valley oak woodland slowly returns as native grasses and acorns are planted in place of invasive annual weeds. Wild rose and California

blackberry, suppressed by invasive Himalayan blackberry, often recover and reestablish themselves after the nonnative blackberry is removed. Groups like the Putah Creek Council work with partners and volunteers to reseed native grasses and plant native trees and shrubs such as valley oaks, cottonwoods, and willows.

Native trees provide habitat for wildlife, especially birds. Looking up into the branches of a valley oak, you might see tree swallows with their iridescent green backs doing acrobatics in the air or nesting in a box hanging from the tree branch. Large old trees provide breeding habitat for cavity-nesting birds like woodpeckers, tree swallows, and bluebirds. Restoration plantings help provide trees for the future, but many birds need help finding nesting sites today. This is where the Putah Creek Nestbox Trail comes in. Volunteers and scientists with the UC Davis Museum of Wildlife and Fish Biology construct and maintain nestboxes that are used by a variety of species.

© Lorrie Jo Williams

Tree swallow

© Melanie Allen Truan

Western bluebird in nestbox

Putah Creek Nestbox Trail

The Putah Creek Nestbox Trail engages students, landowners, and other community volunteers in conserving cavity-nesting birds through active habitat restoration and nest box monitoring. Since its inception in 2000, the program has provided breeding habitat for more than 1,000 pairs of cavity nesting birds, producing over 3,000 fledglings. Many of them return year after year to nest along the creek, helping to boost local populations. For more information see "UC Davis Museum of Wildlife and Fish Biology" in the "Resources & References" section.

Reducing Invasives, Increasing Habitat: What Can I Do?

- Plant native species around your home, especially those used by local pollinators and birds, and use ornamental species that are not invasive. Ask your local nursery about native and noninvasive plants.
- Join volunteer efforts to plant native grasses, shrubs, and trees along the creek's banks.
- Learn about native plants and grasses through publications of the California Native Plant Society, the California Native Grasslands Association, or the Yolo County Resource Conservation District.
- Don't move weed seeds from one location to another.
- Join a weed warrior group in your local area to remove invasive species.
- Learn about invasive species. Many brochures are available through the California Invasive Plant Council with advice on which plants to use in your home landscaping.

What I'm interested in:

"Restoring the creek through cleanup projects, planting native trees and grasses, and expansion of the riparian corridor. I'd also like to work to expand the public's awareness of and access to the creek."

Jim Wellington, Putah Creek volunteer and Putah Creek Council Stewardship Team member

Young cleanup volunteer

Trash picked up from one site

The Agricultural Connection

We've come to realize over the last 25 years that habitat is hugely important, and farmers are doing more to reintroduce it on our farms.

Craig McNamara, farmer and founder of the Center for Land-Based Learning

It's fall again and time for the annual Coast and Creek Cleanup. Two high school boys push a large tire up the steep slope to the growing pile of tires waiting to be recycled. The landowner is there with his truck and winch to help remove some of the larger items left behind many generations ago. He is an essential partner in this effort, which will clean up both the creek and his property.

Twice a year, volunteers remove tons of trash from the creek, beautifying the environment in a larger effort involving local cities, resource partners like the Solano Resource Conservation District, and nonprofit groups like Putah Creek Council. Farm and ranch cleanup grants are available from the California Integrated Waste Management Board to help provide the equipment and muscle needed to assist volunteers with the really heavy lifting.

Early cleanups included removing old cars.

Coast and Creek Cleanup

The Coast and Creek Cleanup happens annually on the third Saturday of September throughout California, the nation, and the world. As volunteers along Putah Creek in Yolo and Solano Counties do their part to help rid the creek of unsightly trash, volunteers from as far away as Thailand are cleaning up their local waterways. Cleanup events are an easy way for families to become involved in creek activities. For more information on Putah Creek cleanups, see "Putah Creek Council" in the "Resources & References" section.

Creekside landowners are key restoration partners. Many are farmers who have begun implementing projects to help protect the creek and its resources. Growers are also partnering with local groups like the Yolo and Solano County Resource Conservation Districts and Audubon California's Landowner Stewardship Program to introduce sustainable and wildlife-friendly practices to their properties. Farmers are integral to the Yolo Bypass Wildlife Area, where rice fields provide food and habitat for waterfowl and grazing cattle are used to control vegetation so the bypass can provide flood protection, one of its primary functions. Agriculture also generates income used for the management of the Yolo Bypass Wildlife Area.

