Klamath Basin Farming and Wetland Collaborative

Regional Conservation Partnership Program



Overview

The Klamath Basin Farming and Wetland Collaborative is a partnership supported by the USDA – Natural Resources Conservation Service (NRCS) Regional Conservation Partnership Program (RCPP). This RCPP grant was awarded in 2021 and completed in 2026. It provided financial and technical assistance for the core partners Ducks Unlimited, Intermountain West Joint Venture, and U.S. Fish and Wildlife Service (USFWS) Partners for Fish and Wildlife Program to incentivize innovative wetland habitat conservation approaches in the Klamath Basin. During

this period, the Klamath Basin experienced extreme water variability and historic shifts in water management infrastructure and policy, creating unforeseen challenges and once-in-a-generation opportunities for wetlands conservation. The following report summarizes the work implemented and the outcomes delivered over the course of this project.

Background







The Klamath Basin's historic natural wetland complexes have supported people, fish, and wildlife since time immemorial. Wetlands spanned the Basin and connected rivers, lakes, and streams, creating a thoroughfare for endemic aquatic species such as Redband Trout, Lost River and Shortnose Suckers, and inevitably shaping their life histories and unique adaptations. Waterfowl also crafted their continental migration patterns to take advantage of wetlands in the basin for reproduction, molting, and migration. Over 330,000 acres of wetlands were estimated within the Upper and Lower Klamath lakes system alone. The rich organic soil and the water that comprise these wetlands provided the basis for an agricultural revolution at the turn of the 20th century, sponsored by the federal government to develop the basin's natural resources for the nation. However, unlike similar efforts elsewhere in the West, draining and evacuating water from the historic lakes and marshes was as much a problem as storing and delivering it to farms and ranches. Today, the Klamath Project, under the jurisdiction of the Bureau of

Reclamation, remains an important economic driver for the Basin and a primary water user in the watershed. The wetlands that remain can be found adjacent to the current footprint of large lakes, protected in land base by several USFWS National Wildlife Refuges, and on a limited acreage of private lands. Even with this reduced habitat footprint, approximately 80% of waterfowl in the Pacific Flyway pass through the Klamath Basin and rely on its wetland resources.

Over the last 30 years, the Klamath Basin has been synonymous with water conflict that is exacerbated by drought, water and environmental policy, and seemingly competing environmental and agricultural uses of water. During this RCPP project, the Basin experienced a drought of historic proportions, further underscoring the need for innovative water management to increase the Basin's resilience to future droughts. Between 2019 and 2023, the remnant of Tule Lake National Wildlife Refuge at Sump 1A emptied, domestic wells went dry, the Klamath Project received little to no water, and hundreds of thousands of waterfowl perished from botulism outbreaks. These impacts demonstrated the watershed-scale risk of drought and further highlighted the interconnectedness of water in the Basin. As impacts reverberated throughout the community, old tensions emerged, but also voices calling for new approaches to water management to overcome these watershed-scale challenges. In these messages, our RCPP partnership observed a renewed emphasis on conserving water in wetlands for people, fish, and wildlife.



An objective of the RCPP was to provide an economic incentive to encourage participants to allocate water and land in their agricultural operations to benefit waterfowl habitat. In doing so, private landowners and farmers experimented with wetland management in new ways that addressed resource challenges beyond bird habitat. Some of these participants have become key messengers for this program and the benefits of integrating wetlands into land and water management in the Basin. Although we do not have data to measure how our project changed the community's perception and narrative around wetlands, our partnership has observed wetlands being discussed more often as central to solutions for the recovery of endangered fish, productive agriculture, and watershed resilience to drought. We believe the Klamath Basin Farming and Wetland Collaborative has contributed to the Klamath Basin-wide conversation about water resources. In this report, we present the outcomes measured in conjunction with this project, as well as the constraints and facilitators to managing wetlands on private lands.

