



# *Cultivated Ecologies*

*An Interdisciplinary Video and Essay Project  
by Cynthia Hooper*

Humboldt State University Third Street Gallery

January 29 - March 4, 2018

# Cultivated Ecologies

*This project examines the extensively reconfigured network of wetland refuges scattered across California's Great Central Valley. Though now disconnected and drastically diminished, these wetlands remain extremely ecologically significant, and have been designed to more-or-less successfully coexist amid one of our planet's most intensively cultivated and astonishingly productive agricultural regions. These refuges were constructed to remedy the near total destruction of Central Valley wetlands during the region's historical reclamation for agriculture, and now depend on agricultural infrastructure to survive. The sites are critical stops for millions of migratory birds along the Pacific Flyway, as well as year-round havens for countless local species. Though carefully tended and protected by decades of legislative efforts, these habitats nevertheless face significant challenges—including ongoing competition with agriculture and cities for water, loss of habitat from crop conversion and urban encroachment, persistent regulatory uncertainties, and an increasingly unstable climate. The four experimental documentary videos in this exhibition patiently depict the graceful and seasonally shifting characteristics of these austere and dramatically mediated habitats, and the humans who make forays into these novel ecosystems. Accompanying essays describe the historical, hydrological, ecological, and political complexities of these carefully engineered places. The essays in this publication are excerpted from the exhibition's essays.*

## Essays by Cynthia Hooper

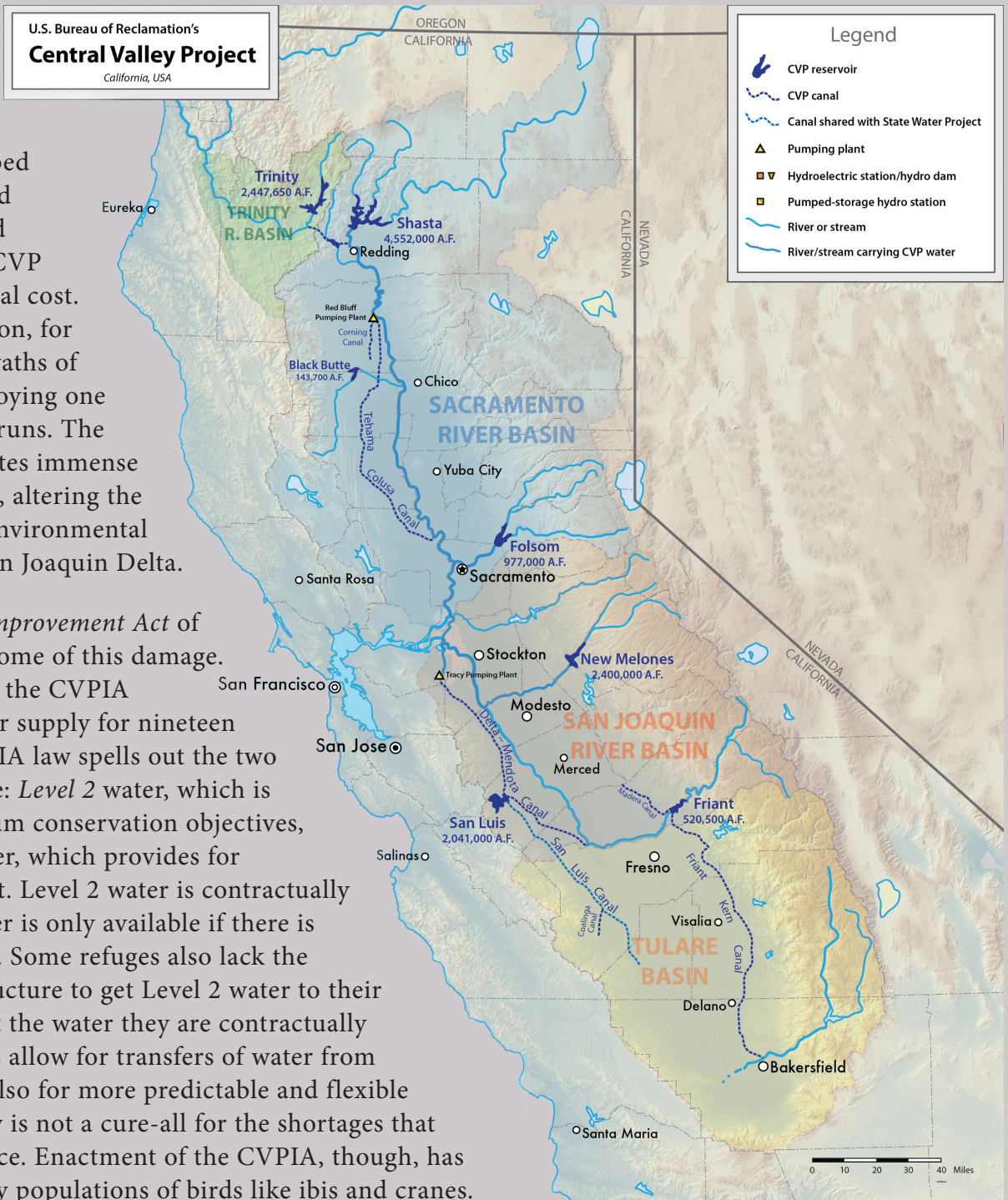
California's Great Central Valley has three major hydrologic basins—the northernmost Sacramento Valley, the central San Joaquin River Basin, and the southernmost Tulare Basin. The Sacramento and San Joaquin basins drain via their respective rivers to the Sacramento/San Joaquin Delta, and the Tulare basin is now hydrologically enclosed. Before the 1800s, the valley was a mosaic of lakes, rivers, wetlands, riparian forests, oak woodland, grasslands, scrubland, and vernal pool habitats, and up to 40 million waterfowl migrated from Alaska and Canada to the valley each winter. Reclamation for agriculture destroyed 95% of its once 4 million acres of wetlands, and almost all that remains—about 205,000 acres—is now intensively managed as wildlife refuges or private duck hunting clubs. And these sites have been highly successful, as 3 million ducks, 2 million geese, and a half million shorebirds use the Central Valley today.

