Evading Dam-Nation:
Land Use History of the Lower Cosumnes River Watershed, ca. 1820-2016

Photos clockwise from top left: A flooded rice field in summer at the Cosumnes River Preserve (CRP; by author, June 2016); the Cosumnes River (by author, June 2016); a flooded field at the CRP (by author, June 2016); riparian forest in today's lower Cosumnes River watershed; same riparian forest as the preceding image from 1937-1939 aerial photographs of Sacramento County (from Lauren Sommer, Alison Whipple, and Geoff McGee, see bibliography for full citation of the preceding two); Greater Sandhill Cranes at the CRP (from Denis Cuff; citation in bibliography).

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~Michelaina Johnson

I. Introduction

The Cosumnes River diverges from the popular history of California's rivers as the last river without a major dam and as the home of some of the largest native habitats remaining in the Central Valley. Of the 20 rivers draining the western Sierra Nevada Mountains, only the Cosumnes River runs free. Large dams impede the flow of the 19 other rivers to generate a reliable urban water supply and to help irrigate seven million acres of farmland in the Central Valley.[1] A century and a half ago, that farmland was a landscape of native habitat occupied and managed by Native Americans. White settlers, who started arriving to California in droves in the 1850s, valued the land for its profit potential and not its native habitat and biodiversity. Today, the opposite is true. The powerful environmental nonprofit, The Nature Conservancy (TNC), and a leading waterfowl conservation organization, Ducks Unlimited, established the Cosumnes River Preserve (CRP) in 1987 to protect the river's free flow and native flora and fauna (notably its unique riparian—river bank—forest) and to restore the river's floodplain. Since its founding, the CRP has curtailed historic habitat destruction and demonstrated that agriculture and native habitat conservation are compatible. That groundbreaking realization redefined conservation policy in California. The Cosumnes River watershed, though still a highly modified system, has become the riparian and floodplain restoration model for the Sacramento-San Joaquin Delta and the Central Valley's rivers, thanks to the efforts of the CRP's partners, including TNC, DU, the Bureau of Land Management, and the Sacramento County Department of Parks and Recreation. A sizeable, dedicated community of volunteers, staff, researchers, and locals today manage and restore the Preserve's 48,859 acres.

[1] Dylan S. Ahearn *et al.,* "Temporal Dynamics of Stream Water Chemistry in the Last Free-Flowing River Draining the Western Sierra Nevada, California," *Journal of Hydrology* 295, no. 1–4, August 10, 2004, 47; "Federal Agencies Release Data Showing California Central Valley Idle Farmland Doubling During Drought," *NASA*, October 21, 2015, accessed November 4, 2016, http://landsat.gsfc.nasa.gov/federal-agencies-release-data-showing-california-central-valley-idle-farmland-doubling-during-drought/.

The Cosumnes watershed had experienced nearly a century and a half's worth of engineering before Californians recognized its ecological value. Between 1848 and 1860, over 300,000 entrepreneurs from across the globe came to California with dreams of becoming rich through mining gold and establishing an inland agricultural Eden by reclaiming the state's native

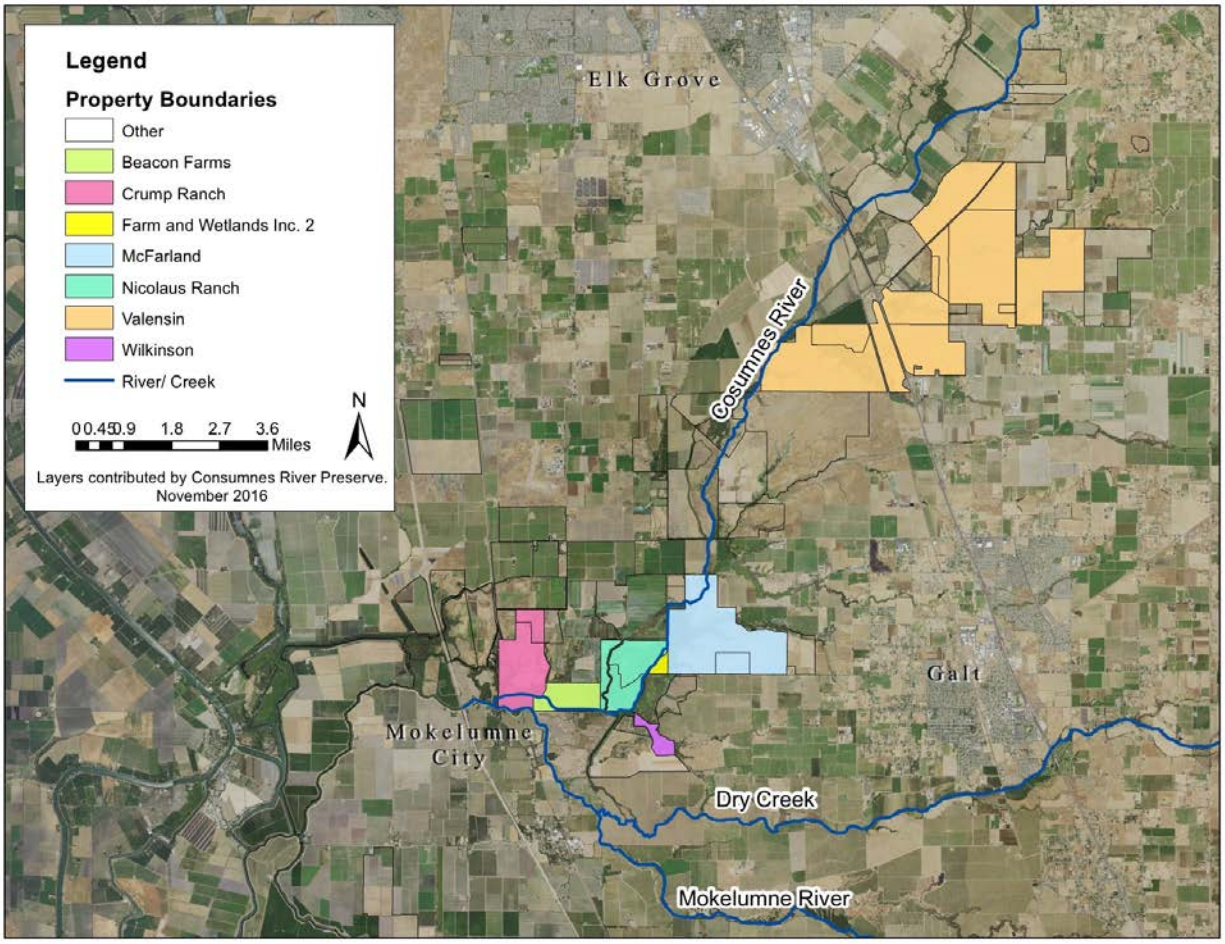

Figure one (the figures in the body of the thesis are labeled numerically and the figures in the 'List of Figures' are labeled alphabetically): This map shows the lower Cosumnes River watershed and delineates in black the properties that comprise the core of the Cosumnes River Preserve. The different colored properties are integral to recounting the story of unintentional native habitat preservation in the lower watershed and are mentioned frequently throughout the thesis. The blue denotes a river or stream, the most important being the Cosumnes River to the north (map created by Lina Aoyama, November 2016).

landscapes and engineering its waterways.[2] The Cosumnes River was not modified to the extent that its larger northern and southern neighbors—the American River and Mokelumne River,

[2] Stephanie Sabine Pincetl, *Transforming California: A Political History of Land Use and Development* (Baltimore: Johns Hopkins University Press, 1999), 2.

respectively—were because it had less overall volume and low base flow in the summer. In terms of volume and water storage potential, the Cosumnes is modest: the average annual flow is 357,082 acre-feet and the vast majority of the river's water comes from rain rather than snow, meaning that it has poor water storage potential compared to the state's other rivers.[3] The Mokelumne River's average annual flow is 741,000 acre-feet and the American River's average annual runoff is 2.7 million acre-feet, and both have two or more major dams.[4] Like the other rivers that flow directly into the Delta, the Cosumnes has three main forks—the North, Middle, and South—that originate in the western Sierra Nevada Mountains (Figure two and three). The three forks converge near Highway 49 to form the Cosumnes, which flows 80 miles from the Sierra Nevada to the Mokelumne before entering the Delta (see Figure three and Figure A).[5]

Figure two: These photos depict the North Fork of the Cosumnes River on the left and the Middle Fork on the right (by author, May 2017).

[3] Robertson-Bryan, Inc., *Lower Cosumnes River Watershed Assessment*, n.p., 2006, Cosumnes River Preserve private archive, Galt, California, 9, 13. The average is based on flow records from 1960 to 2004. The state's dams are designed to capture late spring and summer snowmelt for urban and agricultural use during the warm months between April and October.
[4] John Wesley Noble, *Its Name Was M.U.D.: A Story of Water* (Oakland: East Bay Municipal Utility District, 1970), 313; *American River Watershed Investigation, California, Volume 7, Appendix S* (Fort Belvoir: Defense Technical Information Center, 1991). The average for the Mokelumne is based on records from 1921 to 1998.
[5] Bern Kreissman and Barbara Lekisch, *California: An Environmental Atlas and Guide* (Davis: Bear Klaw Press, 1991), 46.

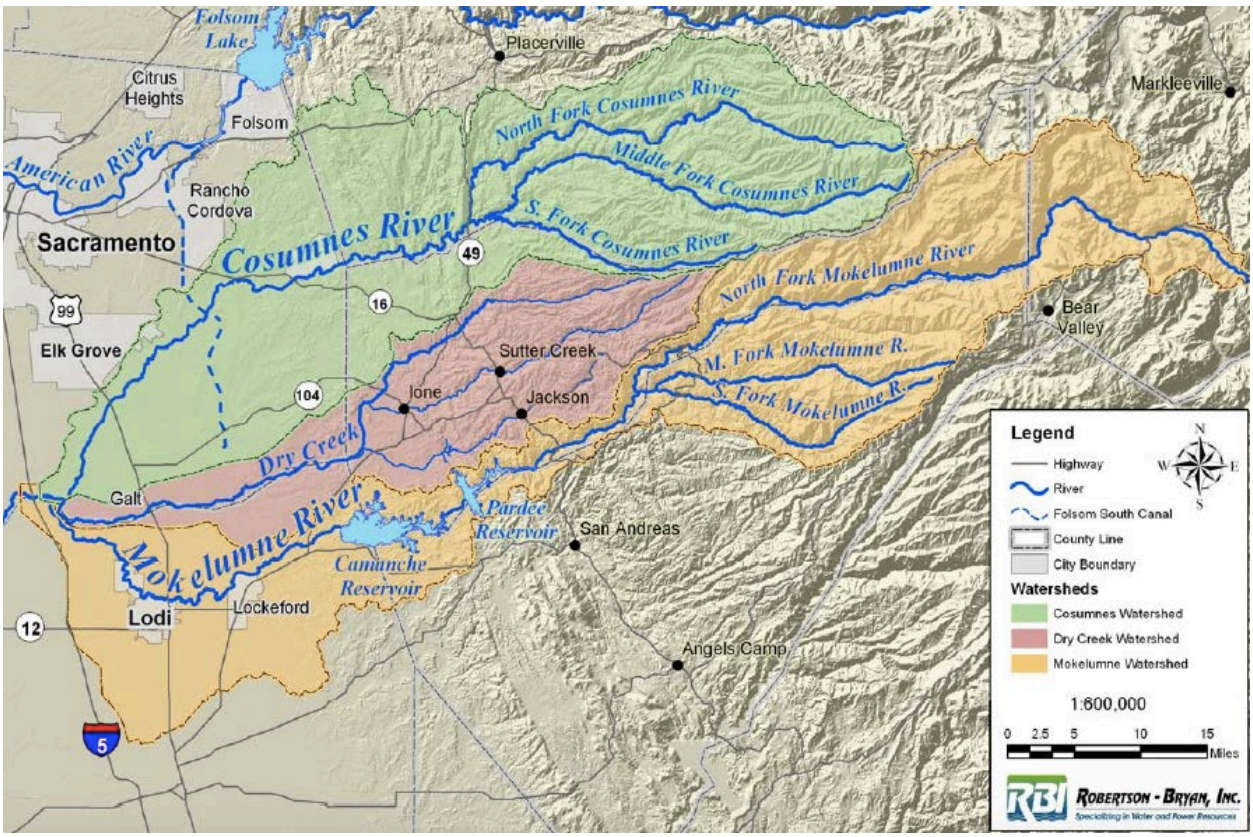

Figure three: This map shows the Cosumnes, Dry Creek and Mokelumne watersheds in relation to the city of Sacramento. Dry Creek is a tributary of the Cosumnes, and both are tributaries of the Mokelumne River. The image also features the three forks of the Cosumnes River (from Robertson-Bryan, Inc., *Lower Cosumnes River Watershed Assessment*, 4).

The Delta is the largest estuary on the west coast of the United States at 738,000 acres. It drains the water that falls in the Central Valley, which accounts for roughly 45% of California's surface water flow.[6] The Cosumnes River watershed contributes less than two percent of the water flowing into the Delta, yet its unregulated flow has allowed some of the largest native riparian plant communities remaining in the state to flourish. The riparian plants and habitats along the Cosumnes include wetlands, grasslands, vernal pools, and the largest oak riparian forest remaining in the state.[7] Since 1850, people have diked and drained 90% of the estimated 922,000

[6] Jay Lund et al., *Envisioning Futures for the Sacramento-San Joaquin Delta* (San Francisco: Public Policy Institute of California, 2007), 2, 12; Peter S. Alagona, *After the Grizzly: Endangered Species and the Politics of Place in California* (Berkeley: University of California Press, 2013), 198.

[7] A vernal pool is a type of seasonal wetland that forms in a depression in the ground where an impervious soil layer prevents rainwater from draining into the subsoil.

to 1.6 million acres of historic riparian forests in California and about 90% of the original four million acres of wetlands in the Central Valley.[8] They also have built 1,400 dams in the state, the largest of which are part of the Central Valley Project and the State Water Project (see Figure B).[9] Among the agriculture and dammed rivers in California, the free-flowing Cosumnes River and its native habitats make the watershed unique and worth protecting.

The Cosumnes River is exceptional not only in the context of California's water systems but also the world's watersheds, of which a third have lost more than 75% of their original forest cover. According to environmental policy scholar Ken Conca, there may be as many as 800,000 dams on the world's rivers and about half of them provide water primarily for irrigation. The vast majority of the largest rivers in the world are dammed, and free-flowing large rivers remain only in desolate areas, such as the tundra regions of North America and Russia and small basins in Africa and Latin America.[10] Though the Cosumnes River is not a large river, its unique characteristics as a relatively unimpaired and natural system have implications for watershed restoration in California and globally. Today countries worldwide contend with balancing the ecological and human needs of freshwater systems, as these biodiverse ecosystems decline and climate change threatens to worsen the situation. A historical case study of the Cosumnes River offers unexpected insights into the complex problem of how to balance the human and environmental demands of a watershed, with the equation equaling the use of wildlife friendly and flood compatible agriculture as a conservation tool.

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[8] Philip Garone, *The Fall and Rise of the Wetlands of California's Great Central Valley* (Berkeley: University of California Press, 2011), 2; Anna Steding, "Restoring Riparian Forests and Natural Flood Regimes: The Cosumnes River Preserve" in *Sustainable Use of Water: California Success Stories*, ed. by Lisa Owens-Viani, Arlene K. Wong, and Peter H. Gleick (Oakland: Pacific Institute for Studies in Development, Environment, and Society, 1999), 229.

[9] David Carle, *Introduction to Water in California* (Berkeley: University of California Press, 2004), 135.

[10] Ken Conca, *Governing Water: Contentious Transnational Politics and Global Institution Building* (Cambridge: The MIT Press, 2005), 75-79.

Despite the Cosumnes River's significance, the river has received little historical scholarly attention, as most environmental scholars of California have focused on the human destruction of the state's natural landscapes and waterways.[11] For example, historian Norris Hundley researched the major water projects of California, notably the Central Valley Project; historian Robert Kelley investigated hydraulic mining and engineering in the Sacramento Valley; and sociologist Karen O'Neill analyzed the origins of flood control on the Sacramento River.[12] Two scholars, Karen Louise Bennett and Philip Garone, laid the groundwork for rethinking California's environmental history, emphasizing the contingent factors in how dam project failures and human land uses produced the opposite outcome of what they were designed for, namely preserving floodwaters and sustaining native fauna. In "The River That Got Away," Bennett explored why the five water projects proposed for the Cosumnes between 1907 and 1968 failed and saved the river's free flow, which was one of the landscape's unique features that inspired The Nature Conservancy to establish the CRP in 1987.[13] In *The Fall and Rise of the Wetlands of California's Great Central Valley*, Garone looked at how rice, corn, wheat, and other crop fields inadvertently became surrogate wetlands for migrating waterfowl in the Central Valley after people destroyed most of the waterfowls' ancestral feeding grounds.[14] This thesis, similar to Bennett's and Garone's approaches, focuses on the role of contingency in telling the

[11] Most contemporary texts in California water literature disregard the river, either briefly mentioning its "diminutive" size or skipping it altogether. See Tim Palmer, *Field Guide to California Rivers*, California Natural History Guides, no. 105 (Berkeley: University of California Press, 2012), 6; Jeffrey F. Mount, *California Rivers and Streams: The Conflict between Fluvial Process and Land Use* (Berkeley: University of California Press, 1995); William L. Kahrl, *The California Water Atlas* (Los Altos: The Governor's Office of Planning and Research, 1979).
[12] Norris Hundley, *The Great Thirst: Californians and Water -a History*, rev. ed. (Berkeley: University of California Press, 2001); Robert Lloyd Kelley, *Battling the Inland Sea: Floods, Public Policy, and the Sacramento Valley* (Berkeley: University of California Press, 1998); Karen M. O'Neill, *Rivers by Design: State Power and the Origins of U.S. Flood Control* (Durham: Duke University Press, 2006).
[13] Karen Louise Bennett, "The River That Got Away: An Investigation into the Proposed Development Projects, the Players and the Political Climate That Helped Shape the Fate of the Cosumnes River" (Master's Thesis, California State University, Sacramento, 1997).
[14] Garone, *The Fall and Rise*, 2.

story of how farming practices and failed dam projects unintentionally preserved the largest oak riparian forest remaining in the state, as well as waterfowl and other rare native habitat types.

The failed dam projects also enabled the Cosumnes to remain the only major river out of 20 draining the western Sierra Nevada to have unregulated flow, which allows its floodwaters to shape the Cosumnes watershed's floodplain. For that reason, this thesis borrows environmental historian Mark Cioc's "eco-biography" framework from *The Rhine: An Eco-Biography, 1815-2000* to recount how and why the lower Cosumnes River watershed "became a degraded biological habitat" and to detail the ideologies that motivated farmers, ranchers, and conservationists to modify the landscape in particular ways.[15] Another historian, Richard White, characterized rivers as organic machines that mold their surrounding landscape, stating, "Like us, rivers work. They absorb and emit energy; they arrange the world."[16] A river's work is done with water—especially when there is lots of it. Human inhabitants in the lower watershed have understood the power of the Cosumnes' floodwaters and related to the river through the work it demands of them, changing their land use practices to live with the river's nearly annual flooding.

