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JOINT VENTURE

INTERMOUNTAIN INSIGHTS:
Inspiring Conservation Action Through Science

UNDERSTANDING WETLAND LOSSES TO BUILD RESILIENT WATERBIRD NETWORKS

Migratory waterbirds using the Pacific Flyway, especially shorebirds and waterfowl, face an erosion of the habitat networks key for survival.

A warming climate combined with intensifying drought and the over-allocation of water resources across the West has diminished wetland habitats that these birds depend on for breeding, wintering, and migration. With some types of wetlands declining faster than others, management adjustments are needed to provide habitat for numerous species of migratory waterbirds in the long term.

However, scientists can help land managers pinpoint important wetland sites to prioritize for conservation by measuring these wetland losses and their impacts on migratory birds and reconciling that data with on-the-ground management practices. In turn, wetland conservation is aided by tools that can maintain habitat that is resilient to stressors like climate change.

RAPID DRYING HAS IMPLICATIONS FOR WATERBIRDS

A study from the Intermountain West Joint Venture and partners, *Functional wetland loss drives emerging risks to waterbird migration networks*, examined wetland hydrology in the Southern Oregon Northeastern California (SONEC) region and California's Central Valley, two of the most significant sites for migratory waterbirds in the Pacific Flyway.

Using over three decades of satellite imagery, researchers monitored the timing and duration of seasonal flooding on both natural and agricultural wetland habitats (the latter being primarily flood-irrigated hay or grain fields flooded post-harvest) from 1988-2020. As wetland flooding determines migratory waterbird use for wintering, breeding, or stopover habitat, it can be a good indicator of network resiliency for many different species.

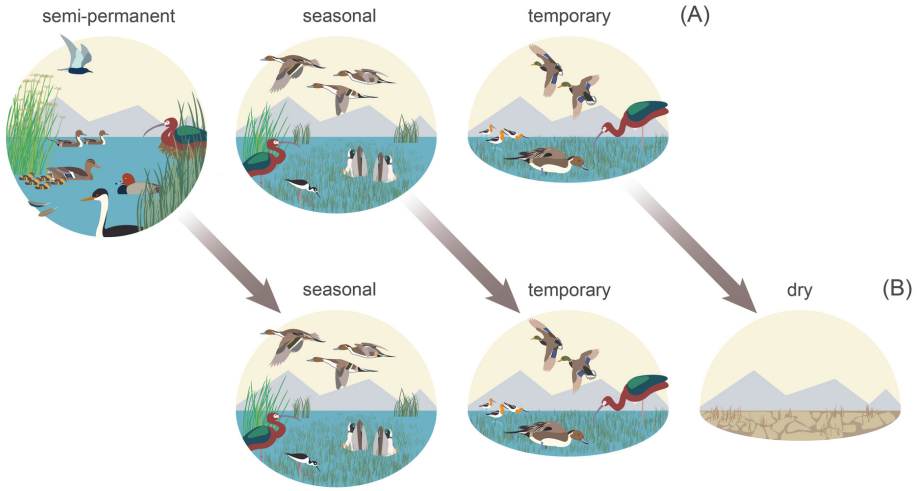
Wetlands that lost surface water over the 32-year time period were further evaluated to determine whether that decline was due to a physical or functional loss. Physical losses can typically be attributed to development or other changing land use, while functional losses align with simply having less water on a

> **"The results paint the picture of a West where water is present on the landscape for shorter and shorter periods each year."**

landscape due to factors like drought or water policy changes. Researchers looked for trends in how birds use habitat in relation to the availability of surface water by combining this information on wetland resiliency with data on 33 species of migratory waterbirds.

