BEST MANAGEMENT PRACTICES FOR WHOOPING CRANES (GRUS AMERICANA): A GUIDE FOR LAND MANAGERS IN THE EASTERN FLYWAY

[1]Lauren Benedict (Outreach Biologist Assistant), Stephanie M. Schmidt (Lead Outreach Biologist – sschmidt@savingcranes.org), and Hillary Thompson (Whooping Crane Project Manager)

INTRODUCTION

The Whooping Crane is a five-foot-tall white bird with a black mustache and legs, a red patch on their forehead, and black wingtips visible in flight. Young Whooping Cranes are a cinnamon brown color throughout their body. After hatching, they may stand only a few inches tall but will reach their full adult size within 3 months. As they grow, their brown baby feathers will gradually be replaced with adult white feathers, and they will have their full adult coloration by the time they are one year old.

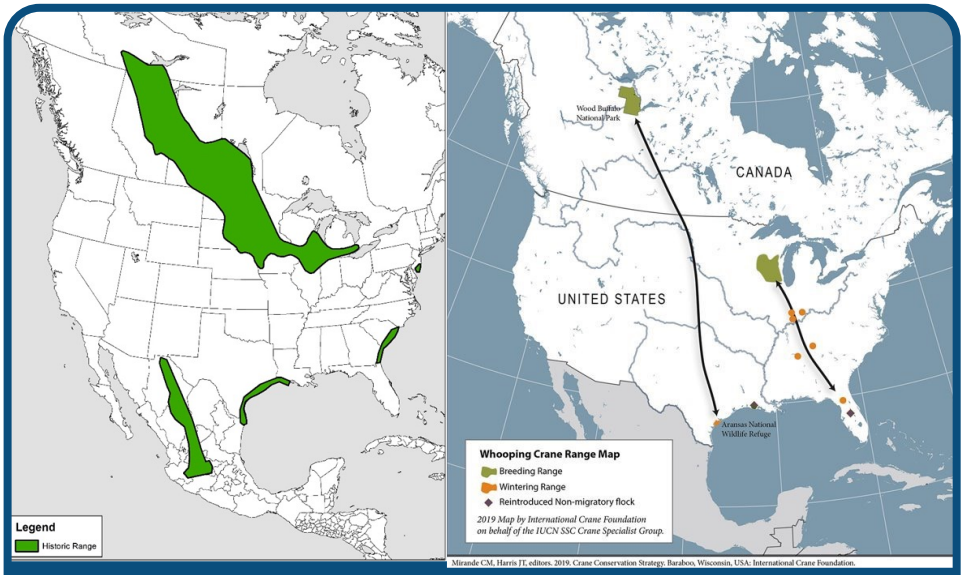
Whooping Cranes are a federally endangered species and presently occupy three distinct populations. Historically, Whooping Cranes have occupied wetlands throughout the northern United States, into Canada, and down into Louisiana, Texas, and parts of Mexico. Due to threats such as wetland loss and overhunting, Whooping Cranes were reduced to a single flyway and faced near extinction. However, thanks to intensive conservation efforts, Whooping Cranes have been reintroduced across their range and their numbers are growing. Updated population estimates can be found here: savingcranes.org/learn/species-field-guide/whooping-crane/.

The largest population of Whooping Cranes, and the only remnant, is the Aransas Wood Buffalo Population. Whooping Cranes in this population breed in Wood Buffalo National Park in Canada and winter in and around Aransas National Wildlife Refuge in coastal Texas. This population is self-sustaining and growing without supplementation from captive-reared cranes. In addition to the Aransas-Wood Buffalo Population, two reintroduced populations aid in the recovery of Whooping Cranes as of 2024. One of these is the Louisiana Nonmigratory Population. This population was extirpated in the 1950's, and reintroduction efforts did not begin until 2011 at White Lake Wetlands Conservation Area in southwest Louisiana. The Whooping Cranes in Louisiana are year-round residents and often use coastal marsh habitats, crayfish farms, and rice farms. The other population is the Eastern Migratory Population. Reintroduced in potential breeding habitat in Wisconsin in 2001, Whooping Crane juveniles were taught to migrate to Florida for the winter. However, around 2007, Whooping Cranes in this population began shortening their migration, and, as of 2024, the majority of Whooping Cranes will winter in Indiana or Alabama. A few individuals will also make migratory stops or winter in Illinois, Kentucky, Georgia, Tennessee, and Florida. To follow along with Whooping Cranes in the Eastern Migratory Population throughout the year and during migration, please check out our interactive Whooper Map: https://whoopermap.savingcranes.org/.