Wildlife-friendly farming such as hedgerows (rows of shrubs or trees that enclose or separate fields) provide habitat and food for pest-eating insects, reptiles, mammals, birds, and native pollinators. They also reduce erosion and act as buffers between fields and water bodies. Tailwater ponds collect excess water draining from cultivated fields, provide wildlife habitat, and filter sediment and harmful pollutants from irrigation water before it returns to the creek. Hedgerow Farms and the Farms on Putah Creek each provide local examples of wildlife-friendly farming. Native grass plantings, bee blocks, bat boxes, and cover crops are also wildlife friendly. Some farmers have placed conservation easements on their lands, ensuring that they will be used for conservation and agriculture in perpetuity.

The interface between agriculture and the riparian environment is important for many species. When this interface is considered, both farmers and the environment reap benefits.

Native pollinators

Since native bees are valuable crop pollinators, in some cases providing 100% of the pollination services required by a crop, the Xerces Society is partnering with Audubon California to educate growers about the value of native pollinators and to monitor pollinators in agricultural areas. Given recent declines in honeybee numbers, the role of native pollinators becomes even more important.

Educating Future Leaders

If we don't understand or care for what we have, we'll lose it.

Jeff Falyn, Nature's Theater program director, Stebbins Cold Canyon Reserve

The young student is absolutely focused, awestruck. Standing by Lake Solano, he is the first to see a black-tailed doe and her fawn just across the lake. Living in a city, he has never seen a large wild animal this close before. The entire class grows quiet as he points out the deer. As the deer take off and the class moves along the dirt path to their next station, the students excitedly notice wild turkey and deer tracks. This is a day that they will remember forever.

Environmental education and outdoor experiences help shape the lives of young people who may not have been exposed to wildlife and natural areas before. They often find a connection with nature that brings out a different side of their personality or reaches them in a new way. However, recent research shows that children—who are tomorrow's environmental decision makers—are spending less time outside. Over the past 20 years, visits to U.S. parks have declined by about 20%.

Yet environmental education is highly effective for more than just learning a collection of facts.

© Dave Feliz

© Dave Feliz

The California Department of Fish and Game's 16,000-acre Yolo Bypass Wildlife Area is continuously advancing ecosystem restoration and agricultural practices to benefit hundreds of species of birds, fish, and other wildlife.

According to the report *Environmental Science and Engineering for the 21st Century*, issued by the National Science Board of the National Science Foundation in 2000, environmental issues are "excellent vehicles" for gaining vital skills such as problem solving, communication, and critical thinking. The report states, "Changes should be made in the formal educational system to help all students, educators, and educational administrators learn about the environment, the economy, and social equity as they relate to all academic disciplines and their daily lives."

Many groups are dedicated to teaching future generations about protecting and enhancing their local natural resources. Environmental education opportunities for students in the communities near Putah Creek include:

- *Adopt-A-Flat and Junior Biomonitors:* Fourth graders take part in the Putah Creek Council's Adopt-A-Flat program to learn about native and invasive species. They seed and raise flats of native grasses while conducting experiments on growth or the influence of soil type. Fifth graders become junior biomonitors and learn about water quality and using benthic macroinvertebrates as indicator species.
- *Discover the Flyway*: This education outreach program of the Yolo Basin Foundation includes docent training, teacher workshops, and classroom field trips. The program focuses on hands-on, interactive learning experiences for K-12 students that introduce them to the wonders of wetlands at the Yolo Bypass Wildlife Area.
- *SLEWS and FARMS:* These two programs of the Center for Land-Based Learning involve high school students in hands-on activities. The FARMS Leadership Program cultivates a meaningful connection between students and their environment by introducing them to environmentally sound agricultural practices. SLEWS, Student and Landowner Education and Watershed Stewardship, engages high school students in habitat restoration projects that enhance classroom learning, develop students' leadership skills, and improve local ecosystems.
- *WaterWays:* Based at Lake Solano, this program serves students in Solano County who use Putah Creek water supplied by the Solano Project. Participants learn about their water source, water quality, and the many ways in which water is used by people and animals. The WaterWays program was created by the Putah Creek Discovery Corridor Cooperative.

In addition to school programs, there are many environmental education activities for families and adults. Activities include bat walks, speaker series, and guided hikes.

Education: What Can I Do?

Many of the educational programs along the creek depend on volunteers. Here is a partial list of roles you can take.

- Be a mentor with SLEWS.
- Be a trip leader for WaterWays or Putah Creek Council.
- Be a Yolo Basin Foundation education docent or public field trip leader.
- Be a guide with the Stebbins Guide Program.

Stebbins Guide Program

Stebbins Cold Canyon Reserve nature outings provide opportunities to explore the natural beauty and scientific importance of the reserve and surrounding ecosystems and to deepen participants' understanding of the interconnectedness of all things.

