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THE CALL OF THE CRANES

What Sandhill Crane Migration Can Tell Us About Water Availability in the West

The ancient call of the sandhill crane is a seasonal harbinger for many who live in the Intermountain West. As the sound drifts out of an irrigated pasture, hay meadow, or wetland, it signals that a flock of this ancient species of birds is resting nearby. Although sandhill cranes migrate hundreds or thousands of miles each year, they can't make these journeys without places to rest and refuel scattered along the way. The ability of cranes to move between their breeding and wintering ranges hinges upon a fragile network of wetlands and irrigated agricultural lands. This web of stopover sites is made up of habitat perfectly situated to provide sandhill cranes and other wetland-dependent migratory waterbirds, such as waterfowl and shorebirds, with enough food to make it to the next stop on their migratory route.

The Intermountain West Joint Venture (IWJV) and partners recently completed cutting-edge research that connects the dots between these stopover sites to put an entire migratory network in context. Scientists used GPS transmitters to track three different populations of western greater sandhill cranes throughout their migratory flights. As a result, they were able to evaluate precisely how the birds move between stopover sites in the Intermountain West each fall and spring—and what the cranes look for when selecting a place to rest. The related paper, "Migration efficiency sustains connectivity across agroecological networks supporting sandhill crane migration," shows that some landscapes are more important to sustaining the migration of sandhill cranes than others. More importantly, this science shows that the habitat in many of these places is supported by agricultural practices like flood irrigation and small grain cultivation. It also shows the long-standing balance of agricultural water use and wetland sustainability is at risk due to increasing aridity and intensifying drought caused by climate change.

A NETWORK OF STOPOVER SITES

Wetland stopover sites, said the study's lead author and IWJV spatial ecologist Patrick Donnelly, are like rest stops for the cranes. Migrating birds must balance food availability and the energetic demands of migration to make efficient transitions between their wintering and breeding grounds. In a semi-arid region like the Intermountain West, these transitions are carefully calculated hops between places with available wetland habitat. Networks were monitored with remote sensing to identify long-term (1988-2019) trends in wetland and agricultural resources supporting migration. They were evaluated using network theory and centrality metrics as a measure of stopover site importance to migratory connectivity. Sandhill crane space-use was analyzed in stopover locations to identify important ownership and landscape factors structuring bird distributions. Of the stopover sites identified by the study, some were more important to cranes and other migratory waterbirds due to their optimal locations along the flyway and the reliability of flooded wetlands at those sites.

"We've learned that sandhill cranes prioritize migratory efficiency above all else when moving between their breeding and wintering grounds," Donnelly said. "That means that some stopover sites are more important than others because they minimize the distance and energetic cost of migration. With the trajectory we're on in the West, with increased drying and water scarcity, those places are important to highlight."

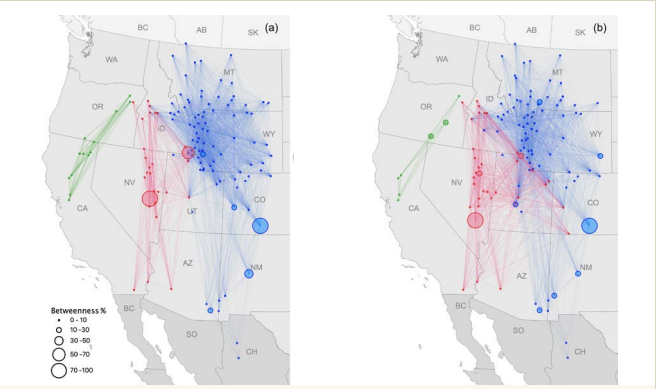
For these reasons, Donnelly points to three areas critical for successful crane migration: Colorado's San Luis Valley, and Nevada's Pharanagut and White River Valleys. In both fall and spring migrations, nearly all of the Rocky Mountain population uses wetlands in the San Luis Valley. In the spring, the White River Valley is an incredibly important stopover site, while the Pharanagut Valley plays a critical role in supporting fall migration.

But these areas are just the tip of the iceberg. The study identified 71 unique stopover sites that are important migration for the Central Valley (CV), Lower Colorado River Valley (LCRV), and Rocky Mountain (RM) populations of sandhill cranes. In addition to the San Luis, Pharanagut and White River Valleys, 16 other stopover sites were also highlighted as conservation priorities important to maintaining fall and spring migration of sandhill cranes (see page 4). In these places, Donnelly said, sandhill cranes don't have many alternatives along their migratory routes. Without the good habitat in these landscapes, they wouldn't be able to make the trip.