An adult Whooping Crane (left), juvenile Whooping Crane (center), and a chick (right)

Photo credits: Pat Husband, Bob Stoil, Tom Lynn.

As an endangered species, Whooping Cranes are protected under the Migratory Bird Treaty Act and the Endangered Species Act. These protections have worked in tandem with conservation and reintroduction efforts to support a significant recovery of Whooping Cranes over the past 80 years. However, there are still several threats that continue to challenge the long-term survival of this endangered species. One major threat is the loss or deterioration of critical wetland habitat that Whooping Cranes use for foraging, nesting, and roosting. Wetland habitat loss and reduced quality due to woody encroachment also heighten the risk of predation for Whooping Cranes as they are forced to seek alternative habitats. Areas with dense or woody vegetation provide potential predators with plenty of places to hide and ambush Whooping Cranes. Additionally, it is difficult for Whooping Cranes to flush from an area with canopy cover. Over half of all known deaths in the Eastern Migratory Population are due to predation, and known predators include bobcats, coyotes, and raptors. Collisions with powerlines, fences, and vehicles are another major threat and the second leading cause of death for Whooping Cranes. This threat is heightened by new energy development within the eastern flyway which can lead to an increased risk of collisions due to more powerline construction and habitat loss as agricultural lands are being converted to solar and wind energy farms. Additional human-caused threats to Whooping Cranes include poaching and disturbance. Whooping Cranes are highly sensitive to disturbance from human activity and tend to avoid human structures and residential areas. You can help protect Whooping Cranes from stress due to human disturbance by giving wild Whooping Cranes a buffer of at least 1,000 feet and refraining from making loud noises.



Maps of the historic range(left) and current range (right) of Whooping Cranes

Whooping Crane recovery is also impacted by their life history as they are a long-lived and slow-to-reproduce species. This means that population growth for this species occurs very gradually and protecting every individual is critical to their continued growth. Many of the threats Whooping Cranes face are related to poor habitat quality that is caused, or heightened, by human activities on both public and private land. As a result, we rely on property owners and land managers like yourselves throughout the eastern flyway to provide Whooping Cranes with safe, high-quality habitat for breeding, roosting, and foraging.

The goal of this document is to provide land management guidance based on Whooping Crane habitat preferences for landowners who are dedicated to conserving their local Whooping Cranes. In addition to playing a role in conserving an endangered species, there are several benefits to sharing your land with Whooping Cranes. Like all native species, Whooping Cranes are an essential part of a healthy food chain and help maintain ecological balance. Whooping Cranes are also an umbrella species and occupy approximately 2 square miles, so by conserving and managing wetland habitat for Whooping Cranes, many other native species benefit resulting in improved local biodiversity and healthier ecosystems. Moreover, there are benefits to managing healthy wetlands as wetlands are able to hold large amounts of water which can help prevent flooding and aid in recharging aquifers while also improving water quality.

WHOOPING CRANE BIOLOGY

The remainder of this document, including management suggestions, will focus on Whooping Cranes in the Eastern Migratory Population. While life history and conservation concerns are relatively the same for all Whooping Cranes across the existing populations, there are important differences in habitat usage and behaviors unique to the Eastern Migratory Population.

BREEDING/ CHICK-REARING (MARCH-SEPTEMBER)

Whooping Cranes live about 25-30 years in the wild and start mating when they are about 4-5 years old, typically with the same mate for life. When on their breeding territory in Wisconsin, Whooping Cranes nest in shallow wetlands with predominantly short herbaceous vegetation and minimal woody vegetation. Wetlands are an essential habitat for Whooping Cranes as the presence of water also provides access to food and deters terrestrial mammalian predators, such as coyotes and raccoons. In wetlands, Whooping Cranes will construct large, mound-shaped nests from grasses, rushes, bulrushes, and sedges pulled from 15 feet around the nest, creating a ring of water directly adjacent to the nest. Once the nest is constructed, Whooping Cranes will typically lay one or two eggs, and they will continue to maintain and add vegetation to the nest while incubating their eggs for ~30 days.