Most outings are interactive and experiential, allowing participants the freedom to explore and interpret for themselves. Trips range from kayaking to nature activities for kids, to nature drawing to full moon hikes. For more information, see "Stebbins Cold Canyon Reserve" in the "Resources & References" section.

Bringing It All Back Home

The dedication and effort of volunteers and landowners inspire us all to care about Putah Creek—the environment in our own backyards.

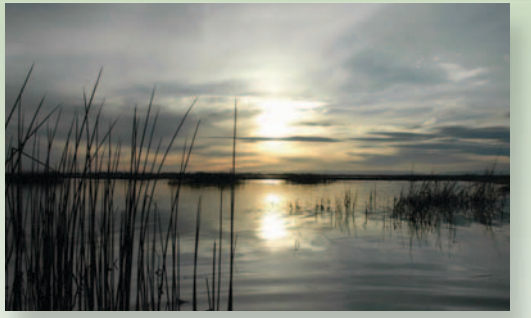
Dawn Calciano,
Executive Director, Putah Creek Council

Miles away from the creek, people are sitting in a room discussing the San Joaquin River. If we can bring salmon back to Putah Creek, they reason, we can bring them back to the San Joaquin. They've found funds and now they're laying out the details: where to find salmon, how to deconstruct dams. Putah Creek, on the verge of dying so recently, has not only found a new life, it has become a model for even larger watersheds.

The people living along the creek have always been dependent on it. But the creek depends on people too. Your help is essential in continuing to restore and enhance Putah Creek.

Lush riparian forest along Lower Putah Creek

As slender as Putah Creek is, the restoration and research done along the creek reaches far beyond the thread of the waterway itself. The creek is a refuge for fish and turtles that are rare elsewhere. It provides vital nesting places and food and shelter for birds that migrate throughout the western hemisphere. The court ruling that mandated environmental flows in the creek is a precedent for water law throughout the state. The cooperation and collaboration around the creek, and the lessons learned in our watershed, inspire people in other watersheds to restore their own. Do you



Yolo Bypass Wildlife Area at sunset

want to help save the planet? Working for the health of your own backyard is a great place to start.

There are many ways to become a steward of Putah Creek. First, get to know it. Explore it at one of the public access points on the map at the back of this book. Experience how rich the life around it is. Then volunteer with local restoration and cleanup projects, join a community science team, or learn more about the creek through one of the many educational programs. The little things you do every day to help the environment add up and can make a world of difference. Go out and get involved!

The escalating reverence on the part of our local community for this small, formerly degraded creek is intoxicating ... to the spirit.

Rob Thayer

Resources & References

Outreach, Recreation, and Restoration Contacts

Get involved! Your help is needed to continue the good work along Putah Creek and to improve your local environment. To become a steward of Putah Creek and other natural resources, contact the local nonprofits and outreach groups listed below.

Putah Creek and Local Nonprofit Resources

Putah Creek Council

Mission: To protect and enhance Putah Creek and its tributaries through education, advocacy, and community-based stewardship.

Activities: Restoration plantings, school programs, stream biomonitoring, cleanup events, weed control, speaker series, and an online guide to public access sites along Putah Creek.

Address: P.O. Box 743
Davis, CA 95617

Location: 5189 Putah Creek Road
Winters, CA 95694

Phone: (530) 795-3006

Web site: www.putahcreekcouncil.org

Center for Land-Based Learning and Farm on Putah Creek

Mission: To engage youth in learning experiences on the land that foster respect for the critical interplay of agriculture, nature, and society.

Activities: High school environmental education, tours, and a demonstration site for wildlife-friendly agricultural practices and riparian restoration. Visitors welcome by appointment.

Address: 5265 Putah Creek Road
Winters, CA 95694

Phone: (530) 795-1520

Web site: www.landbasedlearning.org

Tree Davis

Mission: To enhance our urban forest by teaching the people of our community to plant and care for trees.

Activities: Tree planting, young tree care, pruning, downtown Davis tree walk, and workshops.

Address: P.O. Box 72053
Davis CA 95617

Location: 203 F. Street
Davis CA 95616

Phone: (530) 758-7337

Web site: www.treedavis.org

Upper Putah Creek Stewardship

Mission: To provide long- and short-term watershed management strategies that include but are not limited to restoration of the watershed, fish and wildlife habitat improvement, watershed education and awareness programs, and cultural preservation of the diverse landowner population that resides in the watershed itself.

Activities: Presently involved in a comprehensive assessment of the watershed. Activities include workshops for public education, annual Creek Day for local fourth graders, Trout in the Classroom, bioassessment, hydrological modeling of watershed, Middletown Days, Earth Day, and other local art activities. Emphasis on engaging students in their classrooms.