Understanding the historical land uses that support agriculture, floodplain restoration, and native flora and fauna is timely and necessary, as contemporary policymakers and scientists debate how to best implement the government mandated restoration of the Sacramento-San Joaquin Delta and the Central Valley's rivers. In search of successful examples of riparian restoration and land management models for those regions, researchers at UC Davis, policymakers, and natural resource managers have looked to the Cosumnes River. The fact that this seemingly insignificant river and its lower watershed are considered the exceptions rather

[15] Mark Cioc, *The Rhine: An Eco-Biography, 1815-2000* (Seattle: University of Washington Press, 2002), 4.
[16] Richard White, *The Organic Machine* (New York: Hill and Wang, 1995), 3-4.

than the norms for California's rivers raises two questions: Why were the Cosumnes River and its native habitats spared the extreme modifications that the other rivers in the Central Valley suffered over the past century and a half? Why did The Nature Conservancy and Ducks Unlimited protect this unique landscape in 1987?

The failures to dam the river—on the part of a few water agencies, private companies, and the Bureau of Reclamation as well as the predominance of wildlife friendly land uses along the riparian corridor—unintentionally spared the lower Cosumnes River watershed from the worst of the environmental engineering that the other rivers in the Central Valley suffered. Spurred on by a statewide push to protect California's disappearing native habitats, The Nature Conservancy capitalized on the uniqueness of the Cosumnes River and, in partnership with Ducks Unlimited, established the Cosumnes River Preserve in 1987.

The Preserve today is a 45,859-acre patchwork of agriculture, private property with conservation easements, and native habitats, including vernal pools, grasslands, oak riparian forest, blue oak woodlands, and managed wetlands.[17] The Nature Conservancy and Ducks Unlimited first established the CRP as a traditional preserve designed to protect 1,100 acres of oak riparian forest.[18] Yet, within the first few years of working in the area, the CRP's conservation biologists recognized the pivotal role that agriculture and flooding historically played in the local ecosystem and swiftly incorporated them into their conservation efforts, which were cutting edge in the mid-1990s. The Preserve's conservation strategies and multi-partner management model reimagined the traditional structure of a nature preserve from separating native habitats from anthropogenic land use to integrating both to maintain a

[17] Kleinschmidt Associates, "Cosumnes River Preserve Management Plan," n.p., 2008, 2-12, accessed October 10, 2015, http://www.cosumnes.org/about-the-preserve/.
[18] The Nature Conservancy, "California Nature Conservancy Dedicates Cosumnes River Preserve," press release, May 30, 1987, provided to author by The Nature Conservancy, November 17, 2016.

sustainable ecosystem. The lessons gained from the experimental work at the CRP "permeated water policy and resource management in the Central Valley," influencing state plans for restoration in the Delta and reshaping The Nature Conservancy's preserve management model.[19]

This thesis draws on a diverse cache of sources—from nineteenth century maps to scientific studies to 23 interviews with former and current CRP employees, scientists, and longtime farmers—to recount how specific native habitat types and waterfowl were able to persist in the lower watershed despite the extensive modifications the landscape underwent. The first section of this thesis discusses how the Plains Miwok, a Native American nation, managed the landscape while the second part explains how settlers reclaimed the watershed for agriculture. The third section looks at why five projects to dam the Cosumnes failed, the wildlife friendly practices that sustained the oak riparian forest and vernal pools, and the types of crops grown in the watershed that benefitted waterfowl over time. The fourth section places the establishment of the CRP into the national context of the 1960s and 1970s environmental movement. The conclusion analyzes how the land use history of the lower watershed informed the CRP's cutting edge conservation techniques and enabled the Preserve to become the restoration model it is today. With the many changes unfolding in the lower watershed in the coming years, the epilogue previews the efforts of select environmental groups in the Cosumnes watershed, as they aim to expand the protection of the watershed and implement the Sustainable Groundwater Management Act of 2014.

II. The Plains Miwok and the Native Landscape

If there were two jigsaw puzzles of the pre-settlement and current landscapes of the lower Cosumnes River watershed, the pieces would not fit together.[20] In the early 1800s, the river near

[19] "Cosumnes Profile Notes," n.d., provided to author by The Nature Conservancy, November 17, 2016.

where it joined the Mokelumne River in the lower Cosumnes watershed was not confined to one channel but rather branched into several channels, forming a marshland of dense tules and willow thickets called the Cosumnes Sink. A sink is a landscape in which a river or stream spreads into multiple distributary channels, often dominated by seasonal wetlands and willow thickets.[21] The sink flooded annually with the swampland typically remaining submerged for several months out of the year. According to nineteenth century maps and written accounts, "dense tules" and "wooded sloughs" dominated the swampland with willow thickets residing mostly in the north and gradually transitioning into a tule marsh in the south.[22] The vegetation also included blackberry, wild rose, and wild grape, among other emergent vegetation, which are plants with submerged roots and stems growing out of the water. During the summer, the channels significantly lost flow, which created a string of lakes and ponds that became habitat and feeding grounds for native animals. The southern portion of the sink, however, remained wet due to its low elevation and tidal influence up through the Delta's sloughs from the San Francisco Bay. The marshland rapidly gave way to grassland on the outskirts of the sink.[23]

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[20] For a virtual demonstration of this, see http://web.stanford.edu/group/west/cgi-bin/projects/delta/map/ (accessed November 10, 2016).

[21] AA Whipple et al., "Sacramento-San Joaquin Delta Historical Ecology Investigation: Exploring Pattern and Process," prepared for the California Department of Fish and Game and Ecosystem Restoration Program, a report of SFEI-ASC's Historical Ecology Program, publication #672, San Francisco-Estuary Institute-Aquatic Science Center, Richmond, CA, 2012, 298-9, 206.

[22] J.C. Boyd, "Survey Map of Properties and Swamp and Overflowed Land along the Cosumnes River Located in T6NR5 & 6E, and T5NR5E" [map], no scale, n.p., 1929, survey copied by J. C. Boyd from 1867 plats in U.S. Land Office at Sacramento, CA, County, Public Works Agency, Dept. Transportation Collection, Center for Sacramento History, Sacramento, California; JC Frémont, *Report of the exploring expedition to the Rocky Mountains, Oregon and California* (Washington, D.C.: Gales and Seaton, 1845), quoted in Whipple et al., "Sacramento-San Joaquin Delta Historical Ecology Investigation," 300.

[23] Whipple et al., "Sacramento-San Joaquin Delta Historical Ecology Investigation," 298-300.

Figure four: This 1859 land case map shows the Cosumnes River branching out into multiple channels near the site of the "Old Indian Rancheria" and forming the Cosumnes Sink (from Whipple et al., "Sacramento-San Joaquin Delta Historical Ecology Investigation," 299).

Contrary to the romantic colonial notion of a pristine and untouched California landscape, people had resided in and managed the land for thousands of years. Over that time period, some of the flora and fauna in the Cosumnes Sink evolved to depend on the Plains Miwok. Deer and tule elk grazed the landscape, naturally maintaining the grasslands and forest understory. The Plains Miwok also sculpted the landscape to their benefit through annual controlled burning, which they employed to hunt and to stimulate the growth of certain vegetation.[24] Controlled burning favored the growth of certain plants species, including

[24] Michelle L. Stevens and Emilie Zaloza, "Fire, Floodplains and Fish: the Historic Ecology of the Lower Cosumnes River Watershed," in *Rivers, Fish and the People. Tradition, Science and Historical Ecology of River Fisheries in the American West*, ed. by Pei Lin Yu (Salt Lake City: University of Utah Press, 2015), 163-4; Kat Anderson, *Tending the Wild: Native American Knowledge and the Management of California's Natural Resources* (Berkeley: University of California Press, 2005), 150-1, 207.

milkweed and Indian hemp, which the Miwok harvested for basketry, fishing materials and the construction of reed boats and houses. Annual burning also enhanced the floodplain for native fish species, such as the Sacramento splittail and the extinct thicktail chub, by creating favorable habitat for fish eggs and larvae and by mobilizing nutrients that nourished algae and zooplankton and thus fed fish.[25] The Miwok also managed the landscape through other practices, including the sowing of seeds, pruning, and weeding.[26]

The Plains Miwok benefited from the large number of fish, particularly salmon, sturgeon, and lamprey eels, which formed an integral part of their diet. Millions of migrating waterfowl and shorebirds also dined off the fish in the Central Valley during their annual winter migration from South and Central America to the wetlands of northern Alaska and western Canada.[27] Ethnobotanists Michelle L. Stevens and Emilie Zaloza described the Miwok relationship with the ecosystem as "kincentric," meaning that they "'view themselves as part of an extended ecological family that shares ancestry.'" This environmental attitude resulted in land-management techniques that sustained a beneficial environment for the Plains Miwok and "helped optimize conditions for California native fish species" as well as floral and faunal species that contributed to Miwok subsistence and material culture.[28]

The Miwoks near disappearance from the watershed in the second quarter of the nineteenth century marked a major land use shift in the lower watershed. The early to mid-1800s witnessed the forced removal and missionization of Plains Miwok and a malaria epidemic from 1830-33 that killed most of the Plains Miwok population. Simultaneously, new human actors—Spanish explorers, Mexican settlers (*Californios*), foreign trappers, and white and international

[25] Stevens and Zaloza, "Fire, Floodplains and Fish," 167.
[26] For a more in-depth description of the Plains Miwok material culture, see S.A. Barrett and E.W. Gifford, *Miwok Material Culture: Indian Life of the Yosemite Region*, (Yosemite National Park: Yosemite Association, 1997).
[27] Garone, *The Fall and Rise*, 1.
[28] Stevens and Zaloza, "Fire, Floodplains and Fish," 165-167, 180.

settlers—arrived on the scene with distinct ideas of how to manage the landscape. The introduction of livestock and invasive species, in addition to new human occupants of the land, "stifled efforts of permanent resettlement by Indians who wished to return to their traditional territory after the plague [malaria epidemic] had subsided." These factors contributed to the severe population decrease of Plains Miwok in the region in the mid-1800s.[29]

The Plains Miwok, like all indigenous groups in the United States and California, experienced mass violence, murder, imprisonment, and widespread displacement at the hands of settlers. Though an analysis of the atrocities carried out against Native Americans is beyond the scope of this thesis, it must be noted that nearly all of the approximately 310,000 indigenous people living in California in 1769 were dead nearly a century later with less than 10% of the population alive in 1876. Historian Benjamin Madley in *An American Genocide* explained,

> During the era when Spaniards, Russians, and Mexicans colonized the coastal region between San Diego and Fort Ross, California's Indian population fell from perhaps 310,000 to 150,000 … Under US rule, California Indians died at an even more astonishing rate. Between 1846 and 1870, California's Native American population plunged from perhaps 150,000 to 30,000. By 1880, census takers recorded just 16,277 California Indians. Diseases, dislocation, and starvation were important causes of these many deaths. However, abduction, de jure, and de facto unfree labor, mass death in forced confinement on reservations, homicides, battles and massacres also took thousands of lives and hindered reproduction.[30]

[29] Regina R. Siciliano-Kutchins, "Historical Land Use: A Study of the Early Human Occupation of the North Delta Region of Sacramento County" (Master's Thesis, California State University, Sacramento, 1980), n.p., 76.
[30] Benjamin Madley, *An American Genocide: The United States and the California Indian Catastrophe, 1846-1873* (New Haven: Yale University Press, 2016), 3. See this book for a detailed account of the state-sponsored violence against the Native Americans of California and indigenous resistance between 1846 and 1873.

Madley called the widespread, state-sponsored violence against Native Americans genocide. The Plains Miwok were victims of missionization, murder, disease, forced labor, displacement, and other atrocities. The eradication of indigenous people meant the widespread loss of landscape stewards, which, along with the settlement of immigrants to California, had drastic impacts on California's native flora and fauna and radically transformed the state's landscape.

III. "The Herculean Task": Reclamation and the Advent of Agriculture

Maps spanning the years 1859 to 1903 visually depict the evolution of the lower Cosumnes River watershed from a tule-dominated marshland to a "reclaimed" landscape.[31] All of the maps show the name of the first private landholding in the lower watershed—Rancho San Jon de los Moquelumnes. The rancho became the pie from which the settlers cut out their homesteads and ranches in the mid-1860s. In addition, despondent miners and aspiring white farmers acquired land and township grants to permanently settle in the lower watershed and, along with hired laborers, executed the arduous tasks of parceling up the newly acquired lands and of draining the Cosumnes Sink to make room for crops and cattle. The draining of the Delta generally, along with the deepening and straightening of the Sacramento River, also helped to drain the Cosumnes Sink. Despite being channeled and leveed, the Cosumnes' floodwaters survived the major landscape transformations and haunted farmers for decades to come.

[31] Whipple et al., "Sacramento-San Joaquin Delta Historical Ecology Investigation," 299; G.H. Thompson, "Plat of the Rancho San Juan de los Moquelumnes Finally Confirmed to the Heirs of Anastasio Chabolla" [map], 80 chs: 1 inch, U.S. Surveyor General, 1862, 1980/096/005, Center for Sacramento History, Sacramento, California; Thos S. Stephens, "Map of Ranch San Jon de los Mokelumnes showing the lands awarded to all parties interested in Ranch San Jon de los Mokelumnes according to the decree surveyed and compiled by order of the referees by Thos S. Stephens" [map], no scale, n.p., ca. 1900, Sacramento County Recorder's Office Collection, Center for Sacramento History, Sacramento, California; H.J. Furley, "Official Map of Sacramento County," [map], 60 chains: 1 inch, Sacramento County Surveyor Office, 1903, provided to author by the Sacramento County Surveyor Office, June 2016.

The first recorded white settler in the lower watershed was a Tennessean named William Hicks who came to California with the Walker-Chiles Party in 1843.[32] After working for the famous pioneer John Sutter for a few years, Hicks acquired land, which included today's Valensin Ranch, in 1847 from his former employer and started running cattle on it. A few years later, Hicks established a small town called Hicksville on the ranch and, although it only had a population of 90, the town became the largest settlement between Sacramento and Stockton for a short time in the mid-1800s.[33] Hicksville boomed and busted with the Gold Rush, as did other towns in the Central Valley, but their transient presence forever altered the landscape.

Between 1848 and 1860, thousands of gold seekers passed through the lower Cosumnes River region. Towns sprouted up beginning in the 1850s to supply miners with provisions and services. The town closest to the lower Cosumnes River, Mokelumne City, was founded in 1856 near the confluence of the Cosumnes and Mokelumne (see Figure one). Overnight the town became a "lumber and shipyard nucleus" and catered to travelers passing through the Delta on their way to the mines. A massive flood in 1862 obliterated the town and transformed the Central Valley into a temporary inland sea, washing away whole communities in the process.[34] As mining proved a dying industry in the 1860s, the towns changed character and economic focus, incentivizing the restructuring of settlement patterns and land exploitation in the Central Valley.

At the same time, thousands of miners abandoned their gilded dreams in the mountains and streambeds to pursue a new future in the grasslands and swamplands of the Central Valley. Most of the original settlers in the lower Cosumnes River watershed were former miners and

[32] Elizabeth Pinkerton, "Where in the world was Hicksville? Part 2," *Elk Grove Citizen*, June 21, 1995.
[33] Historic FarmHouse Foundation, "Hicksville Restoration Project," n.p., 1998, Cosumnes River Preserve private archive, Galt, California, B-1.
[34] Thompson, *Settlement Geography*, 417; Lynn Ingram and Frances Malamud-Roam, *The West Without Water: What Past Floods, Droughts, and Other Climatic Clues Tell Us About Tomorrow* (Berkeley: University of California Press, 2013), 31.

transplanted farmers seeking a lucrative future in the enterprise that they knew best—agriculture. As historian David Vaught wrote, "The first generation of California farmers, it must be remembered, had not intended to farm at all, but having failed in the mines, they became desperate to succeed on the land. In their haste to adapt to their new surroundings, they committed themselves not only to the market but to community life as well—and with a resolve and a sense of permanence that can only be described as remarkable."[35] The settlers' determination to establish permanent community started with acquiring private properties and township grants from the federal government.

There were at least 31 people who originally settled the lower watershed and purchased parcels of the 35,508-acre Rancho San Jon de los Moquelumnes in the late 1860s from the family of Anastasio Chabolla, the deceased *Californio* owner who had obtained the rancho from a land grant issued by the Mexican governor José Manuel Micheltorena in 1844.[36] The new owners divided the property into parcels of various acreages and promptly got to work reclaiming the land for agricultural production and pastureland. When the estimated 31 settlers acquired the parcels, the lower watershed was still a "swamp and overflowed land" with "timbered" sloughs and "tules," according to an 1864 *Plat of the Rancho Sanjon de los Moquelumnes* (see Figure C).[37] Nevertheless, the new property owners had the economic incentive and grit to transform the landscape from a "wasteland" to an agricultural Eden and establish communities that were integral to the state's trade network.[38]

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[35] David Vaught, *After the Gold Rush: Tarnished Dreams in the Sacramento Valley* (Baltimore: Johns Hopkins University Press, 2007), 220.
[36] Siciliano-Kutchins, "Historical Land Use," 14; G.H. Thompson, "Plat of the Rancho San Juan de los Moquelumnes." As a result of the rancho's ill-defined boundaries and the legal shifts in governance when California became a state in 1850, the rancho became the focus of a legal land ownership debate. Due to the ensuing court case, Chabolla's heirs did not receive a patent of ownership to the rancho until 1865.
[37] *Ibid.*; G.H. Thompson, "Plat of the Rancho San Juan de los Moquelumnes." I counted 31 distinct names on Stephens' map, although the map is such poor quality that the exact number is difficult to discern.
[38] Kelley, *Battling the Inland Sea*, 41.

The two largest land buyers of the rancho sales were John McFarland and Obed Harvey, who pioneered the transformation of the lower watershed.[39] As the largest landowner, Harvey had a vested interest in the prosperity of the region and founded the town of Galt in 1869, which competed with Liberty, a pioneer town located a few miles south.[40] The Dry Creek Township (which included Galt) and the lower watershed were part of the Sacramento Valley's wheat boom, which spread through the region around the late 1860s.[41] Harvey made sure that Galt became a market center for his wheat and the produce of other growers in the lower watershed by persuading the Western Pacific Railroad Company in 1869 to construct a train line between Galt and Sacramento. The line connected Galt with the national economy and the state's network of crop and human transportation. According to Galt historian Eugenia Olson, the railroad's presence in Galt forced the town of Liberty to relocate to Galt in 1870.[42] The construction of the railroad in Galt facilitated the rise of wheat as a dominant land use in the lower watershed although the exact acreage is unquantifiable. Hops, corn, and alfalfa fields, small vineyards, and fruit orchards were also present in the lower watershed but to a lesser degree than cattle, wheat and grain.[43] Fortuitously, grazing would end up benefitting the native habitats that survived reclamation while the corn, wheat, and alfalfa would nourish waterfowl in the lower watershed and the rest of the Central Valley.