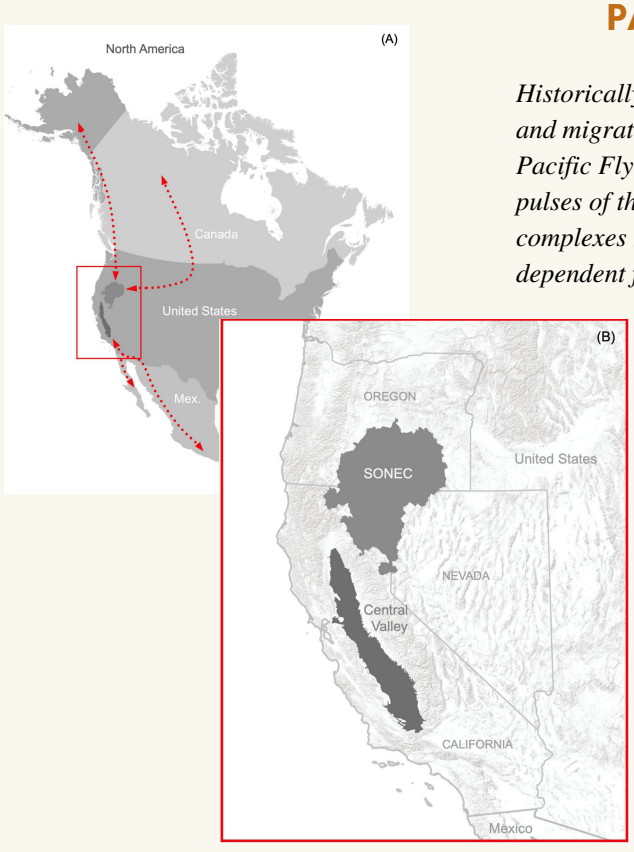
The results paint the picture of a West where water is increasingly absent from the landscape. Across both SONEC and the Central Valley, functional wetland loss was the main contributor to declining habitat availability for many species of migratory waterbirds. Changes in basin-level water use priorities and state and regional water policy translated to declines in the ability of public land wildlife refuge managers to use flooding as a management tool to provide wetland habitat at key times of year. Key private agricultural lands, which provide waterbird habitat all over the West due to their senior water rights and locations along riparian corridors, lose effective wetland habitat when irrigation practices transition from flooding to "efficient" infrastructure like sprinklers.

Of all the wetlands examined in this study, semi-permanent wetlands experienced the heaviest losses. These wetlands, which are typically defined as areas covered with water at least eight months out of the year, rely on a consistent water supply to



(A). Semi-permanent losses resulted from shortened hydroperiods caused by excessive drying that forced the transition of these habitats to seasonal and temporary hydrologies—a process that offset concurrent seasonal and temporary wetland declines. Shorebirds (American avocets and black-necked stilts), migrating-wintering dabbling ducks (northern pintails and mallards), and white-faced ibis benefited from more persistent seasonal and temporary wetlands that were bolstered by stable agricultural habitats (B).

SONEC, CENTRAL VALLEY, AND THE KLAMATH BASIN: WETLAND SYSTEMS OF THE PACIFIC FLYWAY



Historically, these water-rich landscapes provided ample habitat (breeding, wintering, and migratory stopover sites) for the millions of wetland-dependent birds using the Pacific Flyway each year. These basins functioned as wetland systems fed by seasonal pulses of the Klamath, Sacramento, and San Joaquin rivers. Together, these wetland complexes supported huge portions of the Pacific Flyway each year, as well as wetland-dependent fish like the now-endangered C'waam and Koptu sucker species.

The plentiful water in these massive wetland complexes, combined with rich soils, made the Klamath Basin and the Central Valley attractive areas for tribes, and, after colonization, Western-style agriculture. At the dawn of the twentieth century, the wetlands of the Klamath Basin and the Central Valley began to be dyked, dammed, dredged, and dried to provide for crops, livestock, and the communities that raise them. This process created a highly managed system reliant on a steady supply of water and therefore less resilient to drought.