A pair of Whooping Cranes will typically only raise one chick to adulthood, and the second egg in the clutch serves as insurance by increasing the likelihood that the parents will be able to successfully hatch and raise at least one chick each year. However, many Whooping Crane nests will run the risk of failing before hatching due to nest abandonment following black fly harassment, flooding, and predation of eggs. If the water level rises too high, the nest can flood and fail. Alternatively, if the water level falls too low, the eggs or young chicks are more vulnerable to predation. Crane chicks do not continue to use the nest long after hatching, but due to their small size and inability to fly until they are approximately 80 days old, the family will continue to use the wetland habitat near the nest for daytime foraging and nighttime roosting.

As a result, home ranges (2 square miles) and nesting territories (1 square mile) are primarily composed of emergent herbaceous wetlands. Whooping Cranes generally prefer shallow wetlands, usually less than 1.5 ft deep, with minimal woody vegetation, however deeper water in surrounding areas may be beneficial in providing additional protection from predators. Adult Whooping Cranes tend to use the same nesting territory each year and, after reaching breeding age, their young will typically establish a nesting territory close to their parents. Within the Eastern Migratory Population, chicks usually return to a space within 18 miles of where they hatched. In addition to wetlands, Whooping Cranes will use upland habitats with short vegetation like grasslands, pastures, soybean fields, and grain fields for daytime foraging. These off-territory elements tend to be close to their nesting or roosting location, but it is also common for Whooping Cranes to disperse further to a foraging site. Nonbreeding Whooping Cranes, including juveniles or single adults, tend to spend more time in upland habitats during the day than in wetland habitats, while breeding adults spend most of their day in their wetland territory. One major exception to home range size and habitat usage occurs when adult Whooping Cranes molt their flight feathers rendering them flightless for about 44 days. This occurs every two to three years, usually during June and July, often when they are raising a young flightless colt. Their home range size is drastically reduced to about 115 acres during this time and these individuals will almost exclusively use wetlands as this is where they are safest from predators.

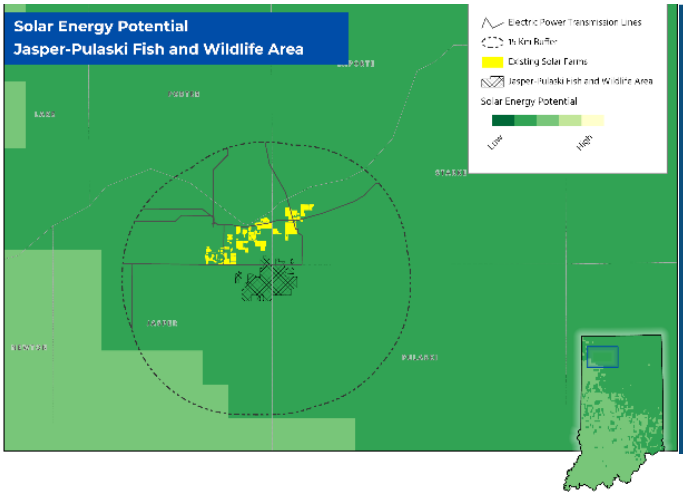
During the nesting season and across the year, Whooping Cranes will avoid areas with tall, dense, or woody vegetation, including forested areas, tall corn fields, and dense cattail stands because these habitats provide predators with plenty of places to hide, making it more challenging for Whooping Cranes to spot predators. Thus, Whooping Cranes tend to prefer flat, open landscapes where they can scan for potential predators. Whooping Cranes also tend to avoid highly developed or residential areas. In addition to being sensitive to human disturbance, developed areas pose increased risks of powerline and vehicle collisions.

Key breeding locations for this flyway are found in central Wisconsin and include areas in and around Necedah National Wildlife Refuge, Horicon National Wildlife Refuge, White River Marsh State Wildlife Area, and Grand River Marsh State Wildlife Area. Whooping Cranes can also be found nesting outside of these areas, and as the population grows, we expect to see this occur more frequently. Young, nonbreeding Whooping Cranes tend to be more mobile as they are not defending a breeding territory, and while they mostly summer in the same core areas in central Wisconsin, these younger cranes occasionally venture to nearby states such as Minnesota, Michigan, Iowa, Illinois, and even North and South Dakota.

MIGRATION

In the eastern flyway, migration can last anywhere from a day to over a week depending on factors such as the distance between wintering and summering locations and weather. The exact timing of migration can vary slightly each year as cranes rely on a variety of cues when deciding to begin migrating including weather and day length. Yearly variations in temperature and precipitation can also impact food and roost availability which in turn impacts the timing of migration. In general, fall migration occurs in October and November, and spring migration during March. Most Whooping Cranes in the eastern flyway will migrate to a specific location for the winter but some are known to move again after spending part of the winter in one location, likely due to weather and resource availability.