[39] Stephens, "Map of Ranch San Jon de los Mokelumnes." I added up the acreages of different parcels belonging to the various landowners and came up with these two owning the most land.
[40] Thomas Hinckley Thompson and Albert Augustus West, *History of Sacramento County, California: With Illustrations Descriptive of Its Scenery, Residences, Public Buildings, Fine Blocks, and Manufactories from Original Sketches by Artists of the Highest Ability* (Oakland: Thompson & West, 1880), 327.
[41] Vaught, "After the Gold Rush," 150.
[42] Eugenia Olson, interview with Eugenia Olson, interview by Michelaina Johnson, July 7, 2016. Historian Eugenia Olson told me that her conclusion that Harvey sold or traded land with the Western Pacific railroad to persuade them to run through Galt was speculative. Though speculative, her argument makes sense, considering that Liberty would have been the logical choice through which to build the railway since it was older and more established than Galt.
[43] Thompson and West, *History of Sacramento County*, 12; "Bios of historical Galt people," n.p., n.d., provided to author by the Galt Area Historical Society, July, 2016.

Though the white settlers received recognition for masterminding the development and reclamation of California, it was not their hands that transformed the landscape. Chinese immigrants and Native Americans were the earliest farm workers in the lower watershed. In an ironic twist of fate, the Plains Miwok, whose ancestral lands the *Californios* and white people usurped, were forced to work as hired hands on ranches in the lower watershed due to the high demand for labor in the state's developing agricultural economy. For instance, in the latter nineteenth century, John McFarland, a large landowner in the lower Cosumnes, hired Miwok Indians to live on his property and cultivate his wheat fields.[44] The presence of Miwoks in the Cosumnes area after 1850 is not a reconciliatory story but rather a tragic reminder that the Native Americans of California who did not die prior to the 1850s were subjected to the forces of an unwelcoming and disempowering society for minority groups. Moreover, reclamation companies and landowners recruited Chinese immigrant laborers primarily from Chinatown boarding houses in Sacramento, Stockton, and San Francisco "to farm [and] to carry out the difficult work of reclamation for white landowners."[45] Chinese laborers were brought to the lower watershed to build "'wheel barrow levees'" as part of a larger effort to drain the lands aligning the Cosumnes River though the years of their labor are unknown.[46] Chinese and Native American workers were underpaid for their physically exhausting labor, which entailed using only a shovel and a wheelbarrow to dam sloughs, cut drainage ditches, build floodgates, and pile up levees.[47]

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[44] Albert L. Hurtado, *Indian Survival on the California Frontier* (New Haven: Yale University Press, 1988), 211, 217.
[45] Philip Garone, "Managing the Garden: Agriculture, Reclamation and Restoration in the Sacramento-San Joaquin Delta," Delta Narratives Project, Delta Protection Commission, 2015, 26, accessed September 23, 2015, http://www.delta.ca.gov/Delta_Narratives.htm.
[46] Siciliano-Kutchins, "Historical Land Use," 28.
[47] George Chu, "Chinatowns in the Delta: The Chinese in the Sacramento-San Joaquin Delta, 1870–1960," *California Historical Society Quarterly* 49, no. 1 (1970): 24. For more of a discussion on Chinese labor in California, see Sucheng Chan, *This Bittersweet Soil: The Chinese in California Agriculture, 1860-1910* (Berkeley: University of California Press, 1986).

Heterogeneous hands crafted a homogenous landscape. Before reclamation, the Cosumnes Sink was a diverse landscape with "a plexus of diverging and converging channels," lakes, sloughs, emergent vegetation, and dense thickets of willows and tules surrounded by grasslands.[48] Beginning in the 1860s, the first reclamation projects were initiated in the lower watershed, demonstrating the massive labor required to undo the river's work. Despite the minimal scholarly information available on reclamation along the Cosumnes, it is clear that the region did not endure the same widespread reclamation and habitat loss as the rest of the Delta even though part of the lower watershed resides in the Delta's boundaries. Geographer John Thompson in his 1957 dissertation, *The Settlement Geography of the Sacramento-San Joaquin Delta*, documented the only recorded reclamation project in the lower watershed, stating,

> In 1865 a drainage ditch was dug across the area from the Mokelumne to Beaver Slough so that the congestion caused by converging Mokelumne and Cosumnes flows could be alleviated. Levees and higher alluvial land were protected by the ditch at the same time that it drew water through the lower part of the basin. It was expected the alleviation would facilitate eventual reclamation of the lower land.

The converging flows of the Mokelumne and Cosumnes Rivers formed the Cosumnes Sink. The drainage ditch, in addition to levees constructed along the Mokelumne north bank and the adjacent Cosumnes bank, undoubtedly facilitated the draining of the sink.[49]

The State of California set up the State Board of Swamp Land Commissioners, also known as the Swamp Land Commission, in 1861 to coordinate reclamation efforts and to sponsor flood control projects, particularly on the 2,193,965 acres of swampland granted to California by the federal Swamp and Overflowed Lands Act of 1850. The Commission had

[48] Whipple et al., "Sacramento-San Joaquin Delta Historical Ecology Investigation," 199-200.
[49] Thompson, *The Settlement Geography*, 215-16.

formed 55 reclamation districts by 1865, one of which executed the construction of the drainage ditch as part of an effort to levee and drain 24,500 acres in the lower Cosumnes and Mokelumne River watersheds.[50] The state legislature dissolved the Commission in 1866 and any hopes of further state-sponsored reclamation in the lower watershed dissolved along with it.[51] According to environmental historian Philip Garone, the dissolution of the Commission exposed a statewide debate over which actors—quasi-regional entities, the state or federal government, or private local enterprises—bore the responsibility of paying for the high cost of reclamation. With respect to the Cosumnes Sink, private local enterprise won out.

While reclamation efforts in the Delta accelerated due to improved dredging equipment and technology beginning in the 1870s, the occupants of the lower watershed were relegated to cumbersome, manual reclamation methods. Chinese workers, among others, built levees and drainage ditches, dammed sloughs, and burned tules and peat soil—a carbon rich top soil layer composed of partially decayed vegetation or organic matter—to clear the land surface for cultivation.[52] The difference in reclamation methods for the Delta and the lower Cosumnes was in part due to the regions' varying physical landscapes. The Delta encompassed more tidal islands with deep peat soils that facilitated reclamation using dredges while the Cosumnes had stronger winter floods, among other factors, that limited the effectiveness of dredging.[53] The amount of acreage reclaimed in the Cosumnes River watershed is unquantifiable. However, a total of 441,000 acres were reclaimed between 1860 and 1930 in the Delta.[54] According to anthropologist Regina Siciliano-Kutchins, "By the late 1870s the agricultural character of the

[50] Garone, "Managing the Garden," 18-20; Thompson, *The Settlement Geography*, 215-16. The federal swamplands granted to the state included nearly 500,000 acres within the Delta, which do not appear to encompass any of the lower watershed.
[51] Garone, *The Rise and Fall*, 63.
[52] Garone, "Managing the Garden," 26-28.
[53] Alison Whipple, email message to Michelaina Johnson, March 26, 2017.
[54] Garone, *The Rise and Fall*, 63.

land [lower Cosumnes River watershed] which exists today [in 1980] was virtually complete and few Indians were in residence."[55]

Reclamation and engineering projects in the Delta also had monumental impacts on the draining of the lower watershed, especially one specific engineering feat on the Sacramento River that may have excavated as much soil as was removed in the building of the Panama Canal. The California Debris Commission (CDC) in the early 1900s obtained state and federal funds to dig "a wide curving channel from above Rio Vista to Collinsville." The project, called the Rio Vista cut, was a mammoth undertaking that deepened and straightened the channel of the Sacramento River, enabling water to exit the Delta more rapidly and lowering water elevations throughout the entire Delta, including the lower Cosumnes River. The Rio Vista cut inadvertently helped to drain the Cosumnes Sink and create favorable conditions for farming as well as riparian forest growth.[56] While the reclamation efforts of people living in the lower Cosumnes watershed are notable, the drying of the Cosumnes sink was largely the result of activities that took place elsewhere due to the interconnectivity of the lower Cosumnes with the Delta and other river systems, including the Sacramento and Mokelumne Rivers. The reclamation efforts and transportation infrastructure developments in the lower watershed and throughout the Central Valley created a self-reinforcing cycle in which reclaimed land produced abundant crop yields that were shipped via boat or train to the market. As the agricultural economy grew, more farmers purchased land in the lower Cosumnes River watershed and increased the area's population, further facilitating the economic growth and the conversion of natural habitat.

[55] Siciliano-Kutchins, "Historical Land Use," n.p.
[56] Kelley, *Battling the Inland Sea,* 279-281.

In less than four decades between 1860 and 1900, the Cosumnes Sink disappeared from the landscape, leaving behind remnant native habitats and a river that refused to stay confined to its channels. Two Sacramento County historians, Thomas Hinckley Thompson and Albert Augustus West, in 1880 wrote about how settlers perceived the work of a river as a destructive force that required subduing, stating that floods regularly ravaged the landscape in "torrential streams … rush[ing] annually an immense volume of water on its way to the ocean … carrying death and destruction along its course."[57] The flood of 1862 spectacularly reinforced that sentiment. That flood was the largest in recorded history in California, forming "a great sheet of brown, rippling water [that] extended from the Coast Range to the Sierra Nevada," that washed away entire communities, including Mokelumne City, and that drowned one-quarter of the state's estimated 800,000 cattle.[58] Thompson and West recognized the "herculean task" of subduing the water systems to man's will and envisioned a time not too far away:

> When immense reservoirs will be constructed, either by the government or the state, for the impounding of the flood water from the rain and melting snow and its distribution during the long, dry summer over the thirsty land, doubling and trebling the crops and bringing greater prosperity to the valley. Then too will the rivers, instead of bringing down destructive torrents upon the valley, remain within their banks.[59]

The authors aptly predicted the future of the Central Valley's rivers, as the federal and state government, individual farmers, and industry tirelessly engineered the state's geography to make the land and its water systems productive. Decades of small-scale engineering feats and public demand for more water instigated basin size water projects that led to the nearly complete straightjacketing of the Central Valley's rivers in dredged channels and levees with engineered

[57] Thompson and West, *History of Sacramento County*, 12.
[58] Ingram and Malamud-Roam, *The West Without Water,* 31.
[59] Thompson and West, *History of Sacramento County*, 13.

flood bypasses. In 1915, for instance, a former gold dredge company named Natomo Consolidated finished a massive project that enclosed the entire 80,000-acre American River basin with levees and berms, which are artificial embankments.[60] With the flood control and reclamation of the Valley's watersheds came not only the extreme loss of native habitats but also the loss of free flowing rivers.

IV. Dammed if You Do, Dammed if You Don't

The Cosumnes River today is the last free flowing river draining the western Sierra Nevada Mountains because every proposal to build a major dam on the river failed. Between 1907 and 1968, five water projects proposed more than 30 dams for the Cosumnes. If any one of those five feats had been executed, the native riparian habitats, particularly the oak riparian forest, either would have been destroyed or reduced to smaller sized remnants. Before the first quarter century of the 1900s, the Cosumnes River was not unique but rather was just another small river in the Central Valley with formidable flood potential. The uniqueness of the Cosumnes River watershed is the unexpected consequence of a series of government agency mishaps and financial fiascos that ruined any prospective projects for the river. The low elevation of the Cosumnes watershed at a peak of 7,500 feet and its small size made the dam projects have an inherently limited cost-benefit rational since most big dams are managed conjunctively with a large snowpack.[61] Proposed projects for other rivers in the Central Valley also failed, but no other river flowing west out of the Sierra Nevada was able to evade the hydraulic development wave that hit California in the 1930s. Environmental policy scholar Karen Louise Bennett's 1997 master thesis, *The River That Got Away*, heavily informs this section by discussing why the five historic projects for the Cosumnes River failed.

[60] Kelley, *Battling the Inland Sea*, 298-99.
[61] Robertson-Bryan, Inc., *Lower Cosumnes River Watershed Assessment*, 3.

The first proposed project for the development of the Cosumnes River competed with the controversial Hetch Hetchy reservoir project. In 1907, the Department of the Interior granted San Francisco legal access to develop the Toulumne River in the Hetch Hetchy Valley as a municipal water supply. The city, however, was met with a major national backlash from wilderness advocates, led by environmental activist John Muir in 1908, who did not want to see "one of Nature's rarest and most precious mountain temples" submerged beneath a reservoir.[62] Two companies, the Bay Cities Water Company and the Sierra Blue Lakes Water and Power Company, proposed two competing projects to Hetch Hetchy, both of which "targeted the Cosumnes River as a source of water from about 1900 to 1915." The Bay Cities' proposal, called the American-Cosumnes Project, was the main competitor of the Toulumne River project and called for the construction of 18 reservoirs on the north fork of the Cosumnes River to supply 104,900 million gallons of water to the city. This project was highly appealing to San Francisco because it was cheaper and would have provided more acre-feet of water than the Tuolumne Project.[63] The Cosumnes did not have a John Muir to fight for its free flow but rather survived because of a series of scandals that discredited the Bay Cities Water Company a few years before President Woodrow Wilson approved the construction of O'Shaughnessy Dam on the Toulumne River in December 1913.[64] Considering the legacy of Hetch Hetchy and the importance of the Cosumnes River today, Bennett asked, "Did we, as a society, in a sense "trade" (unknowingly) the preservation of the Hetch Hetchy Valley for the Cosumnes River Preserve?"[65]

[62] Hundley, *The Great Thirst,* 179-183; John Muir, "Dam Hetch Hetchy!", accessed November 18, 2016, http://historymatters.gmu.edu/d/5720/.
[63] Bennett, "The River That Got Away," 8, 17-18.
[64] Hundley, *The Great Thirst,* 178-184. The Toulumne River was added to the Wild and Scenic Rivers Act on September 28, 1984. See http://www.tuolumne-river.com/conservation.htm for more information (accessed November 18, 2016).
[65] Bennett, "The River That Got Away," 33.

O'Shaughnessy Dam exemplified a larger state trend of the early twentieth century. As the state's population increased, town and city water districts started developing regional water and energy projects in various watersheds in the Central Valley to meet the needs of a growing population and to control floodwaters. For instance, the East Bay Municipal Utility District constructed Pardee Dam on the Mokelumne River in 1929 to supply water to people living in the eastern San Francisco Bay Area. The Sacramento Flood Control Project was another regional undertaking that was nearly completed by 1944. The project covered 101,000 acres and controlled the Sacramento River with 980 miles of levees, five low water check dams, and 438 miles of channels and canals.[66] Between 1927 and 1940, three entities proposed distinct dam and reservoir projects for the Cosumnes River as a means to provide flood control, a reliable water supply, and improved irrigation. El Dorado County Irrigation District in June 1927 looked into building two dams and reservoirs on the Cosumnes River at Bucks Bar and Pleasant Valley but for unknown reasons abandoned the project. Less than a decade later, the Sacramento District U.S. Corp of Engineers investigated flooding in the Mokelumne watershed, which includes the Cosumnes River and a tributary of the Cosumnes called Dry Creek, and recommended constructing reservoirs on the Cosumnes. According to Bennett, the Corp of Engineers in 1937 "concluded that flood control along the Cosumnes by means of impounding reservoirs was not justified at the time," and instead the Corp recommended using the existing reservoirs on the Mokelumne to mitigate flooding on the Cosumnes.[67] Though the reason not to construct a dam was vague, the Corp's decision illustrates the insignificance of the river in the eyes of engineers, which helped to spare its free flow.

[66] Kelley, *Battling the Inland* Sea, 109.
[67] Bennett, "The River That Got Away," 42, 44-46.

The river was still large enough, however, to prompt two more agencies to consider harnessing the river's potential. An industrial engineer from Amador County named Earl E. Storrs proposed in a report in 1942 that the county erect three dams and reservoirs on the Cosumnes River—Bridgeport dam with a 50,000 acre-foot reservoir, the Russian Diggings dam with a 38,000 acre-foot reservoir, and Capps Crossing with a 15,000 acre-foot reservoir—for generating a reliable irrigation and municipal water supply. Storrs urged Amador County to obtain county of origin water rights to the river as soon as possible out of fear that the federal BOR would develop the river for the Central Valley Project first. The county's proposal ultimately failed because Amador neglected to secure their county of origin water rights "in a timely manner."[68]

The Central Valley Project (CVP) was the first federally sponsored project that connected developments on multiple watersheds and formed a complex web of plumbing that sent water from the northern to the southern Central Valley. The passage of the CVP in 1933 by Californians represented a huge victory for them "after almost two decades of pleading" for federal funding to construct costly water projects.[69] The project entailed the construction of some of the largest dams and reservoirs in the state, including the 602-foot Shasta Dam and 4,552,000 acre-foot Shasta Reservoir on the Sacramento River and the 340-foot Folsom Dam and 1,120,200 acre-foot Folsom Reservoir on the American River.[70] These major hydraulic developments, in addition to the CVP's failed water project proposals, highlight the pervasiveness of federal and state dam construction and of public disregard of the intrinsic value of free flowing rivers in the twentieth century.

[68] Ibid., 50. It is unclear whether the BOR obtained the water rights before Amador County or not.
[69] Hundley, *The Great Thirst*, 250-1; Kelley, *Battling the Inland* Sea, 308.
[70] Hundley, *The Great Thirst*, 252-253.

The BOR, the federal agency in charge of the CVP's implementation, began to investigate how to develop and incorporate the Cosumnes River into the CVP. The agency named their proposal the Cosumnes River Project.[71] In September 1964, the National Park Service submitted their *Project Report on the Recreation Potentialities of the Cosumnes River Division Central Valley Project* to the BOR providing data on six dams and reservoirs for the Cosumnes River, the largest being a 900,000 acre-foot reservoir on the Cosumnes' main stem. This project was the most expensive one proposed for the Cosumnes River at $180 million and provided "for the complete control of the water resources in the basin."[72] According to *A Report on the Feasibility of Water Supply Development*, issued by the BOR in 1967, the Cosumnes River Project would provide irrigation water for 34,749 acres of "productive lands" and an estimated 25,000 acre-feet of water for municipal and industrial use as well as flood control, recreation, fish and wildlife enhancement, power generation, and water quality control in the Cosumnes watershed and the Delta.[73] The reasoning behind this massive project was to "create new economic opportunities and realize the area's ultimate potential," which included providing water and electricity for the 16,000 people that lived in the basin in 1965 and for the 84,000 people that were projected to move to the region by 2020.[74]

The Cosumnes River basin in the 1960s was predominantly agricultural. Even though the Cosumnes River Project was designed to benefit farmers, some were opposed to it because they feared that it would cause them to lose their land, water rights, and access to crossing the river.[75]

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[71] Bennett, "The River That Got Away," 55.
[72] U.S. Department of the Interior, "Cosumnes River Division Central Valley Project Water Quality Control Study," San Francisco: Federal Water Control Administration, 1967, Cosumnes River Preserve private archive, Galt, California.
[73] U.S. Department of the Interior, *Cosumnes River Division, Central Valley Project, California: A Report on the Feasibility of Water Supply Development*, Sacramento: The Region, 1968, Special Collections, Water Resources Archive and Collections, University of California, Riverside.
[74] Ibid., 3, 5. The largest town in the lower watershed region, Galt, had a population of only 2,000.
[75] Bennett, "The River That Got Away," 61.