The first state public refuge (Los Banos) was created in 1929. President Clinton dedicated the most recent one (Yolo Bypass) in 1997. Each refuge was fashioned by bulldozer and backhoe and is now irrigated by the state's massive aqueduct system and groundwater pumping. They were initially designed to maintain waterfowl populations for hunters and to keep hungry birds out of agricultural fields. Only more recently have they been managed for species other than hunt-worthy waterfowl. The *Migratory Bird Conservation Act* of 1929 (which authorized the purchase of federal wildlife refuges), and the federal *Lea Act* of 1948 (which authorized the purchase of refuges within California) gave critical early support to these places, as more recently has the federal *Central Valley Project Improvement Act* of 1992, which mandates a firm refuge water supply. Nineteen state and federal refuges throughout the valley receive water from the Central Valley Project Improvement Act. Twelve of these refuges are featured in this exhibition.

# THE CVP AND THE CVPIA

The federal Central Valley Project completely re-plumbed huge swaths of the valley and exploded its agricultural and economic capacity, but the CVP has come at an environmental cost. The Friant Dam's construction, for example, dewatered large swaths of the San Joaquin River, destroying one of the state's largest salmon runs. The Tracy Pumping Plant re-routes immense volumes of water southward, altering the salinity, flow regimes, and environmental health of the Sacramento-San Joaquin Delta.

*The Central Valley Project Improvement Act of 1992 has remedied at least some of this damage. Among its many provisions, the CVPIA establishes a minimum water supply for nineteen Central Valley refuges. CVPIA law spells out the two types of allocations available: *Level 2* water, which is just enough to meet minimum conservation objectives, and *Incremental Level 4* water, which provides for optimal habitat development. Level 2 water is contractually guaranteed, but Level 4 water is only available if there is extra funding to purchase it. Some refuges also lack the needed conveyance infrastructure to get Level 2 water to their boundaries, so they can't get the water they are contractually entitled to. The CVPIA does allow for transfers of water from one refuge to another, and also for more predictable and flexible water deliveries, but this law is not a cure-all for the shortages that these refuges consistently face. Enactment of the CVPIA, though, has dramatically increased valley populations of birds like ibis and cranes.*



# THE TULARE BASIN

Because it once had the largest contiguous expanse of wetland habitat in California, the Tulare Basin was a top destination on the Pacific Flyway. Less than 1% of basin wetlands remain. Despite the seemingly arid landscape one typically encounters when driving on Interstate 5 through this region, the Tulare basin uses more water than anywhere else in the state. This water arrives via the California Aqueduct along the basin's west side, the Friant-Kern Canal along its east side, and from copious groundwater pumping. The Tulare basin is now *endorheic*—completely enclosed and without a natural outlet. This wasn't always the case, as gigantic Tulare Lake would regularly flood to the point of overflowing northward and into the neighboring San Joaquin basin, then onward to the ocean via the San Joaquin Delta. The lake stopped escaping in 1879 once the rivers that fed Tulare Lake had all been diverted.