Adult Whooping Cranes will migrate with their mate if they have one, and family unit if they raised a chick that year. Whooping Cranes can also migrate alone or in a small flock of juveniles or single adults. Throughout this period, it is also common for Whooping Cranes to be found within large flocks of Sandhill Cranes. Moreover, cranes only migrate during the day, and they will seek out wetlands to roost in at night. While migrating, and throughout the winter, cranes will spend most of their daytime foraging hours in agricultural fields where they can be spotted in these mixed flocks with Sandhill Cranes. Even though they might only be at these stopover sites for a few days, ensuring that Whooping Cranes have high-quality stopover habitat is still important as the quality of these habitats can impact winter survival and body condition when entering the breeding season, which in turn can impact reproductive success. See the wintering section below for a more complete description of agricultural and wetland habitat usage.



Map of solar energy infrastructure around Jasper-Pulaski FWA (2024) and solar energy potential. The 15km buffer denotes how far a crane may travel in a day from roost to forage.

WINTERING (OCTOBER – FEBRUARY)

Throughout the winter, Whooping Cranes in the eastern flyway may return to the same wintering territory every year, though they typically will not defend this space. Similar to migration, they can be observed with their mate, family unit, in a small flock with Whooping Cranes and Sandhill Cranes, or alone.

The majority of Whooping Cranes in the eastern flyway will migrate to Indiana or Alabama for the winter, but there are a few Whooping Cranes that choose to winter in Illinois, Kentucky, Tennessee, Georgia, and occasionally Florida or other surrounding states. Major wintering locations include areas in and around Goose Pond Fish and Wildlife Area, Jasper-Pulaski Fish and Wildlife Area, and Cane Ridge Wildlife Management Area in Indiana as well as Wheeler National Wildlife Refuge in Alabama. The wetlands within these refuges are used by Whooping Cranes for roosting, loafing, and foraging. It is also common for Whooping Cranes to disperse up to 9 miles from their roosting site to forage in nearby agricultural fields and grasslands during the day, and these habitats should also be considered for habitat management for Whooping Cranes especially where increased development poses a risk. Development can introduce collision hazards and impact habitat and food availability. For example, powerlines can deter cranes by up to 1 mile and wind turbines by 3 miles. The effects of solar development within a 9-mile range of important roost sites, which is the distance Whooping Cranes will disperse in a day to forage, are presently unknown due to the rapid expansion of this energy sector, which is most pronounced around Jasper-Pulaski Fish and Wildlife Area.

Cranes arrive on their wintering grounds and how long they are there, is variable and dependent on weather and food availability. For example, during years with colder fall and winter temperatures, cranes typically arrive at their wintering grounds earlier than in years with warmer temperatures. In general, Whooping Cranes tend to arrive at their wintering grounds in November and depart in February or March. Most Whooping Cranes in the eastern flyway have a single wintering location but there are a few who spend the winter in multiple distinct areas. For example, some Whooping Cranes who typically winter on the northern portion of the wintering range may fly further south if temperatures become very cold, returning to their northern wintering location once the weather is more favorable. Winter home range size also varies depending on the region. Whooping Cranes wintering further south (Tennessee and Alabama) use approximately 1 square mile of space, while Whooping Cranes wintering further north (Kentucky, Indiana, and Illinois) use 2 square miles. This could potentially reflect reduced habitat quality and/or higher energy needs, which would result in larger foraging habitats for Whooping Cranes wintering further north.

During the winter months, Whooping Cranes are often found foraging in upland areas with bare ground, favoring agricultural fields, especially harvested corn or soybean fields, particularly those that have been seasonally flooded, more often than grasslands. Both agricultural fields and grasslands provide Whooping Cranes with a preferred upland foraging habitat that is large, open, and flat, but they prefer to forage in agricultural fields as they can find high-energy waste grains to feed on. Furthermore, these Whooping Cranes will also forage in areas with hydric soils that become inundated during the winter months. **Due to the increased use of agricultural fields during the winter, Whooping Cranes tend to increase the time they spend on private lands.**

