San Francisco Estuary Partnership

ESTUARY NEWS

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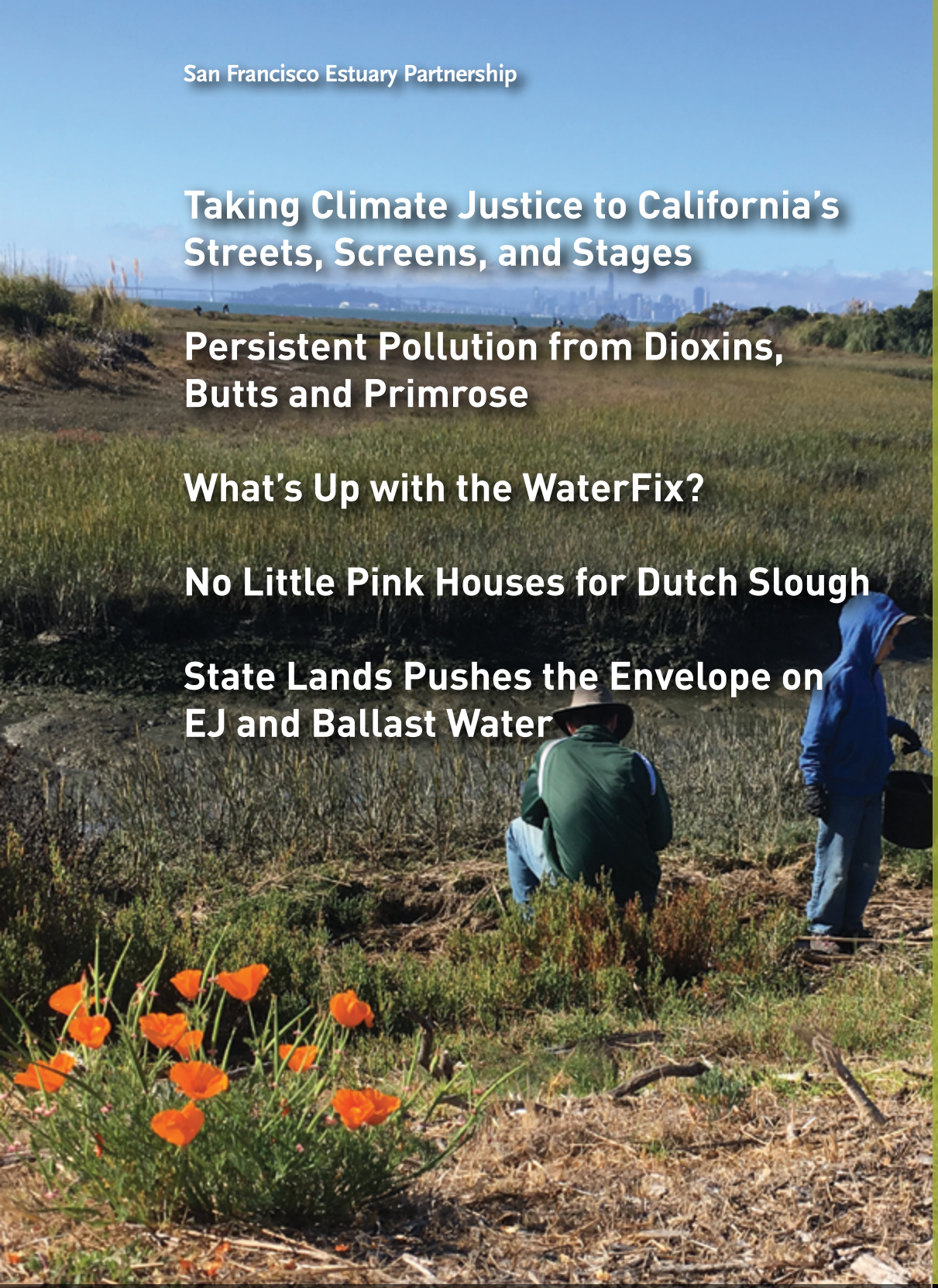

Taking Climate Justice to California's Streets, Screens, and Stages

Persistent Pollution from Dioxins, Butts and Primrose

What's Up with the WaterFix?

No Little Pink Houses for Dutch Slough

State Lands Pushes the Envelope on EJ and Ballast Water

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SEPTEMBER 2018
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MONITORING

Dioxins Sticking Around

Angling from boats or Bay shorelines remains a popular pastime, and even a source of subsistence. Yet as the "Fish SMART" signs at local piers warn, the tissues of fish reeled in from San Francisco Bay waters can contain mercury or PCBs – legacy contaminants that just aren't going away despite decades of restoration, runoff control, and improvements in wastewater treatment. Now scientists are reminding us that a third contaminant of concern to human health continues to turn up in Bay-caught fish: dioxins.

A new report prepared by staff from the San Francisco Estuary Institute (SFEI) and the San Francisco Regional Water Quality Control Board confirms that potentially harmful dioxins are still dropping out of the air and into Bay waters, and ending up in both fish and in the estuarine food chain. Although cores suggest concentrations have declined in sediments relative to their peaks in the last few decades, levels in biota have not declined as much.

Dioxins, carcinogenic and highly toxic compounds, are a byproduct of combustion and some chemical manufacturing processes. They can be released to the air in high concentrations from incinerators and smelters. Because few such sources remain in Northern California, smaller, more dispersed sources like vehicle tailpipes, chimneys, and yard fires represent the bulk of regional emissions — at levels that are still problematic, the report's authors conclude. Forest fires like those of the last two summers add to the burden, as do global background concentrations generated from sources much farther afield.

"Basically any burning process can potentially produce dioxins," says lead author Don Yee, an environmental scientist with SFEI. "That includes diesel engines and even gasoline burning. If you get enough of those, even if it's not individually large sources, it adds up."

Levels in Bay Area air are low to moderate, Yee says, cleansed by sea breezes that push particles inland — but dioxins don't just stay in the atmosphere. They also drift down to land to collect in soils, sediments, and, eventually, the fatty tissues of animals. According to the World Health Organization (WHO), more than 90 percent of human exposure is through food — mainly meat and dairy products, fish, and shellfish. High levels of dioxin exposure can cause reproductive and developmental problems, damage the immune system, interfere with hormones, and cause cancer, the organization says.

Locally, dioxins — and indeed most environmental pollutants — that build up on soils and surfaces can eventually be carried to the Bay by runoff. They may also deposit directly on the water's surface. Either way, once the long-lived compounds reach the Bay, they may sink and be absorbed by sediment where they can persist for decades, or enter the food web and accumulate in the bodies of fish like shiner surfperch and white croaker. Both species feed on other fish and aquatic animals in shoreline areas and shallows (close to the places where pollutants from surrounding watersheds enter the Bay) and are thus more likely to be contaminated, as well as to be caught and consumed.

The Bay's Regional Monitoring Program (RMP) — which unites regulators, storm- and wastewater dischargers, dredgers, and others in the common goal of assessing and improving the Bay's health — has conducted regular surveys of dioxin concentrations in fish since 1994. From then through the most recent test in 2014, the new report details, all 37 shiner surfperch samples and 79 of 81 white croaker samples analyzed contained dioxins at levels considered unsafe to eat

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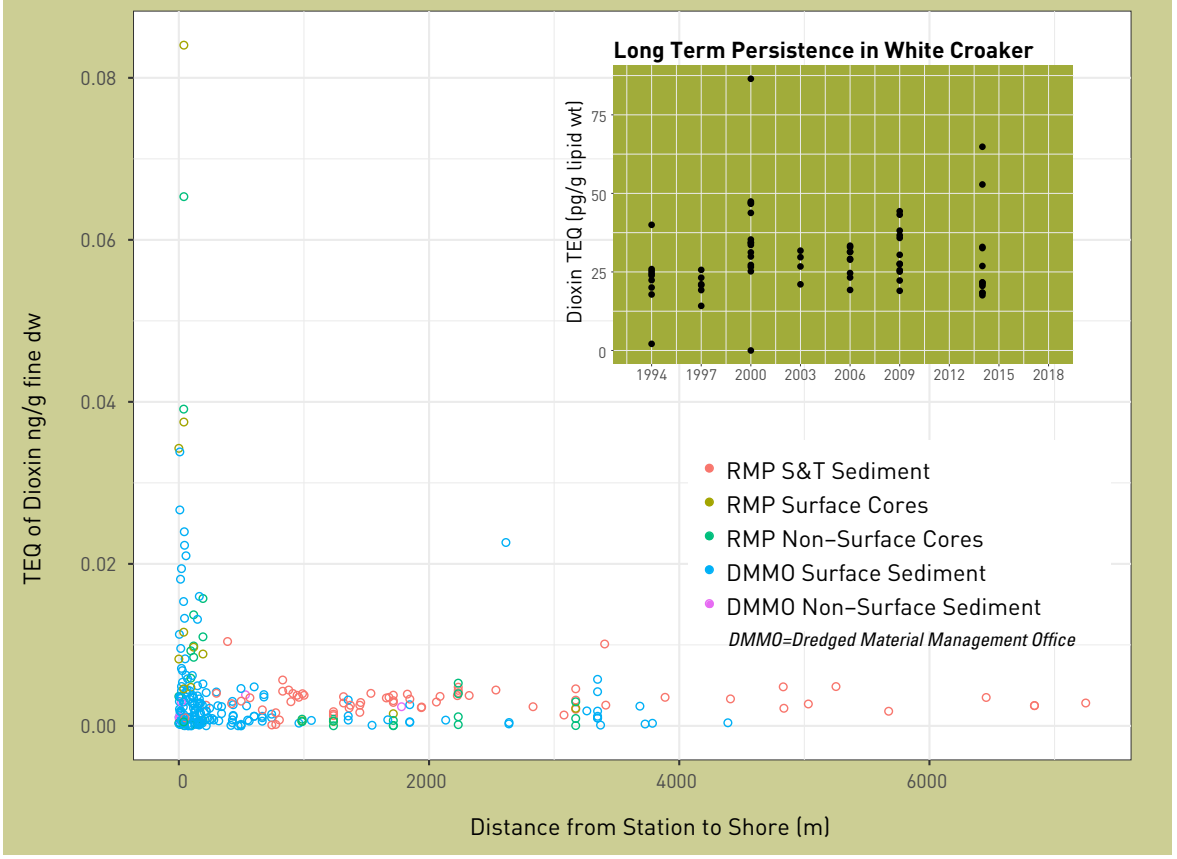
HIGHER CONCENTRATIONS IN NEARSHORE SEDIMENT



TRASH

Unfiltered Stream of Butts

For the environmental advocacy group Surfrider, a plan to curb the littering of cigarette butts began with energetic optimism. It was 1992, and at the time, cigarette filters were the single most frequently occurring item found in most beach cleanups – a statistic the organization hoped to erase.

However, the Hold-On-To-Your-Butt campaign has dragged on and on. Even as the 23rd annual California Coast Clean Up Day on September 15, 2018 calculates its successes – in terms of tons of trash removed from the state's shores — on the butt end it continues as a humbling exercise in futility.

"Cigarette butts are still the number-one item that we find," says Shelly Ericksen, the director of the San Francisco chapter of Surfrider's campaign. "It's pretty clear we haven't made a recognizable dent in the numbers."