Farmers and the counties in the Cosumnes watershed were also afraid that they would lose land and tax revenue to the BOR's wildlife mitigation project. Beginning in the 1960s, in response to public outcry, the federal government mandated that major development projects mitigate for their environmental damage. According to Bennett, landowners interpreted the "federal government's proposal for a mitigation of wildlife and recreation … [as] a 'taking' and they would not give in without a fight." The opposition delayed the submission of the final project proposal to Congress by two years, inadvertently causing the project's original $155 million price tag to rise to $180 million due to inflation and the cost of mitigation. Despite the increased cost, the BOR's commissioner submitted an Initial Phase Report on January 14, 1969 to the Secretary of Interior, who approved it two days later. From there, the project—sealed with the findings and support of eight different government agencies—was sent to Congress for what was expected to be a swift approval. However, the federal government between the late 1960s and early 1970s had more than doubled its discount rate—a type of imputed interest rate used to calculate the benefit of federal projects—which made the Cosumnes River Project no longer economically justifiable. The change in price, among other cost-benefit issues, spurred Congress to return the proposal to the Bureau of Reclamation for reevaluation. In 1974, two working groups with representatives from five government agencies, including the Bureau of Land Management, tried to salvage the project, but high interest rates and a poor cost-benefit ratio ended up terminating the project.[76] None of the projects proposed for the river were scrapped to spare the river's flow, but rather competing agencies and projects, financial problems, and ill timing together over the course of six decades saved the Cosumnes' floodwaters.

Farmers, similar to federal and state agencies, supported dam construction in the early to mid-twentieth century. As a matter of fact, farmers agreed with water agencies that the

[76] Ibid., 62, 68-69.

Cosumnes River's free flow was "wasted" water that required storage to put it to beneficial use.[77] That mindset dated back to the beginning of the Gold Rush when state-sponsored and private reclamation projects laid the legal and physical groundwork upon which future agencies and farmers improved the landscape. However, farmers had more apprehensions about dams than the agencies. The farmers' main concern was ensuring that water projects did not divert the Cosumnes River's flow, which decreased significantly in the summer. As El Dorado County's chief engineer S.J. Norris wrote in a report in 1927, "The longer the District delays its construction of the reservoirs the more difficult it will become to handle the situation owing to possibilities of the riparian owners becoming united on a policy of opposition to diversion of the water."[78] Farmers were against any project—mitigation plan, state park, or otherwise—that might disturb the land that they and their ancestors had worked hard to develop.

The federal government, however, was changing its policies in the mid-twentieth century to require federal agencies to consider a project's impact on the environment in their project reports. For this reason, the Bureau of Reclamation in 1979 *Central Valley Project Reformulation Report* recognized the potential environmental damage of the Cosumnes River Project and the wildlife needs of the lower watershed, noting that "future water needs will also be affected by environmental concerns which might limit economic growth or channel it into the directions considered to be most suitable for preservation and enhancement of environmental quality."[79] The BOR spoke to the growing national concern for endangered and threatened wildlife and foreshadowed the establishment of the Cosumnes River Preserve in 1987.[80]

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[77] Ibid., 56.
[78] Ibid., 42; S.J. Norris, *El Dorado Irrigation District Report on the Riparian Rights in the Lower Cosumnes River*, Oroville: El Dorado Irrigation District, 1927, Cosumnes River Preserve private archive, Galt, California.
[79] U.S. Bureau of Reclamation, *Cosumnes River Division Reformulation Study, Central Valley Project, California: Concluding Report*. S.I.: U.S. Bureau of Reclamation, 1979, Water Resources Archive and Collections, University of California, Riverside, as quoted in Bennett, "The River That Got Away," 72.
[80] Bennett, "The River That Got Away," 72.

Farms and Floods

The failure of every dam project for the Cosumnes River incidentally resulted in the preservation of the only river free of major dams flowing out of the western Sierra Nevada. The only notable impoundment within the Cosumnes River watershed is on Sly Park creek, a tributary of the Cosumnes' middle fork. The BOR constructed a 190-foot dam and a 41,000 acre-foot reservoir on the creek in 1953 as part of the American River Division of the Central Valley Project.[81] Even though the CVP was still able to leave its mark on the river, the dam was not large enough to make an "appreciable effect" on the river's flow, according to the 2006 *Lower Cosumnes River Watershed Assessment*.[82] Besides that impoundment, the river has check dams, which counteract erosion by reducing water flow velocity. Without any major impoundment, the Cosumnes River's floodwaters remained a potent force on the landscape, limiting the growing season and the types of crops that farmers were able to cultivate.

The Cosumnes retained its influence on the landscape through flooding. Due to California's Mediterranean climate, the vast majority of the rainfall in the watershed occurs between December and May and causes flooding on a nearly annual basis.[83] For the properties not protected by levees, flooding restricted the growing season to late spring through fall, forcing agriculturalists to raise cattle and to grow annual crops, including wheat and corn. Some farmers supported dam proposals for the river to be able to extend the growing season. For instance, S.J. Norris wrote in 1927 that one farmer had "too much water come on land in winter and [could] see no objection to storage of flood water and [did] not object to storage if his practice of wetting land [was] not interfered with."[84] During particularly strong flood years, the inundations

[81] Ibid., 21.
[82] Robertson-Bryan, Inc., *Lower Cosumnes River Watershed Assessment*, 3.
[83] A Mediterranean climate is characterized by warm, wet winters and hot, dry summers.
[84] S.J. Norris, *El Dorado Irrigation District Report*, 37.

destroyed property, livestock, and crops and, in some cases, put farmers out of business. A few recorded floods testify to their destruction. Between November 18th and December 10th, 1950, a series of storms caused severe flooding in the lower watershed, breaching several levees and inundating approximately 3,900 acres along Dry Creek and 17,600 acres of agricultural land along the Cosumnes River from Sloughhouse to the river's confluence with the Mokelumne. A major rainstorm in December of 1955 surpassed the damage from five years earlier, flooding 5,200 acres along Dry Creek and 24,900 acres of mostly agricultural and grazing land from Highway 16 to the confluence.[85] The cost of damage of the 1950 and 1955 floods along the Cosumnes River were $234,000 and $1.4 million, respectively. Another major flood in February 1982 drowned cattle and contributed to the bankruptcy of one prominent cattle rancher in the lower watershed, Charlie Coldani. A friend of Coldani and longtime resident of the lower watershed, Wendel Flint, in an interview recalled what happened to Coldani's cattle: "I can remember … when the floodwater receded, [there were] dead calves hanging off the barbed wire fence."[86] The largest peak flow in recorded history at Michigan Bar at 93,000 cubic feet per second took place on January 2nd, 1997 and inundated approximately 24,000 acres. Despite the estimated $13 million in agricultural losses, this flood was instrumental in exhibiting to a statewide audience the benefits of floodplain restoration through levee breaching as a means to mitigate the impacts of major floods.[87] In that year, local news agencies featured the Cosumnes River Preserve as a success story for how to manage floods in a way that reduced damage and provided environmental benefits, which attracted philanthropic and public agency interest in the Preserve and drew the attention of researchers at UC Davis and beyond.[88] While flooding

[85] Robertson-Bryan, Inc., *Lower Cosumnes River Watershed Assessment*, 15.
[86] Wendel Flint, interview with Wendel Flint, interview by Michelaina Johnson, July 28, 2016.
[87] Robertson-Bryan, Inc., *Lower Cosumnes River Watershed Assessment*, 14, 16.
[88] Mike Eaton, email message to Michelaina Johnson, April 23, 2017.

impinged on agricultural life in the Cosumnes region, it also helped to preserve the largest oak riparian forest in the state and revealed the opportunities for floodplain restoration in mitigating flood damage risk.

Groundwater

Beneath the farmers' feet an unseen change was also impinging on the local ecosystem's health and altering the river's flow regime. Three factors—the introduction of improved pumps for agricultural irrigation in the early to mid-1900s, the growth of Elk Grove and Galt, and the construction of levees—contributed significantly to the overdraft of the Cosumnes basin's aquifer. By the 1950s, increased groundwater withdrawals had substantially lowered the aquifer level with two cones of depression forming to the north and south of the river.[89] The construction of levees over time also constrained the river to a narrow channel, which greatly reduced the amount of groundwater recharge due to the loss of floodplain access. The result was the conversion of the Cosumnes River from a gaining to a predominantly losing stream, meaning that the historically high groundwater levels that had supplied base flow to the river during the summer and fall were now recharging the depleted aquifer.[90] Base flows come from groundwater flow in the meadows of the Cosumnes' headwater, intermittent gaining reaches in fractured bedrock of the Sierra Nevada foothills, and historically from the Central Valley's alluvial plain wetlands.[91] The reduction in base flow had major environmental consequences.

Due to the substantial groundwater overdraft, the non-tidally influenced part of the lower Cosumnes River watershed tends to run completely dry by the fall. The base flows of the 1990s were especially low and worsened over the following years with the river, in some cases,

[89] Jan Fleckenstein et al., "Managing surface water-groundwater to restore fall flows in the Cosumnes River," *Journal of Water Resources Planning and Management* 130, no. 4 (2004): 301.
[90] Robertson-Bryan, Inc., *Lower Cosumnes River Watershed Assessment*, 12.
[91] Melinda Hurzel-Frost, Mike Eaton, and Kimberly Petree, *2016 Cosumnes River Watershed Update and Plan*, report for the Cosumnes Coalition, November 2016.

disconnecting in June and not re-connecting until December or even January.[92] The decline in fall flows has impeded the fall-run Chinook salmon migration and has been identified as "a primary stressor of spawning success of fall-run Chinook salmon" in the watershed.[93] The annual fall run of Chinook salmon on the Cosumnes occurs from early October through late December, with a peak in November. By the early 2000s, the salmon situation had become dire with fewer than 600 fall-run fish consistently migrating through the Cosumnes River.[94] More specifically, one study reported that, during 1997 to 2001, the estimated Chinook salmon run numbered between 100 to 580 fish based on carcass counts, which were major lows considering that fall runs had totaled as many as 5,000 over the previous four decades.[95] The nearly unfettered flooding of the Cosumnes River, however, demonstrated the potential of floodplain restoration for groundwater recharge and enhanced fish migration, which the Cosumnes River Preserve capitalized on beginning in the 1990s.

V: A Remnant Remains

While the Cosumnes' floodwaters retained their agency, the area on both sides of the river, as the rest of the Central Valley, experienced a major transformation. The Central Valley lost close to 90% of its original vernal pool habitats and about 90% of its original four million acres of seasonal and perennial wetlands while the state lost 90% of the estimated 922,000 to 1.6 million acres of its historic riparian forests.[96] This section has three parts, each tracing how certain land use practices preserved two rare habitat types—vernal pools and oak riparian

[92] Ibid.
[93] Fleckenstein et al., "Managing surface water-groundwater to restore fall flows in the Cosumnes River," 309.
[94] Ibid., 301.
[95] Jan Fleckenstein, Richard Niswonger, and Graham Fogg, "River-Aquifer Interactions, Geologic Heterogeneity, and Low-Flow Management," *Ground Water* 44, no. 6, accessed May 26, 2017, http://onlinelibrary.wiley.com/doi/10.1111/j.1745-6584.2006.00190.x/full.
[96] Garone, *The Fall and Rise,* 2; Steding, "Restoring Riparian Forests and Natural Flood Regimes," 229; "California's Vernal Pools," *California Department of Fish and Wildlife*, last modified June 13, 2013, accessed November 18, 2016, https://www.wildlife.ca.gov/Conservation/Plants/Vernal-Pools.

forest—and sustained waterfowl, all of which the CRP protects today. Moreover, this section relies on scientific studies, aerial images, and interviews, among other sources to infer which land uses practices saved waterfowl, vernal pools, and oak riparian forest. The historic record is silent on how some habitats and wildlife survived the conversion of the Central Valley to agriculture, with one notable exception. Environmental historian Philip Garone's *The Fall and Rise of the Wetlands of California's Great Central Valley* recounted how waterfowl adapted to consuming some types of annual crops, such as corn, wheat, and alfalfa in lieu of their natural diet after the vast majority of their ancestral feeding grounds were destroyed. The same observation in Garone's book applies to the waterfowl, including sandhill cranes, in the Cosumnes watershed. Scientific studies on vernal pools demonstrated that cattle grazing maintained this sensitive habitat type.[97] These studies, when combined with twentieth century land use maps, can be used to make a compelling case for how the CRP's protected vernal pools endured in the lower watershed. The third part employs tree dating, maps, aerial images of Sacramento County spanning the years 1937 to 1984, and interviews to understand when the oak riparian forest took root in the lower watershed and why the largest oak riparian forest resides in that particular location.

Waterfowl

For at least a million years, millions of waterfowl—ducks, geese, swans, sandhill cranes, and shorebirds—have been using the wetlands of the Central Valley as winter feeding grounds during their annual migration from Central and South America to the wetlands of northern Alaska and western Canada. Due to the widespread reclamation of the Central Valley, today's

[97] Sheila J. Barry, "Managing the Sacramento Valley Vernal Pool Landscape to Sustain the Native Flora," in *Ecology, Conservation, and Management of Vernal Pool Ecosystems – Proceedings from a 1996 Conference*, ed. by C.W. Witham, et al. (Sacramento: California Native Plant Society, 1998): 236-240. Jaymee T. Marty, "Effects of Cattle Grazing on Diversity in Ephemeral Wetlands," *Conservation Biology* 19, no. 5 (2005): 1626-1627.

waterfowl no longer find pervasive wetlands but rather hundreds of thousands of acres of agricultural fields. As Garone explained, "In the Central Valley, the expansion of agriculture … destroyed natural wetland food sources for waterfowl and forced them to turn to whatever food became available," which included rice, alfalfa, wheat, corn, and pastureland, most of which have been prominent in the lower watershed since the 1850s.[98]

Though no historical sources about the Cosumnes mention waterfowl, agriculture in the region was compatible with the waterfowl diet. Following reclamation in the 1860s, the first recorded crop known to provide sustenance for waterfowl was wheat. The crop was grown in large quantities on several ranches, including McFarland Ranch, following the wheat boom in the Sacramento Valley. Waterfowl more than likely consumed a portion of the wheat in the lower watershed, considering that geese were feasting on wheat grown along the Sacramento River in the 1880s.[99] According to anthropologist Regina Siciliano-Kutchins, ranchers in the lower watershed gradually shifted from mostly livestock to crops and dairy in the late 1860s and 1870s as a result of land reclamation and the discovery that some crops, particularly grains, could grow on "adobe" soil.[100] One of the first federal wildlife refuges in the state aimed at protecting waterfowl, the Sacramento Migratory Waterfowl Refuge, grew wheat and alfalfa to feed the birds, and today's Cosumnes River Preserve uses corn and rice as a waterfowl food sources.[101]

Farmers did not sit by idly as hungry birds consumed their harvest. Ban Hickey, the descendent of a pioneer family, described how farmers in the mid-1880s protected their agricultural investment:

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[98] Garone, *The Fall and Rise*, 1, 149-155.
[99] Ibid., 152.
[100] Siciliano-Kutchins, "Historical Land Use," 37; Thompson and West, *History of Sacramento County*, 12, 331.
[101] Garone, *The Fall and Rise*, 153-55.

> The farming land in the Sacramento Valley, and some of the San Joquin [sic], Valley, in the winter time, would be just swarming with ducks, and geese, and some sand-hill cranes. The farmers had to hire men just to shoot and keep the geese, and ducks off the grain, or they would not let the grain get a start, to grow. As an example, or the number of ducks, and geese, Some of the market hunters, reported killing as many as 350 ducks in a single day.[102]

Even though waterfowl adapted to using some annual crops as surrogate wetlands, their population dropped precipitously from 90 million in 1880 to less than ten million in 1992 due to the loss of wetlands and hunting.[103] One species of waterfowl, the Greater Sandhill Crane—a four-foot tall, grey-feathered, red-topped bird—especially suffered. By the 1940s, the breeding population had decreased to fewer than five breeding pairs in the state.[104]

The sandhill cranes, among other waterfowl, became a fixture of the lower watershed during the wintertime when they migrated through the Central Valley along the Pacific Flyway. Local residents would drive on roads surrounding the ranches in the lower watershed to bird watch. Longtime Galt resident Eugenia Olson remembered that in the 1940s her mother would take her to see sandhill cranes and geese on ranches along Desmond Road, which are now part of the Cosumnes River Preserve.[105] The land use in the area encompassing Desmond Rd. a decade prior was "small hay and grain," according to a 1930 map by L.A. Crawford and E.B. Hurd

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[102] Ban Hickey, "Excerpts from the History of the Hickey Family," in *Tapestry, A Collection of Writing from Pioneer Days*, ed. by Eugenia Olson (Galt: The Galt Area Historical Society, n.d.), 5.
[103] Lisa Owens-Vianni, "Winter-Flooded Fields Benefit Farmers and Wildlife," in *Sustainable Use of Water: California Success Stories*, ed. by Lisa Owens-Viani, Arlene K. Wong, and Peter H. Gleick (Oakland: Pacific Institute for in Development, Environment, and Society, 1999), 203.
[104] "Sandhill Crane," *Audubon Society*, accessed November 18, 2016, http://ca.audubon.org/birds-0/sandhill-crane. Thanks in part to the Preserve's protective measures and the bird being added to the state list of threatened species, the breeding pairs increased to 465 pairs in 2000.
[105] Olson, interview with Eugenia Olson.

depicting the types of farming in the Sacramento Valley.[106] Those crops are wildlife friendly, which explains why the waterfowl were roosting in the field. Rich Reiner, who grew up in Sacramento and later lived in the lower watershed, recalled seeing sandhill cranes on Desmond Rd. in the 1950s.[107] Between 1930 and 1984, the crops cultivated in the area changed and diversified, but most of them remained compatible with waterfowl. By the time The Nature Conservancy purchased its first property along the Cosumnes in 1984, the crops along Desmond Rd. included rice, pasture (either clover, alfalfa or pastureland), grain and hay crops, and some field crops.[108] The property growing field crops belonged to the family of long time resident Wendel Flint who substantiated in an interview that the field crops were a mix of corn, tomatoes, and sugar beets.[109]

Vernal Pools

While annual crops benefitted waterfowl, cattle grazing helped to preserve vernal pools and oak riparian forest. Vernal pools are a type of seasonal wetland that forms in a depression in the ground where an impervious soil layer prevents rainwater from draining into the subsoil.[110] The CRP today protects over 14,100 acres of vernal pool landscape, which is about ten percent of the total 137,100 acres remaining in the Central Valley.[111] Twenty percent, or 2,924 acres, of those 14,100 acres is located on Valensin Ranch.[112] Considering that this ranch, of all the

[106] L. A. Crawford and E. B. Hurd, "Type of Farming Areas: Sacramento River Valley, 1930" [map], no scale, n.p., 1935, Map Case B, Earth Science and Map Collection Library, UC Berkeley.
[107] Rich Reiner, interview with Rich Reiner, interview by Michelaina Johnson, July 12, 2016.
[108] California Department of Water Resources, "Sacramento Co., 1984 Land Use" [map], no scale, Sacramento: The Dept., 1984, Map and GIS Data Collection Library, UC Davis. The category of field crops is wide-ranging, covering ten crops from cotton to castor beans to miscellaneous field crops.
[109] Flint, interview with Wendel Flint.
[110] Kleinschmidt Associates, "Cosumnes River Preserve Management Plan," 3-2; "California's Vernal Pools," *California Department of Fish and Wildlife*.
[111] Ibid.
[112] Kleinschmidt Associates, "Cosumnes River Preserve Management Plan," 7-36-43.