PINPOINTING LOCATIONS USING GPS

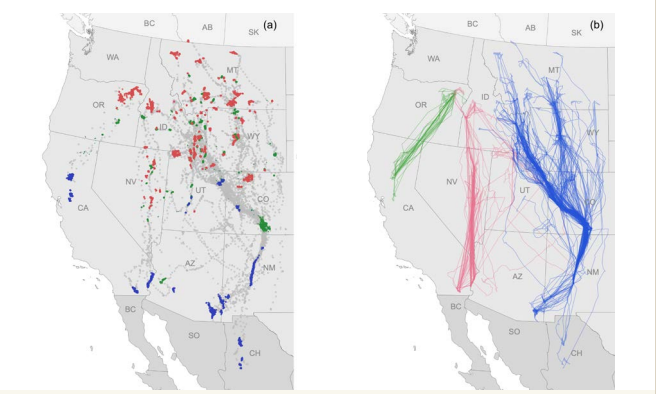
One of the biggest obstacles in keeping these migratory networks connected and intact is the ability of scientists to follow bird movements throughout seasonal migration periods. This study is part of an increasing effort to use GPS satellite tracking to monitor the movements of birds throughout their migratory cycles. Tracking birds throughout the duration of their migration using GPS transmitters is a much more effective means of identifying critical habitat for the birds, as it helps researchers identify where the birds go and how long they stay in each place.

Figure 1



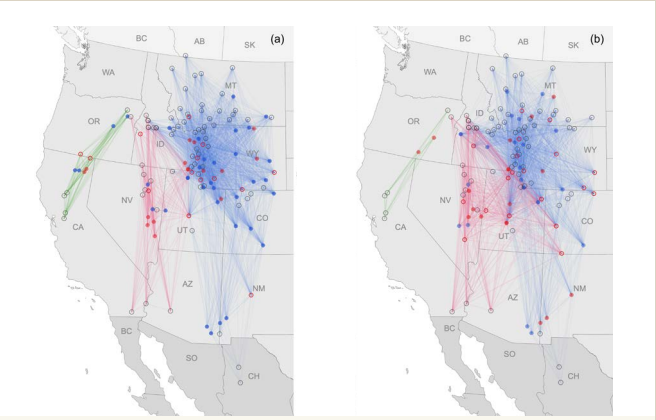
Sandhill crane spring (a) and fall (b) migration networks for Central Valley (green), Lower Colorado River Valley (red), and Rocky Mountain (blue) population segments. Node size scaled by relative network centrality metric of 'betweenness' as measure of stopover site importance to maintaining sandhill crane flyway connectivity.

Figure 2



Sandhill crane GPS locations (a) classified by annual cycle as summering (red), migration (gray), stopover (green), and wintering (blue). Associated satellite tracks (b) for Central Valley (green), Lower Colorado River Valley (red), and Rocky Mountain (blue) population segments. Data acquired from 108 individual birds from fall 2014 to spring 2020. Movements encompass 187 and 150 complete spring and fall migration cycles. Some summer and winter locations also functioned as stopover locations.

Figure 3



Wetland change in sandhill crane migration stopover networks for Central Valley (green), Lower Colorado River Valley (red), and Rocky Mountain (blue) population segments. Changes to 'seasonal' wetlands are shown in spring migration networks (a) due to patterns of high bird use observed in this wetland class. Net change for all wetland classes (temporary, seasonal, and semi-permanent) are shown in fall migration networks (b) to depict impacts of mixed wetland use exhibited by birds. Red circles indicate wetland decline, and solid red circles identify decline as significant. Blue circles indicate stable to increasing wetland availability. Gray circles identify non-stopover (i.e. wintering or breeding) locations.

WHY WATER MATTERS TO CRANES

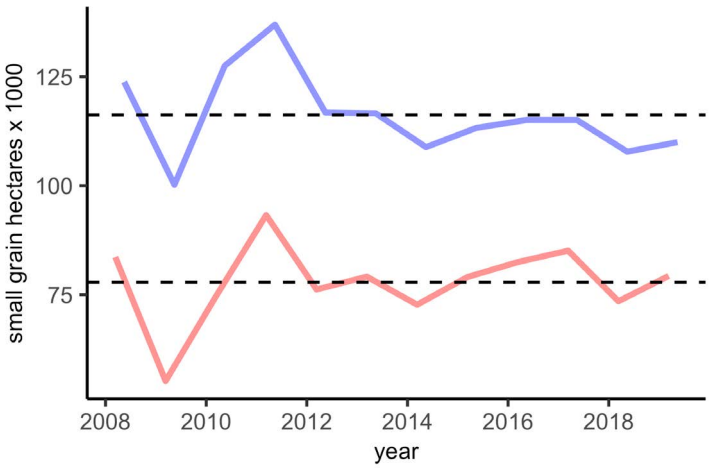
Water is the common thread among all of these sites. Each site pinpointed by the study is characterized by the presence of water at a time that coincides with the arrival of the cranes. And as the impacts of climate change are felt across the region, it's the declining availability of water that puts many of these stopover sites in jeopardy.