Project Accomplishments

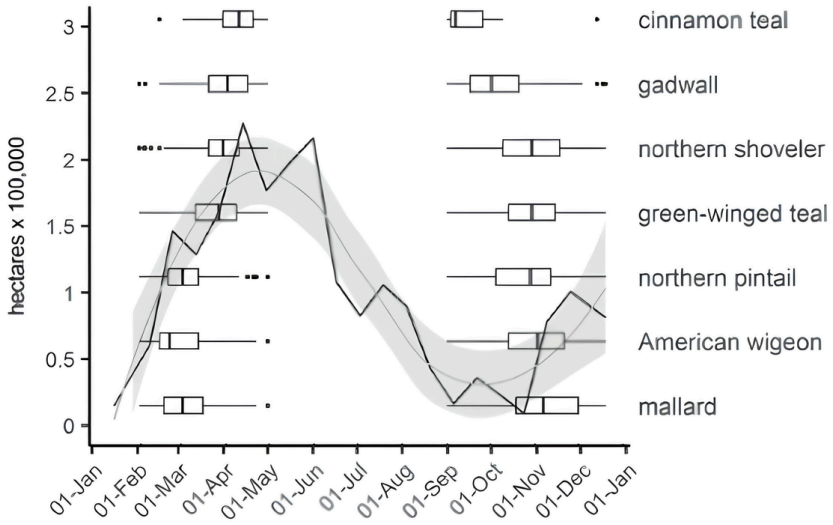
Project Acres

A total of 1257 acres were enrolled in RCPP agreements across 11 contracts. One NRCS practice, Wetland Wildlife Habitat Management 644, was offered, with two scenarios: Flooding for Wildlife (Cropland or Pasture) and Seasonal Flooding Leave-Grain. Some acres were enrolled in both scenarios and transitioned from one management type to the next over the course of the agreement; this is why the total number in the table below is higher. Additionally, some acres were re-enrolled once the original agreement expired.

Program type	**Total acres**	**Total acres x years enrolled**
Seasonal Flooding Leave-Grain (25% Leave)	393	985
Flooding for Wildlife Pasture	38	75
Flooding for Wildlife Cropland	893	3491
Total	**1324**	**4551**

Habitat Management and Wildlife Outcomes

The habitat goals of this program targeted fall-migrating waterfowl, especially dabbling ducks. Past wetland habitat monitoring identified fall as a season of limited water and wetland habitat in the Southern Oregon Northeastern California (SONEC) region; see the figure below (Donnelly, 2019). For migrating waterfowl, food energy is critical for fueling migration, and food is more readily accessible to waterfowl when habitat is flooded. Habitat and water management prescriptions of this RCPP were strategically developed to maximize food availability while matching the temporal availability of this resource with migration chronology.



Bi-monthly abundance of flooded seasonal wetlands (solid black line fit with polynomial regressions and overlaid with spring (February-May) and fall (September-December) waterfowl migration chronology. *Donnelly, 2022.*

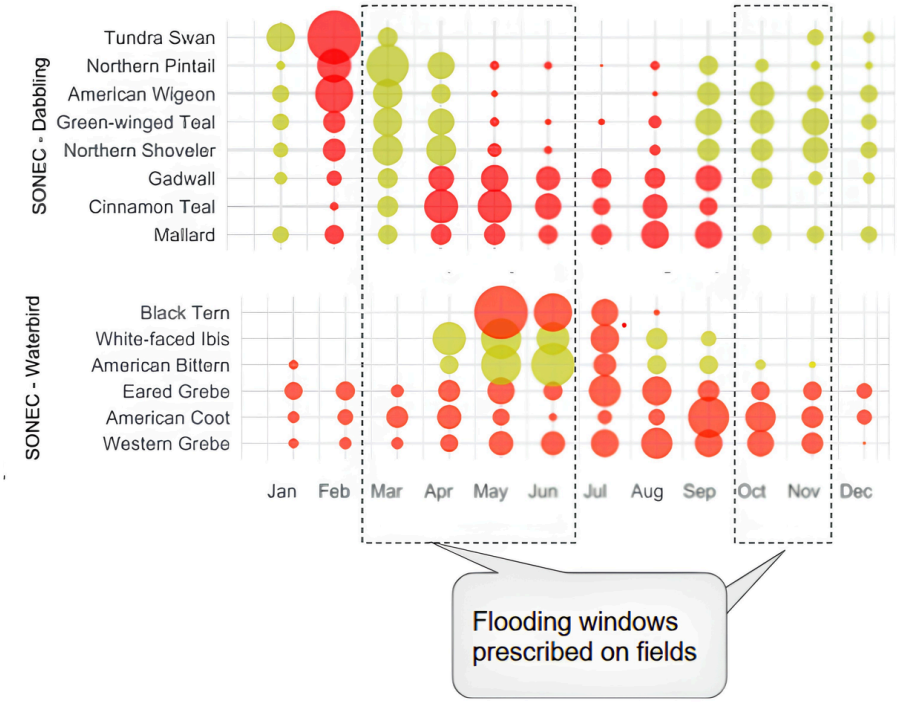
The habitat management prescription for Flooding for Wildlife Cropland required fallowing a crop field. The fallow field was flooded in spring to saturate soils and promote plant germination. Once the field was fully flooded and after May 15, a gradual spring drawdown lasting at least 30 days was implemented to expose soils, trigger germination, and provide early seral wetland plants with ample sunlight during the growing season. Fields were generally dry from late July through September, when evapotranspiration is highest, and water demand in the Basin is near its peak. The timing of the fall flood was scheduled to coincide with the peak fall migration of waterfowl in the region, generally between September 9 and October 30 (Donnelly, 2019). Occasionally, flooding was managed adaptively based on the seed maturity of desirable wetland plants to prevent inundation of seeds