Preserve's properties, is one of the best documented, it serves as the study site for the history of vernal pool grasslands in the lower watershed.

Even though vernal pools did not evolve with cattle grazing, two studies found that vernal pool landscapes in the Sacramento Valley "have developed under grazing" for more than a century.[113] Grazing today sustains the biodiversity of native plants and species found in and around vernal pools, including Burke's Goldfields and Sebastopol Meadowfoam, making this habitat "essentially islands of native flora among a grassland composed primarily of exotic annual species."[114] Conservation biologist Jaymee T. Marty found that grazing helped to maintain native plant and aquatic diversity in vernal pools after studying the impacts of grazing on that habitat type in eastern Sacramento County between 2000 and 2003. The 5,000-hectare site that Marty studied had been grazed from approximately October to June for more than 100 years.[115] Rangeland ecologist Sheila J. Barry also noted that most of the open areas in the Sacramento Valley not under cultivation have been grazed for more than 150 years.[116]

The 4,356-acre Valensin Ranch, situated in the lower southern portion of Sacramento County, has supported grazing for more than 170 years. William Hicks, the Tennessee transplant and one of the earliest settlers in the lower Cosumnes, started running cattle on his newly acquired property in the late 1840s. After Hicks passed away in 1884, his stepdaughter, Caroline Wilson, and her husband, John McCauley, acquired ownership of the property. At the time, McCauley maintained 1,500-2,000 head of cattle and 100-200 horses on the ranch, in addition to

[113] Barry, "Managing the Sacramento Valley Vernal Pool Landscape to Sustain the Native Flora," 236. Elk, antelope, and deer grazed in the Central Valley before cattle and some continue to today.
[114] Ibid.
[115] Marty, "Effects of Cattle Grazing on Diversity in Ephemeral Wetlands." Marty also found that some vernal pool endemic species could not complete their life cycle when grazing was removed from the landscape.
[116] Barry, "Managing the Sacramento Valley Vernal Pool Landscape," 237.

Vernal pool, Howard Ranch

Figure five: This photo shows a vernal pool at Howard Ranch, a property belonging to the CRP (From The Nature Conservancy, "Cosumnes River Summary Materials," 1999, provided to author by The Nature Conservancy, November 17, 2016).

a small wheat operation, which may have benefitted waterfowl.[117] According to the 1930 map by Crawford and Hurd, the land uses in the region in which Valensin Ranch resided were grazing lands and "small hay and grains."[118] From at least the 1930s onward, the Valensin family also leased grazing land to local ranchers. Butch Loretz, a longtime rancher in the area, said in an interview that his father and he leased grazing land from the Valensin family since the 1930s; Loretz continues to graze on the ranch except now he leases from the Cosumnes River Preserve rather than private owners.[119]

[117] Melinda Peak, "Evaluation of Significance of Structures Located within the Valensin Ranch Headquarters, Sacramento County, California" El Dorado Hills: Peak & Associates, Inc., 1997, Cosumnes River Preserve private archive, Galt, California, 7.
[118] Crawford and Hurd, "Type of Farming Areas."
[119] Butch Loretz, interview with Butch Loretz, interview by Michelaina Johnson, July 15, 2016.

To builders, the ranch was vacant land ripe for suburban tract housing development that could meet the needs of Sacramento County's growing population. A development company called Crocker Development II had plans to build 4,500 homes, two golf courses and commercial development on the ranch, and had a $28 million purchase option on the property between 1989 and 1992.[120] At the same time, the Preserve had been hoping to acquire Valensin Ranch to preserve the vernal pools though they were unable to compete with the development company's capital. A decline in the real estate market in the early 1990s, however, killed the economic vitality of Crocket Development II's plans. In another unplanned and unpredictable scenario, the dip in the real estate market gave the Preserve enough time to purchase the ranch in a series of parcels ranging from 140 to 945 acres between 1994 and 1997.[121]

Cattle ranching has been a major land use in the lower watershed since the 1840s. Though the history of the other cattle ranches besides Valensin in the region are not as well documented, the large acreage of vernal pool grasslands on Valensin and two other of the Preserve's properties—6,387 acres on Howard Ranch and 2,832 acres on the Forster property—imply that ranching was an essential part of the historical land management on those properties as well.[122] Together, these three properties contain nearly 86% percent of all vernal pool grasslands on the Preserve. Valensin Ranch also contains other large remnant habitats, including 270 acres of closed-canopy valley oak forest, making this particular property of countywide significance with respect to its rich biodiversity and native habitats. As a 1996 report by The

[120] "New Conservation Solutions: The Valensin Ranch Project," n.p., n.d., Cosumnes River Preserve private archive, Galt, California.
[121] Kleinschmidt Associates, "Cosumnes River Preserve Management Plan," 7-36-43.
[122] Kleinschmidt Associates, "Cosumnes River Preserve Management Plan," 7-55, 60-62.

Nature Conservancy remarked, "Thanks to a history of grazing with a relatively small percentage of cultivated cropland, much of its [Valensin Ranch's] original habitat remains intact."[123]

Oak Riparian Forest

Prior to reduction of water surface elevations in the Cosumnes Sink, oak riparian forests did not exist in the lower watershed even though The Nature Conservancy originally established the Cosumnes River Preserve to protect that habitat type. Limited coring of the forest stands on the Preserve suggests that the oldest stands—meaning a contiguous community of trees distinguishable from other communities—appeared around the turn of the twentieth century, only decades after the reclamation and drying of the sink was completed. The Cosumnes' annual floodwaters maintained the environmental conditions necessary to sustain the riparian forest stands. Moreover, due to the Cosumnes' potent flooding, most farmers along the river opted to run cattle, which is relatively compatible with riparian forests.

According to the historical landscape reconstruction of the pre-1850 Delta by the San Francisco Estuary Institute, most of the lower watershed did not have extensive, wide riparian forests but rather willow stands and wetlands until the landscape was reclaimed beginning in the mid-nineteenth century. The riparian forests in the early 1800s in the Sacramento-San Joaquin Delta were located primarily along the higher elevation natural levees of the Sacramento River, Mokelumne River and in parts of the southernmost reaches of the Delta.[124] Though no sources discuss how the riparian forest stands took root in the lower watershed, former TNC project

[123] "New Conservation Solutions: The Valensin Ranch Project."

[124] Whipple et al., "Sacramento-San Joaquin Delta Historical Ecology Investigation," 82, 298-300. Alison Whipple explained in an email from March 26, 2017 that "there were riparian forests (trees lining the channels), but they probably had more willow than oak and weren't as wide or prevalent it seems as they are now (on balance, it seems there was more area of wetland and willows than riparian forest). Since the woody vegetation lined the channels, it was too narrow/indistinct for that to show up in our mapping [from the "Sacramento-San Joaquin Delta Historical Ecology Investigation"]. It seems it was too wet for trees like oaks to survive in most of the sink area, but they were able to persist along the river channels where there were slightly raised banks (high enough up so the trees didn't die). With reclamation, it seems, the added dryness allowed the new oak stands to establish."

manager Mike Eaton theorized that the reclamation, impoundment, and control of the floodwaters of several of the Central Valley's major rivers as well as the actions taken to expedite flow out of the Delta, such as the Rio Vista cut, made the environmental conditions in the lower watershed favorable for riparian forest.[125] Considering that the Cosumnes River remained nearly undammed and annually flooded the lower watershed, its tree species, such as box elder, Oregon ash and cottonwoods, would have had the opportunity to take root and form pockets of self-sustaining forests. However, the decades in which this happened can only be estimated. A 2000 dissertation by plant biologist I-Yun Mandy Tu found that the oldest riparian forest located at the Cosumnes River Preserve is about 100 years old and is on Valensin Ranch. Since grazing was the dominant land use on the property for 170 years, the trees that were able to take root were not in danger of being cut down for the cultivation of another crop. Cattle graze around the large trees and consume the understory, not the trees themselves. For that reason, Dr. Tu found that the Valensin Ranch forest had almost no shrub layer beneath the upper tree canopy.[126]

The first aerial photos of Sacramento County, taken in 1937, show that stands of riparian forests existed along the edges of sloughs and the Cosumnes although they covered a smaller acreage compared to today. Large stands resided on Nicolaus Ranch and the Preserve properties known as Beacon Farms, Crump Ranch, and Wilkinson. All four of these properties either contained a slough or were located along the Cosumnes River, meaning that they experienced annual flooding, which supported the growth of the riparian forest stands. Moreover, some of those farms and ranches, in addition to surrounding ones, practiced beef and sheep grazing in the

[125] Mike Eaton, interview with Mike Eaton, interview by Michelaina Johnson, June 29, 2016.
[126] I-Yum Mandy Tu, "Vegetation Patterns and Processes of Natural Regeneration in Periodically Flooded Riparian Forests in the Central Valley of California," (Ph.D., University of California, Davis, 2000), 31.

1930s, which in some ways benefited the riparian forest.[127] The livestock also consumed tree saplings, though, which decreased natural forest regeneration. Outside of the aerial images and land use maps, only one source sheds light on the land use practices of this microcosm. In an interview, Wendel Kirth reconstructed the history of Nicolaus Ranch, explaining that his great-great uncle, Wendel Kirth, acquired a few parcels totaling 1,879 acres between 1872 and the mid-1880s and started running cattle, which remained the dominant land use on the ranch into the mid-twentieth century. Wendel explained that his ancestors did not need to clear the forest on their property because Nicolaus Ranch "was a cattle ranch and the cattle can forage in the woods."[128] The forest did not impede the economic goals of the ranch and, therefore, persisted.

Aerial images spanning from 1937 to 1984 depict the precarious life of riparian forests in the lower watershed, as some stands appeared and disappeared on the landscape over the nearly 50 year time period (see Figure D for aerial examples). Generally speaking, the forest cover on what today is the core of the Preserve was decently dense, forming dark masses around sloughs and parts of the river's corridor. The images from 1957 and 1964 show an overall reduction of forested acreage.[129] Siciliano-Kutchins explained that, in the 1950s, the basin witnessed a shift from grazing and labor-intensive crops, especially grains, to more mechanized agriculture.[130] Longtime farmers in interviews corroborated that statement, saying that they or their ancestors in the mid-twentieth century had started to cultivate more types of crops and leveled their land to

[127] Crawford and Hurd, "Type of Farming Areas."
[128] Flint, interview with Wendel Flint.
[129] Map and GIS Data Collection Library, UC Davis, *Aerial photos of Sacramento County, Cartwright Aerial Surveys Inc., United States, and Agricultural Stabilization and Conservation Service* [air photos] 1:63,360, photos #68T-83-88, 157-160, Washington, D.C., 1957; Map and GIS Data Collection Library, UC Davis, *Aerial photos of Sacramento County, Cartwright Aerial Surveys Inc., United States, and Agricultural Stabilization and Conservation Service* [air photos], no scale, photos #3EE-110, 112, Washington, D.C., 1964.
[130] Siciliano-Kutchins, "Historical Land Use," 56.

install irrigation to increase the carrying capacity.[131] For example, around 1955, a prominent farmer in the lower watershed, Charlie Coldani, leased land from Nicolaus Ranch and instituted a major transformation of the ranch from grazing to row crops, which required clear-cutting a portion of the riparian forest. Flint recalled that over the next decade hundreds of acres were chopped down and burned to make room for tomatoes, winter wheat, safflower, field corn, rice, and sugar beets.[132] The aerial images from 1984 show the riparian forest stands in the lower watershed the most reduced in size in comparison to other years, which was more than likely the result of clear-cutting.[133]

Even though healthy, self-sustaining forest stands of varying ages persevered in the lower watershed for more than 110 years since the Gold Rush, the forests' preservation was not guaranteed. Farmers could and did modify their properties and deforest the rare plant communities to meet the demands of the market. Dam projects, though never implemented, also would have inadvertently damaged the forests by impounding the floodwaters behind dams. Some property owners, such as Wendel Flint, "felt the remaining valley oak woodland should be preserved as a natural environment" and made the personal decision not to cut down the trees.[134] Flint made that choice in 1968 when he was helping his cousin Louis Desmond clear-cut the riparian forest in the bottom grounds of Nicolaus Ranch. The Preserve acquired that forest—called the Tall Forest—in 1989 as part of a 465-acre property sale to The Nature Conservancy, making it one of the first riparian forest stands the CRP acquired.[135] Despite all of the landscape changes the Cosumnes basin underwent, the largest intact riparian forest in the state exists there

[131] Loretz, interview with Butch Loretz; Ken Oneto, interview with Ken Oneto, interview by Michelaina Johnson, July 26, 2016; Ron Oneto, interview with Ron Oneto, interview by Michelaina Johnson, July 26, 2016; Mike Johnson, interview with Mike Johnson, interview by Michelaina Johnson, July 15, 2016.
[132] Flint, interview with Wendel Flint.
[133] Map and GIS Data Collection Library, UC Davis, *Aerial photos of Sacramento County, WAC Corp* [air photos], no scale, photos #8-60-62, 72-74, 170-173, Eugene, OR, 1984.
[134] Flint, interview with Wendel Flint.
[135] Kleinschmidt Associates, "Cosumnes River Preserve Management Plan," 7-29.

today and is protected by the CRP. The rest of the Central Valley experienced more intensive landscape modifications, including damming and deforestation, which led to the loss of 97% of its original riparian forest.

The oak-dominated riparian forests present in the lower Cosumnes watershed are not "naturally" supposed to be there. The extensive engineering of the Delta, along with the diking and draining of the Cosumnes' floodplain, a century and a half ago created the conditions necessary for the riparian trees to take root in the lower watershed. The free flowing Cosumnes' annual floodwaters forced ranchers to practice stock grazing, which partly enabled the forests to grow. The unforeseen factors of flooding and grazing produced the most "extensive and naturally

Figure six: This photo depicts a riparian forest stand growing on the edge of a slough in the Cosumnes River Preserve. Tules are located in the front of the image (By author, July 2016).

Figure seven: This photo shows the Tall Forest inundated during a winter flood, which helps to maintain forest regrowth and health (From Carson Jeffres, "Frolicking fat floodplain fish feeding furiously," *California WaterBlog*, June 2, 2011, accessed November 28, 2016, https://californiawaterblog.com/2011/06/02/frolicking-fat-floodplain-fish-feeding-furiously/).

reproducing native riparian Valley Oak forest" in the Central Valley.[136] Except for some environmentally conscious landowners like Wendel Flint, no people or agencies took notice of

[136] The Nature Conservancy, "California Nature Conservancy Dedicates Cosumnes River Preserve."

the Cosumnes' riparian forests until the 1960s when the public began to value native habitats.

VI. Protecting What Remains: The Establishment of the Cosumnes River Preserve

The first government agencies interested in the lower Cosumnes River watershed's ecosystem focused on the riparian forest stands. In 1974, a report was issued to the Sacramento County Department of Parks and Recreation (SCDPR) detailing the natural resources, open space and recreational potential of the watershed. The report stressed that the oak woodland as well as other "riparian habitat along the lower river … [are] constantly being reduced as a result of pressure from intensifying agricultural practices" and called for the protection of the threatened habitats in the lower watershed.[137] Heeding the advice of the report, the State of California approved $2.5 million in funding for a 3,450-acre park in the lower watershed, which was designed to protect the forest and meet the high demand for recreation from Sacramento. The farmers in the lower watershed, however, vehemently opposed the project out of concern that they would lose their property and that a park would interfere with farming.[138]

The conflict between farmers in the lower watershed and the SCDPR embodied a larger ideological clash in the U.S. between environmentalism and productive land use. Historians Samuel and Barbara Hays explained in their 1987 *Beauty, Health, and Permanence: Environmental Politics in the United States, 1955-1985* that American city dwellers pioneered the environmental movement, which started in the years following World War II when Americans in general began spending more time outdoors. Consequently, Americans, especially urbanites, reshaped the nation's perception of the environment from emphasizing nature's economic value to stressing nature's aesthetic, recreational, and intrinsic values.[139] In response to

[137] Bennett, "The River That Got Away," 75.
[138] Ibid., 74, 78.
[139] Samuel P. Hays and Barbara D. Hays, *Beauty, Health, and Permanence: Environmental Politics in the United States, 1955-1985* (Cambridge: Cambridge University Press, 1987), 23, 35, 288.

the public's changing attitude and evidence of the negative effects of human activity on the environment, the federal and state governments beginning in the early 1960s passed legislation to protect native habitats and threatened and endangered species. Congress passed a series of endangered species acts in the mid to late 1960s, culminating in the passage of the Endangered Species Act of 1973. Moreover, the California state legislature passed the California Endangered Species Act in 1970, which defined endangered species "as any member of the plant or animal kingdom that is 'in danger of extinction throughout all or a significant portion of its range'" and threatened species as "those that are likely to become endangered 'in the foreseeable future.'"[140] SCDPR's park plan called for the protection of endangered species, particularly sandhill cranes. Farmers, however, were skeptical of the county's plan and some of them went so far as to threaten to cut down trees if the park was established.[141] The state legislature adhered to the farmers' concerns and did not approve funding for the park in 1977, which killed the project.[142] Nevertheless, two state park directors who worked on the proposed county park, Russ Cahill and Pete Dangermond, decided to take matters into their own hands and brought their appeal to California's then Secretary of Resources, Huey Johnson, who served under Governor Jerry Brown from 1978 to 1982.[143]

The history of how The Nature Conservancy (TNC) and Ducks Unlimited (DU) established a nature preserve in the Cosumnes watershed and Johnson's role in the founding is hard to discern, but from the sources a fragmented narrative emerges. Johnson, after visiting the Cosumnes River a few times and seeing the exceptionality of the native habitat and wildlife, decided to purchase a 40-acre piece of land along the river as the future site of a private

[140] Alagona, "After the Grizzly," 100-102.
[141] Reiner and Cox, *Legacy Profile*, 2.
[142] Bennett, "The River That Got Away," 79.
[143] Rich Reiner and Robin Cox, *Legacy Profile: Cosumnes River Preserve (long version)*, January 2015, 2, provided via email by Brynn Pewtherer, June 15, 2016.

conservation duck club. His vision was to establish the duck club and then sell it as a wildlife refuge to the state. His position as Secretary of Resources presented a conflict of interest, however, so he tried his connections with TNC. As TNC's former western regional director, Johnson had ties to the nonprofit and gave two executive directors—one of them being Steve McCormick—tours of the lower Cosumnes River in hopes of convincing them that TNC should set up a refuge there.[144]

Simultaneously, TNC, under McCormick's leadership, had developed the first California Critical Areas Campaign, listing the Cosumnes River's valley oak riparian forest as one of the priority sites. As a result, Johnson's interest in the region struck a cord with McCormick, who helped to steer TNC to install a preserve in the lower watershed and developing relationships with potential partners.[145] TNC ecologist Barbara Malloch designed the first plan in 1981 to create a preserve in the lower watershed that focused on the preservation of oak riparian forest, freshwater ponds and marshes, and the Greater Sandhill Crane.[146] TNC executed the plan beginning in 1984 when it purchased the 85-acre Wilkinson parcel. The property's acreage was virtually all valley oak riparian forest. One year later in 1985, Johnson sold his property to TNC.[147] By the late 1980s, TNC formed its first partnership with Ducks Unlimited and together they realized the vision of starting a preserve in the Cosumnes basin.