In the Bay Area alone, smokers are estimated to litter three billion used filters every year, and no amount of research, campaigning, legislation and education can stifle this waste stream. There is hardly a city block or a beach, anywhere, that isn't strewn with cigarette butts. Public roadways are lined with billions. Hikers find them on trails. Birds use them to build nests. Animals eat them.

Mobilized by water, wind and gravity, many or most eventually wind up in streams and storm drains and, eventually, the ocean, where it's probable they are having a variety of negative impacts that scientists are trying to understand. Laboratory research has shown that cigarette butts – generally made of a type of plastic called cellulose acetate and laced with chemicals – are acutely toxic. A study published in 2011 in the journal *Tobacco Control* showed that a single butt in a liter of water can lethally poison a fish.

How littered cigarette butts affect wildlife, however, is still unclear. Rebecca Sutton, a senior scientist with the San Francisco Estuary Institute, is collaborating with scientist Chelsea Rochman at the University of Toronto to better understand the impacts that plastic microfibers – including those that come from cigarette filters – have on aquatic ecosystems. So far, their research has found that San Francisco Bay water contains anywhere from two to ten times as many microplastic particles as water samples from Chesapeake Bay. Sutton also says she has found clear evidence that northern anchovy and topsmelt – two key prey species in California – caught in bay waters are consuming anthropogenic microfibers.

"We know cigarette butts contain toxic chemicals, and because they break down in the environment, they probably cause both physical and chemical problems when animals ingest the plastic fibers," Sutton says. "What we don't yet know is what level of concentrations in the environment is harming animals."

Thomas Novotny, a San Diego State University professor of epidemiology and biostatistics, is widely recognized as a leader in tobacco waste research. He collaborated on the *Tobacco Control* paper describing the toxicity of cigarette butts in a laboratory setting. He says it is safe to assume, based on scientific logic and the sheer chemical danger of cigarettes, that they pose a toxic threat to fish and other wildlife in wild ecosystems.

"The precautionary principle says that even without specific data or proof of a health hazard, you can assume contamination is happening because of the fact that you have toxic chemicals coming out of cigarette butts and entering our water," he says.

Novotny adds that, "even if the toxicity isn't an issue, the plastic fibers never completely go away."

Butt can at San Francisco's Ocean Beach. Photo: Surfrider

While scientists investigate how discarded butts affect wild ecosystems, the scale of the problem grows, and grows, and grows. Globally, smokers burn through some six trillion cigarettes each year, according to widely cited figures, and it is estimated that most of them – somewhere between 500,000 and a million tons of cigarette filters – are discarded into the environment annually. Even as the issue of marine plastic pollution draws high-profile attention from media and activism, cigarette butt litter remains one of the last socially accepted forms of illegal polluting.

Anti-littering campaigners are grappling with how to change this, but they are making little progress. To their great dismay, legislation that would have outright banned single-use cigarette filters in California – essentially solving the problem – was rejected in May. That legislation – Assembly Bill 2308 – was promoted both on the grounds that filters provide no protection to smokers, according to research, and that they pose an environmental hazard. The state Assembly voted it down 10 to 5 on May 2, 2018.

"That was extremely disappointing," says Miriam Gordon, the San Francisco-based California policy advocate for the anti-waste organization Upstream. Gordon's organization promotes strategies to reduce the use of disposable and nonbiodegradable packaging and products, currently ubiquitous in most societies.

"Eliminating the filter would have been the solution, but until we raise more awareness among legislators and their constituents of the false health promise of the filter and of the tremendous marine impacts of littering cigarette filters, banning the things is not going to happen," Gordon says.

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PEARLS PREVIEW

Cool Clips from the Bay-Delta Science Conference

WATCH FOR THE NEXT ISSUE OF PEARLS

- Rising tides don't just make waves lap higher; they also cause underground water tables to rise, sometimes miles inland from the Bay. Two recent studies try to gauge how much, where, and when. Bottom line: low-lying cities have time to prepare for a soggier future—but only if they start right now. **JH**
- Forget the philosophers' tree in the forest. If a levee crumbles in the Delta, even with no one there to see it, hydrologists watching tidal action will know it is gone. Prompted by evidence from Liberty Island and the Jones Tract, John DeGeorge of RMA Inc. examined the probable regional tidal effects of 19 potential island breaches, planned or otherwise. **JH**
- A magic number in Delta water affairs is X2, the distance upstream from the Golden Gate at which salinity declines to a level good for young fish and other creatures. With sea level rise, will X2 move inland? And, asks Noah Knowles of the USGS, "how much additional water might we need to release" to keep the salinity sweet spot where current rules require it to be in the spring? **JH**
- Spring-run Chinook are dwindling fast but there's still hope, says Rachel Johnson of the National Oceanic and Atmospheric Administration. "There might be some genetic capacity to assist with restoration," she explains, citing evidence of hidden diversity in these federally-listed salmon. **RM**
- The time is right for a "big, kind of crazy, but maybe doable" idea, says Letitia Grenier of the San Francisco Estuary Institute. She envisions a new way of boosting ecosystem services: a Bay Area-wide plan to restore natural processes — not "just" natural habitats — in our highly altered landscape. **RM**
- Scientists with the United States Department of Agriculture are looking for better ways of controlling invasive water hyacinth. Along with applying herbicides and physically pulling the pesky weeds, managers are increasingly turning to mother nature: non-native weevils, moths, and planthoppers that evolved with the water hyacinth and — researchers hope — won't eat beneficial plants or harm Delta fish. **NS**
- The practice of carefully designing natural gradients along the Bay's edge for habitat and flood protection is the new normal. Out are seawalls and traditional levees and in are low-slope horizontal levees. With enough space, sediment, and shells, these approaches and others like them are primed to moved from pilot to common practice. **NS**

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Trouble is, that seems to be the only real solution. Education, for instance, doesn't seem to be working. Research shows that most smokers litter their butts even though they know they shouldn't. In a paper published in 2012 in the International Journal of Environmental Research and Public Health, the authors reported that 72 percent of 1,000 surveyed smokers admitted knowing that cigarettes are toxic, and 86 percent said they believe them to be litter. Still, 74.1 percent of smokers admitted to having tossed a cigarette butt to the ground or from a car at least once.

Back end of a San Francisco park clean up. Photo: Surfrider.

Placement of disposal bins at littering hot spots is making a nominal difference, at best. Surfrider has reported that the 40 "buttcans" it has helped install in San Francisco keep about 120,000 butts out of the environment each year – relatively insignificant given the billions littered annually in the Bay Area. Ericksen says they tend to make a difference in littering rates only in their immediate vicinity – on the scale of yards. In the scenic Marin Headlands, cigarette butts are routinely discarded just feet from cigarette butt disposal cans – "smoke stacks," as the park service calls them – placed at popular vista points.

Anti-littering laws are not curbing the problem, either, since police officers and park rangers almost everywhere pretty much ignore the matter. Between 2011 and 2015, for one example, the City of Berkeley issued citations for illegal cigarette butt disposal just 27 times.

Since significantly reducing the littering may be an impossible goal, methods are being explored to screen cigarette butts out of waterways. Around the Bay Area, thousands of trash capture devices have been installed in storm drains since 2009 by the order of the San Francisco Bay Regional Water Quality Control Board. Chris Sommers, a private consultant in Oakland who specializes in storm-water and wastewater management, says the devices are designed to catch all debris with a diameter of five millimeters or more.

"That dimension was specifically designed to not allow cigarette butts through," he says.

The devices work, too. Cigarette butts are often found in them, Sommers says, and very rough calculations suggest the screens are preventing several million of the toxic stubs from entering San Francisco Bay each year.

These capture devices (effective but expensive to install everywhere), and other actions that can slow the mass migration of cigarette butts into the environment, are considered to be "downstream" solutions, but Gordon, at Upstream, thinks they aren't up to the sheer scope of the problem. Law enforcement, she says,"is never going to take up cigarette litter as a priority." She also points out that "cigarette butts don't only get into the marine environment through storm drains, so that doesn't solve the problem."

"My organization is called 'Upstream' because we believe in solving marine debris and pollution problems at the source," Gordon says. "With cigarette butts, we are looking at the best way to eliminate them at the source, and the only real solution is to eliminate the filter." **AB**

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Unhealthy Fiber in Bay Diet,
ESTUARY News, December 2015
www.sfestuary.org/estuary-news-unhealthy-fiber/

Tobacco Control
www.ncbi.nlm.nih.gov/pmc/articles/PMC3088407/

International Journal of Environmental Research and Public Health
www.ncbi.nlm.nih.gov/pmc/articles/PMC3397372/

ENGINEERING

What's Up With WaterFix?

The spring and summer of 2018 saw frenzied activity around California WaterFix, the latest iteration of a decades-long, on-again-off-again effort to convey fresh water from the Sacramento River to the South Delta export pumps while bypassing the Delta itself. Governor Jerry Brown has made WaterFix a top priority, but as his administration heads into its final months, the project—one of the largest infrastructure projects in state history—still faces a raft of uncertainties.

"Going back to the 60s, the Department of Fish and Game advised various administrations that the State Water Project had to include a conveyance around the Delta so that the prevailing flow patterns would be more natural," says the State Water Resources Control Board's Steve Moore. Currently, pumping from the state and federal pumps at Clifton Court Forebay draws water into a north-to-south flow pattern, rather than following the historic natural, largely east-west, drainage from the Sierra to the sea.

In its most recent incarnation, WaterFix—sometimes referred to as the "twin tunnels"— consists of two large, 35-mile tunnels that would divert water from Sacramento River and carry it under the Delta to the pumps. Proponents say this will protect endangered fish, including salmon and Delta smelt, by reducing the unnatural flows that pull young fish into the pumps, and will also improve water supply reliability in the face of climate change, earthquake, and potential levee failure.

Critics counter that the proposed operation of the new intakes—which have a total capacity of 9,000 cubic feet per second—could potentially capture too much of the freshwater flows entering the Delta, to the detriment of both wildlife and Delta water users. They also worry that the benefits to fish may be nowhere near what has been promised. "This will reduce the use of the pumps by 50 percent, which is a step in the right direction, but it's leaving us with potential reverse flows in the North Delta, which we've never had before," says Friends of the San Francisco Estuary's Darcie Luce.

During the summer, the State Water Resources Control Board continued hearings on a critical element of WaterFix, the Department of Water Resources' petition to add a point of diversion on the Sacramento River north of the Delta (the southern intakes would remain operational). In July, the Board also released its final environmental document for Phase 1 of its long-delayed update to the Water Quality Control Plan for the Bay and Delta, addressing flows from the San Joaquin River and its tributaries, as well as a framework for Phase 2, which will cover the Sacramento River. To many, the plans seem incompatible with WaterFix.

The framework for Phase 2 calls for an increase in Sacramento River and Delta outflow, particularly during the winter and spring months, to restore a more natural flow regime and assist salmon, Delta smelt and other endangered species. "There is a disconnect," says Natural Resources Defense Council's Doug Obegi. "WaterFix is proposing to reduce Delta outflows during the winter and spring months, and the Board is saying we need to increase outflows during this same time period."