that had not yet hardened, thereby rendering them susceptible to early decomposition and reducing food quality, density, and longevity for waterfowl.



With Flooding for Wildlife Pasture, the extent and volume of flooding were determined by saturating microtopography and filling depressions throughout the field, because most pastures lack field borders like those of flood-irrigated crop fields. In addition, the amount of flooding was deliberately planned to maintain the current plant composition of grasses, rushes, sedges, and other early-seral wetland plants, as the field would remain pasture post-enrollment. Flooding was deliberately applied in spring and every few weeks during the summer and fall to maintain flooded depressions. These fields provided habitat throughout multiple life stages, including brood water during the breeding season.

Seasonal Flooding Leave-Grain required that 25% of a grain crop be left unharvested in alternating strips. The unharvested crop needed to remain through the fall migration window. Fields were flooded as soon as water became available post-harvest, with the goal of maximizing food and water that coincides with peak fall migration.



Dot size illustrates annual proportional abundance by month. Large dots represent seasonal concentrations of bird abundance associated with wintering and migrating behaviors. Similar sized dots occuring over many months represent continuous bird abundance associated with non-migratory populations. Colors are indicators of habitat impacts associated with changes to monthly semi-permanent, seasonal, and temporary wetland abundance. Red = significant impact, yellow = moderate impact, and blue = stable. Donnelly, 2019

Waterfowl Food Energy

The RCPP established acreage objectives to achieve a measurable improvement in waterfowl's food-energy availability for water during fall migration. The loss of a significant wetland area within the Lower Klamath and Tule Lake National Wildlife Refuges due to reduced water deliveries necessitated the provision of additional habitat and food for wetland management. At the commencement of this project in 2020, it was estimated that 8,700 acres of seasonal wetland habitat during fall migration had been lost at Lower Klamath National Wildlife Refuge since 2005 due to the reduced water allocations. These acres, which were no longer functionally available to migrating waterfowl, had previously provided an estimated 4.3 billion KCAL of food during the fall migration based on TRUMET food energy models (M. Petrie, Unpublished). Applying the same food energy modeling across the RCPP enrollment types, all enrolled RCPP fields provided nearly 1.1 billion KCAL each year, or about 25% of the fall food-energy value lost on the Lower Klamath National Wildlife Refuge.

Species Diversity

RCPP-enrolled fields also provided habitat for many other avian species, as well as amphibians and mammals. In an effort to better quantify other wildlife benefits, we partnered with the Bird Alliance of Oregon to deploy SongMeter Micro acoustic recording units on a participating property with fields in the Flooding for Wildlife Cropland option. These battery-operated recorders were deployed in enrolled wetland fields from May 28 to October 20 in 2025 to record wildlife vocalizations at specific time intervals throughout the day. These recordings were then analyzed with vocalization recognition software (BirdNet) to determine the presence/absence of specific species. This monitoring protocol identified 68 distinct bird species in or near enrolled fields (see the bird list in the appendix). Several waterfowl species, like Northern Pintail and Ruddy Duck, were not recorded by the SongMeter but have been observed in the participating fields.