VII. The Cosumnes River Preserve Redefines Restoration

The Nature Conservancy and Ducks Unlimited officially dedicated the Cosumnes River Preserve on May 30th, 1987 as a relatively traditional preserve protecting few habitat types,

[144] Huey Johnson, interview with Huey Johnson, interview by Michelaina Johnson, July 29, 2016; Reiner and Cox, *Legacy Profile*, 2.
[145] Steve McCormick, interview with Steve McCormick, interview by Michelaina Johnson, June 5, 2017.
[146] Reiner and Cox, *Legacy Profile*, 2, 18.
[147] Kleinschmidt Associates, "Cosumnes River Preserve Management Plan," 7-20, 7-74. The actual cost of the Wilkinson parcel is not available. Johnson's property today is called Farm and Wetlands Inc. 2 (see Figure one for its location).

including oak riparian forest.[148] TNC and DU setting down roots in the lower watershed meant significant landscape and management changes for the region from profit-driven, private ownership to conservation-oriented, public-private ownership. In the 1980s, TNC owned the largest private nature preserve system globally with more than 900 preserves totaling 5,121,522 acres. Beginning in 1958, the environmental powerhouse started protecting land in California through land acquisitions and the establishment of preserves. By 1991, the Conservancy had been involved in 209 land acquisition projects totaling 321,786 acres in California. Less than one percent of that land, or 1,454 acres, comprised the Cosumnes River Preserve.[149] Despite its minute size, the Preserve quickly became a hub for experimental restoration and management techniques, such as public-private partnerships, that redefined TNC's institutional preserve model and restoration strategies statewide.

Ducks Unlimited, as the first partner, expanded the Preserve's goal to include the restoration of seasonal wetlands to benefit waterfowl.[150] Over the next several years, five government agencies—the Bureau of Land Management (BLM), the Sacramento County Department of Regional Parks, the California Department of Water Resources, the California Department of Fish and Wildlife, and the California State Lands Commission—joined the CRP as property owners.[151] With each consecutive partnership, the Preserve's acreage and conservation goals increased along with its leverage and resources. DU was foundational in the construction of wetland ponds for migrating waterfowl, which BLM today manages along with providing a wealth of staffing and land management knowledge.[152] In addition to the CRP's

[148] Griggs, "California Nature Conservancy Dedicates Cosumnes River Preserve."
[149] Kreissman and Lekisch, *California: An Environmental Atlas and Guide*, 172-175
[150] Reiner and Cox, *Legacy Profile*, 3.
[151] Reiner Cox, *Legacy Profile*, 4, 18-19; Kleinschmidt Associates, "Cosumnes River Preserve Management Plan," ES-1.
[152] Harry McQuillen, interview with Harry McQuillen, interview by Michelaina Johnson, June 1, 2017.

partners and staff, the volunteers, especially those on the Habitat Restoration Team (HRT), and school children make possible the Preserve's restoration projects and public outreach. Every year for the past two decades, the Sacramento County Department of Regional Parks, in partnership with the Galt Joint Union Elementary School District and other school districts, have educated between 6,000 to 10,000 students about the CRP's ecosystem and conservation practices.[153]

As the number of partners increased, so did the Preserve's acreage. In 1987, the Preserve had a mere 1,100 acres and by 2008 had increased in size by more than forty fold to 45,859 acres because the purchasing power from the CRP's partners made possible the acquisition of large properties, such as the 4,356-acre Valensin Ranch between 1994 and 1997 and the 7,013-acre Howard Ranch in 1999. Such large properties skyrocketed the Preserve's acreage from the late 1990s into the mid-2000s.[154] The Preserve wove together the two land use legacies of the lower watershed—native habitat and agriculture—to create a more sustainable, landscape scale preserve that incorporated human and wildlife demands of the landscape. By the early 1990s, the Preserve's conservation biologists realized that they had a lot to learn from the Cosumnes River's floodwaters and the historical land uses that preserved vernal pools and fed waterfowl. The Cosumnes River Preserve quickly became a proving ground for innovative restoration techniques that have been applied to other watersheds and nature preserves in the state.[155]

Favoring Flooding

Flooding—the powerful shaper of the lower watershed—was the enemy of ranchers and farmers but the friend of conservation biologists. In the CRP's 1992 *Cosumnes Watershed Strategic Plan*, the Preserve replaced the single habitat management model with a watershed

[153] Kleinschmidt Associates, "Cosumnes River Preserve Management Plan," 5-24; harry int
[154] Griggs, "California Nature Conservancy Dedicates Cosumnes River Preserve"; Kleinschmidt Associates, "Cosumnes River Preserve Management Plan," 7-36-43, 7-60-62.
[155] Reiner Cox, *Legacy Profile*, 12.

scale model because of cutting edge research that demonstrated that restoring ecological functions to a landscape created a sustainable ecosystem. The plan set forth distinct goals for threatened native habitats and the entirety of the river, ensuring "the continuation of the [river's] natural hydrological regime" and protecting the "riparian and aquatic communities along the Cosumnes River, and provid[ing] a link between the River's floodplain, the foothill belt, and the River's upper reaches."[156] The proposed watershed scale preserve was the most expensive Nature Conservancy project at the time and necessitated new and innovative strategies, for which the conservation biologists turned to the river itself for solutions.[157]

Floodwaters had breached the levees along the river since the 1860s, inundating crop fields with the natural starter pack for a new forest—organic debris, sediment, and seeds. One major flood in 1985 demonstrated to the CRP staff the restoration potential of intentional levee breaching to restore the floodplain. In that year, floodwaters breached a levee on a farm adjacent to the Preserve, covering a 15-acre portion of a tomato field with sand and organic debris. Within a year, the so-called 'Accidental Forest' started to grow with a natural succession of cottonwoods, Oregon Ash, willow thickets, and eventually valley oaks, demonstrating that the native habitat of the region returned when the natural function of flooding was reintroduced to the floodplain.[158] UC Davis fluvial geomorphologist Jeffrey Mount in an interview equated that isolated incident to a light bulb going off for the river restoration community by proving that levee removals enabled floodwaters to naturally replant forest, which had previously been done by hand.[159] Prior to the mid-1990s, the Preserve's staff and Habitat Restoration Team volunteers planted thousands of acorns in hopes that the trees would grow. However, many of the trees

[156] Ibid, 8.
[157] Ibid., 3. The exact price of the project is unknown.
[158] Steding, "Restoring Riparian Forests and Natural Flood Regimes," 233.
[159] Jeffrey Mount, interview with Jeffrey Mount, interview by Michelaina Johnson, July 7, 2016.

died.[160] The Preserve coordinated two more levee breaches in 1995 and 1997 to facilitate the restoration of more riparian forest stands, including the 'Intentional Forest' on Nicolaus Ranch. Thus the Preserve pioneered a new floodplain restoration technique called process-based restoration.[161] This strategy entails using natural processes instead of hand planting to drive forest regrowth. The record-breaking flood year of 1997 exemplified the benefits of this strategy, as the Preserve's restored floodplain held massive amounts of floodwaters and mitigated damage downstream while providing habitat and groundwater recharge. The Preserve's success with this flood management technique in 1997 drew the attention of eminent UC Davis scientists whose subsequent research propelled the CRP to prominence as a test-bed for restoration in the Delta, Central Valley, and beyond by the turn of the twenty-first century.

Figure eight: The Cosumnes River flooding its floodplain (Robertson-Bryan, Inc., *Lower Cosumnes River Watershed Assessment*, 23)

The Cosumnes Research Group at UC Davis formed in July 1998, in partnership with the Preserve, to study the natural processes in the Cosumnes watershed in order to improve the restoration practices not only on site but also in the Mokelumne River watershed and in the

[160] Reiner and Cox, *Legacy Profile*, 5; Tom Griggs, "History of the Riparian Forest Restoration Project, 1988-1990," n.p., 1991, Cosumnes River Preserve private archive, Galt, California, 6.
[161] Robertson-Bryan, Inc., *Lower Cosumnes River Watershed Assessment*, 5; Reiner and Cox, *Legacy Profile*, 5.

North Delta.[162] The studies conducted by UC Davis researchers have proven groundbreaking for the fields of ecology and conservation biology, as they have brought science to bear on the natural processes that sustained the remaining native habitats over the past century and a half and restored the newer additions of forest. The researchers studied the free flow of the Cosumnes River to understand how dams affected water quality; groundwater dynamics; how native fish used a floodplain; how flows change the topography of the floodplain; and how the free-flowing Cosumnes River could be used to develop a systematic classification of hydrologic variability.[163] Together these studies demonstrated the importance of restoring natural processes back to the ecosystem, specifically granting floodwaters larger access to the river's ancestral floodplain. The restoration of the floodplain not only sustains the riparian forest stands that persevere on the landscape but also create new seasonal wetland habitat for waterfowl and fish and naturally restored forests.[164]

Restoring the floodplain revives some aspects of the Cosumnes Sink, including periodic inundation, sediment deposition, and wetland enhancement. However, the lower watershed, as well as the Delta, has been "irrevocably altered" to the point that complete restoration of the sink and its ecosystem is impossible, especially considering that native habitats, such as the oak riparian forest stands, now exist where they had not before.[165] Other considerations that impede

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[162] "Project History," UC Davis Center for Watershed Sciences, accessed November 18, 2016, https://watershed.ucdavis.edu/doc/cosumnes-research-group/project-history.
[163] Ahearn et al., "Temporal Dynamics of Stream Water"; Peter B. Moyle, Patrick K. Crain, and Keith Whitener, "Patterns in the Use of a Restored California Floodplain by Native and Alien Fishes," *San Francisco Estuary and Watershed Science* 5, no. 3 (January 1, 2007): 1-27, accessed October 11, 2016, http://escholarship.org/uc/item/6fq2f838; Eric Booth, Jeff Mount, and Joshua H. Viers, "Hydrologic Variability of the Cosumnes River Floodplain," *San Francisco Estuary and Watershed Science* 4, no. 2 (January 1, 2006): 1-19, accessed October 11, 2016, http://escholarship.org/uc/item/71j628tv.
[164] Robertson-Bryan, Inc., *Lower Cosumnes River Watershed Assessment*, 87.
[165] Whipple et al., "Sacramento-San Joaquin Delta Historical Ecology Investigation," p. xx. The investigation also stated, "The majority of the approximately 106,000 acres (42,900 ha) of natural habitat (within the Legal Delta and study area boundary) did not exist historically in their present locations. For example, seasonal wetlands are found where perennial wetlands once existed and willow thickets on artificial levees are now present where tidal wetland

the restoration of the landscape include non-native species, channel incision, and artificially lowered groundwater levels, among others.[166] What can be restored to the landscape are natural processes and ecological function. The Cosumnes River Preserve is the first nature preserve in the Delta in which ecological function was restored to the floodplain, and their success has made the CRP become the reference for future floodplain restoration along the Cosumnes' neighboring rivers, within the Delta, and beyond.[167] As Jeffrey Mount said in an interview, "This natural living laboratory [the Cosumnes River], I would argue, is probably the best in the country in terms of what we learn about floodplain systems."[168]

Agriculture as a Conservation Tool

Prior to the establishment of the CRP, The Nature Conservancy tended to consider agriculture incompatible with wildlife and habitat conservation. However, conservation biologists in the first few years in the lower watershed observed the benefits of cattle grazing for vernal pools and annual crops for migrating waterfowl. By the early 1990s, the CRP formally incorporated ranching and an organic rice operation into their conservation efforts not only to provide habitat for birds but also to generate income to fund the Preserve's operations.

In 1996, the Preserve partnered with an organic rice grower named Allen Garcia to launch Living Farms, an experimental farm designed to help meet the ecological and economic demands required of the Preserve. In the pilot year, Living Farms converted 240 acres of grazing land into the rice fields on the Crump Ranch and Desmond properties (see Figure one). The pilot year was very successful economically, yielding 1,081,502 pounds of organic rice to sell and $43,000 in

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edges once met water. The Delta has undergone an almost complete transformation, due to land use and water management" (107).

[166] Whipple, email message to Michelaina Johnson.

[167] April Robinson, Samuel Safran, and Julie Beagle, "A Delta Renewed: A Guide to Science-Based Ecological Restoration in the Sacramento-San Joaquin," *San Francisco Estuary Institute—Aquatic Science Center*, a report of SFEI-ASC's Resilient Landscapes Program, publication #799, Richmond, CA, 2016.

[168] Mount, interview with Jeffrey Mount.

revenue for habitat improvements for the Preserve. After the harvest, 200 acres of rice fields were flooded with a few inches of water and converted into surrogate wetlands for waterfowl.[169] In addition to the 120,000 pounds of leftover rice intentionally left in the fields, as much as 50,000 pounds of naturally occurring food sources, such as invertebrates and tubers, were available in the flooded rice fields for waterfowl to consume.[170] Over the next several years, Living Farm's organic operation expanded to 1,000 acres and incorporated crop rotations between cattle pasture, nitrogen fixing clover, and organic rice to maintain soil fertility.[171] The waterfowl also benefitted the growers by generating natural fertilizer for the soil and accelerating rice decomposition via foraging.[172] Though Living Farms ceased operations around the year 2000, the Preserve continues to lease approximately 1,000 acres of rice fields in addition to more than 500 acres of grain and hay crops and nearly 12,350 acres of annual, truck and berry crops.[173] In 2008, these crop fields in conjunction with irrigated agriculture covered at least one third of the Preserve's approximately 45,859 acres.[174]

Cattle ranching also formed an integral part of the Preserve's conservation goals with grazing on 4,750 acres, or 39%, of the Preserve's 14,000 acres in 1998.[175] The acreage of cattle ranching more than tripled in a ten-year period thanks to the Preserve acquiring a few critical grassland and vernal pool rich properties, particularly the 4,356-acre Valensin Ranch and the

[169] "The Cosumnes River Preserve Sustainable Farm Plan: A Three Year Transition to Wildlife Friendly Organic Farming," n.p., 1996, Cosumnes River Preserve private archive, Galt, California.
[170] Sylvie M. Brouder and James .E. Hill, "Winter Flooding of Ricelands Provides Waterfowl Habitat," *California Agriculture* 46, no. 6 (1995): 58-64. According to Brouder and Hill, 350 pounds per acre of residual rice from a dry, harvested field and 250 pounds per acre of naturally occurring food sources, such as invertebrates and tubers, are available in flooded rice fields for waterfowl to consume as they forage.
[171] Steding, "Restoring Riparian Forests and Natural Flood Regimes," 235.
[172] According to Brouder and Hill, flooded rice fields may supply as much as 600 pounds per acre of food, which is approximately 80% of the total amount of food available for waterfowl in one acre of natural wetland. The productivity of flooded rice fields, therefore, indicates that they are a "good alternative to [the] full restoration of original wetlands."
[173] Kleinschmidt Associates, "Cosumnes River Preserve Management Plan," 3-2. The one third is calculated based on data from this source.
[174] Ibid.
[175] Steding, "Restoring Riparian Forests and Natural Flood Regimes," 235-23.

7,013 acre Howard Ranch, in the mid to late 1990s and early 2000s. Thanks to the CRP's recognition of the value of grazing, "ranching is now viewed as a key conservation activity" for The Nature Conservancy.[176]

In fact, wildlife friendly agriculture has become so integral to the Preserve that almost "90% of the protected lands are maintained in compatible agricultural production, including grazing, annual crops, and organic rice."[177] The Preserve's protected lands are owned in fee title by one of the seven partners or are held under a conservation easement, which entails a landowner selling the property development and subdivision rights to a CRP partner and placing certain conservation restrictions on the property. The purpose of the easement is to ensure that the historic, wildlife compatible land uses present on 21,271 acres, or 46% of the Preserve's property, continue in perpetuity.[178] Anna Steding praised the CRP's innovative land management, declaring, "CRP staff have shown that the ostensibly conflicting land uses of agriculture, grazing, habitat restoration, and floodplain management can, in fact, be compatible."[179]

While ranchers and farmers are participants in the Preserve's conservation agenda, their reasons for selling easements to the CRP and leasing grazing and agriculture land is economic rather than environmental. Six of the ranchers and agriculturalists I interviewed said that the economic incentive, coupled with a dip in the market, spurred them to sell one or multiple easements on their properties to the Preserve. Duane Martin Jr., a cattle rancher based out of the lower Cosumnes, explained in an interview his reasoning for selling an easement on his property to the Bureau of Land Management in 1999:

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[176] Reiner and Cox, *Legacy Profile*, 13.
[177] Kleinschmidt Associates, "Cosumnes River Preserve Management Plan," 2-12.
[178] Ibid.
[179] Steding, "Restoring Riparian Forests and Natural Flood Regimes," 237.

> The cattle business has gotten tough, and I needed the income to help pay down the debt on the ranch. And I figured that I was not giving anything up. The easement says no trees, no vines, no homes. This country floods. It is never going to be tree ground. Mostly likely isn't very good vineyard ground and damn sure is not going to be homes. The only thing I didn't count on was the geese eating me out of house and home every winter.