WaterFix and the water plan updates have been proceeding along parallel tracks for a decade, says

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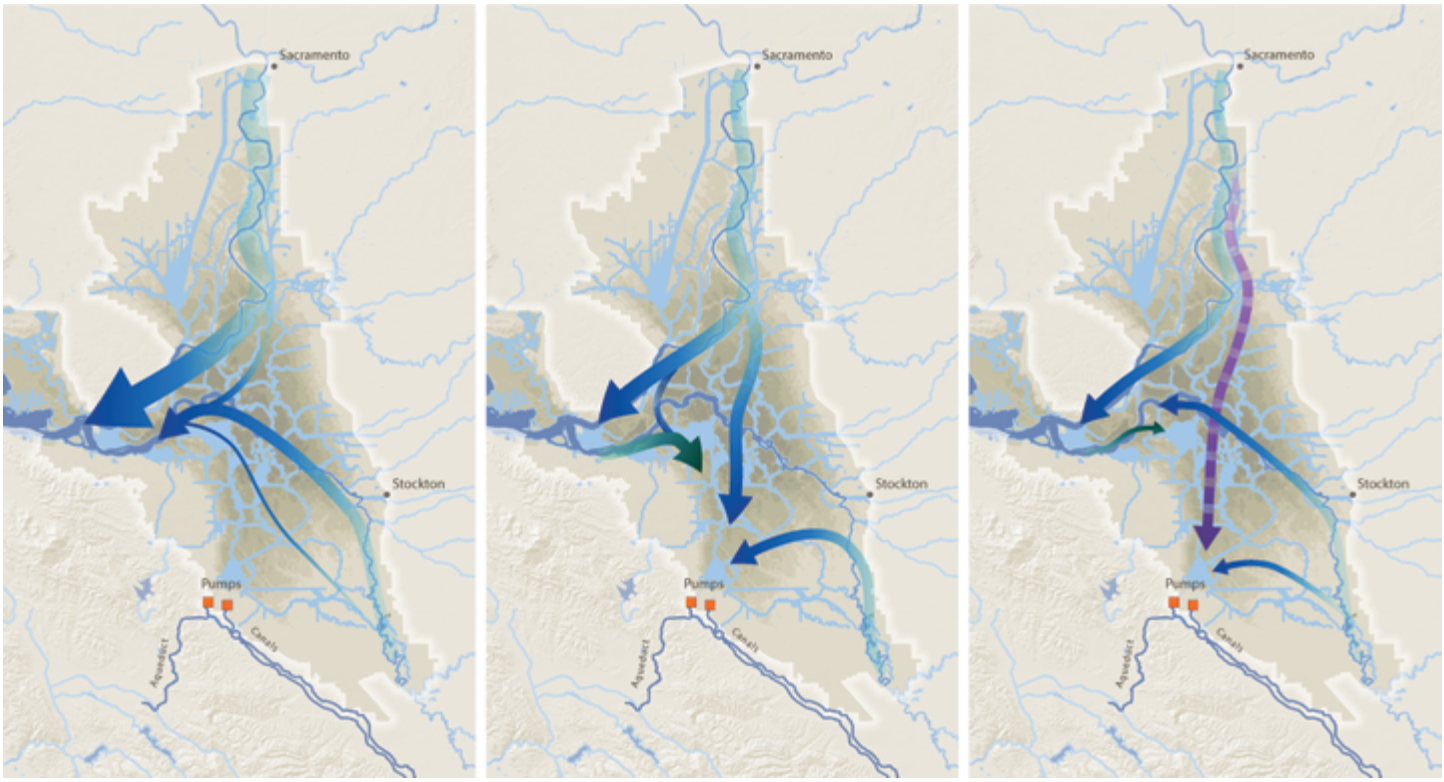


These maps provide a very generalized picture (not for planning or scientific purposes) of 1) flow patterns in absence of pumping, (2) flow patterns when river inflows are low and pumps are operating and (3) flow patterns with tunnels operating under similar conditions as map 2. (Patterns may look different under a variety of conditions). Maps: Amber Manfree

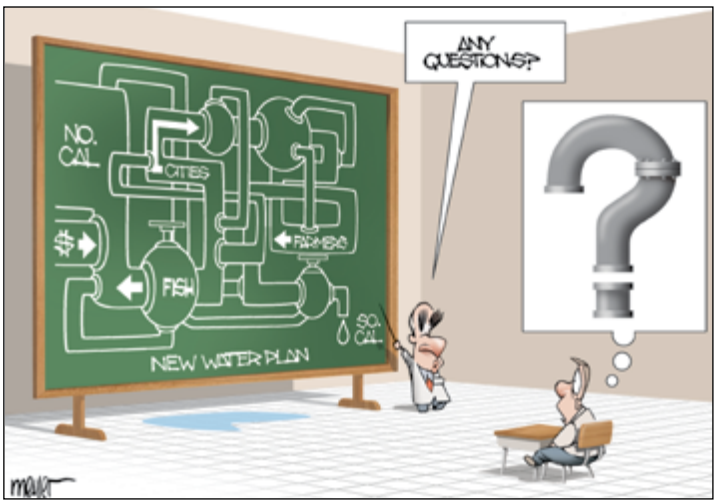
Obegi, and the Board has repeatedly emphasized that the updates should be completed before WaterFix was approved. "But that's not what has happened. So the expectation is that the Board will have to impose conditions on Waterfix that will increase outflow and reduce water supply. For a project that already doesn't pencil out for many of its supposed proponents, it seems to exacerbate the economic problems with WaterFix."

In addition to new flow objectives from the State Board, the U.S. Fish and Wildlife Service and the National Marine Fisheries Service have reinitiated consultation under the Endangered Species Act for Delta smelt, Chinook salmon, Central Valley steelhead and green sturgeon, which could also "produce requirements that are not consistent with what the WaterFix plan describes as the operations of this facility," says The Bay Institute's Jon Rosenfield. "Again it's a cart before the horse sort of thing—if you approve and rally all the money together to build a new diversion and start putting it in the ground, and then overarching regulations indicate that you can't operate it the way you thought, then the people who invested money might be disappointed in the results that they get."

The regulatory uncertainty seems to have spooked some potential WaterFix funders, including Westlands Water District, which decided not to invest in it. Nevertheless, Metropolitan Water District of Southern California has gone all in on the project, committing to provide almost 65% of the project's roughly $17 billion budget. MWD is also a key participant in a new joint powers authority, the Delta Conveyance Design and Construction Authority, which was formed in May to oversee the project.

MWD Assistant General Manager Roger Patterson notes that some of the agency's board members did express concerns about regulatory uncertainties. The range of possibilities didn't change MWD's mind about the fix, however.

"We looked at our projections with and without the project and then let them ride on top of whatever regulatory scheme there may be," he says. "Our overall conclusion was that if the State Board required significantly more Delta outflow, the benefit of the project might be a little bit less but not radically less, and we took that into account when we made our decision to invest in the project."



Cartoon by Tom Meyer/meyertoons.com

WaterFix is designed to make the most of big winter storms in a way that won't interfere with flow objectives, says Patterson. "The project mostly just captures really, really big storm flows that produce way more outflow than what the regulations would require. During those events you can divert full capacity at the Delta and hardly notice it at all in the effect on outflow."

"The idea that WaterFix will take more water out of the Delta is a common misconception," says the State Board's Steve Moore. "I don't think that there is automatically a conflict between changing the point of diversion and increased Delta outflows." Moore notes that the Board has held roughly 100 days of hearings on changes to the points of diversion, as well as nine days of hearings on the proposed San Joaquin basin flow objectives. "All of that robust process and public discussion should give folks some assurance that these two items are closely coordinated," he says.

Beyond the activity at the State Board, in July DWR filed a Determination of Consistency with the Delta Stewardship Council, avowing that WaterFix comports with the Delta Plan. That set off a number of appeals from environmental groups and Delta water users, including the East Bay Municipal Water District, the City of Stockton, as well as agricultural water users north of the Delta. A hearing on the appeals is scheduled for October 24.

On another front, on September 11 the Joint Legislative Budget Committee held a hearing on a 50-year extension of the state water contracts, an essential step to selling bonds to pay for WaterFix, and one which, under the water code, could have ended legislative oversight of it. Critics had lobbied hard for a delay in the hearing, arguing that it was premature, since contract amendments between the water contractors for California WaterFix were not complete, and since a detailed public financial plan for the project, and cost-benefit analysis for two tunnels, had yet to be developed. However, at the hearing DWR pledged that the extensions would not be used to advance bond purchases and that the agency would return to the legislature with a financial plan for WaterFix. Critics are somewhat mollified by the promise, as it seems to assure continued legislative oversight of the project. "You don't always get what you want, but sometimes you get something useful," says Restore the Delta's Barbara Barrigan-Parrilla, "The ball is still in play."

A common thread in the criticism of the WaterFix is that it seems to be a 20th century approach to 21st century conditions, says Luce. "Maybe it's not the best way to use the money, maybe a better way would be 21st century solutions like advanced purified water treatment, distributed water reuse, or any number of what might be locally and regionally more relevant solutions than transporting water." **CHT**

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In a Q & A with Lester Snow in ESTUARY's June 1995 issue, the CALFED director noted in relation to ongoing Delta decisions and water wars: "This is probably our last chance to redefine how we, and even the whole country, should deal with resource management in the next century.... There's no resilience left in the system." Celebrating 25 years of the magazine and the CCMP/Estuary Blueprint.

Simple Isn't the Answer for Salmon

Salmon once flourished in California despite huge swings in climate — from mega-droughts to massive floods — that were far more extreme than those today. But then people re-engineered the state's waterways to meet their own needs. More than 150 years of dams, diversions and flood control have chipped away at the intrinsic resilience of salmon, and most populations statewide are now gone or on the brink of disappearing.

"Complexity is what salmon thrive on, and we've been making their habitat simpler and simpler," says Bruce Herbold, a former Environmental Protection Agency biologist focusing on fish in the Sacramento-San Joaquin Estuary. "We haven't been playing to their strengths."

Even so, a turnaround may still be within reach. In 2015, Herbold joined forces with salmon experts from universities, nonprofits, and state and federal agencies at a workshop held at UC Davis. Called the California Salmon and Climate Variability Symposium, the workshop's goal was to translate the latest science into management. The team presents their vision for boosting salmon resilience in the latest issue of *San Francisco Estuary and Watershed Science.*

Takeaways include that habitat diversity is key to restoring salmon, and that prospects for restoring Central Valley wetlands to benefit fish are surprisingly high. In support of their message that varied habitats are vital to salmon, the team points to spring-run Chinook. These fish are currently listed under the federal Endangered Species Act but were plentiful enough historically to be the mainstay of California's commercial salmon fishery.

Today spring-run Chinook are essentially confined to low-elevation streams and levee-lined rivers. But they once spawned in cold streams high in the mountains and were reared in a mix of waterways and wetlands. Some of the young fish grew in streams and rivers, while others grew in floodplains, where they stayed longer and got fatter before migrating from fresh to salt water.