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Social and Economic Outcomes

Production, ownership, and management of the enrolled farms varied widely. All participating farms relied on agricultural production to remain economically sustainable. Crop types grown or previously grown on participating fields included alfalfa, barley, grain mix-hay, potatoes, and pasture. Most farms were leased out to tenants, with only one being owner-operated. All farms were used by owners for waterfowl hunting or leased for waterfowl hunting, with the exception of one farm where no waterfowl hunting was permitted by the landowner.



Water insecurity has created a challenging economic paradigm for farms and ranches in the Klamath Basin. The lack of a steady water supply affects many aspects of agricultural production and the local economy. For producers and farm owners, it also creates challenges in revenue forecasting, crop rotation planning, and scheduling. Many farms and ranches in the Basin have been forced to wait each spring to see what irrigation allocations will be, and subsequently, which programs will be available for the growing season. Farmers then have a short window of time to make management decisions.

A goal of this program was to provide a short-term planning margin of up to five years by enrolling fields into management contracts with set payment rates. The contract provided managers with certainty about revenue from enrolled fields for multiple years. As a result, we observed that enrolled farmers tested new crop types, management strategies, and even supported additional habitat on farmable acres without financial assistance. In recent years, other programs in the Basin, like the Drought Response Agency, have also shifted to offering multi-year enrollments. Although annual precipitation and, therefore, water allocations will undoubtedly continue to vary, crafting programs that provide greater stability and mid- to long-term planning was deemed important in conversations with producers.

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Infrastructure to enable water management in wetlands was a critical step in making this project possible on conventional agricultural lands. Although our original RCPP proposal included funding for infrastructure practices such as Structures for Water Control, the awarded RCPP did not include funding for these practices. The USFWS Partners for Fish and Wildlife Program (PFW) therefore became a key partner in providing technical and financial assistance to participants looking to improve fields to meet flooding and drainage requirements for high-quality wetland management. Field improvements included land leveling, field berms, ditches, swales, and water control structures. Without PFW support, it

would have been impossible to implement the infrastructure components and habitat management under the same RCPP land management agreements due to the required capacity and funding. The partnership with PFW was instrumental in making this project economically and practically viable for participants.



Retiring agricultural land, whether to reduce irrigated acres or for restoration purposes, has been a hot-button issue within the community. For this reason, programs that set land aside temporarily rather than permanently are more easily accepted by producers. One of the attractions of this program, as communicated by participants, is the ability to rotate the practice throughout the farm and have fields available for production once the agreement is complete, with the benefits of improved soil organic matter and eligibility for organic designations. Keeping the land and water under a participant's full control is another component valued by participants. In summary, options that provide landowners with flexibility, control over land and water, and a degree of certainty appear to be an important combination when developing new conservation program offerings.

Constraints and Opportunities

National Wildlife Refuge Water Instability

Wetland habitat on the Tule Lake and Lower Klamath National Wildlife Refuges reached historic lows in 2021 when the Klamath Project received no water, and Sump 1A at Tule Lake went completely dry. Lower Klamath, which had already experienced a significantly reduced wetland footprint from years of reduced water allocations, shrank even further without water to be conveyed from Tule Lake via D Plant. In 2022, the drought continued, and Tule Lake 1A remained completely dry.

The drought highlighted the dire risks to habitats and wetlands at the two refuges. Along with restricting refuge habitat, the drought eliminated habitat opportunities elsewhere, like the aforementioned cooperative wetland program, which incentivizes off-refuge habitat trades. The drought harbored environmental conditions conducive to botulism outbreaks in waterfowl and other waterbirds at Tule Lake. This bacterium, which is naturally found in soils, becomes deadly to birds when water is stagnant and warm. In 2024, after Tule Lake sumps had finally refilled, a botulism outbreak killed over 100,000 birds when water became stagnant and hot summer temperatures heated the water.



