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Inspiring Conservation Action Through Science

WHITE-FACED IBIS & WATER IN THE WEST:

INDICATING THE PATH TO RESILIENCY IN AN ARID REGION

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photo: Robert Ander

WETLANDS IN PERIL

Since time immemorial, water has drawn animals and people to the wetlands that are often the only green spots in the otherwise arid West. Public wildlife refuges like National Wildlife Refuges, State Wildlife Management Areas, and Waterfowl Production Areas scattered across the region are important stopover sites to migratory waterbirds. Humans have also gathered and settled around water and wetlands in this arid region for thousands of years, developing agricultural systems and communities around these fragile sources of life. Because of the water resources they provide, tracts of private land associated with agriculture are often just as important as public land refuges for migratory waterbirds.

Changing climate regimes and increasing human demands will heavily influence the allocation of water resources in the West. This inevitability highlights the need to identify and conserve a private and public wetland network that has immense value to wildlife. Researchers from the University of Montana and the Intermountain West Joint Venture used a recent study on white-faced ibis to help address this need. Their research, *Monitoring change across North America's white-faced ibis (Plegadis chihi) breeding colony network; a framework for priority wetland conservation* identified and evaluated the west-wide network of wetlands that supports wetland-dependent wildlife, particularly migratory waterbirds like white-faced ibis.

> **"White-faced ibis serve a key role in marking ecologically valuable wetland systems on both public and private land."**

IBIS AS A RED FLAG

White-faced ibis (Plegadis chihi), a wading bird reliant on wetlands throughout its annual cycle, serves a key role in marking ecologically valuable wetland systems on both public and private land. In the West, ibis breed and forage exclusively in wetlands. The birds rely on both deep water habitats and shallow temporary wetlands, including agricultural fields. This means they require high wetland diversity to support the energetic demands of raising offspring and daily migrations between nesting and foraging locations. Because their reliance on spatially broad and diverse wetlands aligns with the needs of other wetland-dependent wildlife, ibis are a useful umbrella species for wetland diversity and function. Identifying wetland systems important to ibis will dictate the wetlands of highest conservation priority at a spatial scale that is relevant to other migratory birds.

Researchers completed the first-ever long-term monitoring of ibis breeding habitat in the western U.S. and used satellite imagery to estimate monthly wetland flooding at these sites during the ibis breeding season. The study encompassed 153 breeding colony locations and periphery wetlands and measured wetland flooding from 1988-2020. Comparisons of wetland flooding (across land ownership, flooding duration, and land-use types), as well as irrigation extent and climate variables, occurred across two time periods: 1988-2003 and 2004-2020.

Evidence from this study supports previous studies suggesting ibis are what are referred to as a nomadic species—they move to breeding areas with the best habitat when previously used ones have unfavorable conditions like unsuitable water quality or depth. Wetland flooding across the West is variable from year to year, making for unpredictable habitat conditions that result in annual intermittency of breeding areas. Ibis' high mobility enables them to respond to the dynamic nature of wetlands and stressors like drought, moving among existing breeding colonies and establishing new ones. Furthermore, the wetland landscape acts as a regulatory feature for ibis populations, which means that ibis populations are intrinsically tied to hydrological patterns in the West. It also means that they depend heavily on coordinated management across the network of public and private wetlands that are critical to their survival.