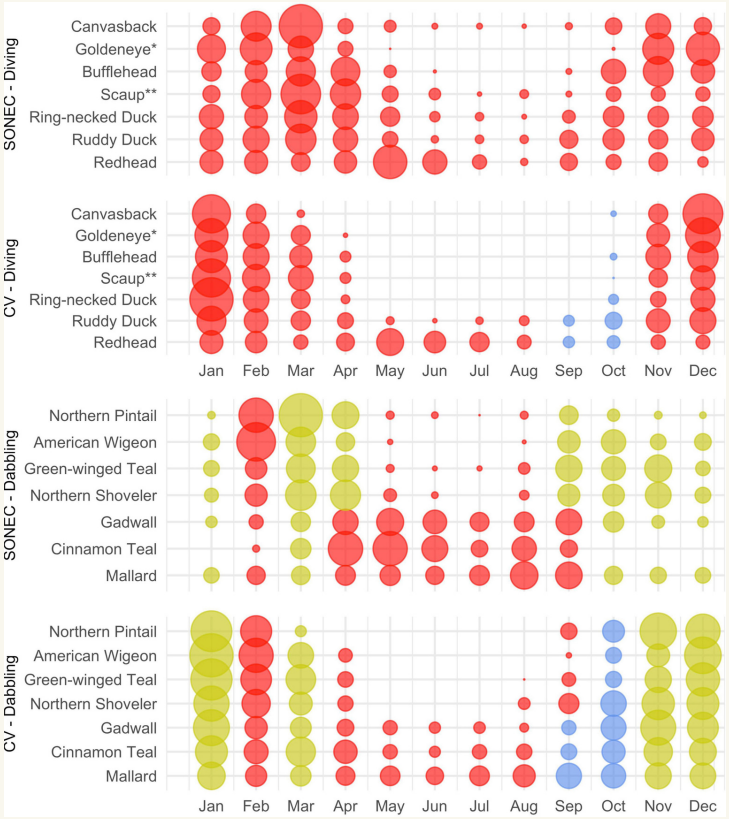
Today, that steady supply of water is a decreasingly realistic scenario. Conservation—of migratory birds, native fish, and agriculture—depends on coming up with innovative ways to operate in a drier system.

remain wet. Across the entire Pacific Flyway, significant amounts of semi-permanent wetland habitat are found in the massive wetland complexes of the SONEC region (such as Summer Lake, Lake Abert, and Malheur Lake). As water recedes from the landscape in drier months of the year, it's not uncommon for them to dry up; however, as annual dry periods start earlier and earlier, these wetlands will disappear earlier and earlier each year. The result will be a functional loss of landscape features that have long been the hydrologic drivers of their respective watersheds.

Their disappearance means that an important habitat niche—deeper, late-season water for molting and migrating waterbirds—also disappears. Birds like diving ducks, coots, terns, and grebes, which need the habitat provided by deeper water and longer hydroperiods were found to be significantly impacted by decreases in available habitat at these sites (see figure). As a consequence of semi-permanent wetland loss, migratory bird use is condensed onto any remaining suitable wetland habitat. Alternatively, waterbirds may go hundreds of miles out of their way to locate wetlands in other parts of the Pacific Flyway during migration.

However, as semi-permanent wetlands dry out, many of them transition to seasonal and temporary wetland patterns that offset these losses by filling the habitat needs of species like dabbling ducks and shorebirds. As areas that were once considered semi-permanent wetlands become dry for more months out of the year, they transition into hydroperiods that look more like seasonal wetlands. Thus, the study noted an increase in seasonal wetland habitat. This means that species of birds that need shallower water for habitat would be less affected by drying in many areas, as they could use the sites that previously had water too deep for their use.

The catch? As drying eats away the edges of all types of wetlands, these shallow-water species will also lose habitat and face population declines.



*Southern Oregon and Northeast California (SONEC) and Central Valley (CV) monthly diving and dabbling duck distributions. Dot size illustrates proportional abundance from January to December. Large dots represent seasonal concentrations of birds associated with wintering and migrating behaviors. Similar-sized dots occurring over many months represent continuous bird abundance related to regional populations. Colors are indicators of habitat impacts related to changes to flooded agriculture and wetland (i.e., semi-permanent, seasonal, and temporary) abundance. Red indicates "significant impacts"—declines to a majority of wetland-agricultural habitats utilized by a species. Yellow indicates "moderate impacts"—declines to a minority of wetland-agricultural habitats used. Blue indicates stable conditions. *Includes common and Barrow's goldeneye. **Includes greater and lesser scaup.*

These shifting flooding regimes illustrate the need to identify and conserve the best remaining wetland habitat in order to provide the most birds with the most habitat for the longest period of time. For conservationists and land managers who are trying to predict the future, science like this can help make decisions that determine wetland resiliency in the face of increasingly challenging conditions.

