

ClimateBrief: Rice Farming -- and a 1991 Agriculture Law -- Are Key in Conserving California's Biodiversity

Rich Blaustein April 16, 2025



Rice, one of California's major crops, [generates](#) about \$5 billion to the state's economy and over 25,000 rice-related jobs, according to the official California Rice Commission. California's rice crop is grown in the Central Valley, with a high concentration in the northern Sacramento Valley. The acreage in California devoted to the crop depends on the weather, water availability, market factors, and policy determinants.

Since the 1990s, a central policy input shaping rice agriculture has been environmental and conservation considerations. In 1991, the California Legislature enacted the Connelly-Areias-Chandler Rice Straw Burning Reduction Act. This led to farmers wetting the fields in winter to decompose the straw, which in turn led to a phenomenal return in migratory birds and other wildlife in the Central Valley.

The rice areas that have water in winter -- which in non-drought years are over half of the roughly 500,000 rice acres in California -- play a major role in supporting the Pacific Flyway, which runs from Alaska down to the Baja Peninsula. Millions of migratory birds use that flyway sustain themselves in the Central Valley in the winter, along with many other key species that make their seasonal or year-round home in or near rice fields.

To further understand how rice farming synergizes with conservation in a time of environmental change, UC Davis and the environmental organization Point Blue Conservation Science recently released a major study on rice and conservation. Instigated and supported by the California Rice Commission, the study has a major focus on winter wetting.

[John Eadie](#), UC Davis emeritus professor of conservation biology and co-lead editor of the report, recalls that when he came to UC Davis almost 30 years ago, rice drew criticism as an unsustainable crop.

"Rice was actually considered a bad boy for a while, viewed as a heavy water user," Eadie tells ClimateBrief. But that perspective has changed in the last three decades, Eadie says, "because there has been good science," with much of the research conducted at UC Davis.

Earlier in geological history, California's Central Valley was a giant floodplain, but at this point has lost 90 percent of its natural wetlands. Rice farming occurs in areas that featured wetlands.

“Now, with rice, we have these huge spectacles of millions of ducks, all these cranes, and even endangered species like the giant garter snake using these flooded fields in winter,” [Daniel Karp](#) -- associate professor in UC Davis’s Department of Wildlife, Fish, and Conservation Biology, and co-lead editor of the report -- tells ClimateBrief. “Fifty percent of the calories that are fueling ducks during winter are coming from rice. If you do the right practices, like flooding in winter -- which is going to be a challenge with climate change and droughts and water availability -- we can have big conservation wins.”

Karp and Eadie emphasize that the rewetting and return of wildlife is not a rewilding of the Central Valley, noting that the rice fields are a surrogate for the lost natural wetlands -- a “reconciled” landscape. “We cannot go back to that primeval benchmark. Too much has happened, the human footprint is too large, too significant and too permanent,” Eadie says. “But we can recreate some of the ecosystem functionality that used to exist in a now human-dominated landscape.”

Rice was introduced to California in the early twentieth century by Chinese immigrant farmers. In 1912, the acreage in the state was recorded at about 600 acres, increasing by 1920 to around 150,000. More recently, there were around 256,000 acres of rice grown in the drought year of 2022, with the wetter years of 2023 and 2024 planting 512,000 and 485,000 acres respectively. In non-drought years, about 50 percent of rice agriculture is wetted in winter.

The report [states](#) that it’s an initial attempt to quantifiably and qualitatively address four focused questions: “(1) How much rice is needed to meet minimum requirements for species of conservation concern in the California Central Valley? (2) How much planted rice needs to be flooded in winter and/or managed in specific ways to continue providing ecological benefits? (3) Are there specific locations where rice is especially needed to maintain high levels of wildlife abundance and diversity? (4) ... (W)hich management practices, or suites of practices, are economically feasible to implement and benefit the greatest number of species, without negatively impacting other species?”

The report provides sections on the agroeconomics, mapping and modelling techniques that the researchers used to explore rice and conservation. It also has a chapter focusing on five key species groups of concern that resort to the watered rice agroecosystem: the giant garter snake, an endangered species endemic to California; non-breeding waterfowl; shore birds and black terns, for which wetted rice

fields in the Central Valley provide 90% of breeding habitat; sandhill cranes; and California native freshwater species, especially salmon.

Eadie explains that as the researchers refined those broad questions for the key species, one question they sought to address is “where in the valley might rice acreage be of high conservation value to the greatest number of species? Are there some areas where there are opportunities to benefit multiple species simultaneously, or areas where there may be tradeoffs that need to be considered?”

[Kristen Dybala](#), principal ecologist for the Pacific Coast and Central Valley with Point Blue Conservation Science, was a lead co-author on the report, and also the reporter on the black tern and shore birds section. She highlights that Point Blue is connected with members of Central Valley Joint Venture (CVJC), a partnership with organizations and government agencies in the Central Valley that in 2020 released an implementation plan for bird habitat conservation.

Dybala says that bringing together experts from different fields and different species focuses for the study was exciting, challenging and valuable. “It was also important to be working with the land managers and the Rice Commission, those who will be managing the land,” Dybala says. She adds that Point Blue has been working with the Rice Commission for many years on conservation.

The report notes that the turning point for California was the shift to winter wetting for the rice fields that began in the 1990s, with the [Connelly-Areias-Chandler Rice Straw Burning Reduction Act of 1991](#).