Objective: To provide outreach and education to nurture good stewardship of our watershed.

Address: Box 27
Middletown, CA 95461

Phone: (707) 987-0663

Web site: Search web for "Upper Putah Creek Stewardship" for latest Web site address.

Yolo Audubon Society

Mission: To foster an appreciation of birds and other wildlife through educational programs and field trips, bring conservation issues to public awareness, and act to preserve Yolo County bird life and habitat.

Activities: Birdwatching and collaboration with local groups on conservation issues.

Address: P.O. Box 886
Davis, CA 95617

Phone: (530) 756-9531

Web site: www.yoloaudubon.org

Yolo Basin Foundation

Mission: Dedicated to the appreciation and stewardship of wetlands and wildlife through education and innovative partnerships.

Activities: School programs in the Yolo Wildlife Area, bat walks, wetland tours, and a speaker series.

Address: P.O. Box 943
Davis, CA 95618

Location: 45211 County Road 32B (Chiles Road)
Davis, CA 95618

Phone: (530) 757-3780

Web site: www.yolobasin.org

Other groups active along the creek include:

- Putah Creek Discovery Corridor Cooperative, a public-private stakeholder group promoting public outreach along the interdam reach.
- Winters Putah Creek Action Team, a group of Winters residents involved in local-action projects, including restoration and cleanup events.
- Winters Putah Creek Committee, an advisory committee to the Winters City Council on issues related to Putah Creek, especially the Winters Putah Creek Nature Park.

Restoration Resources

Lower Putah Creek Coordinating Committee

Address: P.O. Box 349
Elmira, CA 95625

Location: 6040 Vaca Station Road, Building 84
Elmira, CA 95625

Phone: (530) 902-1794

Web site: www.watershedportals.org/lpccc

Audubon California Landowner Stewardship Program

Audubon California acquired the 7,000 acre Bobcat Ranch in 2007 and provides guided hikes of the ranch. Near Putah Creek, the ranch contains portions of tributaries Enos Creek and Dry Creek.

Address: 5265 Putah Creek Road
Winters, CA 95694

Phone: (530) 795-2921

Web site: ca.audubon.org/lsp

Solano County Resource Conservation District

Address: 1170 N. Lincoln St., Suite 110
Dixon, CA 95620

Phone: (707) 678-1655 x 3

Web site: www.solanorcd.org

Yolo County Resource Conservation District

Address: 221 W. Court St., Suite 1
Woodland, CA 95695

Phone: (530) 662-2037

Web site: www.yolorcd.org

Monitoring Efforts

Putah Creek Council

Activities: Putah Creek Stream Biomonitoring Group surveys for stream benthic macroinvertebrates and the New Zealand mudsnail at least six times per year.

Contact: Please see information above under "Putah Creek and local Nonprofit Resources."

Yolo Audubon Society

Activities: Yolo County Breeding Bird Atlas to monitor bird populations and their breeding status.

Contact: Please see information above under "Putah Creek and local Nonprofit Resources."

UC Davis Museum of Wildlife and Fish Biology

Activities: Houses one of the most significant, modern collections of birds, mammals, and fish in California; provides information on status, trends, and ecological relationships of plants and wildlife in riparian areas of California and the West; operates Putah Creek Nestbox Trail, supporting research and conservation of riparian cavity-nesting birds.

Address: 1394 Academic Surge Bldg.
University of California, Davis
Davis, CA 95616

Phone: (530) 754-8813

Web site: mwfb.ucdavis.edu

Xerces Society

Activities: Pollinator conservation, aquatic invertebrates, endangered invertebrates, and butterfly conservation.

Address: 5265 Putah Creek Rd.
Winters, CA 95694

Phone: 530-510-0976

Web site: www.xerces.org

Recreation Programs

For information on how to get involved in recreation along Putah Creek at public access sites, please see the contacts below.

Stebbins Cold Canyon Guide Program

The guide program provides opportunities to explore the natural beauty and scientific importance of Stebbins Cold Canyon Reserve. Join the guides for a hike on topics ranging from natural history to plants to kids' exploration. Become a guide and receive training to share your love of nature with others.

Web site: nrs.ucdavis.edu/stebbins/guides/guides.htm

Yolohiker

The Yolohiker site provides descriptions of trails and hikes, dates for group outings such as the Capay Valley Hiking Club hikes or whitewater rafting trips, GPS files, maps, images of the region, and other information about the local area.

Web site: www.yolohiker.org

Public Access Sites

For more information on public access sites and recreational opportunities along Putah Creek, please see the *Exploring Putah Creek* guide (cited in References, pg. 100), or go to the Putah Creek Council Web site (www.putahcreekcouncil.org) and view the online interactive Putah Creek Guide. See the map on the inside back cover of this book to get started.