The Tulare basin now has three major wetland refuges. The *Kern National Wildlife Refuge* near Tulare Lake's south shore was established in 1960 in order to mitigate the destruction of the basin's waterfowl habitat by agricultural development. The 11,249-acre site includes managed seasonal wetlands that are flooded in winter and slowly drained every spring, as well as grassland, alkali playa, and scrub habitats that are mostly reliant on scarce annual rainfall. Kern refuge managers flood their wetlands with surface water from the California Aqueduct. Because of the limited water available for full habitat development, the Kern refuge is able to lure only small numbers of the geese that are seen by the hundreds of thousands in the Sacramento Valley farther north. Plenty of birds find a home here, however—including many species of ducks during the fall and winter, shorebirds in spring, as well as herons, egrets, grebes, and blackbirds at all times of the year. Up to 6,000 nesting White-faced Ibis also commandeer the Kern refuge each spring—an admirable metric for a species that had once completely abandoned the region.

As does most of the Tulare basin, the Kern refuge suffers from contamination by salt and sometimes nitrate from agricultural fertilizers and waste. Salt comes to the basin by way of irrigation. The Friant-Kern Canal, for example, imports 63,000 tons of salt into the basin each year, and the California Aqueduct imports another 336,000 tons. With no current alternatives to disposing this irrigation's aftermath—salty and sometimes toxic return flows—evaporation ponds have been constructed to perpetually store it. Two such enormous ponds are located just north of the Kern refuge. Birds are attracted to these ponds—including shorebirds like Black-necked Stilts and American Avocets who arrive in the spring to forage and build nests. The Tulare Lake Drainage District has built a “compensation habitat” and taken other measures to mitigate bird mortality rates on account of these ponds, but the Tulare basin's agricultural drain water problems are acute and lack clear solutions at this point.

The *Pixley National Wildlife Refuge* in Tulare County was established in 1959. The site lacked sufficient water for wetland habitat development until 1994 when the Central Valley Project Improvement Act funded an onsite deep water well. This well allows refuge managers to seasonally flood about 300 of Pixley's 7,100 acres. The seasonal wetlands, moist soil units, and upland habitat at Pixley support numerous species of local and migratory birds, including an impressive and dedicated flock of up to 6,000 Sandhill Cranes every winter.



Video still from *Kern National Wildlife Refuge (Tulare Basin)*, 2017, running time: 7.5 minutes

These large and elegant birds forage in the row crops by day and roost in the refuge at night. Pixley is isolated and seemingly desolate—hemmed in on every side by numerous dairies and agricultural fields. It's an austere and apocalyptically lovely place with little conventional aesthetic appeal. Because of the cranes, no hunting at Pixley is allowed.

The *Mendota Wildlife Area* by contrast is intensively managed for hunting. Established in 1954 at the northern edge of the Tulare basin near Fresno, Mendota is the only refuge in the Tulare basin with year-round fresh water. The refuge gets its water from the Fresno Slough and the Mendota Pool at the terminus of the Central Valley Project's Delta-Mendota Canal, and irrigates crops of safflower and millet specifically for waterfowl food. Some parts of the refuge must use low lift pumps to deliver water to individual management units because the entire region suffers from subsidence (sinking) from the groundwater overdraft that affects much of this part of the valley. Mendota is a very popular place for local communities, who use it for both subsistence and recreational hunting and fishing.

# THE SAN JOAQUIN BASIN

The San Joaquin River and its tributaries inhabit the portion of the Central Valley that extends from Fresno to the Sacramento-San Joaquin Delta. Upstream from the Delta, the once-mighty San Joaquin nurtured a vast floodplain, some parts of which drained poorly and had naturally high levels of alkali and salts. Thus significant chunks of this region proved unsuitable for agriculture, but very profitable for ranching. Vast tracts of grasslands inhabited this floodplain along with the cattle, as did great expanses of wetlands, vernal pools, and alkali sinks. By the early 20th century, many duck hunting clubs also thrived in this relatively wild and marginally cultivable corner of the valley.