The Act [states](#): “Each grower shall be eligible to burn up to 25 percent of the grower's planted acres, as determined by the air pollution control officers in the Sacramento Valley Air Basin and subject to the maximum annual number of acres burned set forth in paragraph”. The 2025 report says that currently only 10 percent of the rice acres are burnt.

[George Soares](#), partner in the Sacramento office of Kahn, Soares & Conway, participated in the drafting of the Act, as well as the legislative authorization of the California Rice Commission almost a decade later. In an interview with ClimateBrief, Soares recalls the focused cooperation in enacting the 1991 law.

"I remember the time vividly that there were quite some frictions among some groups about these environmental circumstances," says Soares, who also farms crops including pistachios and agave. "The important part of it was the rice industry recognized that they existed in this larger community of California. They actually engaged."

Along with colleagues at his firm, Soares worked with California lawmakers on putting the bill together. "There we were, saying, Let's figure out a way to dispose of this rice straw with less burning, less environmental impact," Soares recalls. There was an exception for burning, during times of disease or extreme conditions, which the California Air Resources Board (CARB) [authorized](#) in 1995 following severe flooding in the Sacramento Valley.

Soares and his colleagues also drafted the [legislation](#) that authorized the Rice Commission. He points out that the law enabling agricultural commissions is a derivative of the California Marketing Act of 1937, which enabled farmers to come together during the Great Depression under the state's [Marketing Orders](#), of which there are still many in California. Marketing orders are established under an administrative process of the California Department of Food and Agriculture, while commissions are authorized by the legislature.

"Commissions are more independent to some degree, with government having some authority," Soares explains. "It is like a partnership arrangement with government. The commission is subject to some rules, but there are times when the commission can make decisions independent of the state."

In the instance of this report, the Rice Commission sent queries to UC Davis scientists about researching the actual footprint of the rice sector on species conservation, and also on management practices and tradeoffs.

For waterfowl, the researchers modeled a central scenario of 300,000 acres of rice planted, which led to a 50% drop below conservation goals; and another one with 500,000 acres planted, which attained 100 percent conservation. The modeling took into account contexts in which geese competed with ducks for food in the rice farming areas.

For black terns, the Sacramento Valley rice fields provide 90% of nesting habitat. Dybala notes that those birds, which are unusual in their coloring, inspire passionate

feelings from bird lovers. They nest in the Central Valley -- and some farther north -- and often build floating nests on emergent vegetation in freshwater marshes. They have steeply declining populations.

The report modelled five scenarios and conclude that “a rice footprint of >172,414 ha (426,043 ac) is needed to maintain a Black Tern population above 1,000 individuals, reducing the risk of local extirpation and loss of genetic diversity”. Restoring more high quality habitat with a rice footprint of more than 191,333 ha (472,794 ac) would be sufficient “to meet the CVJV’s long-term population objective for Black Tern, provided flooding is maintained throughout the entire breeding season,” the report found.

The report also has a section on freshwater fish, in particular salmon. The report states: “87% of California’s native fish populations are under severe decline and face extinction if present trends continue ... Negative trends are only intensifying, and as of the writing of this report, multiple runs of Chinook salmon in California are collapsing in real-time.”

Karp says that in the last decade, researchers have realized that wet rice fields support zooplankton, on which salmon feed. “There was a realization at UC Davis and CalTrout that you could take these salmon into the rice fields, and they would eat these invertebrates and grow much faster than in the Sacramento River channel,” Karp says.

The report also discusses the Yolo and Sutter bypasses, which are floodplains that are used to manage the Sacramento River overflow. “You could have the practice where the salmon would enter the flooded fields at those points in those years and feed and grow a lot; and volitionally leave,” Karp explains. The modeling showed that while this would not completely reverse salmon declines, Karp says, it helps with “increasing survival and the cohort replacement rate, if these bypasses were allowed to support salmon this way and provide this conduit for food.”

Eadie underscores that the Yolo Bypass has many different stakeholders with different interests. “It is a microcosm of the tradeoffs that extend for the whole valley. We can't do everything for all species at once in the same place,” Eadie says. “And that was part of the point and focus of the report -- what do different species need, and what are the points of overlap and what are the points of difference. Could we do something that benefits multiple species? That is what we sought to do.”

Another idea that Karp highlights, and that CalTrout is pursuing within its fish-food program, is for rice farms to grow the zooplankton and systematically flush them into the river as food for salmon. Karp is also currently involved in a USDA-supported study with eight Central Valley half-acre plots, examining how fish introduced to rice fields can catalyze the food chain in a way that mitigates methane releases. Currently, this is the second year of a two-year study, but Karp says preliminary trends seem to demonstrate that fish were actually reducing methane emissions in year one, which corroborates a similar European [study](#).

Dybala adds that regarding climate change, there are a lot of potential long-term benefits for wetlands, which sequester carbon and bury organic carbon in the soil, alongside the short-term methane releases.

"Wetlands, and rice as surrogate wetlands, are so important," Dybala says. "For any conservation strategy, we need to be thinking about trade-offs and be aware that biodiversity is affected by climate change efforts one way or the other. Hopefully, we can find strategies that are good for both climate mitigation and biodiversity conservation."

The rice experience in the Central Valley does point to hopeful possibilities.

"We are safeguarding the environment, and we did it by learning -- by figuring out that if we brought water onto the fields after the crop was harvested, that would bring the birds and the rice would decompose, and with the next spring the ground was ready to work again and repeat the cycle," Soares says. "It is an amazing transition that the rice industry made over those decades."

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