Native and Invasive Plant Information

California Invasive Plant Council

The California Invasive Plant Council's mission is to protect California wildlands from invasive plants through restoration, research, and education.

Address: 1442-A Walnut St. #462
Berkeley, CA 94709

Phone: (510) 843-3902

Web site: www.cal-ipc.org

California Native Plant Society

The California Native Plant Society's mission is to increase understanding and appreciation of California's native plants and to conserve them and their natural habitats through education, science, advocacy, horticulture, and land stewardship.

Address: 2707 K Street, Suite 1
Sacramento, CA 95816-5113

Phone: (916) 447-2677

Web site: www.cnps.org

California Native Grasslands Association

Mission: Promote, preserve, and restore the diversity of California's native grasses and grassland ecosystems through education, advocacy, research, and stewardship.

Address: PO Box 72405
Davis, CA 95617

Phone: 530-759-8458

Web site: www.cnga.org/index.php

References

Many sources were consulted in the writing of this book. Those below represent good resources for the general reader. The California Natural History Guides, published by University of California Press, are too numerous to list, but they are excellent resources for learning about all aspects of California natural history.

Alt, David, and Donald W. Hyndman. 2000. *Roadside Geology of Northern and Central California.* Mountain Press. Missoula, Montana.

Anderson, M. Kat. 2005. *Tending the Wild.* University of California Press. Berkeley, California.

Bakker, Elna. 1985. *An Island Called California.* Second Edition. University of California Press. Berkeley, California.

Boyer, Amy J., Jan Groggans, Daniel Leroy, David Robertson, and Rob Thayer (eds). 2001. *Putah and Cache: A Thinking Mammal's Guide to the Bioregion.* bioregion.ucdavis.edu/book/contents.html. 2001.

Bossard, Carla C., John M. Randall, and Marc C. Hoshovsky, (eds.) 2000. *Invasive Plants of California's Wildlands.* University of California Press. Berkeley, California.

Brice, Ann (No date). *Exploring Putah Creek from Monticello Dam to the Yolo Wildlife Area.* Putah Creek Council. Davis, California.

EDAW. 2005. *Lower Putah Creek Watershed Management Action Plan.* Phase 1: Resource Assessments and Map Volume. Sacramento, California.

EDAW. 2008. *Lower Putah Creek Watershed Management Action Plan,* Proposed Projects. Sacramento, California.

Larkey, Joanne, and Shipley Waters. 1987. *Yolo County: Land of Changing Patterns.* Windsor Publications. Northridge, California.

Greene, Correigh and Mikaela Huntzinger (eds). 2001. *The Natural History of Stebbins Cold Canyon Reserve.* University of California Natural Reserve System. Oakland, California.

Louv, Richard. 2006. *Last Child in the Woods: Saving Our Children from Nature Deficit Disorder.* Algonquin Books. Chapel Hill, NC

Kelley, Robert. 1989. *Battling the Inland Sea: American Political Culture, Public Policy, and the Sacramento Valley, 1850-1986.* University of California Press. Berkeley, California.

Kemper, John. 1996. *Discovering Yolo County Wildlife.* Yolo Audubon Society and Yolo Basin Foundation. Davis, California.

McPhee, John. 1993. *Assembling California.* The Noonday Press, Farrar, Strauss and Giroux. New York, New York.

Madison, Mike. 2004. *Walking the Flatlands: The Rural Landscape of the Lower Sacramento Valley.* Heyday Books. Berkeley, California.

Moyle, Peter B. 2002. *Inland Fishes of California.* Revised and expanded. University of California Press. Berkeley, California.

Schoenherr, Allan A. 1995. *A Natural History of California.* University of California Press. Berkeley, California.

Smith, Jo, and Peter J. Hayes, (eds). 2006. *The Outdoor World of the Sacramento Region: A Local Field Guide.* Revised and expanded edition. The American River Natural History Association. Sacramento, California.

Stevens, Michelle L., and Andrea Ryan. 1997. *Healing the Land, Healing the People: A Guidebook to the Ethnobotany of the Putah and Cache Creek Eco-region.* University of California. Davis, California.

Thayer, Robert L. 2003. *LifePlace: Bioregional Thought and Practice.* University of California Press. Berkeley, California.

University of California, Davis Natural Reserve System. 2004. *Natural History of the Quail Ridge Reserve.* Davis, California.

Vaught, David J. 2007. *After the Gold Rush.* Johns Hopkins University Press. Baltimore, Maryland.