By yielding fry that ranged from small to large and that reached the ocean at different times, habitat diversity helped buffer salmon from environmental stresses. "California's weather changes a lot from year to year," Herbold says. "That means what was good in the ocean, on the spawning grounds, or in the rivers last year may not be good this year." Diversifying salmon habitat to protect against the vagaries of the climate, he explains, is much like diversifying a financial portfolio to protect against the vagaries of the stock market.

One of the biggest limitations for Central Valley salmon is lack of rearing habitat, says Rene Henery, California science director for Trout Unlimited and one of Herbold's co-authors. Of the nearly three million acres of Central Valley floodplains that historically served as salmon nurseries, only about 190,000 acres remain.

While that sounds grim, there is hope. "It's not like it's permanently lost — we can get it back," Henery says. He and his colleagues estimate that more than a third of the Central Valley floodplains still exist as wetlands in some form, and so have the potential to nurture young salmon once again. The idea is to restore the benefits of a combination of rice fields, wildlife refuges, and seasonal wetlands totaling more than one million acres.

"There's no question about salmon being recoverable in California, but there's a huge question over whether we will take the necessary steps before we lose them," Henery says, adding that diverse stakehold-

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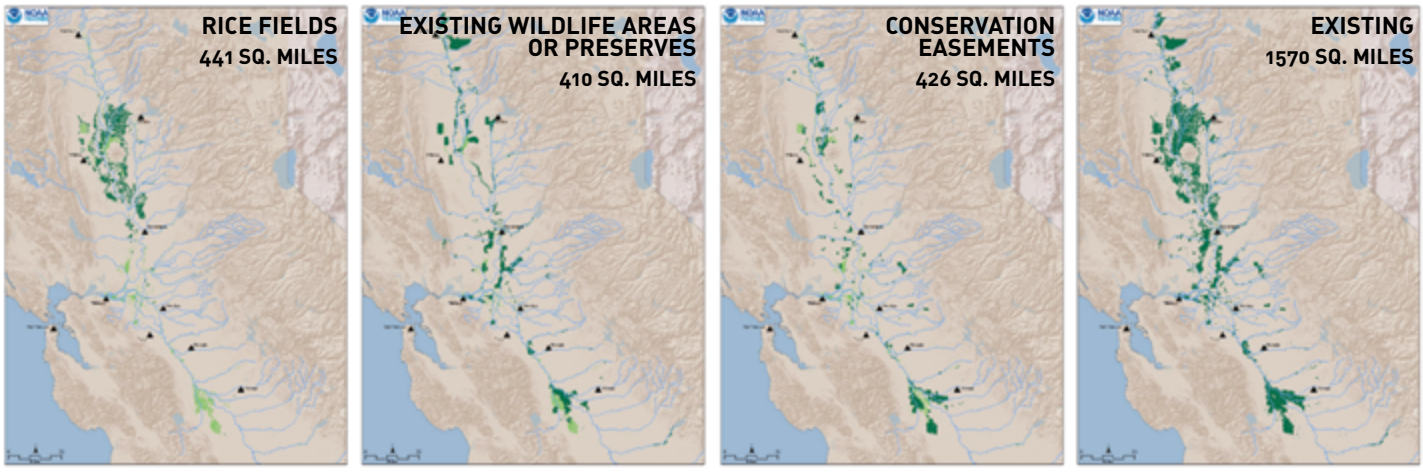
OPPORTUNITIES FOR HABITAT RESTORATION



Opportunities for recovery of Central Valley wetland and floodplain habitat extent and function through the reoperation of seasonally inundated landscapes to provide habitat benefits. Source: SFEWS 2018

ers have recently united in the Central Valley Salmon Habitat Partnership, an effort to hasten the pace and scale of projects critical to salmon recovery. "Instead of everyone fighting over water all the time, it's going to require all of us coming together with a common vision."

Is this vision realistic? "That's the $64 million dollar question," says Paul Buttner, manager of environmental affairs for the California Rice Commission. If anyone can do it, though, he can.

Biologist holds fall-run Chinook reintroduced to San Joaquin River.

Buttner coordinates voluntary programs that pay rice farmers to flood their fields for waterbirds migrating along the Pacific Flyway. Funded primarily by the US Department of Agriculture's Natural Resources Conservation Service (NRCS), these programs have cost some $24 million since 2011. California has roughly a half million acres of rice, and up to one quarter of them have been enrolled in bird habitat programs in a given year. "Everyone has seen what rice has done on the bird side and that's the model we're following for salmon," he says.

The best bet for salmon is rice fields in flood control bypasses, which are still connected to waterways rather than separated by levees. "Once birds fledge they can go wherever they want, but fish have it much harder because they don't have wings," he notes. "Fish require unimpeded access to the river so they can just swim out on their own."

Pilot projects show that salmon can be raised in winter-flooded rice fields in the Yolo Bypass, which is near Sacramento. However, Buttner says rice farmers need to know a lot more before embracing the practice widely. Unknowns include whether the project will scale up, whether rearing in rice fields instead of rivers actually translates to more salmon making it to the ocean and returning to freshwater, and whether rice fields can be managed for both birds and fish.

Buttner hopes to answer these questions in collaboration with Andrew Rypel, a fish ecologist at UC Davis. They propose a two-year project that entails raising half a million hatchery salmon a year in winter-flooded rice fields. They also want to radio-tag about 1,000 young salmon a year, half from the rice fields and half from the Sacramento River, to track their comparative survival out the Golden Gate and into the ocean.

The biggest need for moving the project forward is a commitment from the California Department of Fish and Wildlife to supply that many hatchery salmon fry. Funding for the project is largely ready to go. Buttner puts the cost at up to $1.5 million and has already lined up $600,000 from NRCS and another $750,000 in donor matching funds. "There are a lot of moving parts," he says.

The same is true more broadly of salmon needs in California. And making the various parts work for — instead of against — salmon will help strengthen their resilience to climate change-driven stresses both on land and at sea. "It's not like we're scrambling trying to figure out what to do," Henery says. "We know what to do." **RM**

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OFF SHORE

Burgeoning Blob

From 2013 to 2015, a mass of abnormally warm water dubbed "the Blob" pushed temperatures off the Pacific Coast some 2.5°C higher than normal. Stretching from California to southeastern Alaska, the strangely balmy conditions attracted warm-water species, drove auklets to starvation, fueled algal blooms, and confused migrating salmon.

According to new research, such marine heat waves are getting hotter, wider, and more frequent. If global warming isn't kept to a bare minimum, the researchers report in the journal *Nature*, toxic algal blooms, mass coral bleaching, and other effects could cause irreversible changes to marine ecosystems around the world.

In the study, Thomas Frölicher and Swiss colleagues used reports of sea surface temperature as far back as 1861 and modern satellite observations to identify past heat waves and develop computer models. They then used the models to project marine heat wave occurrences over the next century.

The models indicate that in pre-industrial times, marine heat waves typically lasted on average about a week and a half and increased water temperatures by less than half a degree Celsius. Since then, the scientists find, marine heat waves have become considerably more frequent. Between 1986 and 2016, the number of days that a heat wave affected any ocean waters doubled. And human activities already appear responsible for nearly 90 percent of events.

Yet if the world continues to get toastier, the future of the oceans looks even more dire. If humans can limit warming to a conservative 1.5 degrees Celsius, the scientists estimate the number of heat wave days will increase by about 16x. That number skyrockets to an unthinkable 42x if countries stick to current policies headed for 3.5°C warming. Equally frightening is the extent of the 3.5-degree scenario, which will increase the ocean area affected by marine heat waves by an average of 21x. The hardest hit waters will be in the tropics and the Arctic, though no ocean basins will be spared. **KMW**

LEGISLATION

Bitter Taste Lingers in San Joaquin Groundwater Struggles

A trip through the San Joaquin Valley on Highway 99 travels south of Fresno to the city of Tulare, named for the nearby, now-dry lake, and into the surrounding rural communities. These sprawling, non-incorporated settlements are often small, ranging from two hundred to a few thousand inhabitants comprised of predominantly low-income communities of color.

The pastoral rows of stone fruit orchards and earthy scent of dairy farms belie a less wholesome reality. The majority of those who call the area their home do so without what many consider a basic human right: Access to clean, safe drinking water.

While the status-quo of driving miles into town for potable water and teaching children to shower with their mouths closed has lasted for the better part of the last century, recent California legislation has opened the door for local activists to begin the process of connecting well-dependent communities with existing public water infrastructure sometimes a scant few miles away.

Assembly Bill 685, passed in 2012, declared that "it is the established policy of the state that every human being has the right to safe, clean, affordable, and accessible water adequate for human consumption, cooking, and sanitary purposes."

While AB 685 didn't set any specific projects in motion, community activists like Kelsey Hinton, Communications Manager for Community Water Center, see it as an essential first step. "There's not really anything there about how to achieve the human right for all Californians," she says, "but it's a powerful tool for future legislation to reach that goal." At the close of the 2018 California congressional session, community partners came to Sacramento to advocate for three new bills leveraging AB 685.

On August 30th, the penultimate day of the 2018 congressional session, Phoebe Seaton stands in the capitol rotunda with a clipboard and addresses a group of advocates from the San Joaquin and Coachella Valleys. They all wear aqua blue t-shirts with white text reading "Thirsty for Justice." Seaton, Co-Director of the Leadership Counsel for Justice and Accountability, gives news on the current standing of Assembly Bill 2501. While there are more yes votes than no, they currently sit one vote short of passing the senate. Seaton seems confident that one of the did-not-votes could be persuaded to cast a vote before the end of the session, sending the Bill to the assembly and ultimately the governor's desk.

AB 2501, Seaton explains, "makes sure the state's consolidation authority can order a city or a special district to extend clean drinking water services to people in domestic dwellings." California State Assembly Member Kansen Chu, author of the bill, says it was "decades in the making," and "while small, required immense coordination." Opposition to the bill seems centered on the balance between local and state control, with some assembly members voting against the interests of their constituents for the sake of maintaining local authority in areas with a strong provincial heritage.

Among the advocates present with Seaton is Hugo Trujillo, from Matheny Tract in Tulare County. Trujillo, who has been coming to Sacramento for years to push for clean water access, has since seen the results of legislative success in his own home. "Our water was poisoned with arsenic," says Trujillo. "Our children couldn't eat the local vegetables." Arsenic and nitrates toxic for human consumption enter the groundwater via agricultural runoff. Matheny Tract, despite its proximity to the city of Tulare, operated a two-well system that had provided contaminated water for years, if not decades, according to a UC Davis report published in February 2018. Under Senate Bill 88, which allowed the California Water Board to step in when realistic, Matheny Tract was consolidated with Tulare in 2016.

San Joaquin Valley community activists traveled to Sacramento during the last week of August to bring the reality of unsafe water to our legislators. Photo: CWC

continued on page 19

RESTORATION

Ambitious Experiment for Dutch Slough

Development agreements were already in place for three parcels of land around Dutch Slough when John Cain first visited the area in the spring of 1999. Cain, then working for the Natural Heritage Institute, had brought his young family out to the west Delta to hike the Marsh Creek Trail. Walking along a levee, he had a vision for the slough that inspired a long-term commitment. "It was clear as day to me that removing the levee would be a great way to restore freshwater wetlands at the mouth of Marsh Creek," says Cain, now with American Rivers.

