Environmental Assessment of Grazing Program at Crab Orchard National Wildlife Refuge

Date: March 2022

Crab Orchard National Wildlife Refuge

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A **Draft** Environmental Assessment (EA) has been prepared to evaluate two alternatives concerning the management of the grazing program to meet the conservation and agriculture goals and purposes of Crab Orchard National Wildlife Refuge (refuge). This EA examined the environmental consequences that each management alternative could have on the human environment which includes cultural and natural resources, as well as, social and economic considerations, as required by the National Environmental Policy Act of 1969 (NEPA) in accordance with Council on Environmental Quality regulations (40 CFR 1500-1509) and Department of the Interior (43 CFR 46; 516 DM 8) and U.S. Fish and Wildlife Service (550 FW 3) regulations and policies.

Proposed Action

The U.S. Fish and Wildlife Service (Service) is proposing to make changes to the current grazing program at Crab Orchard National Wildlife Refuge (refuge). A grazing program review discovered issues with overall program sustainability and compliance with the Service's biological integrity, diversity, and environmental health policy. While an agricultural Environmental Assessment was completed in 2018 (USFWS 2018), consideration of additional management alternatives related solely to the grazing program were not considered individually from the agriculture program as a whole; therefore, this Environmental Assessment was prepared to analyze potential alternatives for the grazing program.

Background

National Wildlife Refuges are guided by the mission and goals of the National Wildlife Refuge System (Refuge System), the purposes of an individual refuge, Service policy, and laws and international treaties. Relevant guidance includes the National Wildlife Refuge System Administration Act of 1966, as amended by the National Wildlife Refuge System Improvement Act of 1997, Refuge Recreation Act of 1962, and selected portions of the Code of Federal Regulations and Fish and Wildlife Service Manual. For this Environment Assessment, emphasis is placed on the National Wildlife Refuge System Administration Act of 1966 as amended by the National Wildlife Refuge System Improvement Act of 1997 Section 4(a)(4)(B) that states the following:

"*In administering the System, the Secretary shall . . . ensure that the biological integrity, diversity, and environmental health of the System are maintained for the benefit of present and future generations of Americans . . . .*".

The mission of the Refuge System, as outlined by the National Wildlife Refuge System Administration Act (Administration Act), as amended by the National Wildlife Refuge System Improvement Act (16 U.S.C. 668dd et seq.), is

"... to administer a national network of lands and waters for the conservation, management and, where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans".

Additionally, the Administration Act mandates the Secretary of the Interior in administering the Refuge System (16 U.S.C. 668dd (a) (4)) to

- Provide for the conservation of fish, wildlife, and plants, and their habitats within the National Wildlife Refuge System.
- Ensure that the biological integrity, diversity, and environmental health of the refuges are maintained for the benefit of present and future generations of Americans.
- Ensure that the mission of the Refuge System described in 16 U.S.C. 668dd (a) (2) and the purposes of each refuge are carried out.
- Ensure effective coordination, interaction, and cooperation with owners of land adjoining refuges and the fish and wildlife agency of the states in which the units of the Refuge System are located.
- Assist in the maintenance of adequate water quantity and water quality to fulfill the mission of the Refuge System and the purposes of each refuge.
- Recognize compatible wildlife-dependent recreational uses as the priority public uses of the National Wildlife Refuge System through which the American public can develop an appreciation for fish and wildlife.
- Ensure that opportunities are provided within the Refuge System for compatible wildlife-dependent recreational uses; and
- Monitor the status and trends of fish, wildlife, and plants in each refuge.