Glossary of Species

The species listed below are mentioned in this guidebook and currently or historically known to occur along Putah Creek

*** indicates nonnative species**

PLANTS

Arroyo willow *Salix lasiolepis*
Arundo* *Arundo donax*
Barbara's sedge *Carex barbarae*
Black walnut *Juglans californica* ssp. *hindsii*
Blue elderberry *Sambucus mexicana*
Blue oak *Quercus douglasii*
Blue wild rye *Elymus glaucus*
Box elder *Acer negundo*
Brodiaeas *Brodiaea* spp.
Buttonbush *Cephalanthus occidentalis*
California blackberry *Rubus ursinus*
California rose *Rosa californica*
California wild grape *Vitis californica*
Coast live oak *Quercus agrifolia*
Coyote bush *Baccharis pilularis*
Creeping wildrye *Leymus triticoides*
Dutchman's pipe *Aristolochia californica*

Prickly milk thistle

Manzanita

© Lorrie Jo Williams

Western tiger swallowtail

© Dave Feliz

Dragonfly

Eucalyptus* *Eucalyptus* spp.
Foothill pine *Pinus sabiniana*
Fremont cottonwood *Populus fremontii*
Goodding's black willow *Salix gooddingii*
Himalayan blackberry* *Rubus discolor*
Interior live oak *Quercus wislizenii*
Lady's thumb* *Polygonum persicaria*
Manzanita *Arctostaphylos* spp.
Narrow leaf cattail *Typha angustifolia*
Parrot's feather/water milfoil* *Myriophyllum* sp.
Poison oak *Toxicodendron diversilobum*
Prickly milk thistle* *Silybum marianum*
Purple needlegrass *Nassella pulchra*
Redbud *Cercis occidentalis*
Red willow *Salix laevigata*
Rushes *Juncus* spp.
Sandbar willow *Salix exigua*
Sedges *Carex* spp.
Soap plant *Chlorogalum pomeridianum*
Shining willow *Salix lucida* ssp. *lasiandra*
Tamarisk* *Tamarisk* spp.
Tule *Scirpus acutus*
Valley oak *Quercus lobata*
Water hyacinth* *Eichhornia crassipes*
Water primrose *Ludwigia peploides*
Western sycamore *Platanus racemosa*
White alder *Alnus rhombifolia*
Wild grape *Vitis californica*
Wild oats* *Avena* spp.
Yellow starthistle* *Centaurea solstitialis*

INVERTEBRATES

Aquatic moths *Paragyractis* spp.
California velvety tree ant *Liometopum occidentale*
Carabid beetles *Carabidae* family
Damselfly *Odonata zygoptera suborder*
Dragonfly *Odonata epiprocta suborder*
Ground spiders *Lycosidae* family
Honeybee* *Apis mellifera*
New Zealand mudsnail* *Potamopyrgus antipodarum*

Northern crayfish* *Orconectes virilis*
Orb-weaving spiders *Argiope* spp.
Pipevine swallowtail butterfly *Battus philenor*
Red crayfish* *Procambarus clarki*
Signal crayfish* *Pascifasticus leniusculus*
Springtail *Entomobryidae* family
Tarantula *Aphonopelma* sp.
Western tiger swallowtail butterfly *Papilio rutulus*
Valley carpenter bee *Xylocopa varipuncta*
Valley elderberry longhorn beetle *Desmocerus californicus dimorphus*

FISH

Bluegill* *Lepomis macrochirus*
California roach *Lavinia symmetricus*
Channel catfish* *Ictalurus punctatus*
Chinook salmon *Oncorhynchus tshawytscha*
Common carp* *Cyprinus carpio*
Crappie* *Pomoxis* sp.
Fathead minnow* *Pimephales promelas*
Largemouth bass* *Micropterus salmoides*
Pacific lamprey *Lampetra tridentata*
Prickly sculpin *Cottus asper*
Rainbow trout *Oncorhynchus mykiss*
Red shiner* *Cyprinella lutrensis*
Riffle sculpin *Cottus gulosus*
Sacramento perch *Archoplites interruptus*
Sacramento sucker *Catostomus occidentalis*
Sacramento tule perch *Hysterocarpus traski traski*
Smallmouth bass* *Micropterus dolomieui*
Speckled dace *Rhinichthys osculus*
Steelhead *Oncorhynchus mykiss*
Sturgeon *Acipenser* sp.
Thicktail chub *Gila crassicauda*
Threespine stickleback *Gasterosteus aculeatus*

© Bradford Norman

Threespine stickleback

AMPHIBIANS AND REPTILES

Bullfrog* *Rana catesbeiana*
California kingsnake *Lampropeltis getula californiae*
California red-legged frog *Rana aurora draytonii*
Foothill yellow-legged frog *Rana boylii*