In 2022, our program enrolled the first two properties, providing additional habitat for waterbirds and waterfowl during the drought. Although no official counts occurred, landowners noticed large concentrations of birds on private lands with water during this period. In the prior year (2021), approximately 5,000 tundra swans, or 10% of the Western population, were observed on Lakeside Farms, which was later enrolled in the RCPP. In 2021-2022, USFWS aerial bird counts found that most birds near the refuges were on winter-flooded fields in the Klamath Drainage District (per communication with USFWS staff). No birds experiencing botulism symptoms were ever reported by participants or observed in the RCPP-enrolled fields, likely due to the timing of flooding and the ability to keep water moving on

these private farms.

The National Wildlife Refuges in the Basin are critical anchors for waterfowl and waterbirds on the Pacific Flyway. They are also important centerpieces in the community for public recreation like waterfowl hunting, bird watching, and photography. None of these attributes can be wholly replaced by private lands, but private lands that support wetland habitat, as accomplished in this program, can work in concert with refuges to maintain connectivity on the Pacific Flyway when intense drought disproportionately impacts public lands.

Agricultural Tailwater and Water Quality

Water quality arguably plays as much of an issue in water resource management in the Klamath Basin as does water quantity. Upper Klamath Lake is listed as impaired for methylmercury, sedimentation, dissolved oxygen (DO), pH, and chlorophyll-a (ODEQ 2024). The U.S. Environmental Agency (EPA) approved Total Maximum Daily Loads (TMDL) for temperature, pH, DO, and chlorophyll-a (2002) and nitrogen and phosphorus (2019) (ODEQ 2022).

In recent years, agricultural lands adjacent to Upper Klamath Lake that drain into surface water have come under increased scrutiny for contributing to impaired water quality. Many of these farms previously irrigated fields to saturate the lake-bottom soils and prepare them for spring planting. This post-harvest flooding coincided with waterfowl migration and wintering seasons, providing habitat on private lands. However, the Oregon Department of Agriculture regulates pumping into Upper Klamath Lake, discouraging pumping from farms to the lake when total phosphorus concentrations in on-farm water exceed 190 ug/L. The tailwater from flood-irrigated fields often carries sediment that is naturally high in phosphorus, causing this water to exceed the concentration and putting agricultural producers in violation. As a result, producers have been discouraged from using flood irrigation and have been forced to reduce tailwater to remain in compliance. This reduction in field flooding affects waterfowl habitat on these farms, which were carved out of the fringe wetlands of Upper Klamath. On the surface, this conflicted with the water management promoted by the RCPP.

Natural wetlands are synonymous with improved water quality, and studies indicate that managed wetlands can also serve to reduce phosphorus in water inflows (Skinner, 2022). One of the RCPP participants, Lakeside Farms, set out to test the hypothesis that managed wetlands on farm fields adjacent to Upper Klamath Lake could provide water treatment benefits for agricultural tailwater high in

phosphorus. Lakeside Farms worked with USFWS PFW, Klamath Watershed Partnership, and other partners to reconfigure its fields to improve water management and set aside a field for water-quality treatment. The treatment field was planned to be sufficiently large to accommodate the volume of water leaving the farm. Total phosphorus was monitored by water quality specialists with USFWS and partners. In the first year of implementation, the tailwater treated in the wetland fell below the 190 ug total phosphorus/L during the late winter and early spring months, when water needs to be pumped off the farm (communication with M. Skinner). In treating water within this wetland, the project provided both a wetland habitat and a water quality improvement. The success of this management approach has been widely communicated in the Klamath Basin and, coupled with sucker rearing efforts also underway on the farm, has become an example that agricultural lands are part of the solution to multifaceted conservation challenges in the Basin.

Klamath Project Water Allocations and Beneficial Use

Water rights and water policy have a significant impact on wetland habitat in the Klamath Basin. Annual water allocations for the Klamath Project, as previously mentioned, impact the amount of habitat on refuges and adjacent private lands. Due to the annual variability of water allocation in the Klamath Project in recent years, including allocations of little to no water, it is challenging to develop agreements with landowners that require a certain level of water application.



For the purposes of this project, all Flooding for Wildlife Cropland and Pasture enrollments occurred on land with water rights senior to the Klamath Project or on land with unclaimed water from spring sources.