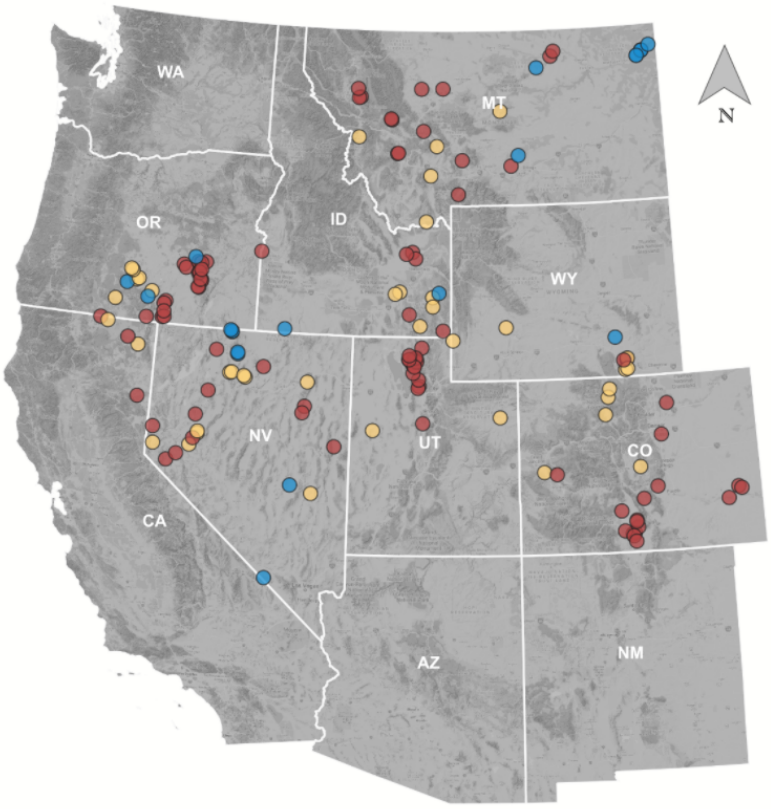


Figure: Wetland surface water trends within 18 km of ibis colony locations. Results measured as differences between T1 (1984-2003) and T2 (2004-2020). Red shows significant decline (p.value < 0.05), yellow shows decline (p.value > 0.05), and blue shows stable to increasing.

A DRYING NETWORK

Wetland complexes in the West form an important network that supports ibis populations. However, the study revealed trends of deterioration across this network through wetland drying: approximately 60 percent of all ibis breeding colony sites demonstrated increased wetland drying from 1988 to 2020.

Because wetlands are innately tied to climate and hydrologic change, researchers measured climate variables and irrigation extent across watersheds associated with ibis colonies and ranked their importance in predicting changes to wetland flooding. The factors driving wetland flooding varied by region and wetland type, but three variables were prevalent across the board: snowpack, temperature, and irrigation extent. Snowpack influences runoff volume and timing, groundwater recharge, and drought, all of which determine the timing and volume of wetland flooding. Temperature drives evaporative demand and can increase water needs for crops, in turn affecting the demand for crop irrigation. Finally, irrigation practices can make or break a system. Although irrigated agriculture as a whole is responsible for the vast majority of consumptive water use in the West and many types of irrigation practices may have detrimental effects on wetlands, practices like flood irrigation can provide surrogate wetland habitat values.

Ibis rely on flood irrigation on agricultural lands for much of their foraging opportunities. Researchers found that 88 percent of white-faced ibis colony network locations were associated with flood-irrigated agriculture. Flood irrigation practices have a secondary benefit of creating and sustaining wetlands through groundwater recharge. In addition to investigating overall wetland flooding trends, the researchers also measured changes in flood-irrigated agriculture adjacent to ibis colonies. They found widespread declines in flood irrigation, which limits the availability of foraging resources and reduces the wetland diversity available to ibis colonies. Land conversion and development, which reduce irrigation opportunities, are typically the culprits of these declines. Additionally, water conservation efforts in drought-impacted communities place social, economic,

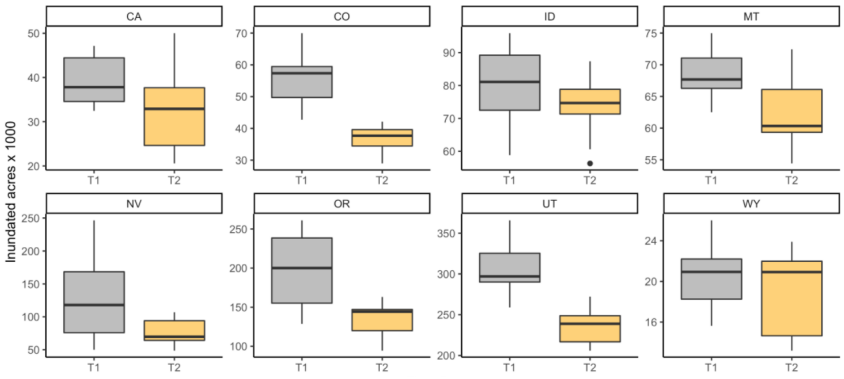
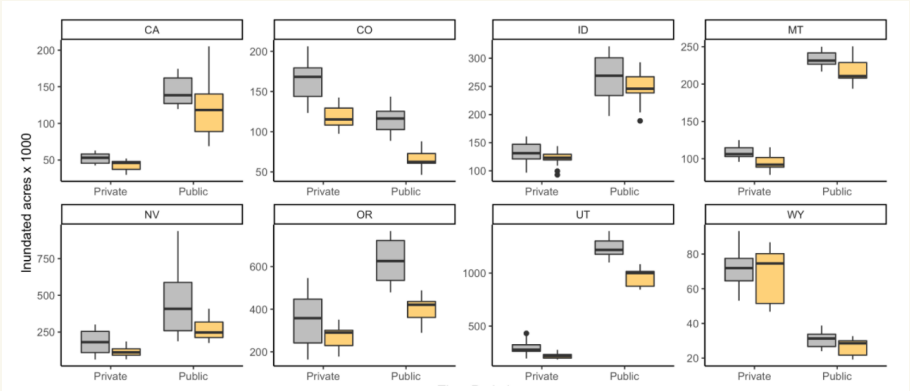


Figure (left): Boxplots of total surface water area for each region between monitoring periods (Time 1, in grey: 1988-2003; Time 2, in yellow: 2004-2020). Boxes indicate 25th, 50th (heavy horizontal line), and 75th percentiles; whiskers indicate 5th and 95th percentiles; points signify outliers.