Despite increased use of upland habitats during the daytime, Whooping Cranes are still reliant on wetlands for a safe place to roost at night or loaf during the day. They will continue to use wetlands as a foraging habitat too, and family units will tend to spend more time foraging in wetlands than Whooping Cranes who are not caring for a juvenile. They will continue to prefer shallow wetlands less than 1.5 feet deep that are not frozen over, have short vegetation that is less than 1 foot tall, and have limited woody vegetation. They tend to avoid areas with tall or dense vegetation as these areas can be challenging for Whooping Cranes to walk through and it may be more difficult for them to spot potential predators in dense vegetation. Wetlands can provide a large variety of potential food items including fish, mollusks, amphibians, crustaceans, and tubers as well as water for the cranes to drink. While roosting, Whooping Cranes will use wetlands that are at least 500 square yards and will avoid roosting close to the shoreline. Another important aspect of habitat selection is distance from roads. Whooping Cranes are sensitive to human disturbance and avoid areas with busy roads as this increases the risk of being struck by a vehicle. As a result, across the wintering range Whooping Cranes may avoid roads by up to 1.5 miles.

Ensuring that Whooping Cranes have access to quality upland and wetland habitats is important as this can impact winter survival, timing of spring migration, and fat reserves when entering the nesting season, further impacting a Whooping Crane's reproductive success and the continued growth of the Eastern Migratory Population.

BEST MANAGEMENT PRACTICES

The remainder of this document provides methods you can implement on your land to provide high-quality habitat for Whooping Cranes. Furthermore, if you observe Whooping Cranes on your property or in your area, please report your sighting here: www.bandedcranes.org/. Reporting your observations of Whooping Cranes provides invaluable data on the habitats and spaces Whooping Cranes depend on across their flyway.

Before implementing any of the suggested management strategies, there are a few general habitat management guidelines to be mindful of.

1. Determine what time of year Whooping Cranes may be in your area and how you can provide the habitat that best meets their seasonally dependent needs.

2. Consider the possible negative impacts management activities may have and time them to occur during the season with minimal disturbance impacts. For example, entering a wetland to remove invasive vegetation during the summer may impact nesting species. It can be difficult to predict how the landscape may respond to a specific treatment, so it is often beneficial to start by treating a small patch of land and observe how the habitat changes before fully enacting a large management plan.

3. Remember that both grasslands and emergent herbaceous wetlands are single stages in a series of habitat succession. Due to this, habitat

management actions must be cyclically performed to prevent the landscape from naturally succeeding to another stage and habitat type over time. Thus, repeated active management across an appropriate time scale is necessary to provide Whooping Cranes with long-term high-quality grasslands and wetlands.

TERRESTRIAL HABITAT

Grasslands are primarily used by wintering Whooping Cranes. Whooping Cranes prefer grassland habitats with short vegetation that is less than 1 foot tall and have limited woody vegetation. They will avoid areas with tall, dense, or woody vegetation because it can be difficult for Whooping Cranes to walk in these areas, and the ambush risk from potential predators is high. Removing dense vegetation, invasive plants, and woody vegetation are all key in providing suitable grassland habitat for Whooping Cranes. Some management strategies that could be used include controlled burns, tree clearing, targeted grazing, chemical and mechanical removal of invasive species, and periodic inter-seeding of native species. Furthermore, implementing multiple management strategies together or over consecutive years can often be more effective.

Controlled burns are useful for reducing woody encroachment, removing invasive species, and increasing grassland health by preventing excessive litter accumulation and promoting soil fertility. Controlled burns can be even more effective when combined with other management strategies. For example, inter-seeding native species after burns can help establish native plant communities. Native plant communities create healthy, stable ecosystems by promoting biodiversity and soil health, and provide or support habitat for many food items for Whooping Cranes including seeds, invertebrates, and small mammals.

Targeted grazing uses hoof stock to mimic how bison historically maintained grasslands. Cattle are the most commonly used hoof stock in current targeted grazing regimes, but horses, sheep, or goats could be used to provide similar benefits. Cattle can promote grassland health by shortening the height of the vegetation, thinning grasses to allow other types of plants to grow, and cycling nutrients in the form of their waste. Grazing also has the potential to remove invasive species. When using targeted grazing, light to moderate grazing intensity over several consecutive years is recommended. Overgrazing a system can harm grassland health by removing too much vegetation, and large amounts of fecal matter can negatively impact soil health. It can be helpful to have a flexible grazing system that allows you to easily move cattle in and out of specific areas. Additionally, it is important to note that targeted grazing is a generalized form of plant removal and is not intuitive for protecting specific or sensitive plants. Thus, it may not be the best management strategy for all grasslands.