The massive federal Central Valley Project, however, transformed this region's hydrology in the 1940s, and initially threatened both the wetlands and duck clubs. The CVP's Friant Dam, for example, intercepts the San Joaquin River and diverts its flow southward into the Tulare basin. The Tracy Pumping Plant pulls immense volumes of water out of the Sacramento-San Joaquin Delta and routes it into the San Joaquin basin via the Delta-Mendota Canal. Now everything and everyone in this basin—from agriculture and ranching to hunt clubs and nature—relies on CVP water and groundwater pumping in place of the San Joaquin's original flow. This imported Delta water has also brought more salt into the basin, and through the State Water Project, has leached toxic amounts of naturally occurring minerals (like selenium) that contaminates the region's water and soil. Despite all this, the San Joaquin basin still very successfully supports the largest contiguous expanse of wetlands in all California and a huge population of birds.

Four of this basin's numerous state and federal refuges are featured in this video. At 70,000 acres, the *Grasslands Wildlife Management Area* is the largest in California, and is a unique consortium of more than 200 private duck hunting clubs and cattle ranches who perpetually maintain their land for waterfowl habitat with conservation easements, a publically managed water district, and a permanent contract for CVP water. Duck hunters were among the earliest valley conservationists, and two thirds of Central Valley wetlands are still privately owned. The Grasslands is mammoth and sprawling, with a fascinating assemblage of both upscale and ramshackle hunt clubs situated amid boundless expanses of pastureland and alkali meadows.

*The Volta Wildlife Area* includes intensively managed waterfowl habitat and an enormous irrigation canal (the Volta Wasteway) that bisects the refuge. The Volta Wasteway has two new groundwater wells that provide additional CVP water for habitat development, and these wells can also dilute contaminants detected in the Wasteway. Numerous sensors and monitor wells at this site also generate baseline data for water quality monitoring projects at other nearby refuges. The Wasteway also provides important year-round habitat for the Giant Garter Snake—a threatened species found only in the Central Valley.

*The Merced National Wildlife Refuge* is celebrated for the large populations of Snow and Ross' geese it attracts every winter, who blanket refuge ponds in white. The largest population of Lesser Sandhill Cranes in the Pacific Flyway (up to 20,000 birds) also arrives at this refuge each season to feast in the cornfields that are specially grown for them.



Video still from *Merced National Wildlife Refuge (San Joaquin Basin)*, 2017, running time: 8.5 minutes

Merced is a completely spectacular place—one of the best valley refuges in winter for its sheer concentration of birds.

At 26,800 acres, the *San Luis National Wildlife Refuge* has many diverse and lovely habitats within its four individual management units, including seasonal and permanent wetlands, grasslands, riparian corridors, alkali mudflats, and numerous vernal pools. The refuge inhabits an island of alluvial deposits alongside the San Joaquin River, and is downstream of the Grasslands refuge. San Luis is also problematically downstream from more than 97,000 acres of irrigated farmland. This has historically caused salinity, selenium, and other water quality issues for its units (including in the former *Kesterson National Wildlife Refuge*) that must still be remedied today. Selenium occurs naturally in low levels in the soils on the west side of the San Joaquin and Tulare basins, but decades of irrigation have leached and concentrated this mineral, which in turn can be deadly to wildlife. One mitigation measure called the *Grasslands Bypass Project* treats, dilutes, and then routes this drain water through the San Luis refuge and then onward to the San Joaquin River. This project has been successful over time in lowering salt and selenium accumulations in this region's refuges, but the intractable problem of salty and toxic farmland in this basin remains.

# THE SUTTER AND YOLO BASINS

Until the late-nineteenth century, the Sacramento Valley regularly exploded into a vast inland sea that could reach 100 miles long and up to 8 miles wide. These historical flood regimes naturally irrigated the valley's many tule marshes, grasslands, floodplains, and dense riparian forests. When gold miners and farmers arrived in this region, they never heeded time-honored tribal adaptation strategies for peaceable living alongside these floods. Instead of adapting to them, the new arrivals reasoned, these epic deluges would be relentlessly battled.

Nineteenth century flood control measures were locally organized, insufficiently engineered, and often overwhelmed by gigantic sediment loads from hydraulic mining operations then endemic to the Yuba and the Feather River watersheds. The massive and federally coordinated *Sacramento Valley Flood Control Project*, however, managed to largely tame the Sacramento River and its major tributaries by 1933. More than 1000 miles of huge earthen levees, six weirs (low dams), and two major bypass structures roughly follow the course of the Sacramento River and intercept its flood stage at critical junctures. The Sutter Bypass, for example, runs through the center of the valley and gathers up the Feather River's flow as it moves southward. Below its confluence with the Feather River, the Sutter Bypass then crosses the path of the Sacramento River to grab more overflow and push it over the Fremont Weir. At the Fremont Weir, floodwater spills southward and into the Yolo Bypass, which (along with additional control structures) detours it safely around the city of Sacramento and then onward to the Sacramento-San Joaquin Delta.