According to the stipulations of the easement, Martin Jr. is not allowed to disturb the wildlife on his property, meaning that the waterfowl's grazing decreases the land's carrying capacity for his cattle and sometimes decrease his profit.[180] For rangeland lessees, such as Butch Loretz, working with the CRP is not much different than private landowners except for tighter restrictions on how much grass his cattle are allowed to graze.[181] The most significant challenges for farmers, such as Ron and Ken Oneto, who have easements on their properties, are the crop restrictions, which limited the Onetos to growing annual and waterfowl compatible crops. As lucrative crops in California have transitioned in the past decade to vineyards and nut trees, the Onetos have been able to match the market demand by planting grapes, cherries, and walnuts on their properties that do not have easements.[182]

Even though several farmers and ranchers lease and work with the Preserve, many do not understand why the CRP conserves the native habitats. Some even view the protected land as a "drain on the economy" and a "waste."[183] Some longtime residents, including the Onetos and Loretz, do not think that the Preserve maximizes the land's productivity potential. For instance, Loretz described the Preserve's restored, managed wetlands as "productive farmland and

[180] Duane Martin Jr., interview with Duane Martin Jr., interview by Michelaina Johnson, June 29, 2016.
[181] Loretz, interview with Butch Loretz.
[182] Oneto, interview with Ron Oneto; Oneto, interview with Ken Oneto.
[183] Martin Jr., interview with Duane Martin Jr.

irrigated cattle land [reverting] back to flooded potholes" and the restoration of the riparian forest understory as "overgrowth" and "a jungle."[184] The farmers' and ranchers' perception of the Preserve speaks to the ideological differences between conservation biologists and agriculturalists, which have vied for influence in the lower watershed for nearly 40 years. Conservationists tend to villainize farmers and ranchers, claiming that they overexploit the land for profit at the expense of native flora and fauna, while farmers and ranchers have a tendency to view conservation as an unproductive land use because it is not economical.

Both views, however, are too simplistic and do not listen to the other. Farmers and ranchers in the lower watershed care about their land because it sustains them and helps to feed the world.[185] Some farmers I interviewed said that they intentionally left several acres of native habitat on their property for wildlife. In some cases, however, this land was not farmable to begin with and flooded in the wintertime.[186] The Preserve, on the other hand, has recognized the economic and ecological benefits of some types of agriculture, which has enabled the two groups to work together even though their motives are different. Ultimately the winner of the two groups working together is not the farmer or conservationist but rather the thousands of hungry waterfowl and flourishing native habitats that depend upon humans actors making environmentally conscious decisions to survive in the highly altered Central Valley.

VIII. Conclusion

The lower Cosumnes River watershed is a contested place unlike any other in the Central Valley. Undammed floodwaters limit farmers' and ranchers' autonomy on the landscape and sustain native habitat remnants. The proliferation of vernal pools and oak riparian forests is a

[184] Loretz, interview with Butch Loretz.
[185] Martin Jr., interview with Duane Martin Jr.; Oneto, interview with Ron Oneto; Oneto, interview with Ken Oneto.
[186] Oneto, interview with Ron Oneto; Oneto, interview with Ken Oneto; Mark Ackerman, interview with Mark Ackerman, interview by Michelaina Johnson, July 21, 2016.

picture of the failed hopes of California's white settlers and the modern state. Two Sacramento County historians, Thomas Hinckley Thompson and Albert Augustus West, in 1880 captured the vision of the pioneers of California for the Central Valley's rivers: "Immense reservoirs will be constructed, either by the government or the state, for the impounding of the flood water" to irrigate a "thirsty land" and bring "greater prosperity to the valley."[187] The authors imagined a California with a strong government that would wield its power for the growth of the state's agricultural economy and the taming of its water systems. Because California's government was weak in the first several decades following the state's founding in 1850, county and city water agencies assumed the responsibility of developing several rivers, including the Mokelumne and Toulumne rivers, with reservoirs and dams. As the state government gained power, it joined the hydraulic effort with the Central Valley Project in 1933, building 20 dams and reservoirs over the course of the next five decades.[188] The city, county, and state water agencies were very successful in carrying out the settlers' vision of subduing the "destructive torrents" with "immense reservoirs" for the purpose of flood control, providing irrigation for agriculture, and creating sustainable municipal water supplies, among other reasons.[189]

Despite five proposed projects, the Cosumnes River evaded dam-nation, leaving an unregulated river open to stakeholder contestation. Water agencies today control the flow of all the rivers draining the western Sierra Nevada, except for the Cosumnes, through timed releases from dams. As a consequence, the Cosumnes' floodwaters, in conjunction with unintentionally wildlife friendly land uses, in the lower watershed have supported oak riparian forests, vernal pools, and waterfowl. When government policies started to regulate native habitats and

[187] Thompson and West, *History of Sacramento County*, 13.
[188] "About the Central Valley Project," *U.S. Bureau of Reclamation*, May 18, 2016, accessed December 1, 2016, http://www.usbr.gov/mp/cvp/about-cvp.html.
[189] Thompson and West, *History of Sacramento County*, 13.

endangered species in the 1960s, the lower watershed became open to dispute and negotiation between government agencies, farmers, and private environmental interests. First, the Bureau of Reclamation in the early 1960s proposed a wildlife mitigation project to offset the environmental damage of the Cosumnes River Project's dams and reservoirs, which farmers in the region vigorously fought against to the point of delaying the project's submission to Congress by two years. Roughly a decade later in 1974, the Sacramento County Department of Parks and Recreation (SCDPR) attempted to construct a 3,450-acre park in the lower watershed to protect the riparian forests. Farmers along the Cosumnes also opposed this environmental project, arguing that any "'park would be incompatible with farming, interfering with such operations as spraying and dusting.'"[190] Even though those two projects failed in part because of farmer resistance, they represent the changing priorities of government agencies from trying to control the environment to protecting the state's remaining natural heritage.[191]

By the time The Nature Conservancy purchased their first property in the lower watershed in 1984, the farmers were leery of environmental interests buying up their land and disrupting the agricultural character of their community. As Wendel Flint said in an interview, "The feeling of the local ranchers was one of muted hostility. They didn't like the idea of environmentalists nor did [they] like [the] Nature Conservancy coming in here."[192] Yet, as more partners joined TNC, including DU and five government agencies, the CRP staff made an effort to integrate local farmers and ranchers into their conservation efforts through easements and the adoption of wildlife friendly agriculture. Today, the lower watershed remains a contested space, but tensions

[190] Bennett, "The River That Got Away," 62, 77-78.
[191] In 1976, the National Park Service added the Cosumnes River Riparian Woodlands to the list of national natural landmarks. The goal of the National Registry of Natural History Landmarks is "to identify and encourage the preservation of nationally significant examples of the full range of ecological and geological features that constitute the nation's natural heritage" (Keissman and Lekisch, *California: An Environmental Atlas and Guide*, 170-173).
[192] Flint, interview with Wendel Flint.

between conservationists and agriculturalists have eased. In terms of money and land management, the Preserve—in particular one partner, the Bureau of Land Management (BLM)—has become an influential actor in the region. The influence of the BLM, as well as the Preserve's Sacramento County and state government agency partners, demonstrates the government's success in finally asserting some authority over the Cosumnes River. However, in an ironic twist, the county's and state's failure to dam the Cosumnes has become the virtue of the region today and kept alive the Cosumnes' native habitats and waterfowl that ultimately attracted the county, state, and federal government agencies to join TNC and Ducks Unlimited in the 1990s. The CRP's partners, staff, and researchers today celebrate the state's failure to dam the river because it made possible the protection of some of California's best remaining natural heritage.

Because the Preserve has demonstrated that agriculture and grazing can be compatible with conservation, it has become a preserve model for several environmental organizations. The two other nature preserves located along the fringes of the Delta, the Yolo Bypass Wildlife Area and Stone Lakes National Wildlife Refuge, were founded after the CRP and also employ wildlife friendly agriculture to meet the dietary needs of waterfowl.[193] Policymakers looking to restore the heart of the Delta as well as its peripheries have praised the CRP as the ideal model for future nature reserves and restoration projects in the Delta because it satisfies both human and wildlife demands of the landscape. The Preserve's conservation techniques, especially conservation easements and wildlife friendly farming, attract policymakers because they make farmers active participants in the restoration of the Delta and respect the Delta's agricultural heritage. The latter is especially important considering that about 442,800 acres (or 60%) of the Delta is privately

[193] Garone, "The Fall and Rise of the Wetlands of California's Great Central Valley," 245-247.

owned agricultural land.[194] One government agency, the Delta Protection Commission, established a pilot conservation program in 2010 designed to introduce wildlife friendly land uses on private properties in the Delta.[195]

The success of wildlife friendly agriculture has ramifications not only for the Delta but also for the Central Valley and beyond. Corn, wheat, rice, and alfalfa are cultivated throughout the Central Valley, and migrating waterfowl forage on the private crop fields. As the CRP has demonstrated, conservation agencies can partner with farmers to effectively manage crop fields to maximize the benefit for waterfowl and attract more birds to the site. The Nature Conservancy has already proven the advantage of public-private partnerships through their BirdReturns program, which in the pilot year in 2014 paid 32 rice growers in the Sacramento Valley to flood 42 fields totaling 10,000 acres to create surrogate wetlands for waterfowl.[196] Another conservation organization, Point Blue, in partnership with TNC and the Audubon Society and other environmental groups, is currently researching how to expand the types of crops used for surrogate wetlands beyond rice. They conducted research at the CRP to study the benefit of flooded corn and wheat fields for waterfowl.[197] Point Blue scientist David Shuford in his co-authored 2015 study found that the benefits are so immense that he encouraged "Delta farmers to widely adopt practices beneficial to waterfowl," specifically flooding corn and wheat fields.[198]

The Preserve was also one of the first in California to demonstrate the effectiveness of restoring physical processes and ecological functions to a landscape, which include levee

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[194] Jay Lund et al., *Envisioning Futures for the Sacramento-San Joaquin Delta*, 12.
[195] The Delta Protection Commission et al., "Delta Working Lands Final Program Final Report," September 2013, accessed November 23, 2016, http://www.delta.ca.gov/res/docs/landscapes/DWL_Final_Report_9-2013.pdf.
[196] Matt Jenkins, "On the Wing," *Nature Conservancy Magazine*, August/September 2014, accessed November 23, 2016, http://www.nature.org/magazine/archives/on-the-wing-2.xml.
[197] "Waterbirds & Agriculture," *Point Blue*, accessed November 23, 2016, http://www.pointblue.org/our-science-and-services/conservation-science/working-lands/waterbirds-agriculture#corn.
[198] D. W. Shuford et al. "The benefits of crops and field management practices to wintering water birds in the Sacramento-San Joaquin Delta," *Renewable Agriculture and Food Systems* v. 31, no. 6 (2015): 504.

breaching to restore floodplains and the use of wildlife friendly agriculture to feed native species. Within the last two decades, scientists have lauded the Preserve's restoration methods as exemplars for the rest of the Delta and the Central Valley, thanks to the research done by UC Davis' Cosumnes Research Group. Most recently, the San Francisco Estuary Institute (SFEI) on November 14th, 2016 released a groundbreaking report entitled *A Delta Renewed: A Guide to Science-Based Ecological Restoration in the Sacramento-San Joaquin Delta*, which asserted that "process-based restoration" is the best approach "to create dynamic, resilient ecosystems [in the Delta] that provide desired ecological functions over long time scales with minimal intervention, rather than static habitat patches." The SFEI highlighted the Preserve's levee breaching efforts as

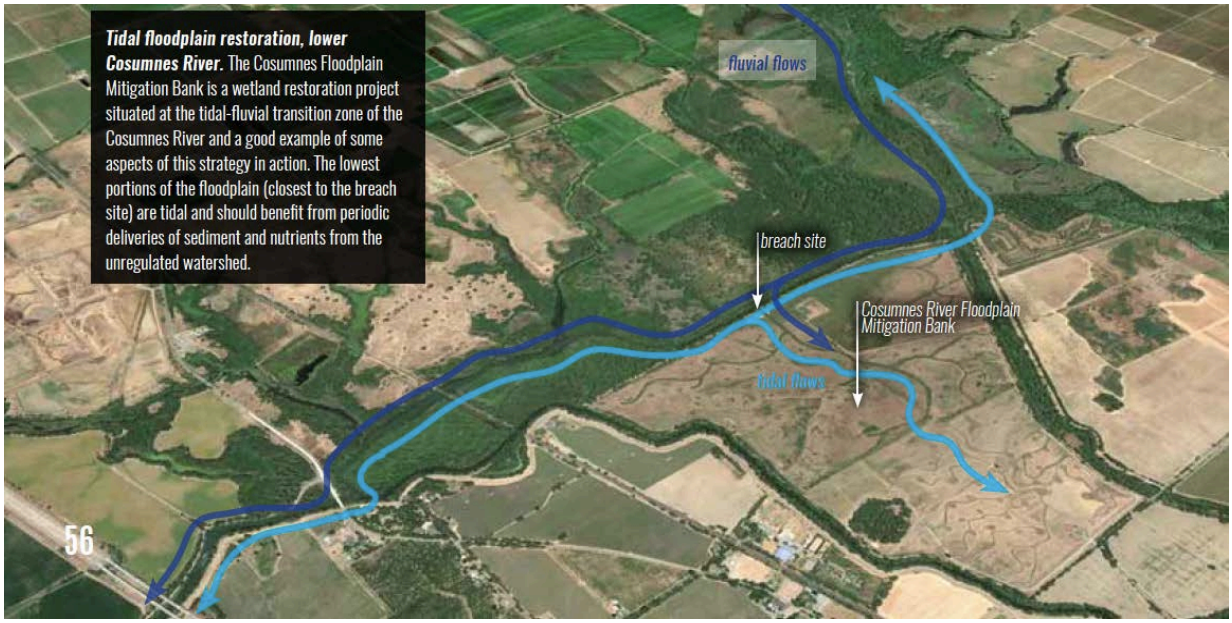

Figure nine: This image depicts a recent floodplain restoration project at the CRP (From Robin, Safran, and Beagle, "A Delta Renewed," 56).

the example for floodplain restoration and as proof that the Delta can support "both people and native wildlife sustainably."[199] Despite the importance of scientific research, the CRP staff did not wait for science to prove that the historical land use practices in the lower watershed were

[199] Robinson, Safran, and Beagle, "A Delta Renewed," 41, 115.

working to conserve the flora and fauna that they desired to protect. Rather, the Preserve's first employees were bold, breaching levees, institutionalizing wildlife friendly land uses, and inviting scientists to research their experimental strategies. As a result of the Preserve's scientifically proven success, the CRP has become the foundation for field-redefining conservation work.

IX. Epilogue

Despite the huge strides conservation has made in the lower watershed, the future of the Preserve is uncertain, especially in the face of climate change, pressures associated with population growth, proposed hydraulic projects, and the conversion of the properties surrounding the CRP to non-wildlife compatible land uses. In terms of short-term challenges, several farmers who live near the Preserve have sold their properties to developers or converted their cattle ranches to vineyards and nut trees because those crops have become more lucrative. Moreover, the city of Elk Grove has ballooned in size from about 50,000 in 1990 to 153,454 people in 2010, necessitating the conversion of rangelands and farms to housing.[200] The development of that open space resulted in a loss of vernal pools and wildlife friendly agriculture, which placed more wildlife demand on the already strained habitats within the Preserve. Roughly within the last decade, the CRP has ceased acquiring more properties and easements to focus its staff energy on the wellbeing of its 48,859 acres, but the lack of growth has come at the cost of historically wildlife friendly properties being overlaid with concrete and grape vines. As Mike Eaton, who has lived and worked in the lower watershed for more than 25 years, observed, "Over the past five years, we've seen a dramatic conversion of open lands in the north Delta—literally thousands of acres—from open land [that is] farming friendly to cranes [and other species] to

[200] Lynda Gledhill, "Elk Grove/Sacramento County city is nation's fastest-growing/Census confirms status – police, builders, schools try to keep up," *SF Gate*, June 25, 2000, accessed November 18, 2016, http://www.sfgate.com/bayarea/article/ELK-GROVE-Sacramento-County-city-is-nation-s-2532741.php.

vineyards and orchards, and the conversion continues."[201] One solution to this problem is for the CRP's partners to invest more in expanding the size of the preserve to meet the increased wildlife demand placed on the Preserve, as unprotected habitat is destroyed.

Climate change, on the other hand, is a long-term challenge for the CRP, as for the rest of the world, and there is no easy solution. The impact of climate change on the Cosumnes watershed are understudied, although UC Davis researchers have demonstrated that, since the mid-1900s, the Cosumnes has experienced more early winter rather than late spring floods due to global warming. The continued changes in the timing and duration of flooding "could affect habitat availability and aquatic productivity of seasonal wetlands on the floodplain" and perhaps

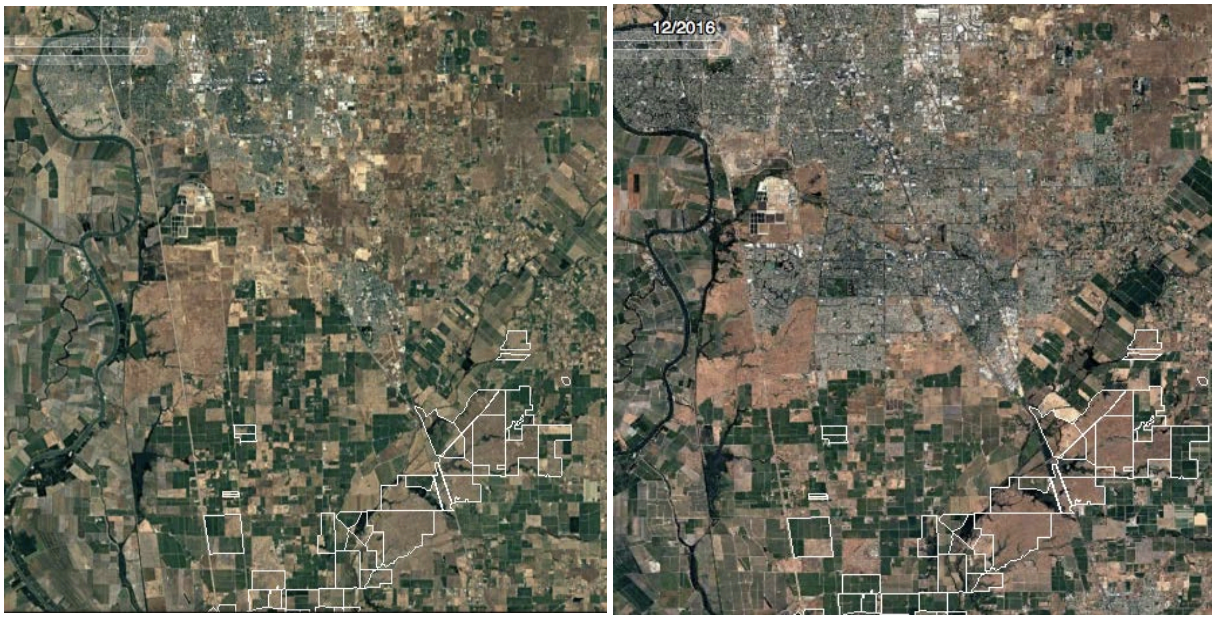

Figure ten: These two images show Elk Grove and the lower Cosumnes River watershed to the south of the city in the years 1987 (left)—the year the Cosumnes River Preserve was established—and the same image from nearly thirty years later in 2016 (right). The growth of Elk Grove is evident over that time period, as the suburb of Sacramento rapidly developed farm and rangeland north of the Preserve, which is outlined in white. The CRP for about the past 10 years has capped it growth to focus on managing the land it currently has, but Elk Grove has not. As seen in the images, the city's growth places more habitat pressure on the Preserve. The Preserve needs to invest in expanding or else there will less land available to protect ("Lower Cosumnes River Watershed," 37 25' 19.1" N, 122 05' 06" W, Google Earth, December 1987, accessed January 10, 2017; "Lower Cosumnes River Watershed," 37 25' 19.1" N, 122 05' 06" W, Google Earth, December 2016, accessed January 10, 2017).