Herbicides are effective for very specific and targeted invasive species removal, especially when other practices such as prescribed burning, targeted grazing, or mechanical removal are not sufficient to control invasive species. Furthermore, herbicides can be used in conjunction with controlled burning and targeted grazing to remove invasive species more efficiently and effectively. Herbicides tend to be most effective when used multiple years in a row as doing so can fully deplete the invasive seed bank in the soil. Before using herbicides, make sure to research potential herbicides and select the one that is most effective and safest for each specific situation. Your local extension office can provide assistance on herbicide selection. **Using herbicides for any use other than what is specified on the label is illegal and can harm both you and the environment.** If you are planning to use herbicides near water, make sure that the label specifies that it is approved for aquatic use. It is crucial to understand

that even though an herbicide is approved for use by the Environmental Protection Agency, there are still negative side effects that can be caused by misuse such as failing to limit exposure time to the herbicide or to wear the proper personal protective equipment. It is also important to carefully consider any potential indirect effects or impacts on non-target species that are near areas you plan on applying herbicides. There are both selective (e.g., control either forbs or graminoids specifically) and non-selective herbicides (i.e., impact all plants), which can be tailored to your specific target species. Therefore, if you decide to use herbicides, ensure that you carefully read the label and follow all instructions for proper use. See the **Additional Reading** section at the end of this document for more resources on proper herbicide selection and use.

Agricultural lands, especially corn or soybean fields, are used by Whooping Cranes year-round for foraging habitat except when the crops grow thick and tall which usually occurs towards the middle of summer. Whooping Cranes may also forage in crop fields that create grassland habitats such as alfalfa fields. Agricultural lands tend to have the greatest use as preferred foraging habitat during the migratory and wintering months of October-February when the standing vegetation has been harvested and waste grain remains. Additionally, Whooping Cranes are more likely to use agricultural fields within 9 miles of the wetlands they use for roosting or loafing. While foraging in agricultural fields, Whooping Cranes are mostly eating waste grains but may consume invertebrates and small mammals too. During the breeding season when cranes are in Wisconsin, they may also forage for germinating corn seeds. **Sandhill Cranes have the potential to cause a great deal of damage to corn fields as Wisconsin supports a large breeding population of this species; Whooping Cranes have not been reported as causing damage to agricultural fields in their range.** The most effective way to protect corn against depredation from cranes is to treat seeds with Avipel: a non-toxic taste repellent that can be applied to corn seeds prior to planting to prevent cranes from foraging on them. More information about Avipel is available here: savingcranes.org/sandhill-crane-crop-damage/.

There are three main things to keep in mind when providing agricultural foraging habitat for Whooping Cranes: food availability, water availability, and human disturbance. To provide the most food for migrating and wintering Whooping Cranes, consider planning harvest to occur immediately prior to when Whooping Cranes arrive in your area. In corn fields, this could mean chopping the corn stalks after harvest and leaving the crop residue on the soil surface as mulch instead of tilling your fields in the fall. Tilling buries waste grains while mulching results in the waste grain being more readily available for Whooping Cranes and provides habitat for invertebrates that Whooping Cranes will feed on as well. Mulching also benefits soil health by helping to retain soil moisture, reduce erosion, limit weeds, and reduce the need for tilling. Planting cover crops can improve soil health in similar ways by reducing erosion, fixing nitrogen in the soil, controlling weeds, and more. Cover crops can also increase the abundance and diversity of invertebrates, including earthworms, which Whooping Cranes may feed on. Additionally, consider limiting pesticide use on crops as prolonged consumption of pesticides can weaken Whooping Cranes which will increase the risk of mortality and make them more susceptible to disease, predation, and collisions.

Whooping Cranes will also use flooded agricultural fields. While they may largely use this space for roosting or foraging invertibrates, it is possible that prolonged flooding of a field may reduce the caloric value of waste grains, another valuable resource for cranes. Therefore, by timing harvest and flooding to occur right before Whooping Cranes arrive, you can provide them with the most high-quality food and habitat. To maximize foraging benefits for Whooping Cranes, it is recommended that the flooding and drawdown of a field occurs over a two-week time period. Furthermore, if you plan on flooding multiple units, consider staggering when each unit is flooded so that there is always one flooded unit for Whooping Cranes to use. If the water depth exceeds 1 foot, it is possible that Whooping Cranes might use the flooded field to roost in overnight. Whooping Cranes will also use flooded fields, ditches, and ponds or wetlands near agricultural fields as a water source for drinking. Providing Whooping Cranes with a water source will further encourage them to forage on your fields. If you have a pond or wetland on your property, you can consider leaving a riparian