By examining surface water trends, the study showed that many places—especially stopover sites in the Great Basin and the Middle Rio Grande Valley—are seeing higher rates of wetland loss due to increasing aridity. In the spring, the availability of seasonal wetlands declined by 40 percent in stopover sites used by the RM population (50 and 69 percent of wetlands used by the CV and LCRV populations declined, respectively). In the fall, that number is higher: net loss of wetland habitats used by the RM population occurred in 59 percent of stopover sites, while 72 percent of stopover sites used by the LCRV population experienced surface water declines. One hundred percent of wetlands used by the CV population during fall migration experienced wetland drying. The changes do not represent outright wetland loss due to wetland drainage or filling, but rather a general trend of the site being flooded less frequently within years or among years over the last three decades.

Public wetland complexes like national wildlife refuges and state wildlife areas play an important role in supporting sandhill crane migration throughout the Intermountain West. However, the research found that roughly 90 percent of wetland sites used by sandhill cranes occur on private lands. Historically, the Intermountain West was interspersed with a network of seasonally flooded and permanent wetlands that extended outward from the region's riparian corridors. These oases of rich biodiversity, water, and food resources drew people, wildlife, and migratory birds for millennia. Today, flood irrigators manage these wet meadows in a way that mimics the hydrology of snowpack-driven seasonally flooded wetlands. These flood-irrigated wetland habitats now sustained by agricultural irrigation play a key role in maintaining the sandhill crane migration network.

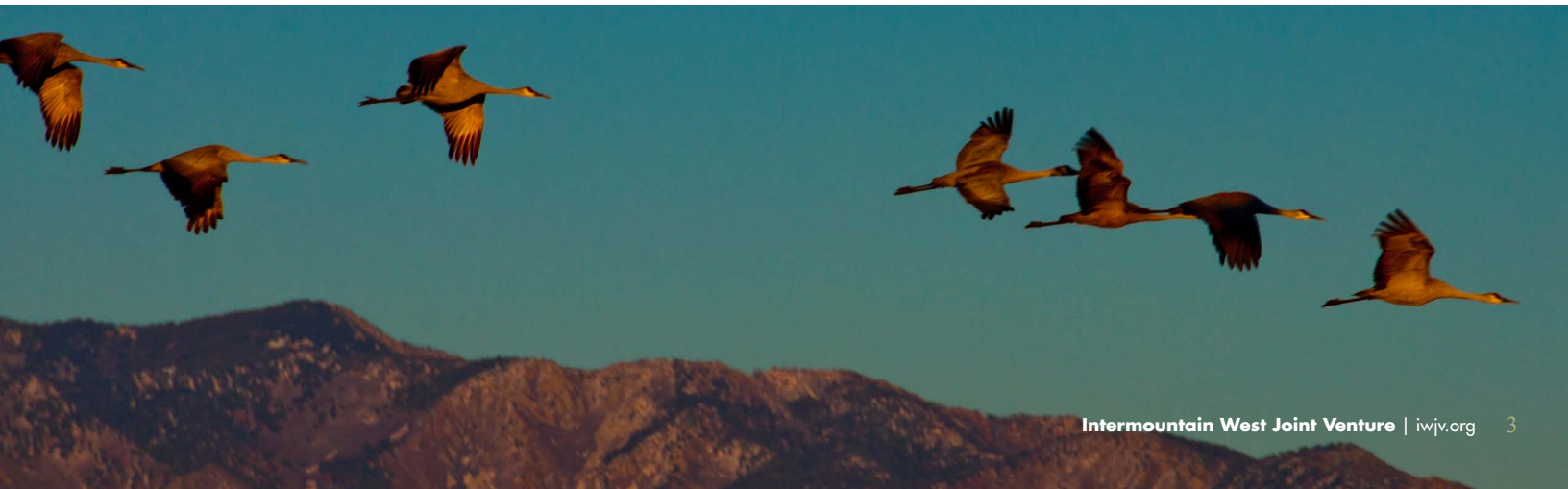
What is more, the crops grown on and near these "working wetlands"—typically with irrigation water—provide important food resources in the form of waste grain left behind in harvested barley and wheat fields. The study looked at the distribution and abundance of these small grain crops in relation to crane stopover sites, honing in on the practice of tilling these crops post-harvest in the fall. Ultimately, researchers found the presence of these crops was the most important landscape predictor of crane distribution within the stopover network. In the spring, these crops occurred in 89% (CV), 69% (LRCV), and 84% (RM) of migration stopover sites. In the fall, distribution was even more telltale, occurring in 100% (CV), 71% (LRCV), and 95% (RM) of stopover sites.