Crab Orchard National Wildlife Refuge was established on August 5, 1947, by Public Law 80-361. This Act of Congress transferred 22,575 acres from the Department of War (Illinois Ordnance Plant) and 21,425 acres from the Soil Conservation Service (Crab Orchard Creek Project) to the Secretary of the Interior. This directive stipulated the lands transferred would be administered by the Secretary of the Interior through the Fish and Wildlife Service "for the conservation of wildlife, and for the development of the agricultural, recreational, industrial, and related purposes specified in this Act"

The refuge began farm management in 1948 with 35 cooperative and 18 cash farmers. The original focus of the farm program was to reclaim farmland that was fallow during ordnance plant operations, improve soil fertility and farm practices, establish pastureland, and use crops to establish a wintering flock of Canada Geese (*Branta canadensis*). Currently, the refuge maintains an agriculture program consisting of approximately 3,899 acres of row crops with seven cooperators, 311 acres of hay fields with seven cooperators, and 1,049 acres of fescue and warm season grazing pastures with eight cooperators (Table 1).

In 2007, the refuge Comprehensive Conservation Plan (USFWS 2007) established specific goals, objectives, and strategies to guide management for all refuge purposes. However, a drastic decline in wintering goose numbers, decreased agriculture acreage, reduced field productivity, and failing infrastructure signaled a need to re-evaluate refuge agricultural goals. This culminated in the 2018 Crab Orchard National Wildlife Refuge Agriculture Program Environmental Assessment and Finding of No Significant Impact that selected Alternative C (USFWS 2018). Under Alternative C, the refuge would pursue strategic abandonment and/or deconstruction of agricultural infrastructure (i.e., roads and fences) where feasible to decrease annual maintenance costs. Additionally, the 2018 Environmental Assessment indicated there may be administrative need to remove certain crop fields, pastures, and/or hay units from production for a variety of reasons, e.g., unexploded ordnance (UXO), access issues, or if

funding or maintenance needs outweighed the Refuge's capacity to maintain certain units. Grazing acres and strategies as outlined in the 2018 Environmental Assessment's Alternative C would remain relatively constant, however the Comprehensive Conservation Plan prescribed paddock system would be eliminated or simplified. Furthermore, the location and methodology of some agricultural practices could change over time to address invasive species, soil health, field access issues, restore degraded sites, or address other unforeseen issues.

Overall, this Environmental Assessment aims to re-evaluate our grazing goals with the potential for total agricultural acreage on the refuge to remain the same, grow, or be reduced by a negligible amount. Recently, an internal review of the grazing program found a continued lack of goose use, extensive erosion, over-grazing issues, declining infrastructure (fences, roads, levees, etc.), overlap with UXO contaminated fields, and soil nutrient concerns. Recreational and industrial user conflicts within grazing units also exist. Cattle regularly escape from public access gates that are left open by recreational users and industrial tenants; this is a major liability with regard to proximity of escaped cattle to public highways and roads along the Refuge boundary. In addition, standard operating procedures for some bunker tenants are to leave bunkers open for periods as required by their policies, which can lead to cattle entering these storage bunkers and causing issues. Furthermore, the financial cost to maintain the grazing program outweighs the financial revenue generated.

Purpose and Need for the Action

The purpose of this proposed action is to evaluate alternatives not considered during the 2018 Crab Orchard National Wildlife Refuge Agriculture Program Environmental Assessment related to the grazing program and select an alternative that will provide management options for the refuge's wildlife and habitats within each unit. Grazing program changes implemented from the 2018 Environmental Assessment included elimination of fall mowing for Canada goose (*Branta canadensis)* browse and simplification/elimination of the paddock system. Each alternative is evaluated on environmental impacts (biological and socioeconomic), in accordance with the National Environmental Policy Act (NEPA) and maintaining compliance with the National Wildlife Refuge Administration Act (Administration Act), the refuge's purposes, and the mission of the National Wildlife Refuge System. The potential impacts of taking no action are a reduction of adequate grassland habitat for wildlife species, permanent loss of soil and soil nutrients too costly to remediate, potential infrastructure failure of fences (total of ~100,881 ft. of 6-strand barbwire and ~8,300 ft. of World War II era chain-link fencing), stock pond levees and watering ramps, a reduction in water quality in those ponds, and increased safety concerns with UXO contaminated fields.