The Sacramento Valley Flood Control Project's obvious benefits nevertheless came at an enormous environmental cost. When the project was completed by the late 1920s, nearly every remaining Sacramento Valley wetland had been drained and plowed under, primarily for rice cultivation, which still dominates the region today. These bypasses became the valley's re-engineered floodplains, and also became a handy place for reassembling new wetland and waterfowl habitat, like the *Sutter National Wildlife Refuge*. The Sutter refuge was established in 1945 to provide sanctuary for birds and to alleviate their consumption of rice in nearby fields. The refuge's seasonal wetlands are flooded in winter, and in the years when the Sutter Bypass springs into action as a floodwater conveyance facility, the refuge can find itself under up to 10 feet of water. As many as 150,000 ducks and 100,000 geese use Sutter each winter, in addition to a significant colony of nesting White-faced Ibis each spring. There are no auto tours at Sutter, and most visitors enter by foot to hunt and fish when the refuge is passable.

The *Fremont Weir Wildlife Area* is located at the confluence of the Sacramento River and the Sutter Bypass near the Sacramento airport, and has open meadows, oak woodland, and permanent freshwater ponds. Its vintage 1924 two-mile long six-foot high weir spans the entire length of the refuge's northern boundary, and with its graceful and gently curving form, this weir calms the velocity of river floodwater as it enters the Yolo Bypass. As is the case with many of the Sacramento Valley Flood Control Project's structures, the Fremont Weir has long been an obstacle to migrating salmon. Modifications to the weir and the refuge's waterways are now being planned so that stranded fish in this refuge can successfully make their way back to the Sacramento River.



Video still from *Fremont Weir Wildlife Area (Sutter and Yolo Basins)*, 2017, running time: 7.5 minutes

The *Yolo Bypass Wildlife Area* is a state-managed refuge of agricultural fields, cattle-grazed grasslands, and seasonal and permanent wetlands. The refuge's rice, corn, safflower, and millet cultivation is tremendously beneficial to the many birds and other species that find a home here. Both Interstate 80 and the Amtrak commuter rail line bisect the Yolo Bypass Wildlife Area along its northern boundary, so this refuge is one of the most frequently—albeit fleetingly—viewed wildlife areas in the United States. The Yolo Bypass in its entirety is only a fragment of the Yolo Basin's once gigantic natural floodplain, but it can still serve some of the biological functions that its much grander ancestor once did. Plans are now underway, for example, to modify bypass flood regimes to mimic the nutrient rich and lower water velocity habitat that outmigrating juvenile fish once enjoyed in the basin's original floodplain. Improved conditions in the bypass for this basin's salmon could possibly mitigate their increasingly degraded conditions in the Sacramento-San Joaquin Delta downstream.

## THE COLUSA AND BUTTE BASINS

The Colusa and Butte basins are located along the north and west sides of the Sutter Buttes—the tiny volcanic mountain range majestically sited in the center of the northern Sacramento Valley. The windswept Colusa Plain hugs the Coast Range along the west side of the Colusa basin, and once was a region of treeless scrubland, alkali meadows, vernal pool habitat and intermittent lakes. The Colusa Plain drains into the Colusa Trough (where the *Colusa National Wildlife Refuge* is located) a region once dense with tule wetlands. The Butte basin (where the *Gray Lodge Wildlife Area* is located) north of the Sutter Buttes is a vast floodplain that drains both Butte Creek and sometimes the Sacramento River's overflow as well. Butte Sink is located at the base of this floodplain along Sutter Buttes' northwest slopes—another region once thick with wetlands 100 years ago. Butte Sink still has incredible wetlands, and now supports the highest concentration of waterfowl in the world on a per-acre basis. Both the Colusa and Butte basins are completely dominated by rice cultivation. This region is also a great place to be a duck.