Figure 4



The area of small grain cultivated (blue line) across sandhill crane stopover sites from 2008-19 (blue line) and untilled post-harvest small grain remaining during spring migration (red line).

The presence of these small grain crops is generally stable throughout the migratory network over the last three decades, Where fall tilling occurred, it reduced the crane's access to the waste grain when they revisited these sites on their spring migrations, but the impacts of fall tillage were localized and do not currently threaten sandhill crane migration connectivity. Overall, waste grain availability is not, at this time, a major concern relative to sandhill crane habitat. Rather, it is wetland drying that most threatens the stability and resiliency of sandhill crane migratory networks. Growing urban water demands and climate change pose a considerable challenge to the sustainability of agricultural communities and practices that support migratory networks needed by sandhill cranes and other migratory waterbirds in western North America.



DELIVERING THE DATA RIGHT TO THE FIELD

Although it has been speculated that birds have used these sites long before agricultural development, agricultural development changed the natural pattern of water movement across the landscape. This research shows the tightly interwoven nature of agricultural landscapes and crane habitat in today's world, especially in the face of climate change. This data supports new conservation strategies that sustain key irrigation practices important to local producers and wetland habitats—and also provides vital science that links the importance of agriculturally sustained wetland areas to an iconic migratory bird species. Results like these are transformational in shaping the perception of irrigated agriculture and the role the mosaic of public-private wetland availability plays in conservation.

The research also supports the trend toward greater cross-boundary collaboration between public and private land managers. People who value the land, from farmers and ranchers to planners and funders, need to collaboratively invest in efforts that support this whole-landscape view of a sustainable habitat for people, birds, and landscape function.

The IWJV is releasing a new suite of tools to accompany the research and help practitioners do just that. An app breaks down the results of the study, enabling users to see both fall and spring migration data, as well as crane movement and land use patterns revealed by the study. Additionally, IWJV scientists will help explain how to use the app and the data. Tools tracking local-scale habitat use in important stopover locations are also in the works, including one specific to the San Luis Valley. Tools covering other high-priority landscapes will be rolled out in the future.

By making the data easy to understand, access, and put into action, the science conveys a powerful message: working lands are vital in sustaining the fragile network of stopover sites for migratory birds. Because the wetland sites used by cranes are important sources of water in an otherwise-arid landscape, they also support a variety of other wildlife and fish populations—not to mention human communities, making this science translatable and scalable.

"By identifying and protecting these sites, we're translating sandhill crane conservation values to a suite of other wetland-dependant species," Donnelly said.

This is the first of a two-part research series focusing on sustaining sandhill crane migration habitat. The second phase examining breeding habitat resilience will follow.

> "By identifying and protecting these sites, we're translating sandhill crane conservation values to a suite of other wetland-dependant species"

SANDHILL CRANE STOPOVER SITES IN THE WEST

This study also identified the following sites as important for sandhill cranes on their fall and spring migrations:

SPRING

Cokeville, WY (Rocky Mountain Population)
Delta, CO (Rocky Mountain Population)
Malad Valley, ID (Lower Colorado River Valley Population)
Middle Rio Grande Valley, NM (Rocky Mountain Population)
Wilcox Playa, AZ (Rocky Mountain Population)

FALL

Cache Valley, UT (Lower Colorado River Valley Population)
Cliff, NM (Rocky Mountain Population)
Harney Basin, OR (Central Valley Population)
Middle Rio Grande Valley, NM (Rocky Mountain Population)
Paradise Valley, MT (Rocky Mountain Population)
Ruby Valley, NV (Lower Colorado River Valley Population)
Richfield, UT (Rocky Mountain Population)
Three Forks, MT (Rocky Mountain Population)
Warner Valley, OR (Central Valley Population)
Wheatland WY (Rocky Mountain Population)
Wilcox Playa, AZ (Rocky Mountain Population)

All photos: Paul Tashjian

SOURCE

Donnelly, J.P., King, S.L., Knetter, J., Gammonley, J.H., Dreitz, V.J., Grisham, B.A., Nowak, M.C., Collins, D.P. (2021) Migration efficiency sustains connectivity across agroecological networks supporting sandhill crane migration. Ecosphere. https://esajournals.onlinelibrary.wiley.com/doi/10.1002/ecs2.3543