The proposed action is needed to stop and reverse damage in grazing pastures such as extensive erosion, over-grazing issues, declining infrastructure (fences, roads, levees, etc.), overlap with UXO contaminated fields, soil nutrient concerns, and recreation/industrial user conflicts in grazing pastures. The overgrazing and erosion issues are in large part due to the continuous grazing structure that has occurred for years without resting the pastures in combination with limited monitoring of cattle numbers as the season progressed annually. In addition, this action is needed to maintain compliance with the biological integrity, diversity, and environmental health policy for refuge lands and maintain safe working conditions for cooperators, refuge staff and

visitors. Any change to the refuge's grazing program must continue to meet the refuge's purposes and the Service's priorities and mandates as outlined by the Administration Act to "provide for the conservation of fish, wildlife, and plants, and their habitats…","ensure that the biological integrity, diversity, and environmental health of the refuges are maintained for the benefit of present and future generations of Americans", "assist in the maintenance of adequate water quantity and water quality…", and "ensure that opportunities are provided within the System for compatible wildlife-dependent recreational uses…" (16 U.S.C. 668dd (a) (4)).

Description of Alternatives

Alternative A – No Action

This alternative would continue the status quo as described in the 2018 Crab Orchard National Wildlife Refuge Agriculture Program Environmental Assessment and Finding of No Significant Impact that selected Alternative C (USFWS 2018). Please see the 2018 Environmental Assessment for a detailed description. The document can be accessed through the following link, https://ecos.fws.gov/ServCat/DownloadFile/204848. The complete removal of grazing on the refuge would not be pursued and the conditions of the grazing units would likely continue to deteriorate and fail to meet wildlife management objectives. Continued conflicts with recreational and industrial users should be expected.

Alternative B –Complete Removal of Grazing Pastures

This alternative would remove all grazing pastures, associated infrastructure such as gates, fences, cattle grates, cattle ramps, etc. and clean up field edges of invasive woody species that have grown through fences for the past few decades. This alternative would allow wildlife management objectives to adapt to changing wildlife needs including the drastic reduction of Canada goose numbers and subsequent habitat needs. Additionally, it would reduce recreational and industrial user conflict, escaped cattle, reduce/stop erosion, address over-grazing issues, provide additional areas to hunt and fish, improve water quality and wetland pond margins within each pasture, and eliminate safety concerns due to failing infrastructure and UXO contaminated fields.

Overall, the outcomes related to elimination of the current grazing pastures on refuge will allow an expansion of uses into these areas and increase compliance with biological integrity, diversity, and environmental health policy. Although failing infrastructure will be removed, the potential exists for using grazing as a management tool in the future. If grazing is reinstated as a management tool in the future, temporary infrastructure will be utilized to the maximum extent possible, e.g. electric fencing that is installed at the beginning of the grazing season and removed at the end of the season. The agricultural program acreage is not being substantially reduced under this alternative although a slight reduction could be realized due to UXO and erosion issues. Some pastures may be converted to row crop or hayfields and additional acreages may be dedicated to agriculture in non-agricultural areas such as failed tree plantings, or degraded or failed grassland areas.

Under this alternative, the refuge would evaluate each grazing pasture on potential use and current wildlife management objectives. This may include establishment of permanent red clover hay fields for pollinators such as the monarch butterfly (a candidate species for listing under the

Endangered Species Act) and establishment of oak savanna and native prairie in UXO areas. Reforestation may occur in areas of severe erosion and may increase hunting and fishing opportunities. The removal of fences and gates and elimination of potential for cattle escapes will reduce conflicts with recreational and industrial users and reduce infrastructure that impedes wildlife movement across the refuge. In areas where agricultural use can continue, row crop farming and haying will remain an option at the discretion of management to provide habitat and food resources for wildlife, limit the growth of invasive plant species, and to meet refuge agricultural purposes.