Figure (right): Boxplots of private and public surface water area for each region between monitoring periods (Time 1, in grey: 1988-2003; Time 2, in yellow: 2004-202). Boxes indicate 25th, 50th (heavy horizontal line), and 75th percentiles; whiskers indicate 5th and 95th percentiles; points signify outliers.



and political pressure on irrigators to reduce water consumption or implement more efficient* water-use infrastructure, which can have unintended consequences for nearby wetlands.

Underlying mechanisms influencing wetland drying are complex and hinge on local hydrology, surrounding land practices, water policies, human water demands, and climate. Inequity among wetland declines from watershed to watershed indicates some regions and resources are more sensitive to climate change and anthropogenic factors that cause drying. Additionally, drying reduces wetland redundancy that buffers against local changes in habitat availability, thus restricting migration connectivity and degrading stopover locations.

Wetlands on public wildlife refuges form the backbone of the west-wide wetland network that migratory birds rely upon. For ibis, 57 federal and state-managed wildlife refuges act as central points that allow birds to access surrounding wetlands and agricultural habitats important for foraging. Limited protections for the water resources that supply wildlife refuges make these locations sensitive to neighboring water uses. As a result, geographically distant yet hydrologically connected activities

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*It is important to point out the "paradox of efficiency" and that rarely is water "saved" due to changing irrigation practices, rather it is used elsewhere, moves through the system faster, and can at times result in increased water use. *R.Q. Grafton et al. (2018).* The paradox of irrigation efficiency. *Science.* https://science.sciencemag.org/content/361/6404/748


photo:Cary Aloia

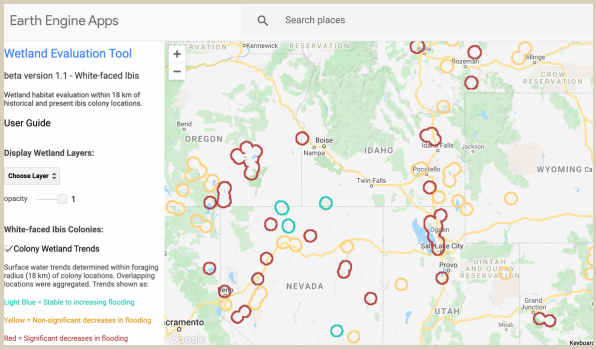
can have considerable impacts on wetland habitat within wildlife refuges. Continued degradation of wetlands on public lands could fracture the network's ability to sustain viable populations of ibis and other migratory waterbirds—and the fish, wildlife, and human communities that depend on these fragile systems.

A PATH TO WETLAND RESILIENCY

Ibis inhabit wetlands that have high value to numerous wildlife species and other migratory waterbirds. Periodic drought is inherent to wetland hydrology; however, climate models predict more frequent and severe drought and deluge conditions in the future. Uninterrupted trends in drying will negatively impact the wetland network that is critical to ibis and other migratory waterbirds.

Conservation investments in climate-resilient wetland complexes, as well as water policies that address wildlife needs and encourage the agricultural practices that meet those needs, can offset wetland loss. Placing an increased value on flood irrigation and its associated benefits to wildlife preserves the biodiversity and foraging resources vital to a functioning wetland complex. Using economic incentives and conservation easements to sustain agricultural practices that provide wetland benefits is an important step in doing so. These actions can be complimented on public lands by using science to inform water management in the face of declining water supply.

Perhaps the most important action is supporting partnerships between private landowners and public land managers. To facilitate ibis breeding network protections and to bridge the gap commonly found between research accomplishments and management implementation, researchers developed an interactive web application. Additional coordination at regional or national scales will be essential to sustaining the landscape scale of the wetland network and facilitating connectivity between regions and watersheds. Implementing an ensemble of strategies that optimize wetland conservation is imperative for long-term preservation of breeding networks that ibis and other migratory waterbirds—as well as all humans and wildlife in this region—rely upon.



A Google Earth Engine application allows users to view and download data showing white-faced ibis use of stopover habitat with wetland and surface water trends over a 35+ year period.

Access the app here.

ACCESS & APPLY THE DATA

SOURCE

Coons, Shea, J. Patrick Donnelly, and Victoria J. Dreitz (2021). Monitoring change across North America's white-faced ibis (Plegadis chihi) breeding colony network; a framework for priority wetland conservation. *Technical Report.* https://iwjv.org/wp-content/uploads/2022/01/ibisTech.pdf