pesticides from entering the body of water. A riparian buffer is a section of land, recommended to be at least 50 yards wide, between worked agricultural land and a body of water, that is not farmed and has vegetation growing on it. The vegetation helps absorb potential runoff from agricultural lands and thus prevents sediments and pollutants from entering waterways. When managing for Whooping Cranes, it is important that the vegetation that composes the riparian buffer is not woody vegetation (trees, shrubs, etc.) and the vegetation is short stature, as both tall vegetation and woody vegetation will discourage Whooping Cranes from using that wetland. The last thing to consider is human disturbance. Cranes are highly sensitive to human disturbance so regularly working in your agricultural fields while cranes are in the area can discourage them from foraging in your fields. If possible, try to complete large workdays before Whooping Cranes arrive in the fall and wait until they depart in the spring to begin prepping fields for planting.

AQUATIC HABITAT

Whooping Cranes rely on wetlands year-round for roosting, foraging, and loafing habitat, but they become especially reliant on wetlands during the breeding season as this is where they will nest and raise young. Whooping Cranes prefer wetlands with areas of shallow water less than 1.5 feet deep and with short herbaceous vegetation less than a foot tall. Some management actions to provide Whooping Cranes with their preferred habitat include thinning dense vegetation, removing woody vegetation, removing invasive plant species, and water level manipulation. Mechanical removal of plants, including discing and mowing, and controlled burning are potential treatments that may be effective. When creating your management plan, it is very important to consider the negative impacts that entering a wetland can have. For example, Whooping Cranes are highly sensitive to human disturbance, so it is recommended to perform management actions during the seasons that Whooping Cranes are not in your area.

Mechanical removal of plants involves actions such as cutting, clipping, sawing, and more. These techniques are best for removing woody vegetation and invasive plant species. A major benefit of mechanical removal is that you can be very selective about which plants to remove and how much is removed at a given time. When removing woody vegetation, you should consider how it may impact the herbaceous wetland vegetation below the canopy cover. To avoid harming the wetland ecosystem, it is recommended to only open canopy cover by 25-50% each year. Two more mechanical removal techniques are mowing and discing. Mowing reduces vegetation height and discing creates sandbars or bare ground that Whooping Cranes can use for foraging. Discing may be a less targeted strategy, but it is effective at quickly clearing an area that has a lot of invasive plant species. Following up by applying herbicides approved for use near water on disced sections over several years can help completely remove invasive plants by depleting the invasive species seed bank.

If you are able to manipulate the water levels on your property, doing so can be an extremely useful tool for providing Whooping Cranes with high-quality wetlands. When Whooping Cranes are in your area, try to keep water on the wetland throughout the breeding season and keep water levels around 1.5 feet as this is the preferred water depth for Whooping Cranes. Throughout the rest of the year, water level manipulation can be used to diversify and maintain the native plant community in and around the wetland. Seasonally high-water levels in the spring can knock back woody plants and thick grasses, reeds, and cattails which can help thin vegetation for Whooping Cranes to easily maneuver through. Raising water levels can increase insect and earthworm abundance and availability in the newly flooded areas. Alternatively, lower water levels in the summer and fall can expose moist soil, encourage new growth of native wetland grasses and plants, and increase availability of aquatic food items such as fish, crayfish, and other invertebrates that will serve as high-energy food resources for Whooping Cranes.

ADDITIONAL RESOURCES

WHOOPING CRANES

Whooper Map: https://whoopermap.savingcranes.org/

Annual reports for the Eastern Migratory Population of Whooping Cranes: https://savingcranes.org/whooping-crane-reintroduction-annual-reports/

Whooping Crane Life History: https://www.allaboutbirds.org/guide/Whooping_Crane/lifehistory

WETLAND MANAGEMENT

Wetland habitat information and management techniques: https://www.rwbjv.org/wetland-management/

Managing wetland vegetation: https://www.wcc.nrcs.usda.gov/ftpref/wntsc/strmRest/SEwetlands/ch5.pdf

https://dnr.wisconsin.gov/sites/default/files/topic/Wetlands/esScience/WRH5.pdf

HERBICIDE USE

National Pesticide Information Center: http://npic.orst.edu/pest/weeds.html

How to read an herbicide label: https://cropwatch.unl.edu/2018/what-should-you-look-herbicide-label