The beautiful and very popular *Sacramento National Wildlife Refuge* was established in 1937 on Colusa Plain former ranchland where no significant wetlands had existed before. The initial idea for the site was to create an irrigated rice farm to keep birds on the refuge and out of surrounding crops, and to encourage migrating waterfowl to make a stop in the Sacramento Valley on their way south. The Sacramento refuge now gets its CVPIA water from the nearby Glenn-Colusa Irrigation District and also from a local creek. Seventy percent of the Sacramento refuge is comprised of intensively managed seasonal and permanent wetlands, serving upwards of 750,000 ducks and 200,000 geese, among countless other species. The refuge also has a spectacular auto tour and a welcoming interpretive center.

The seasonal wetlands at Sacramento are managed like most other refuges in the Central Valley. The season starts with a gradual late summer flood-up to a water depth of no more than 12" for optimal foraging by arriving dabbling ducks and geese. As many ponds as possible are kept flooded throughout the winter so waterfowl can fatten up and perform their courtship rituals, and so human visitors can either watch them or hunt them. The flooded units are then gradually drawn down in the spring as the waterfowl leave and migrating shorebirds arrive to probe the shallow water for aquatic invertebrates. After draining, a managed wetland is ideally irrigated at least once in the summer to germinate beneficial food plants like smartweed, swamp timothy, and millet. As these food plants mature, the fall flood-up begins, migrating waterfowl return, and the cycle begins anew. Managed wetlands are also occasionally disked or mowed to promote the growth of beneficial plants and discourage undesirable ones. Small islands of cattail or tule are also often rhythmically scattered in the ponds to provide hiding places for resting birds.

These managed wetlands are very successful at feeding birds, but the 500,000 acres of rice fields in the Sacramento Valley are an extremely beneficial food source as well. Since the 1990s, costly depredations of fields have been largely curtailed by the adoption of early-maturing rice strains that can be harvested before most migrating birds return in the fall, and also by the post-harvest flooding of fields, where birds can forage for waste grain, weed seeds, and invertebrates left in the mud. The birds also fertilize the fields for the next crop and help decompose old rice straw.



Video still from *Colusa National Wildlife Refuge (Colusa and Butte Basins)*, 2017, running time: 7.5 minutes

Managed wetlands are almost twice as productive for benthic invertebrates as flooded rice fields, and post-harvest rice fields contain only half the nutritional value of the wetlands. Because of sheer acreage, however, agricultural habitats provide 68% of all food for Central Valley birds—most of it coming from rice fields.

Other types of crops—like row crops—can have some habitat value, but orchards have no value at all. This is a particular problem for the central and southern parts of the valley, where almond production has recently exploded. Some south-of-delta water contractors (like those in the Tulare and San Joaquin basins) must pay more for their water, which in turn incentivizes crops that have higher market value per irrigated acre, which at this point in time translates into more almonds. Sacramento Valley rice farmers have more senior water rights and lower cost water, so they can still profitably grow crops that also benefit wildlife. Urban encroachment in the Central Valley threatens both ag lands and the birds that depend on them. Our warming climate is making California's water supply increasingly unpredictable, competitive, and costly. All of these facts do not bode well for the future of the refuges.

## PROJECT NOTES

I am deeply indebted to Historian Phillip Garone's astonishingly well-researched book *The Fall and Rise of the Wetlands of California's Great Central Valley*. Other important publications for this project include *Seeking Refuge: Birds and Landscapes of the Pacific Flyway* by Geographer Robert Wilson, *Battling the Inland Sea* by Historian Robert Kelley, *The Great Thirst: Californians and Water: A History*, by Historian Norris Hundley, *Floodplains: Processes and Management for Ecosystem Services* by Researchers Jeffrey Opperman, et al, and *The King Of California: J.G. Boswell and the Making of A Secret American Empire* by Journalists Mark Arax and Rick Wartzman.

Critical research reports include the refuge *Comprehensive Conservation Planning* documents published by the U.S. Fish and Wildlife Service, and the *Central Valley Joint Venture Implementation Plan* published by Audubon California, the California Rice Commission, the California Waterfowl Association, et al. Additional helpful online resources include reports and articles published by the UC Davis Center for Watershed Sciences, the California Department of Water Resources, the Central Valley Regional Water Quality Control Board, and *Maven's Notebook*.

I am also indebted to the refuge biologists, birders, hunters, and duck club managers I informally talked to during my many visits to these refuges to film and observe.

# *Cultivated Ecologies*

*Cynthia Hooper*

## Acknowledgements

All videos © 2017: Cynthia Hooper

All essays are licensed under a Creative Commons  
Attribution-NonCommercial-NoDerivs 3.0 Unported  
License.