Almost two decades after Cain's epiphany, earthmoving equipment is now preparing 1,178 acres of former agricultural land for conversion to marsh habitat. In the much-subsided Delta, restoration opportunities are few and far between; but in this area east of Big Break near Oakley, alluvial deposits from the creek had kept elevations relatively high, with average subsidence in the intertidal range. After years of slow progress – involving land acquisition, planning, and permitting – Dutch Slough is a go.

Leveed and drained in mid-to-late 1800s, the three tracts comprising the Dutch Slough site, the Emerson, Gilbert, and Burroughs parcels, have long histories as agricultural land. Silas Emerson settled there during the Gold Rush; into the 2000s his great-great-nephew Stan Emerson was still running the last dairy farm in Contra Costa County. Developers had an eye on the land, and in 1989 the area was zoned as residential in the county general plan.

When Cain first followed-up on his vision, he found that the three land-owning families were working with the newly incorporated city of Oakley on a 4,500-home development, with agreements already in place for all three parcels; some city leaders also envisioned a marina and hotel complex. Cain contacted Stan Emerson and his wife Katie, and explained that the CALFED Bay-Delta Program had prioritized tidal marsh restoration and would be able to pay market price for the land.

Around Labor Day of 2001, Emerson told Oakley's mayor about a pending application to sell the land for restoration. The irate mayor scheduled an emergency council meeting to quash the project, but it was postponed after the attack on the World Trade Center. On the evening of the rescheduled meeting, Cain revisited the Marsh Creek Trail, brooding about the project coming unraveled as he watched a lightning storm over Mount Diablo. Rain began to fall as he rushed to the meeting at a high school gym. It began with the usual formalities, then: "As soon as the mayor started to speak, there was a "Kaboom!" and the lights went out."

The lighting strike required another postponement. That gave Cain and his allies, including the California Coastal Conservancy, the Conservation Fund, and the local Sierra Club chapter, time to rally support. With a full house of restoration advocates, the city council approved the project by a 3-2 vote. The ensuing settlement included a 55-acre community park and regional trail access for the city.

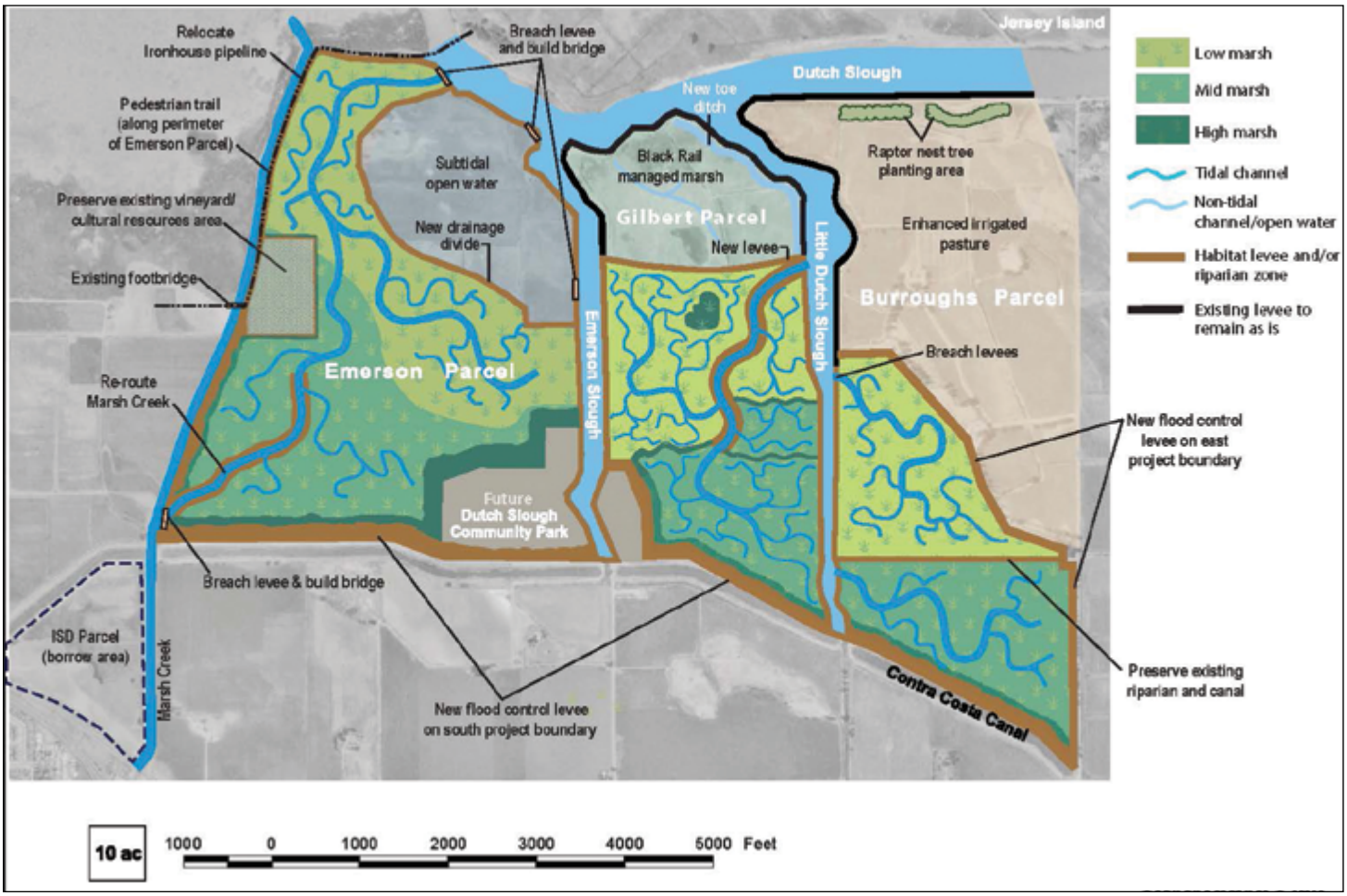
With funding from the state's Ecosystem Restoration Program and the Conservancy, the Department of Water Resources (DWR) bought the three parcels for $28 million. The Dutch Slough project – which encompasses a diversity of restoration approaches on different parts of the site — is designed to be a living experiment in adaptive management to inform future Delta restoration efforts. After the groundbreaking in early 2018, it will only be a few years until a levee is breached, creating a new delta for Marsh Creek and a mix of seasonal, riparian, and tidal wetlands.

Project manager Patricia Finfrock has been with DWR since 1994, working on water quality and endangered species issues. Dutch Slough will be her last job before retirement. "It's a biologist's dream come true to actually do habitat restoration," she says. DWR brought in Philip Williams & Associates, now Environmental Science Associates (ESA), as consultants. ESA's Michelle Orr, who became involved in 2003 and worked on the planning phase, says Dutch Slough's size alone makes it significant: "It 's the first large planned restoration to be implemented in the Delta."

Compared to San Francisco Bay projects she's worked on, Dutch Slough will rely more on hands-on intervention and less on natural processes. "In the Bay, estuarine sedimentation can often be relied on to raise subsided areas over time to elevations where [marsh plants can grow,]" she explains. But differences in sediment supply and freshwater

Swainson's hawk Photo Rick Lewis.

Moving dirt around on the Dutch Slough restoration site Photo Christina Sloop.



depositional processes in the Delta call for more intervention. "If restoration in the Bay is evolutionary, in the Delta it's creationist," she says.

On site, that means massive grading. Crews are moving a million and a half cubic yards of material within the project site to create a marsh plain and riparian channel margin, which will then be planted with native vegetation. Once the plants get established, crews will breach the levee and reroute Marsh Creek.

"The project was designed to test different approaches to wetland restoration," Orr explains. For inspiration, the ESA engineers and others on the design team looked at 10 reference sites in the Delta, including unplanned breaches where tidal marsh came back. Their resulting design is an experiment which tests a diversity of marsh elevations and channel structures. Some channels will be shallower to serve as rearing habitat for native freshwater fish, "keeping them out of deeper water where the predators are," says Orr. "Restoration objectives come first, but the experiments are complementary."

At 560 acres, tidal marsh will be the biggest piece of a landscape mosaic, with other habitats to meet the needs of sensitive species: a managed freshwater marsh for California black rails and giant garter snakes, trees and grassland left in place for Swainson's hawks, riparian corridors. Part of the Emerson parcel was considered for restoring dune plant communities, but this was scaled back. "The acreage is so small and management, including weeding, would have to be so intensive," says Finfrock. However, there's a pilot project growing endemic plants from seed collected at Antioch Dunes.

The original plan called for removal of a 14-acre unirrigated vineyard on the Emerson parcel, where a Basque or Madeiran (stories vary) farmer named Joaquin José had planted Carignane grapes in the late 1800s. In response to a save-the-vineyard campaign and other considerations, only six-tenths of an acre will be taken out; the remainder will be leased to a private operator.

Grading and planting will be phased, beginning with the Emerson and Gilbert parcels. Work on the easternmost Burroughs parcel is on hold pending clarification of development and flood protection plans for the adjacent, privately owned Hotchkiss tract.

The pieces are coming together, though. "It was John Cain's vision," says ESA's Ann Borgonovo, involved with the implementation phase. "I remember talking to him at the site almost 20 years ago. We're all super excited for it finally to be happening."

Cain applauds DWR for "the institutional capacity and staying power to stick with the project and drive it to completion." Orr says of Finfrock: "She had the energy that pulled the project until it was all the way there."

For Finfrock, it's been a "lesson in patience," but with a "fantastic" outcome. **JE**

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ESTUARY first covered Dutch Slough in December 2001, quoting Cain: "If we don't do something quickly, it's going to be covered in little pink houses." Celebrating 25 years of the magazine and the CCMP/Estuary Blueprint.

CLIMATE

State Law Fires Up Adaptation Action

"We are seeing events we have never seen before," said California Natural Resources Secretary John Laird to the over 750 attendees of the California Adaptation Forum on August 28th. Inside the cavernous ballroom of the Sheraton Grand in downtown Sacramento, Laird ticked off to the audience the evidence that climate change is present in California: wildfires burning faster and hotter, rainfall five hundred percent above normal, and longer lasting Central Valley heatwaves. "[Climate change] is happening, we're experiencing it, and we're in the middle of it right now," concluded Laird. "What we've seen is frightening, but we can't allow ourselves to be paralyzed."

Far from paralyzed, many of the scientists, planners, and community organizers were at the three-day conference to take action. Dana Murray, a voluble new environmental sustainability manager for the southern California city of Manhattan Beach, was there to learn more about tools and resources for the city's sea level rise vulnerability assessment she is spearheading. Philip Gibbons, a program manager at the Port of San Diego, came to learn about decision-making under uncertainty. Christina Snider, the tribal advisor to Governor Brown's office, spoke on a panel to represent the voices and needs of native Californian tribal members in climate adaptation.

"I find events like this a good learning opportunity to hear what other people are doing, and pick up some new best practices to infuse into our work," said attendee Bryn Lindblad, the associate director of Climate Resolve in Los Angeles. "A couple of years ago, climate adaptation was much more science-focused. There's still that focus, but I've been very inspired by some of the practices at this conference that put people at the center of climate adaptation."