Some Seasonal Flooding Leave-Grain enrollments were located on fields within the Klamath Project that held a winter water right. Given that winter water is less contested than summer growing-season water, these fields had a high likelihood of receiving water in any given year.

In Oregon, state water rights designated for irrigation must be used to irrigate a plant. Wetland plants, much like pasture grasses and lawns, are included in this definition. Enrolled fields received water via an irrigation water right. In communication with Oregon Water Resources Department (OWRD) staff, it was made clear that water applied for irrigation must directly benefit plant production and should not remain in the field for longer durations than necessary, which could be interpreted as storage. This direction from OWRD was used to develop the program's habitat management prescriptions.

Conclusion

> Private lands that support wetland habitat, as accomplished in this program, can work in concert with refuges to maintain connectivity on the Pacific Flyway when intense drought disproportionately impacts public lands.

Wetlands in the Klamath Basin have an undeniable role in the Basin's history, hydrology, and ecology. Bringing wetlands back into the human-developed footprint of the Klamath Basin is challenging for a multitude of reasons, ranging from water availability and policy to community willingness to restore previously reclaimed wetlands to a semblance of their former state. This RCPP project highlighted that with the right incentives, partnerships, and management approach, conservation partners can bring some of the functionality of wetlands into an agricultural setting. Furthermore, the landowners and farms participating in this program were able to experiment with wetland management and test the effects of these practices beyond wildlife habitat, including crop production, water quality, and recreational opportunities. In doing so, the participants demonstrated how this practice can address multiple resource challenges and offer a glimpse of a different future for the Klamath Basin. Although this project cannot and did not intend to replace the scale of habitat of Tule Lake and Lower Klamath National Wildlife Refuges, it is additive and promotes resilience of waterbird habitat in this linchpin of the Pacific Flyway.

Acknowledgements

The Intermountain West Joint Venture would like to acknowledge our key partners in this effort: USDA Natural Resources Conservation Service – Oregon, Ducks Unlimited, and the U.S. Fish and Wildlife Service Partners for Fish and Wildlife Program. Support from these entities was absolutely essential to the success of this RCPP. We are grateful for their partnership.

We would also like to thank Bird Alliance of Oregon for their partnership on the Song Meter Survey. Last but not least, we would like to express our deep gratitude to the participating landowners for their partnership with this RCPP and within the Klamath Basin.

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Appendix

Species List from Song Meter Survey on one enrolled field between May 28-October 20, 2025.

American Avocet	California Gull
American Barn Owl	California Quail
American Coot	Canada Goose
American Goldfinch	Caspian Tern
American Pipit	Cinnamon Teal
American Wigeon	Cliff Swallow
Bald Eagle	Common Nighthawk
Bank Swallow	Common Raven
Barn Swallow	Common Yellowthroat
Belted Kingfisher	Forster's Tern
Black-billed Magpie	Franklin's Gull

Black-crowned Night Heron	Gadwall
Black-necked Stilt	Great Blue Heron
Blue-winged Teal	Great Egret
Brewer's Blackbird	Great Horned Owl
Brown-headed Cowbird	Greater White-fronted Goose
Bushtit	Greater Yellowlegs
Green-winged Teal	Sandhill Crane
Horned Lark	Savannah Sparrow
Killdeer	Song Sparrow
Least Sandpiper	Sora
Lesser Goldfinch	Spotted Sandpiper
Long-billed Dowitcher	Tree Swallow
Mallard	Virginia Rail
Marsh Wren	Western Meadowlark
Mourning Dove	Western Wood-pewee
Northern Harrier	White-faced Ibis
Northern Rough-winged Swallow	Willet
Northern Shoveler	Wilson's Phalarope
Osprey	Wilson's Snipe

Pied-billed Grebe	Wood Duck
Red-tailed Hawk	Yellow-headed Blackbird
Red-winged Blackbird	
Ring-billed Gull	
Ring-necked Pheasent	
Sage Thrasher	

More information about this RCPP, included related press and media, can be found at:

iwjv.org/klamath-basin-farming-and-wetland-collaborative-rcpp

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