Using herbicides to control invasive species: https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5386111.pdf

AVIPEL

https://savingcranes.org/sandhill-crane-crop-damage/

COVER CROPS

Sustainable Agriculture Research and Education: https://www.sare.org/resources/cover-crops/

USDA: https://www.climatehubs.usda.gov/hubs/northeast/topic/cover-cropping-improve-climate-resilience

ADDITIONAL READING

Armbruster, M. J. (1990). Characterization of Habitat Used by Whooping Cranes During Migration. U.S. Fish & Wildlife Service., Biol. Rep. 90(4).

Baasch, D. M., Farrell, P. D., Pearse, A. T., Brandt, D. A., Caven, A. J., Harner, M. J., Wright, G. D., & Metzger, K. L. (2019). Diurnal Habitat Selection of Migrating Whooping Crane in the Great Plains. USGS Northern Prairie Wildlife Research Center. 407. http://digitalcommons.unl.edu/usgsnpwrc/407

Barzen, J. A., Lacy, A. E., Thompson, H. L., & Gossens, A. P. (2018). Habitat Use by the Reintroduced Eastern Migratory Population of Whooping Cranes. In Whooping Cranes: Biology and Conservation, Biodiversity of the World: Conservation from Genes to Landscapes (P. J. Nyphus, J. B. French Jr, S. J. Converse, J. E. Austin, and J. H. Delap, Editors). Elsevier, United Kingdom.

Cantrell, A. W. & Wong. Y. (2018). Habitat Selection and Con- and Heterospecific Associations of Wintering Whooping Cranes at Wheeler National Wildlife Refuge, Alabama. Wheeler National Wildlife Refuge. Proceedings of the North American Crane Workshop 14:35-45.

Caven, A. J., A. T. Pearse, D. A. Brandt, M. J. Harner, G. D. Wright, et al. (2022) . Whooping Crane Stay Length in Relation to Stopover Site Characteristics. Proceedings of the North American Crane Workshop 15: 6-33.

Ivey, G. L., Herziger, C. P., & Hardt, D. A. (2014). Conservation Priorities and Best Management Practices for Wintering Sandhill Crane in the Central Valley of California. Prepared for The Nature Conservancy of California. International Crane Foundation. Baraboo, WI, USA.

Niemuth, N. D., Ryba, A. J., Pearse, A. T., Kvas, S. M., Brandt, D. A., Wangler, B., Austin, J. E., & Carlisle, M. J. (2018). Opportunistically Collected Data Reveal Habitat Selection by Migrating Whooping Cranes in the U.S. Northern Plains. The Condor 120: 343-356. https://doi.org/10.1650/CONDOR-17-80.1

Pickens, B. A., King, S. L., Vasseur, P. L., Zimorski, S. E., & Selman, W. (2017). Seasonal Movements and Multiscale Habitat Selection of Whooping Cranes (Grus americana) in Natural and Agricultural Wetlands. Waterbirds, 40(4): 322-333. https://doi.org/10.1675/063.040.0404

Pearse, A. T., K. L. Metzger, D. A. Brandt, J. A. Shaffer, M. T. Bidwell, and W. Harrell. (2021). Migrating Whooping Cranes Avoid Wind-Energy Infrastructure when Selecting Stopover Habitat. Ecological Applications. doi: 10.1002/eap.2324

Thompson, H. L., Gordon, N. M., Bolt, D. P., Lee, J. R., & Szyszkoski, E. K. (2022). Twenty-Year Status of the Eastern Migratory Whooping Crane Reintroduction. Proceedings of the North American Crane Workshop, 15, 34-52.

Thompson, H. L. (2018). Characteristics of Whooping Crane Home Ranges During the Nonbreeding Season in the Eastern Migratory Population. Master's Thesis, Clemson University.

Timoney, K. (1999). The Habitat of Nesting Whooping Cranes. Biological Conservation, 89, 189-197. https://doi.org/10.1016/S0006-3207(98)00121-9

Van Schmidt, N. D., Barzen, J. A., Engels, M. J., & Lacey, A. E. (2014). Refining Reintroduction of Whooping Cranes with Habitat Use and Suitability Analysis. The Journal of Wildlife Management, 78(8), 1404-1414. https://doi.org/10.1002/jwmg.789