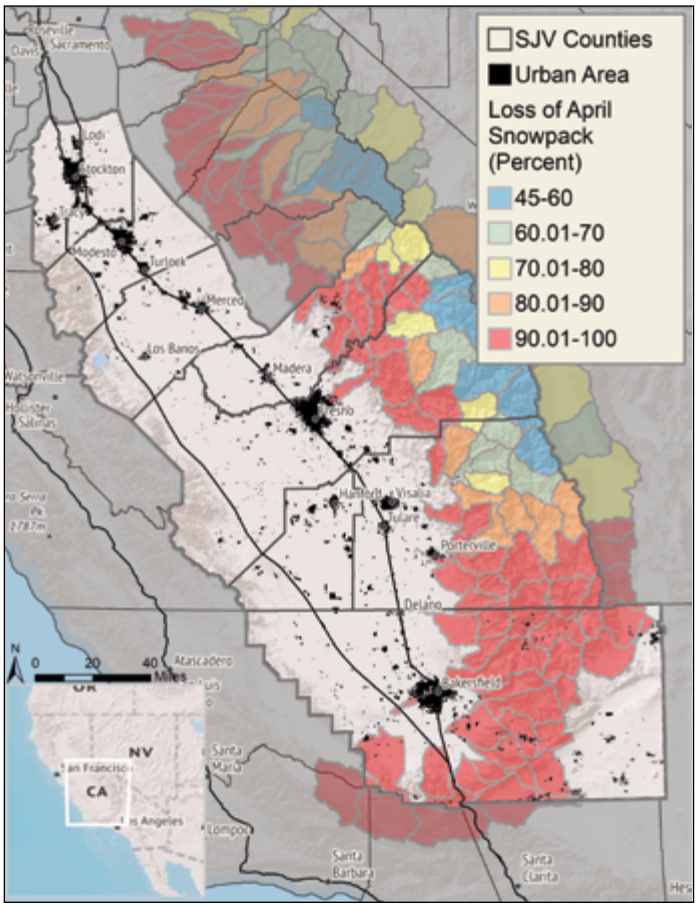
The presentations ranged from wonky to practical, from session topics on the minutiae of how to codify climate adaptation into local government, to financing natural infrastructure, to restorative climate resilience for communities. Participants assiduously took notes and earnestly discussed climate impacts and solutions as they shuffled between 75 distinct sessions amidst the climate-conditioned Sheraton ballrooms, while Sacramento sweltered outside. "It's like trying to drink out of a fire-hose," commented one attendee on the dizzying amount of sessions and information.

The forum's first day coincided with the release of California's fourth climate assessment, a statewide report summarizing the best available science on what Californians can expect in the state's future climate. In a nine-person panel, academics ranging from UC Riverside to UC Berkeley discussed findings for California's nine regions and for the state overall – such as how future wildfires will burn 77% more area than today, how the average water supply from the Sierra snowpack will decline by two-thirds by 2050, and how downtown Fresno will go from about four extreme heat days (defined to be above 106.6 Fahrenheit) per year today, to 43 days per year by 2100 if emissions aren't reduced.

"If the Paris climate agreement comes to pass [these impacts] ease off a bit, but suffice to say adaptation is in our future," said Dan Cayan, a climate scientist at the Scripps Institute of Oceanography and one of the assessment's lead coordinating authors.

"The basic message from these studies is a call to action," said Robert Weisenmiller, chair of the California Energy Commission, to the audience of climate professionals. "The impacts on the ground are outpacing the science."

Many speakers at the forum highlighted the urgent need to begin preparing for impacts already being felt today. California Ocean Protection Council executive director Deborah Halberstadt opened her presentation on coastal flooding with pictures of Hurricane Harvey, and deliberately mentioned the near



In session on the future of agriculture during the August Climate Adaptation Forum, Dustin Pearce of the Conservation Biology Institute presented new maps designed to help guide decisionmaking about future agricultural land preservation in the San Joaquin Valley based on water and other stresses. This map shows the projected loss of April snowpack across the Sierra Nevada range draining into the San Joaquin Valley by mid century. Source: San Joaquin Land and Water Strategy, American Farmland Trust, July 2018.

3,000 people dead in Puerto Rico from Hurricane Maria. "It's easy to get lost in the sea level rise jargon on projections," she said. "But I want to emphasize what we are talking about is extreme flooding and its human impacts." Sheridan Enomoto, from the Bay Area's Greenaction environmental justice organization, spoke eloquently about how sea level rise and flooding of contaminated land at Bayview Hunter's Point threaten the health and safety of the nearby low-income community.

But few spoke as forcefully as James Gore, Sonoma County's 4th District Supervisor representing much of the Santa Rosa area charred in the Tubbs fire last year.

"If you can't tell, I'm fired up – pun intended," Gore said with a straight face, staring intently at the gathered attendees during a panel. "We're sitting here still talking about creating networks, and networks of networks," he pointed out, to audience laughter on the climate geek nature of the forum and its topics. "Intentionality and campaigns are where we need to go," continued Gore. "WAKE UP. This is go time. This isn't time to be pessimistic, this is time to step up to show grit."

Some of the loudest applause went to Kat Taylor, the CEO and co-founder of Beneficial State Bank. In the forum's closing plenary panel on financing resilience, the tattooed and backwards ballcap-wearing Taylor garnered repeated cheers with her rapid-fire rejection of the capitalist banking system and its role in our unsustainable system and unstable climate.

"The best thing we can do in the private banking system is discipline lending practices," said Taylor, mentioning the choices banks have about underwriting projects like the Dakota Access pipeline. "We [at the Beneficial State Bank] are not going to use our deposit funding to trample on indigenous rights, destroy a local resource called water, and accelerate global climate change."

An oft-repeated mantra across the climate adaptation practitioners was the need for everyone to come together to tackle climate change and protect those in its path. However it was easy to see that for some, there is still a long ways to go in order to include all Californians in the effort to adapt to climate change.

"As California Indians, we are largely invisible," said the governor's advisor Christina Snider, pointing out that native tribes have generations of knowledge living with changing environmental conditions, yet often aren't deemed experts or involved in adaptation. At a youth-led session on restorative climate resilience for communities, a dozen or so people discussed the colonizer implications of referring to communities as vulnerable to climate, and noted in frustration how many people had left the room in order to wander to other sessions. At the panel discussion of California's regional climate impacts, Francesca Hopkins of UC Riverside asked the hundreds of attendees how many were from the inland Imperial Valley region that she focused on – and pointed out to the audience that the only ones raising their hands were her collaborators.

Despite the long path ahead, there was no shortage of inspirational examples of disparate actions, large and small, that Californians are doing today to make the state resilient. Up in Humboldt Bay, the California Department of Fish and Wildlife formed a partnership with the local Wiyot tribe in order to monitor ocean acidification and its impact on the locally important oyster population. Lucas Zucker from the Central Coast Alliance United for a Sustainable Economy told how his community successfully fought to prevent a new shoreline fossil fuel power plant near Oxnard. Beneficial bank's Kat Taylor pointed out that her institution pays employees 150% of their area's living wage. Beverly Scott, CEO of Beverly Scott Associates, Parker Infrastructure Partners, noted that Vallejo was the first city in the country to establish true participatory budgeting (in which community votes govern a portion of public spending), and is now on its sixth round. Many pointed to various California state policies and executive orders mandating inclusion of climate change and adaptation in public planning and investment.

"It's really exciting to see the work that's already being done, and how we can lift up those solutions," said Julia Kim, a senior project manager with the Local Government Commission and one of the principal organizing forces behind the forum.

At the forum — the first affiliate event for September's star-studded Global Climate Action Summit —many of the anonymous climate professionals working on the ground to protect California remained optimistic.

"In 2014 we had dozens of people working in adaptation at the state level," said Michael McCormick, a senior planning advisor at the Governor's Office of Planning and Research. "Now we have hundreds. The discussion has shifted from 'you know, we should do this because it's really important and we all need to come together' to now being 'we must do this in California, it's required by statute'."

"Honestly, I consider myself very hopeful when it comes to [climate adaptation]," said Philip Gibbons. "If you look at the San Diego skyline 80 or 100 years ago, it's very different than what it is today. In 80 to 100 years in the future, it's going to look very, very different too. I have great belief that we can help design a better and more resilient waterfront."

"I find hope in a lot of places," said Julia Kim. "I find hope in the technological solutions, I find hope when I see the coalitions of people of different disciplines and backgrounds come together. I find hope in our youth coming up with creative approaches, and in the different community engagement strategies out there. I find hope all around me."

"People preserve what they love," said Jacquelyn Dupont-Walker, President of the Ward Economic Development Corporation, to the forum's attendees. "This is the story of each one of our lives." **INP**

Background image: "Pala Bird", Audrey Carver and Pala Little Feathers, 2016. Courtesy Art of Change, www.climatescienceallliance.org/art-of-change

Don't miss ESTUARY's extended online coverage of the State's Fourth Climate Assessment and the Global Climate Summit at www.sfestuary.org/estuary-news/constellation-of-climate-events-lifts-california-spirits

ESTUARY's April 2001 headline was "Freaky Weather and Water Loom." Celebrating 25 years of the magazine and the CCMP/Estuary Blueprint.

GOVERNMENT

The State's Biggest Landlord Reconsiders Its Neighbors

When Mari Rose Taruc approached California environmental justice (EJ) leaders about advising the California State Lands Commission on its EJ policy, they didn't know what she was talking about. "They were like, what does the State Lands Commission do?" recalls Taruc with a chuckle.

Over the past six months, a two-way discovery has since taken place between the agency and the resulting EJ working group. Overlapping interests emerged, revealing a surprising abundance of opportunities for collaboration. The discovery is significant because State Lands wields bureaucratic power often out of reach of small EJ groups. As Taruc quips, it is "the state's biggest landlord."

State Lands controls a variety of public lands, many at the water's edge, be it ocean, river, or lake (including submerged lands three miles off the coast). The commission issues permits or leases that dictate how the land gets used, a power that affects all people who live near these state lands. And while waterfront property might bring to mind luxury condos and vacation homes, it notably also includes less glamorous or healthful locations. Imagine for instance the areas around ports and their accompanying heavy industry. Moreover, climate change further threatens land at water's edge. "The shoreline communities are now the frontline communities," according to Sheridan Noelani Enomoto, a San Francisco Bayview Hunters Point community organizer and speaker at the California Climate Change Adaptation Forum held this past August in Sacramento (see p.12).

As State Lands set out to update its environmental justice policy, the commission realized it needed to consult with groups at the frontlines, shorelines, and fence lines of EJ issues in California. Taruc, the Working Group coordinator, reached out to EJ organizations throughout the state whose concerns overlapped with State Lands' jurisdiction. For the most part, State Lands was on no one's radar.

For the commission's part, their initial thoughts on their role in promoting environmental justice were tame, with an emphasis on recreational access to state lands and waterways. Taruc and the Working Group saw that State Lands had the potential to influence a whole lot more.