Alternative B was initially identified as the preferred alternative to remove all grazing and grazing infrastructure from the refuge while maintaining the current overall agricultural acreage on refuge. This does not eliminate the potential for future grazing in existing or new areas. The preferred alternative to achieve the proposed action evolved during the NEPA process as the agency refined its proposal and gathered feedback from the public, stakeholders, and other agencies.

Alternatives Considered, but Dismissed from Further Consideration or Evaluation

Manage pastures in proximity as paddocks
The refuge considered allowing grazing units to be combined to allow for a robust paddock system in areas where units are close in proximity. In the past, the paddock system was not feasible because most units have one water source and the need to increase the fencing infrastructure in the units with more than one water source was difficult to maintain and not economically feasible. Only units 4, 5 and 6 are close enough for this to be considered and unit 5 and 6 have potential UXO contamination, reducing the possibility of infrastructure construction and maintenance. Therefore, this alternative was dismissed from further consideration due to feasibility and safety concerns.

Require a mandatory rest year or a shortened grazing period
The refuge considered a mandatory rest year or shortened grazing period to allow for grasses and clover to rebound, however, this would not address the immediate infrastructure concerns, safety concerns in areas with UXOs, current erosion issues, multiple user group conflicts, or water quality concerns in wetlands within units. Therefore, this alternative was dismissed from further consideration.

Phased reduction in available pastures
The refuge considered a phased reduction of available grazing units focusing on the most severely degraded pastures and those with UXO concerns to be removed first to allow refuge staff to manage the change in agricultural use and to remediate the pastures as needed. This would prevent the potential of fallow pastures where invasive species such as autumn olive, eastern red cedar, black locust, etc. could invade into open acreage. However, this alternative was removed from further consideration as it would be possible to change the agriculture use of these fields to a temporary or permanent row crop or hay use, as outlined in Alternative B, thus maintaining the staff capacity needed to administer this program while remediation efforts took place for the most severely degraded units first.

Affected Environment and Environmental Consequences of the Action

This section discusses the affected environment and the potential effects of the actions proposed in the alternatives. The affected environment and potential effects of Alternative A are thoroughly described under Alternative C of the 2018 Crab Orchard National Wildlife Refuge Agriculture Program Environmental Assessment and Finding of No Significant Impact (USFWS 2018; https://ecos.fws.gov/ServCat/DownloadFile/204848. The effects of implementing Alternative A and B are organized in categories for each affected resource where the effects and impacts of the proposed action on each resource are discussed. The effects and impacts of the proposed action considered here are changes to the human environment, whether adverse or beneficial, that are reasonably foreseeable and have a reasonably close causal relationship to the proposed action or alternatives. This Environmental Assessment includes the written analyses of the environmental consequences on a resource only when the impacts on that resource could be more than negligible and therefore considered an "affected resource." Any resources that will not be more than negligibly impacted by the action have been dismissed from further analyses.

Crab Orchard National Wildlife Refuge is in southern Illinois in Williamson, Union, and Jackson counties, west of Marion and south of Herrin, on the northern edge of the Ozark foothills (Figure 1). The refuge is one of the largest refuges in the Service's Great Lakes Region. Established in 1947 for wildlife, agriculture, recreation, and industry, the 45,446-acre refuge includes 1,049 acres of fescue and warm season grazing pastures. The refuge landscape also includes hardwood and pine forests, open oak woodlands, savanna, croplands, grasslands, wetlands, rolling hills, and rugged terrain with slopes of 24 percent. The 4,050-acre Crab Orchard Wilderness, the first wilderness area designated in the State of Illinois, lies within the refuge.