Giant gartersnake *Thamnophis gigas*
Gopher snake *Pituophis catenifer*
Slender salamander *Batrachoseps attenuatus*
Valley gartersnake *Thamnophis sirtalis fitchi*
Western fence lizard *Sceloporus occidentalis*
Western pond turtle *Emys marmorata*
Western rattlesnake *Crotalus viridis*
Western yellow-bellied racer *Coluber constrictor mormon*

BIRDS

Acorn woodpecker *Melanerpes formicivorus*
American kestrel *Falco sparverius*
Ash-throated flycatcher *Myiarchus cinarescens*
Bald eagle *Haliaeetus leucocephalus*
Barn owl *Tyto alba*
Belted kingfisher *Ceryle alcyon*
Bewick's wren *Thryomanes bewickii*
Brown-headed cowbird* *Molothrus ater*
Bullock's oriole *Icterus bullockii*
Burrowing owl *Athene cunicularia*
Bushtit *Psaltriparus minimus*
California quail *Callipepla californica*
Cliff swallow *Hirundo pyrrhonota*
Common merganser *Mergus merganser*
Cooper's hawk *Accipiter cooperii*
Downy woodpecker *Picoides pubescens*
European starling* *Sturnus vulgaris*
Great horned owl *Bubo virginianus*
Merlin *Falco columbarius*
Northern harrier *Circus cyaneus*
Northern pygmy owl *Glaucidium gnoma*
Oak titmouse *Baeolophus inornatus*
Osprey *Pandion haliaetus*
Peregrine falcon *Falco peregrinus*
Prairie falcon *Falco mexicanus*
Red-shouldered hawk *Buteo lineatus*
Red-tailed hawk *Buteo jamaicensis*
Sharp-shinned hawk *Accipiter striatus*
Short-eared owl *Asio flammeus*
Swainson's hawk *Buteo swainsoni*

Western fence lizard

American kestrel

Townsend's warbler *Dendroica townsendi*
Turkey vulture *Cathartes aura*
Tree swallow *Tachycineta bicolor*
Western bluebird *Sialia mexicana*
Western screech owl *Otus kennicottii*
Western scrub jay *Aphelocoma californica*
Western tanager *Piranga ludoviciana*
White-tailed kite *Elanus leucurus*
White-breasted nuthatch *Sitta carolinensis*
Wild turkey *Meleagris gallopavo*
Wood duck *Aix sponsa*
Yellow warbler *Dendroica petechia*
Yellow-billed cuckoo *Coccyzus americanus*
Yellow-billed magpie *Pica nuttalli*
Yellow-breasted chat *Icteria virens*
Yellow-headed blackbird *Xanthocephalus xanthocephalus*

Cliff swallow

MAMMALS

Beaver *Castor canadensis*
Black rat* *Rattus rattus*
Black-tailed deer *Odocoileus hemonius*
California ground squirrel *Spermophilis beecheyi*
Coyote *Canis latrans*
Dusky-footed woodrat *Neotoma fuscipes*
European house mouse* *Mus musculus*
Grey fox *Urocyon argenteus*
Grizzly bear *Ursus arctos*
Mink *Mustela vison*
Mountain lion *Puma concolor*
Muskrat* *Ondatra zibethicus*
Pronghorn *Antilocapra americana*
Raccoon *Procyon lotor*
Red fox *Vulpes vulpes*
River otter *Lontra canadensis*
Tule elk *Cervus elaphus*
Western grey squirrel *Sciurus griseus*
Western red bat *Lasiurus xanthinus*