When Sheri Pemberton, State Lands' Chief of External Affairs Division and Legislative Liaison, met with frontlines communities, she was dismayed to hear how difficult it had been to work with state agencies in the past. Improved communication and stronger relationships with frontline communities emerged as points of emphasis for the new policy. According to Pemberton, the commission is determined to create "real equity, transparency, and inclusion, and to have relationships with communities so they are able to tell us their concerns and priorities, and [so that those concerns] can be factored into the decision making process." State Lands hopes that making structural changes in its bureaucracy to incorporate community voices will guide it towards the issues of highest priority for impacted groups.

In the latest draft of the policy, the Commission settled on ten main goals, which span from external engagement with impacted communities to internal work educating commission staff. The policy also outlines steps to more integrally weave environmental justice into standard commission procedures, from making sure to analyze potential impacts of proposed plans to encouraging community-oriented leases. Additionally, a proposed new dedicated EJ liaison could serve as a primary point of contact between the Commission and vulnerable communities.

Some input could come from communities such as those served by Communities for a Better Environment, one member of the Working Group. In Wilmington, California, where the organization is based, toxic exposure yields problems

Although EJ groups welcome some state commitments to making EJ a strong new priority, other areas of state management are lacking according to protestors at the governor's Global Climate Action Summit in September. Cap and trade programs that price carbon aren't doing enough to reduce air pollution in impacted communities; likewise, California still allows new oil drilling and fracking that compromises the health of nearby communities, local groundwater, (see p. 9) and the climate. Photo: Mari Rose Taruc

ranging from asthma and rosacea to cancer and birth defects. In this predominantly Latinx community, there are fencelines everywhere: the flimsy fence surrounding the local refinery, the fence of criss-crossing highways that enclose the neighborhood, the green buffer meant to block nearby port pollution (which doubles as a children's park), and the oil rigs in people's backyards.

Now consider that State Lands has varied degrees of jurisdiction over offshore oil platforms, ports, and certain related activities, as well as oil and gas facilities that touch the water. These sites host the kinds of activities that burden surrounding communities with pollution and environmental risk — and more often than not, the hosting communities tend to be low income and communities of color. Since State Lands has jurisdiction over the land where these activities occur, the potential for impact, it turns out, is huge.

Across the board, it seems obvious it was high time for State Lands to update its environmental justice policy, first drafted in 2002. "There's a lot more awareness of environmental justice since then," says Pemberton.

As Josh Bradt of the San Francisco Estuary Partnership has observed, State Lands and other public agencies are expanding their prior "laser focus" on natural resource protection to additionally "examine current and legacy injustices to communities and commit to more equitable and inclusive decision-making processes." The approach offers a different way of looking at estuary management, where conservation and environmental justice are not separate, but connected, interests. "Many of the same drivers that put the health and function of San Francisco Bay so at-risk have also placed certain communities at-risk as well," says Bradt.

While it may have been a long time in coming, there seems to be a sincere and resolute desire for institutional change from within the Commission. During the policy development process, Pemberton and other Commission staff visited a community in Martinez to witness in person the scale of industry that they'd been hearing about from impacted communities. "It's profoundly affecting to hear and see what communities experience— on a personal and professional level," says Pemberton.

Throughout the policy's development, the "sense of commitment has increased from the start to the finish," she says of Commission staff.

State Lands hosted community roundtable in Martinez. Photo: SLC

In light of the injustices of the past and present, there is also a chance to start making things right. Taruc sees an "opportunity to meet the goals of the agency and repair harm" by cultivating stronger relationships with communities that have felt left behind by state agencies in the past, especially displaced and landless Native tribes. Indigenous ways of managing land that utilize traditional ecological knowledge offer benefits including habitat and watershed restoration, carbon sequestration, sustainable infrastructure, and improvement of salmon runs, according to the state's inaugural *Tribal and Indigenous Communities Report.*

"You cannot walk anywhere in California and not find tribal land and remains," said Anecita Agustinez, the Tribal Policy Advisor for the Department of Water Resources, at a workshop during the August Climate Adaptation Forum. "If you appeal back to the land as a starting point, all will be revealed."

According to Agustinez, what is missing from the mainstream conversation is an acknowledgement of the social history woven into California land, which needs to play a greater role in its management. "You're only talking about urban and environmental landscapes, but you're not talking about cultural landscapes," she said to the room of policymakers and bureaucrats at the forum.

Taruc believes there is a special opportunity for State Lands and Native tribes to cooperate by incorporating tribe-led traditional knowledge into state management practices while restoring tribes' access to ancestral land. It would be a "beautiful way to repair harms and protect land," she says.

Overall, Taruc is hopeful. In response to the EJ Working Group recommendations, State Lands has amended its original policy. Additionally, state law now mandates that EJ be a consideration in local general plan updates for state agencies. Moreover, State Lands is only one of multiple state agencies interested in re-prioritizing environmental justice. The Coastal Commission along with the San Francisco Bay Conservation and Development Commission are also currently updating their EJ policies.

"We hope our policy will be a model for other agencies," says Pemberton. "We hope it will help swing the pendulum toward equity, toward inclusion, toward people who have felt like they are sometimes ignored and disproportionately impacted."

The updated EJ policy will go to a vote on October 18th or December 2nd in Sacramento. Regardless of the outcome, the community organizations of the EJ working group will continue their local campaigns for environmental justice; chances are, their work won't become obsolete just yet. **AMYB**

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Don't miss the online version of this story https://www.sfestuary.org/estuary-news/state-lands-reconsiders-neighbors

WILDLIFE

Prowling the Waterways

From a bird's eye view, the area in between the Santa Cruz and Diablo mountain ranges looks like any typical valley. But the work being done by Tanya Diamond, a wildlife ecologist with Pathways for Wildlife, shows that this land and its waterways, known as the Coyote Valley, offer much more to native wildlife and conservationists than mere open space.

Considered by many to be the last piece of untouched land of the area, Coyote Valley connects the two mountain ranges — not unlike a natural highway for animals and plants. This area, known as a wildlife corridor, is imperative for survival rates as it allows animals to move in between more remote wilderness areas on either side. This movement also enables genes to cross from one population to another, bolstering the health of both individual species and the overall ecosystem.

Throughout her research, Diamond and her team have found that water, in particular, influences wildlife movement. "Animals were following the creek system as a passage route ... literally following it through the whole valley floor," she says.

Of the 7,400 acres in this wildlife corridor, the most-used waterways are Fisher Creek and Coyote Creek. Diamond's team confirmed this via satellite tracking collars on larger mammals and footage captured by hidden cameras. "They really use these creeks and streams to navigate across the landscape," she says. The creeks act as a natural thoroughfare to animals on the move while the bankside riparian trees and shrubs protect and hide them from predators.

As local researchers became more familiar with wildlife movement in Coyote Valley, they also noticed a spike in water-focused traffic during breeding season. From black-tailed deer and their fawns to bobcats and their kittens, "it just blew us away!" says Diamond.

Whether during vulnerable breeding and rearing periods – or during other seasons of life – creek corridors offer many species favored habitats. "Especially the larger species — like mountain lions, bobcats and gray foxes — tend to prefer following that riparian cover naturally offered by our creek systems," says Diamond.

While the wildlife of Coyote Valley will continue to survive with the help of Pathways for Wildlife and similar organizations, cities and suburbs press in all around. Urban, agricultural, and water supply development have reduced natural habitats in the area by 88-100% since the 1800s.

For the moment, the Santa Clara Valley Open Space Authority and Water District are working with local cities to keep the Coyote Valley wildlife-friendly. In the future, holding this line so wildlife and people remain peaceful neighbors could be challenging. The remaining open spaces have to be big enough — like the Coyote Valley.

Galli Basson, Resource Management Specialist for the Open Space Authority, is optimistic, "We are seeing wildlife have adapted and are using modified habitat, especially around the riparian corridors, so it is important for us to protect and enhance these habitats." **AP**

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Santa Clara Valley Open Space Authority – Wildlife Cams

www.flickr.com/photos/scvopenspaceauthority/sets/72157656374930758

Bobcat in the Coyote Valley follows Fisher Creek. Photo: SCVWD

INVASIONS

Kitchen Sink Update On Every Last Critter

On multiple fronts, with multiple forces and weapons, California's battle against invasive aquatic organisms continues. Notoriously, San Francisco Bay is the world's most invaded estuary. Keeping invaders out, and preventing their spread once established, requires coordination among agencies and levels of government. At best, meshing jurisdictional gears can be a challenge. At worst, friction between the state and federal governments can make pending agreement for the benefit of all falter.

An invasive species is a plant, animal, or microorganism that's not from around here but makes itself at home. Invasives may come from elsewhere in North America or from other continents and oceans. Many arrive in ballast water or on the wetted surfaces of vessels; others are released, intentionally or otherwise, by aquaculturists, sport fishers, or pet owners and aquarium hobbyists. These organisms run the gamut from microscopic plankton to rodents of unusual size. Some appear pre-adapted to succeed in their new environments. Others just get lucky, benefiting from a favorable conjunction of temperatures and salinities. What successful invasives have in common is their ability to alter environments, compete with native species, and interfere with human activities and interests.

It's convenient to think of aquatic invasives in terms of saltwater and freshwater habitats, although these distinctions aren't absolute and many have shown unexpected flexibility. Scientists have been tracking two Asian clams, *Potamocorbula amurensis*, thought to be restricted to salt or brackish water, and *Corbicula fluminea*, a freshwater specialist. *Potamocorbula*, a filter-feeder on plankton, has perturbed estuarine food webs. According to US Geological Survey biologist Janet Thompson, larval *Potamocorbula* moved upstream when a salinity barrier was removed during recent drought years and adults survived there longer than expected. Conversely, *Corbicula* became established downstream with increased freshwater pulses into San Francisco Bay and appears to be tolerating the return of more normal salinity.

UC Davis researcher notes extent of invasive weeds in Delta on GPS. Photo courtesy Shruti Khanna.

Potamocorbula clams have been in California since the 1980s, *Corbicula* decades longer. Invasives may experience booms and busts; the Chinese mitten crab, a concern in the past, seems to be fading away on its own. Targeted eradication efforts sometimes succeed, as with the northern pike, introduced to Lake Davis in the 1990s, and the marine alga *Caulerpa* that turned up in a Southern California lagoon in 2000. Other species have proven as hard to kill as Rasputin. And there's no guarantee that an invasive species, once extirpated, will stay gone.

Two pipe-clogging freshwater invasive mollusks, the zebra and quagga mussels from Eastern Europe, have proliferated massively in the Great Lakes. So far, zebras have been detected in California only in a reservoir in San Benito County, where the US Bureau of Land Management is still developing an eradication plan. Quaggas are more widespread in Southern California, with the most recent finds in the upper San Gabriel River, the Santa Clara River, and lower Piru Creek.

Ten years ago, the California Department of Fish and Wildlife (CDFW) led the development of a state aquatic invasive species management plan and is currently revising it, focusing on accomplishable goals. That's been delayed by the redirection of resources to deal with the nutria — a South American rodent — found in Merced County last year and subsequently documented in five other Central Valley counties. "The goal of our nutria work is eradication," says CDFW's Martha Volkoff. "An important component of achieving that goal is looking for them in all suitable habitat, including in the Delta."

Other freshwater invasives are on the radar. In 2016 egg masses of the channeled apple snail, a large plant-eating South American mollusk, were found at Big Break Regional Shoreline in the Delta. The closest known population was in Kern County, a giant step for a snail. East Bay Regional Parks naturalist Michael Moran says eggs are still being found (and destroyed) at Big Break, although no adult snail sightings have been confirmed.