The proposed action is located on multiple units in the northern half of the refuge (Figure 1, 2 and 3). Detailed information regarding the affected environment is provided in Chapter 3 of the refuge's Comprehensive Conservation Plan (USFWS 2007), which can be found here: https://ecos.fws.gov/ServCat/DownloadFile/214353. This environmental assessment includes the written analyses of only "affected resources". Any resources that will not be more than negligibly impacted by maintaining the status quo or pausing grazing have been dismissed from further analyses. Therefore, the following resources either do not exist within the project area, are not affected, or are only negligibly affected by the proposed action and are not analyzed further in this environmental assessment:

- Wilderness and Wild and Scenic Rivers Act
    - Congress designated the Crab Orchard Wilderness as a unit of the National Wilderness Preservation System in 1976. The 4,050-acre wilderness was the first in the State of Illinois. The Crab Orchard Wilderness is located at the extreme southern end of the refuge bordering the shores of Little Grassy and Devil's Kitchen Lakes. This wilderness area is over two miles from the nearest grazing area and will not be affected by the continuance or removal of the grazing program.

- Air quality
    - The effects on air quality at the grazing units will be negligible under either alternative. The small increases in air emissions from heavy equipment to remove infrastructure or invasive plant species under Alternative B would not be expected to exceed the applicability thresholds outlined under the general conformity rules, or contribute to a violation of any federal, state, or local air regulations.
- Unexploded Ordnance (UXO)
    - All alternatives would adhere to the refuge's Environmental Land Use Control Plans (USFWS 2008) and all future amendments. Five grazing units overlap this land use control plan (Figure 4 and Table 3). These plans reduce exposure to contamination by limiting land or resource use and modify or guide human behavior where hazardous substances prevent unlimited use and unrestricted exposure (EPA 2012). Protective measures will be followed to limit risk and promote safety on the refuge. About half of Crab Orchard National Wildlife Refuge was the Illinois Ordnance Plant during World War II. Munitions ranging from primers and land mines to 500-pound bombs were manufactured here by the millions. Some portions of the refuge were used to destroy munitions after World War II, and this resulted in some unexploded ordnance (UXO) being left behind creating a potential safety issue. Some restrictions on agricultural use may occur as land use control plans are developed or modified. Restrictions on areas contaminated with unexploded ordnance will be the same across all alternatives.
- Cultural Resources
    - The consequences of the planned management on cultural resources are the same across all alternatives. Since most of the agricultural activities have resulted in ongoing ground disturbance, any additional effects to cultural or historic resources are likely to be minor or non-existent. Any management actions with the potential to affect cultural resources require review by the FWS Regional Historic Preservation Officer in consultation with the State Historic Preservation Office as mandated by Section 106 of the National Historic Preservation Act. Areas considered in this review have been previously farmed or disturbed, reducing the likelihood that impacts to cultural resources could occur. For any ground disturbing activities, clearance will be obtained from the Regional Historic Preservation Officer to confirm negligible to no impacts on cultural resources.
- Watershed and Floodplains
    - Negligible impacts to the watershed and floodplain are expected. The wetlands in the grazing units are generally small and do not have a substantial impact on the overall watershed or floodplains. Ponds range in size from less than one acre to seven acres. In addition, no wetlands or ponds will be filled as a result of either alternative and no structures that impact flow within the floodplain are proposed in either alternative. Ponds constructed or maintained for water supply for cattle will be evaluated on a case-by-case basis for their value to the refuge. Those ponds that can provide quality habitat to meet wildlife management objectives

could be left in place. Ponds that could pose a safety risk or require costly maintenance with little or no benefit could be abandoned in place or removed

Natural Resources

Geology and Soils

Affected Environment

Description of Relevant General Features of the Affected Environment

A thorough description of the affected environment is provided in the 2018 Crab Orchard National Wildlife Refuge Agriculture Program Environmental Assessment (USFWS 2018; https://ecos.fws.gov/ServCat/DownloadFile/204848), 2007 Comprehensive Conservation Plan and accompanying Environmental Impact Statement (USFWS 2007).

Description of Relevant Environmental Trends and Planned Actions

Soil erosion from cattle use is expected to continue promoting invasive species in disturbed areas and a loss of soil nutrients. Lack of adequate soil nutrient amendments is a primary concern due to the high cost to remediate. In addition, some ponds are not fenced, leading to heavy erosion, deep gullies, and a lack of vegetation. The environmental trends from lack of vegetation in these areas will lead to continued erosion. This is exacerbated from years of overgrazing in many units.