Bewick's wren

Yellow-billed magpie

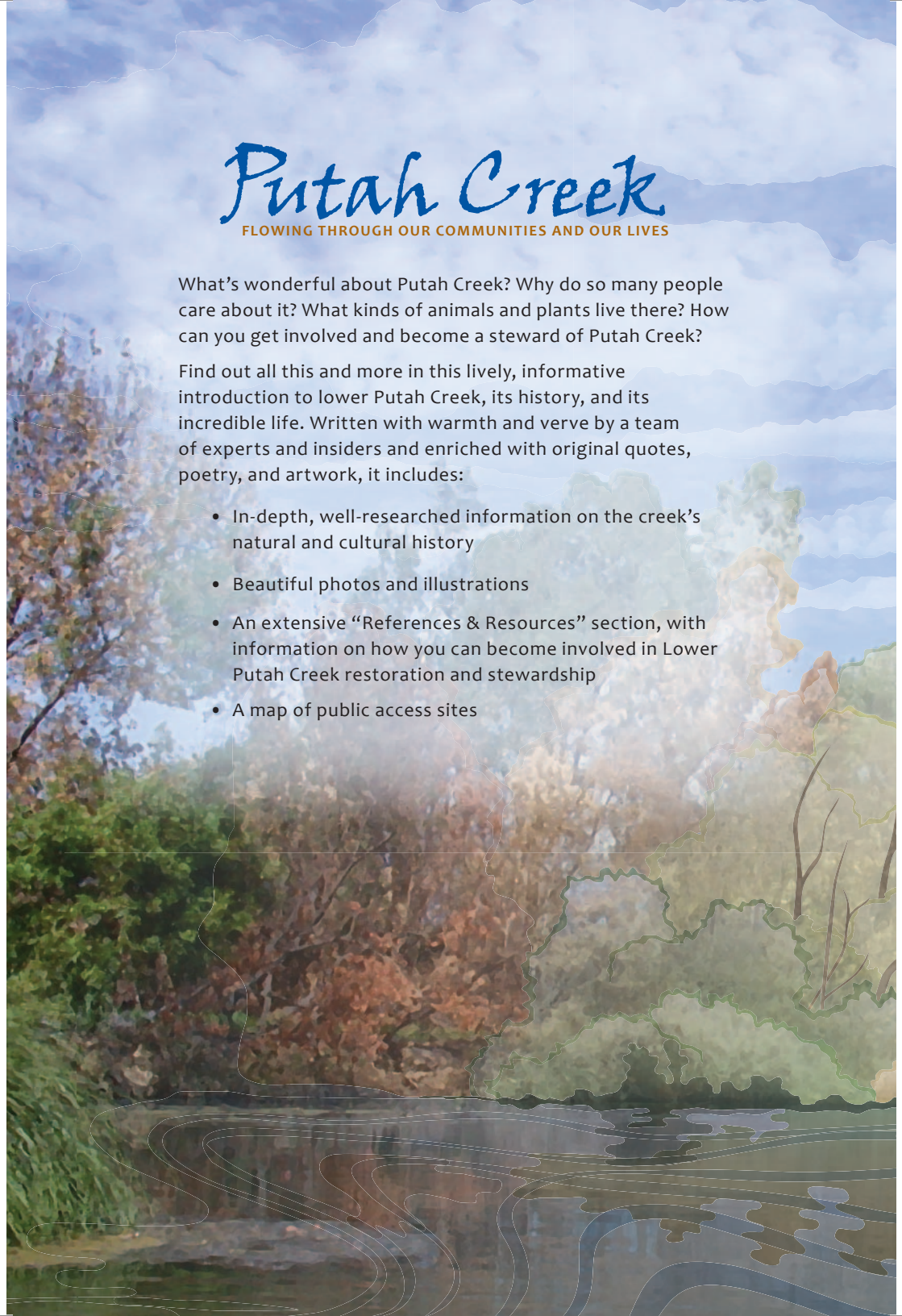
Putah Creek Public Access & Recreation Opportunities

Most of the land next to Putah Creek is privately owned. Please be respectful and do not trespass on private property. As indicated on this map, there are many opportunities on public lands for access to the creek and other natural areas in the watershed. Call ahead or check online for hours of operation and seasonal closures.

- Motorized Boating
- Nonmotorized Boating
- Hunting
- Fishing
- Swimming
- Hiking
- Wildlife Viewing
- Environmental Education
- Camping
- Picnicking
- Restrooms

Public Access / Recreation Opportunities

1. LAKE BERRYESSA RECREATION AREA
2. STEBBINS COLD CANYON NATURAL RESERVE
3. PUTAH CREEK WILDLIFE AREA
4. PUTAH CREEK FISHING ACCESS SITES
5. LAKE SOLANO COUNTY PARK
6. CITY OF WINTERS PUTAH CREEK PARK
7. PUTAH CREEK RIPARIAN RESERVE
8. YOLO COUNTY GRASSLANDS REGIONAL PARK
9. PUTAH CREEK SOUTH FORK RIPARIAN RESERVE
10. YOLO BYPASS WILDLIFE AREA



Putah Creek

FLOWING THROUGH OUR COMMUNITIES AND OUR LIVES

What's wonderful about Putah Creek? Why do so many people care about it? What kinds of animals and plants live there? How can you get involved and become a steward of Putah Creek?

Find out all this and more in this lively, informative introduction to lower Putah Creek, its history, and its incredible life. Written with warmth and verve by a team of experts and insiders and enriched with original quotes, poetry, and artwork, it includes:

- In-depth, well-researched information on the creek's natural and cultural history
- Beautiful photos and illustrations
- An extensive "References & Resources" section, with information on how you can become involved in Lower Putah Creek restoration and stewardship
- A map of public access sites