[201] Mike Eaton, interview with Mike Eaton, interview by Michelaina Johnson, June 1, 2017.

even the growing season of some crops in the lower watershed.[202] According to Philip Garone, the increasing temperature and seasonal changes in rainfall will also negatively affect vernal pools and riparian forests. Vernal pools may decrease in size and suffer a loss of endemic floral and faunal species while "current riparian tree species may no longer experience the conditions necessary for germination, establishment, and growth."[203] The way that people in the lower watershed respond to climate change, such as cultivating new crops or managing local water sources, will also determine how the ecosystem changes. Despite the threat of climate change, the Preserve is better poised to deal with the consequences than much of the Delta, according to the SFEI's criteria, because the CRP has fostered a dynamic native ecosystem through restoration and employs an adaptive management approach, which entails responding to the needs of the landscape as it evolves.[204]

The reality is that policy agendas and priorities of government agencies do not guarantee environmental protection and restoration, even if the property in question is part of a nature preserve. For instance, a large property of the CRP called Staten Island recently became embroiled in the Delta twin tunnels project, also known as the California WaterFix, which called for the construction of two 40-foot wide, 30-mile long tunnels that would have transported water from the lower Sacramento River underneath the Delta, including Staten Island, to the Central Valley Project's and State Water Project's pumps at the Clifton Court Forebay to the south.[205] The example of the twin tunnels points to the challenge that agencies and organizations working in the Delta face, as they try to balance the human and environmental needs of such a modified

[202] Kleinschmidt Associates, "Cosumnes River Preserve Management Plan," 2-3.
[203] Garone, *The Fall and Rise*, 266.
[204] Robinson, Safran, and Beagle, "A Delta Renewed," 19.
[205] Lauren Sommer, "About that $17 Billion Water Project: Delta Tunnels 101," *KQED Science*, July 25, 2016, accessed November 28, 2016, https://ww2.kqed.org/science/2016/07/25/about-that-17-billion-water-project-delta-tunnels-101/.

landscape. Considering that the Delta has an extremely modified ecosystem yet supplies 25 million Californians and three millions acre of farmland with water, ecological restoration of the Delta is very difficult and restoration has been relegated to the Delta's fringes.[206] This is in part due to the numerous, conflicting demands placed on agencies working in the central Delta as well as the fact that the best locations for restoration are in the Delta's periphery.[207]

The future of the Cosumnes River watershed boils down to the values and priorities of the stakeholders. The CRP is committed to the preservation and restoration of its protected lands within the lower watershed and public outreach through education and accessible open spaces. Recently, another partnership advocacy group has emerged called the Cosumnes Coalition whose vision entails caring for the Cosumnes at a watershed scale from its headwaters to its confluence with the Mokelumne River.[208] The Cosumnes Coalition Partners and Collaborators have long worked in the Cosumnes watershed, preserving thousands of acres, removing fish passage barriers, and sharing Native American traditional ecological and watershed knowledge. The Cosumnes Coalition was formed in 2014 to monitor water quality, create a coordinated Watershed Scale Update and Stewardship Plan, and work with agencies to ensure the 2014 Sustainable Groundwater Management Act (SGMA) Sustainability Plans and the Integrated Regional Water Management Plans include the co-objectives of sustaining ecosystems and providing water supply.[209] SGMA requires local water agencies to form groundwater sustainability agencies, to monitor groundwater extraction, and to draft plans over the next

[206] Matt Weiser, "California to dam Delta sloughs if drought persists," *The Sacramento Bee*, March 11, 2014, accessed December 1, 2016, http://www.sacbee.com/news/state/california/water-and-drought/delta/article2592919.html; Garone, *The Fall and Rise*, 245.
[207] Whipple, email message to Michelaina Johnson; Garone, *The Fall and Rise*, 245.
[208] "Cosumnes Coalition Vision," provided via email by Melinda Hurzel-Frost, June 3, 2017.
[209] Melinda Hurzel-Frost, email message to Michelaina Johnson, June 11, 2017; Melinda Hurzel-Frost, interview with Melinda Hurzel-Frost, interview by Michelaina Johnson, June 3, 2017; Hurzel-Frost, Eaton, and Petree, *2016 Cosumnes River Watershed Update and Plan*, 32, 43. The American River Conservancy has preserved over 6,000 acres while the Sacramento Valley Conservancy has protected a substantial amount of land in the Deer Creek area, which is a tributary of the Cosumnes River.

several years that address groundwater overdraft and foster resiliency.[210] The Cosumnes Coalition is engaging stakeholders in the effort to make the Cosumnes River basin a model for proper groundwater management for other water systems seeking to meet SGMA's regulations. In the arena of groundwater recharge, the Cosumnes again has proved groundbreaking due to the research occurring at the CRP. Specifically, preliminary results from an ongoing University of California Water study on the Cosumnes River suggest that breaching levees to allow small- and medium-sized floods to inundate agricultural fields could triple the recharge provided by irrigation.[211] The effectiveness of floodplain restoration and setback levees along the lower Cosumnes River for groundwater recharge demonstrates the potential of this method not only for other parts of the Cosumnes but also for rivers in California, as other basins seek to comply with SGMA. In the eyes of Melinda Frost-Hurzel, engineer and co-founder of the Cosumnes Coalition, intentional groundwater storage is "really, really important ... because [the aquifer] does not fill in with sediment and does not require as much maintenance [as a dam]."[212] By focusing on groundwater recharge, the Cosumnes Coalition aims to increase base flows to the river and sponsor water sustainability for users within the basin and beyond. Enhanced restoration of the Cosumnes River and recharge of its basin are critical for the health of the South American River Groundwater Sub-basin and the Cosumnes Groundwater Sub-basin, which research has demonstrated the Cosumnes River helps to recharge with over 88,000 acre-feet of water a year.[213]

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[210] "Sustainable Groundwater Management Act," *Water Education Foundation,* accessed June 3, 2017, http://www.watereducation.org/aquapedia-background/sustainable-groundwater-management-act-sgma.
[211] Michelaina Johnson, "Cosumnes River Provides Model for Floodplain Restoration in California," *Water Deeply*, April 19, 2017, accessed June 3, 2017, https://www.newsdeeply.com/water/articles/2017/04/19/cosumnes-river-provides-model-for-floodplain-restoration-in-california; "Floodplain Management Can Increase Groundwater Supply," *UC* Water, April 9, 2015, accessed June 3, 2017, http://ucwater.org/news/floodplain-management-can-increase-groundwater-supply.
[212] Hurzel-Frost, interview with Melinda Hurzel-Frost.
[213] Hurzel-Frost, Eaton, and Petree, *2016 Cosumnes River Watershed Update and Plan*, 15.

Groundwater recharge and storage is just one tool in the toolbox required to fix California's complicated and ever growing water problem. The state population is expected to increase by more than 15 million people, which places further pressure on the Delta's already over-allocated water supply. Moreover, the population of the four counties along the Cosumnes River cumulatively will more than double with Sacramento County and San Joaquin County absorbing 1.65 million people by 2060.[214] In fact, some farmers in the lower watershed recommended in interviews that a dam be built on the Cosumnes to control its floodwaters and to provide for irrigation.[215] As Duane Martin Jr. said, "If they build more dams in the mountains, we'd have more water to go down all summer long."[216] The BLM in 2007 drafted a plan to add more than 55 miles of the North Fork, Middle Fork, and main stem Cosumnes River to the National Wild and Scenic Rivers system, recognizing that "the Cosumnes is the only Sierra river that flows from its headwaters to the valley floor without major dams or diversions. Consequently, it has great value as a scientific reference for how Sierra river ecosystems function."[217] While the status of the BLM's plan is not clear, their effort highlights the exceptional significance of the Cosumnes River and the conflicting agendas within government agencies on the best use of the river. At the end of the day, agencies, environmental organizations, and local landowners will decide the future of the CRP and the Delta based on the land uses they consider most important. As the SFEI stated in the *Delta Renewed* report, the success of the Cosumnes River Preserve and the Yolo Bypass Wildlife Area "suggest that the

[214] "Sacramento—region counties will see strong population growth," *Sacramento Business Journal*, February 1, 2013, accessed November 28, 2016, http://www.bizjournals.com/sacramento/news/2013/01/31/sacramento-region-population-growth.html.
[215] Johnson, interview with Mike Johnson; Martin Jr., interview with Duane Martin Jr.
[216] Ibid.
[217] "BLM draft plan proposes Mokelumne River protection," *Bureau of Land Management*, January 2007, accessed November 28, 2016, http://www.foothillconservancy.org/pages/latest_focus.cgi?_pf_=1&magid=27&magi_detail=376&magcatid=. The calculations are based on the population numbers and projects provided in this article.

Delta can be renewed into a place that supports both people and native wildlife sustainably, if we choose to make the investment."[218]

[218] Robinson, Safran, and Beagle, "A Delta Renewed," 115.

List of Figures

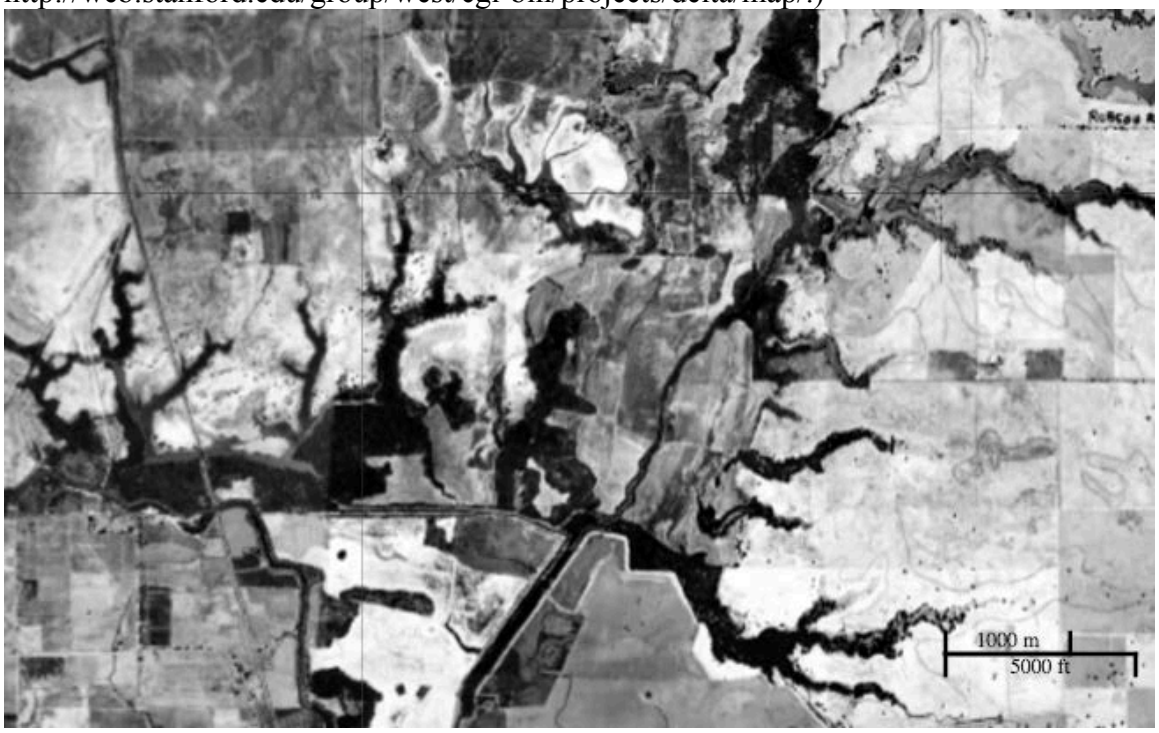
Figure A: This map shows the major tributaries of the Sacramento-San Joaquin Delta. This map also features the two largest rivers in the state—the Sacramento and San Joaquin rivers—in addition to some of the Delta's smaller tributaries, such as the Cosumnes and Mokelumne rivers, which all flow into the Delta (From "Major Tributaries of the Sacramento-San Joaquin Delta," State Water Resources Control Board, accessed November 23, 2016. http://www.swrcb.ca.gov/waterrights/images/tributary_map.gif).

Figure B: This map shows the Central Valley Project and the State Water Project, the two projects responsible for the construction of a lot of the largest dams, aqueducts, and canals in California (From "California: Enough Water for the Future?", *CQ Researcher*, April 19, 1991, accessed December 2, 2016, http://library.cqpress.com/cqresearcher/document.php?id=cqresrre1991041900).

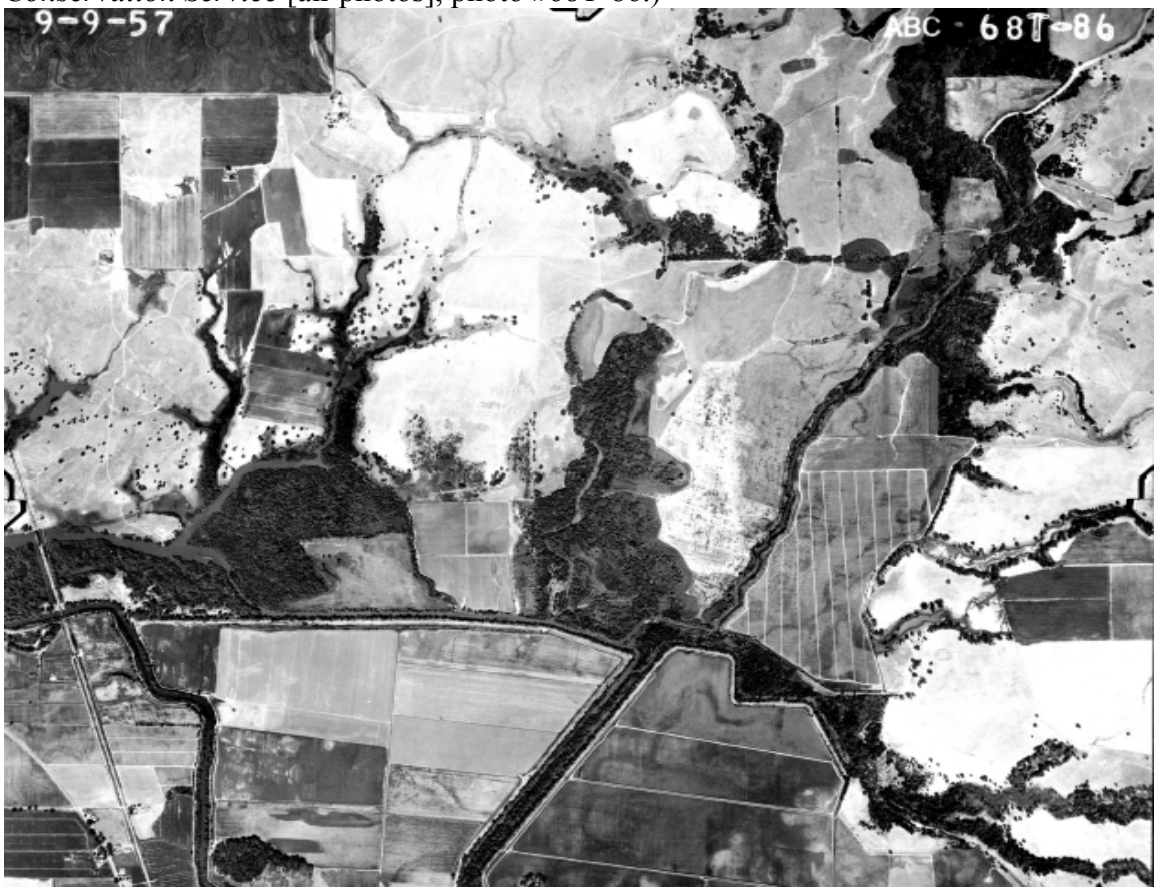
Figure C: This map illustrates the "swamp and overflowed land" and "timbered" sloughs and "tules" along the Cosumnes River in 1864 (From G.H. Thompson, "Plat of the Rancho San Juan de los Moquelumnes Finally Confirmed to the Heirs of Anastasio Chabolla.").

Figure D: The aerial photos below cover the years 1937, 1957, 1964, 1984, and 2016 and visually represent the changes in riparian forest stands present in the lower watershed over the course of 79 years. Other years are not included due to quality issues. The aerial images focus on the bottomland properties: Nicolaus Ranch and the properties on the Preserve known as Beacon Farms, Crump Ranch, and Wilkinson.

Year 1937 (From Lauren Sommer, Alison Whipple, and Geoff McGee, "Explore the Delta Through Time" [map], layer: 1937-1939 aerial photography, 1000 meters: 5000 feet, KQED Quest, San Francisco Estuary Institute – Aquatic Science Center, Bill Lane Center for the American West, and Stanford University, n.d., accessed November 29, 2016, http://web.stanford.edu/group/west/cgi-bin/projects/delta/map/.)



Year 1957 (Map and GIS Data Collection Library, UC Davis, *Aerial photos of Sacramento County, Cartwright Aerial Surveys Inc., United States, and Agricultural Stabilization and Conservation Service* [air photos], photo #68T-86.)



Year 1964 (From Map and GIS Data Collection Library, UC Davis, *Aerial photos of Sacramento County, Cartwright Aerial Surveys Inc., United States, and Agricultural Stabilization and Conservation Service* [air photos], photo #3EE-110.)

Year 1984—the year The Nature Conservancy purchased its first property in the lower Cosumnes River watershed (From Map and GIS Data Collection Library, UC Davis, *Aerial photos of Sacramento County, WAC Corp*.)

Year 2016—nearly 30 years after the CRP was formally established (From Lauren Sommer, Alison Whipple, and Geoff McGee, "Explore the Delta Through Time" [map], layer: no layer, 1000 meters: 5000 feet, KQED Quest, San Francisco Estuary Institute – Aquatic Science Center, Bill Lane Center for the American West, and Stanford University, n.d., accessed November 29, 2016, http://web.stanford.edu/group/west/cgi-bin/projects/delta/map/.)

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