In general, assessing the nutrient soil status encompasses the nutrient-release and nutrient-holding capacity of the soil for nutrients such as phosphorus (P), potassium (K), secondary macronutrients such as calcium (Ca), magnesium (Mg), and sulfur (S), micronutrients such as boron(B), chlorine (Cl), copper (Cu), iron (Fe), manganese (Mn), molybdenum (Mo), zinc (Zn), and the overall soil pH level (Fernández and Hoeft 2009). Overall, Williamson County has some of the poorest soils in the entire state of Illinois and the refuge has the poorest soils in Williamson County (Figure 5 and 6; Fernández and Hoeft 2009). As shown in Figure 5 and 6, southern Illinois is low in phosphorus-supplying power and low in cation-exchange capacity where refuge pastures are located. Phosphorus-supplying power is defined by the parent material and degree of weathering over time. Low supplying power areas were formed from 2-1/2 to 7 feet of loess over weathered Illinoisan till and are slowly or very slowly permeable. While soil tests may indicate high subsoil levels of P, root development is more restricted as compared to high or medium regions; this can potentially offset access to P due to higher bulk densities and slow permeability of the soil. Cation-exchange capacity (CEC) is defined as the measure of the amount of attraction of soil to chemical elements such as hydrogen (H), Ca, Mg, K, ammonium (NH_4), Fe, Mn, Zn and Cu. A high CEC is desirable but not necessarily needed for high crop yields. A high CEC allows for a higher retention of positively charged ions from leaching that are exchanged for hydrogen to growing plant roots. CEC is not heavily influenced by fertilization, so farming practices that limit erosion and maintain soil humus are preferred. Essentially this means that soils low in capacity may not hold excess reserve nutrients.

In addition, just because nutrients are applied does not mean those nutrients are available (Fernández and Hoeft 2009). Other factors such as root growth and activity, soil compaction, soil water content, temperature, light intensity, diseases and pests can all impact nutrient uptake by plants. Poor soil quality can lead to increased prevalence of undesirable or invasive species and erosion based on the site use. To understand the soil nutrient baselines, soil samples have

been requested from refuge agriculture cooperators annually. However, these results have not been consistently turned in or monitored by cooperators.

The biology team will continue to monitor pastures and annual conditions to determine immediate remedies to slow erosion and maintain nutrient capacity within pastures. This includes reducing the carrying capacity and recommending nutrient inputs. For the past few years, all revenue generated from the farm program has been used solely toward the grazing program, in addition to the in-kind services from grazing cooperators to remedy these issues.

Environmental Consequences

Impacts on Affected Resource

Alternative A

While mentioned briefly in the 2018 Crab Orchard National Wildlife Refuge Agriculture Program Environmental Assessment (USFWS 2018; https://ecos.fws.gov/ServCat/DownloadFile/204848) for Alternative C, more impacts have recently become apparent. Under this alternative, a continuous grazing model would continue to be used with cattle grazing from April to November. Due to cattle being present the entire growing season, grasses are not able to rebound. Furthermore, the shift to not mowing in the fall for geese did not benefit pastures as woody invasive species began to invade and cooperators still must mow. This has led to erosion, compacted soils and some pugging around heavily used sites such as water resources. Under this alternative, it is reasonable that these effects will continue to be exacerbated if no changes are made. While some of these processes can be beneficial in moderation to break up soils through hoof action, effects of compaction are visible on the landscape due to overuse. Typically, nutrients in a grazing system are not removed like in haying operations but redistributed based on animal movements, leading to heavier concentrations in areas of high use. This nutrient redistribution in combination with the loss of soil pore space will be difficult to overcome if this alternative is selected.