While CDFW deals with invasive animals, non-native aquatic plants in the Delta like water primrose and alligator weed fall within the purview of Boating and Waterways. Recent research led by UC Davis' Shrutri Khanna suggests that the water primrose, proliferating in the Delta, may outcompete native plant

continued to next page

species and change the structure of plant communities. The plant's ability to spread over open water and encroach into marshes poses a challenge to tidal wetland restoration efforts.

In some ways, the story of marine invasives is less complex. Most arrive on the hulls of ships or via ballast water. Many "biofouling" organisms are sedentary creatures like barnacles and sea squirts that encrust vessel hulls, as well as docks and other permanent structures. By some estimates, the biofouling vector accounts for more than half of marine invasive species introductions. New state regulations for vessel operators took effect this January. John Berge of the Pacific Maritime Shipping Association says the final rule "provided a rational path to compliance for vessels that performed industry-standard hull husbandry, reflecting existing best practices in the fleet." The San Francisco Estuary Partnership's Karen McDowell suggests similar management requirements could apply to mobile marine infrastructure, like equipment used to rebuild the Bay Bridge.

Ballast water management is a little more complex. Invasive species introductions happen when a vessel takes on water in a coastal port and discharges it in a new port miles or oceans away, along with its cargo of organisms. Exchanging ballast water at sea is considered inconsistently effective, a stopgap measure at best. Finding a way to rid the water of these hitchhikers before releasing it has been an ongoing challenge, with debate over the best treatment technology, the best location (shipboard versus shore-based), and the appropriate standard for measuring the result.

One set of results-based treatment standards has been adopted by the International Maritime Organization, under a convention that came into force without being ratified by the United States. The US Coast Guard and the US Environmental Protection Agency have aligned their numerical standards with the international standard, although the US agencies use different terminology. The California State Lands Commission (SLC), however, has developed a state standard which is much more rigorous than the international/federal standards. It's in the process of being phased in, with interim standards beginning to be implemented in 2020 and final standards in 2030. No other US state has comparable standards.

Container ships entering California ports are asked to voluntarily exchange ballast water at sea before entering the Bay. Photo courtesy Port of Oakland.

So far, the Coast Guard has approved 10 shipboard ballast water treatment systems, with 10 more under review. "The treatment methods are fairly well split between chemical/electrolysis and ultraviolet, both with some kind of filtration," says the SLC's Nicole Dobroski. "There's no dominant technology or evidence that any existing system could meet the California final standard, or the interim standard based on the data we have right now." Dobroski says the state's ability to evaluate treatment technology is being hindered by the Coast Guard's reluctance to share information.

Responding to interest in alternatives to shipboard treatment, the SLC funded and the Delta Stewardship Council managed a feasibility study of shore-based treatment. The resulting report, released in April, considered treatment in facilities on land, including retrofitted wastewater treatment plants, a nonstarter, in part because of higher cost and local obstacles to creating a uniform statewide system. What was found feasible, likely capable of meeting the interim standards, and 5 to 11 times less costly than a land-based alternative, was treatment on shoreside barges, with ballast water pumped from vessels to the barge. The study estimated the cost of building and operating a statewide barge system as $1.45 billion, with an additional $2.17 billion in retrofit costs for marine vessel operators.

According to Berge, the shipping industry is concerned whether barge treatment can actually meet the state standards, and whether its phased deployment can be reconciled with the time line for their implementation. "The federal government and the international regime say the solution should be ship-based because every port in the world would benefit," he adds. "It's like the herd effect with vaccination."

Pending federal legislation may render the issue of state standards moot. The Vessel Incidental Discharge Act, sponsored by Senators Roger Wicker (R-MS) and Robert Casey (D-PA), would impose uniform federal standards preempting more rigorous state standards. As part of a Coast Guard authorization measure, VIDA lost a Senate vote in April. But the legislation isn't dead. Berge's PMSA supports VIDA, as part of a coalition of companies and organizations: "For a while we did not because we were trying to work things out with the state of California."

Dobroski sees state preemption as a threat for California's ability to continue enforcement and data collection, maintain the fees that fund research, and pursue its biofouling program. "There are environments in California, like San Francisco Bay, that a one-size-fits-all approach doesn't take into account," she says. "Preemption really ties our hands. We're working with Congressional staffers to negate the impacts as much as possible." **JE**

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Pearls on Nutria: www.sfestuary.org/estuary-news-pearls-hcp-5/

Shore-based Treatment Study 2018: http://deltacouncil.ca.gov/docs/final-ballast-water-study-summary-report

Don't Miss the extended online version of this story – www.sfestuary.org/estuary-news/report-on-status-estuary-invasions

ESTUARY first described what James Carleton called the "invasion roulette" of ballast water discharge in the Bay in December 1995. Celebrating 25 years of the magazine and the CCMP/Estuary Blueprint.

GROUNDWATER, *cont'd from page 9*

It was the first and, as of early 2018, only instance of completed implementation of SB 88.

The UC Davis report, authored by Jonathan London, views the Matheny Tract-Tulare consolidation as an important milestone. It "demonstrates how the new law can be an important policy tool for the state. It shows the effectiveness of using diverse strategies, from creating collaborative partnerships, to threatening state-mandated consolidations, to making financial incentives available to receiving water systems."

Community advocates, like Trujillo, were essential in the parallel story of East Porterville, a low-income Latino community reliant on private wells. During the summer of 2014 an estimated 300 wells in East Porterville went dry. By 2016, at the height of California's drought, as many as 1600 wells experienced outages in Tulare County, as many as 500 in East Porterville alone. The UC Davis report cites Tomas Garcia, a water justice advocate helping to lead East Porterville for Water Justice (now Porterville United), as the organizer of community-based action that eventually connected approximately 1200 households to the City of Porterville's water system. "This case shows the importance of community advocacy in providing assistance and resources to find funding," argues the report. "Although it took a drought for the city, regional and state agencies to step in, this case can serve as an example to other cities and counties."

Alpaugh resident Raquel Lemus buys bottled water for her family to use because their tap water is contaminated with arsenic. Photo: Charlotte Weiner, CWC

Back at the Capitol rotunda, the advocacy continues. Those like Trujillo who have already won their personal struggle acknowledge the hardships facing those still without access to clean water. "It's expensive," he says, "you have to drive miles into the city just to get water." Maria Diaz, from the San Joaquin Valley, shows her utility bill. She spends over one hundred dollars on water she can't use to drink. "It's just me that lives here," says the silver-haired woman. "No grandkids. Just me." Some have estimated that, for those without access to clean drinking water, as much as 10% of household income is spent on bottled water in addition to utilities.

UC Davis research has also shown a link between a lack of access to clean water and higher rates of obesity. According to an article published by UC's Center for Poverty Research, "the prevalence of obesity and type-2 diabetes in California is higher among low-income minority populations." Among other environmental factors, such as a lack of access to nutrition education, low-quality tap water is a potential barrier to reducing the consumption of sugar-sweetened beverages.

As the legislative session draws to a close, there seems to be no sign of flagging among those "Thirsty for Justice." These are, after all, people who have fought for their rights for decades. "I've really gotten to know them over the years," says Kelsey Hinton. "They're fired up and ready to do what needs doing to ensure safe water for their communities."

At the conclusion of the session AB 2501 gained the vote it needed to pass the senate and went on to pass the assembly by a large margin. It awaits the Governor's signature. Unfortunately, another bill didn't fare as well. SB 1215, similar in scope to AB 2501 but with regards to the management of wastewater that could in turn help prevent the contamination of groundwater, failed to pass the senate. "It just shows we need to educate more," says Phoebe Seaton. "We've been so focused on drinking water that maybe we haven't said enough about the importance of wastewater as well."

There's still a lot of work to be done, but, since the passage of AB 685 opened the door to water rights legislation, the positive is starting to outweigh the negative. "It's incremental change," says Hinton, "but headed in the way it needs to go." **MHA**

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San Francisco Bay and the Sacramento-San Joaquin River Delta comprise one of 28 "estuaries of national significance" recognized in the federal Clean Water Act. The San Francisco Estuary Partnership, a National Estuary Program, is partially funded by annual appropriations from Congress. The Partnership's mandate is to protect, restore, and enhance water quality and habitat in the Estuary. To accomplish this, the Partnership brings together resource agencies, non-profits, citizens, and scientists committed to the long-term health and preservation of this invaluable public resource. Our staff manages or oversees more than 50 projects ranging from supporting research into key water quality concerns to managing initiatives that prevent pollution, restore wetlands, or protect against the changes anticipated from climate change in our region.
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MONITORING, *cont'd from page 2*

more than once a week. Concentrations in some samples were roughly 15 times the screening level, which is based on cancer risk. Average levels do not appear to have declined since testing began.

The report also includes new data on dioxins in water, sediment, and bird eggs. Levels in the latter two appear to have declined over time, but the authors caution that future reductions will be harder to attain because the "low-hanging fruit" of reductions in point source pollution from the likes of incinerators and smelters have already occurred.

"There's not much we can do," says San Francisco Bay Regional Water Quality Control Board assistant executive officer Thomas Mumley. "The types of sources that we normally regulate and control are relatively minimal compared to other sources. ... We're not going to solve the issue on the backs of our wastewater dischargers."

Still, says Ian Wren, a staff scientist with the nonprofit San Francisco Baykeeper, cities bordering the Bay should make better use of swales, infiltration basins, and other landscape features to capture and filter stormwater before it reaches the Bay. "More green infrastructure and more efforts to manage municipal storm runoff seems to be the most feasible solution for addressing dioxin-like compounds, as well as a lot of other contaminants that make their way into the Bay," Wren says. **NS**

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Dioxins report due out this October. Stay tuned.

In the February 1997 issue, ESTUARY announced a new study of dioxin by the RMP and Water Board. The story began "ever since birds, cats, dogs and even horses began dropping dead in Times Beach, Missouri, 25 years ago, the word "dioxin" has set off alarm bells." The story ended with a projection by Kim Taylor that has turned out to be true. "Even if we shut off all emissions we may still have dioxin the environment for many, many years." Celebrating 25 years of the magazine and the CCMP/Estuary Blueprint.

Calling all Bird Brains!

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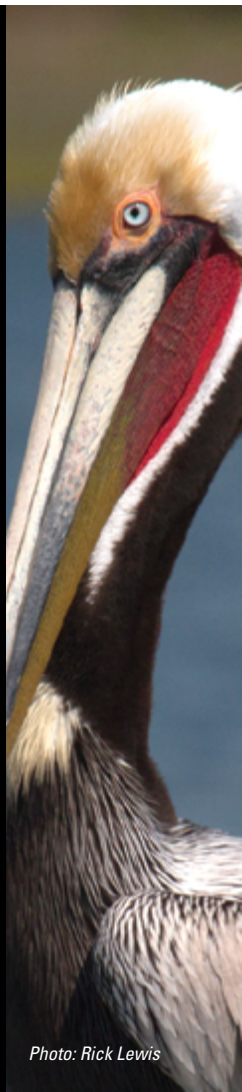

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