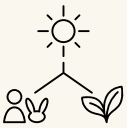
MANAGING FOR A DRIER FUTURE

This study highlights a trend that, if continued, could result in massive population losses for migratory waterbird species in the Pacific Flyway. Yet, it also indicates actions land managers and conservationists can take in order to prevent further system-crippling change. Four such actions are imperative for bolstering the resilience of landscapes in SONEC and the Central Valley:

MAKE HABITAT AND RESOURCES LIKE WATER AN IMPORTANT PART OF THE FLYWAY-LEVEL CONSERVATION DISCUSSION.

A long-standing focus on species-specific population levels that support hunting regulations has led to a disconnect between landscapes and how migratory birds use them at different stages of life. With its emphasis on how different waterbirds use flooded habitat at different times of the year, this study strongly indicates the importance of including habitat and water resources in conservation decision-making.

INVEST IN PROJECTS THAT MAINTAIN AND RESTORE AREAS THAT PROVIDE MULTIPLE BENEFITS TO MULTIPLE SPECIES.



The less water there is to go around, the more important it is to maximize wetland benefit for the highest number of species. This science pinpoints locations where conservation dollars can be strategically applied in order to maintain already resilient wetlands that provide ecosystem services that can support multiple types of birds, as well as fish, other wildlife, and human communities.

PROMOTE MANAGEMENT THAT PRIORITIZES HABITAT DIVERSITY ACROSS SPACE AND TIME.

This study highlights the advantage of keeping water on the landscape in the right places at the right times of the year in order to meet life history needs of multiple species of wetland-dependent birds. Traditional management practices prioritized keeping as much wetland wet for as long as possible—a strategy that, as water availability declines, will not only be costly and difficult to achieve but will create conflict among multiple competing uses for a scarce resource.

INCREASE COORDINATION AMONG AND DIRECT CONSERVATION RESOURCES TO PUBLIC WETLAND MANAGERS TO SUSTAIN THE COLLECTIVE HABITAT CONTRIBUTION OF PUBLIC WETLANDS.

As drought persists, public wetland areas are more frequently winding up dry and unable to support the wildlife resources that directly translate to conservation dollars from hunters, anglers, and other recreationists. Connecting state and federal refuge managers with each other and the support they need to continue providing important ecosystem services and habitat for multiple species of wildlife will help maximize conservation returns.

The less water there is to go around, the more important it is for decisions to be made to protect existing wetlands and maximize the ecosystem benefits they provide. In highly managed landscapes like the Central Valley, this research can help decision-makers know when and where to allocate resources to align for both human use and waterbird habitat needs. In areas like SONEC, where the majority of waterbird habitat comes in the form of seasonally flooded irrigated wet meadow habitat, it can identify the most important areas to keep wet at the right times of the year for declining waterbird species.

This science is most powerful when combined with local knowledge of water resources and policy. Science-to-implementation efforts that integrate high-level data on wetland resilience with local knowledge are key to producing resilient conservation outcomes. Presenting science in easy-to-use resources like the Intermountain West Joint Venture's Wetland Evaluation Tool is one way to enable practitioners to combine wetland data with on-the-ground knowledge.

However, the ultimate key to making this kind of strategic water use (and habitat conservation) happen is collaboration among water users in taking proactive measures to restore system resiliency. Coordinating across fencelines and involving multiple parties in decisions about water use will be important for this science to reach its full potential in maximizing benefits for birds, fish, wildlife, and people.

KEY TERMS

Physical Wetland Loss	wetland loss attributed to changing land use, e.g., development.
Functional Wetland Loss	wetland loss attributed to a reduction in water in a given area.
Hydroperiod	the number of days per year that an area of land is wet or the length of time that there is standing water at a location.
Semi-Permanent Wetland	area covered with water for at least eight months out of the year, e.g., lakes, ponds, small reservoirs.
Temporary Wetland	area that is only flooded as a result of natural runoff or irrigation for a period shorter than two months, e.g., wet meadows.
Seasonal Wetland	area that is only wet for two to eight months of the year.

SOURCE

Donnelly, J.P., Moore, J.N., Casazza, M.L., Coons, S.P. (2022) *Functional Wetland Loss Drives Emerging Risks to Waterbird Migration Networks.* Frontiers in Ecology and Evolution. https://www.frontiersin.org/articles/10.3389/fevo.2022.844278/full