Alternative B

Under this alternative, positive effects to the geology and soil include stabilization of soil through vegetation growth from row crop agricultural use, cover cropping, clover fields, or restoration to native habitat. All these options will lead to increased nutrient input, mechanical or chemical options, or a diverse plant community to prevent invasive plant species from spreading. Furthermore, after completing a custom soil resource report for all the refuge's grazing pastures, 78% or 822.7 acres are farmland of statewide importance or prime farmland (Appendix A). Row crop farmers have more incentive to conduct soil testing to ensure profitable growth of their crops and tend to have higher compliance. It is reasonable to conclude that elimination of grazing and conversion to row crops or another agricultural use will lead to more consistent recordkeeping of the soil nutrients without an increase in refuge staff time. Furthermore, row crops are more profitable on a per acre basis leading to increased revenues and decreased expenditures and staff time needed to stabilize and reverse the current soil damage. However, not all fields maybe suitable for row crops. Other options that would benefit the soil include conversion to clover fields to add atmospheric nitrogen to the soil and reforestation that would reduce erosion and surface water runoff while adding more organic matter to the landscape.

Water Quality, Fisheries, and Wetlands

Affected Environment

Description of Relevant General Features of the Affected Environment

Thoroughly described in the 2018 Crab Orchard National Wildlife Refuge Agriculture Program Environmental Assessment (USFWS 2018; https://ecos.fws.gov/ServCat/DownloadFile/204848.

Description of Relevant Environmental Trends and Planned Actions

Continued wetland margin erosion from cattle is expected to decrease water quality as cattle ramps and fence lines around some water bodies are degraded. Decades of neglect have left this infrastructure difficult to maintain without complete removal and new construction. Multiple woody species have grown through the fence lines making it impossible for mowing maintenance on both sides of the fence. In addition, some ponds are not fenced at all, leading to heavy erosion along margins and levees creating dangerous mowing conditions and inadequate water access for calves. This degraded infrastructure necessitates cattle standing in water bodies to drink water leading to direct defecation and urination into the wetlands. This can lead to a toxic blue green algae bloom capable of depleting oxygen and fish kills. Furthermore, this erodes wetland margins leading to reduced plant growth needed to stabilize the soil and remove excess nutrients. The environmental trends from lack of vegetation in these areas will lead to a continued decline in overall wetland productivity, high levels of turbidity and lack of oxygen in the water column.

The biology team will continue to monitor the current infrastructure and cattle ramps to limit the time cattle are present in wetlands. For the past few years, all revenue generated from the farm program has been used in addition to in kind services from grazing cooperators to remedy soil nutrient concerns and slow erosion along water sources. However, the need outweighs the revenue generated. Furthermore, not all wetlands are fenced and the cattle ramps continue to fall further into disrepair annually. In 2021, all cattle ramps were regraded and graveled, however, this was a temporary remedy that will require subsequent and continual monitoring, reshaping, and gravel additions. Additional funds beyond those generated through grazing revenues will be needed to construct sustainable and adequate water access.

Environmental Consequences

Impacts on Affected Resource

Alternative A

Wetlands and water quality are described in the 2018 Crab Orchard National Wildlife Refuge Agriculture Program Environmental Assessment (USFWS 2018; https://ecos.fws.gov/ServCat/DownloadFile/204848). However, detrimental effects for fish resources on refuge would continue with increased nutrient inputs and sedimentation into these water sources if cattle were not fenced out. This can lead to fish kills due to increased water temperatures and a drop in dissolved oxygen levels. This can occur with a loss of vegetative cover along shorelines and a decrease in the photic zone within the water column. Toxic blue green algae can form and is deadly to wildlife within the water column as well as animals that may drink the water, including cattle, deer, and etcetera. Fisheries resources on refuge are managed in collaboration with the Illinois DNR.

Alternative B

Under this alternative, reduced shoreline erosion, reduced nutrient inputs, and a decline in overall turbidity would lead to an increase in wetland vegetation along shorelines and improved water quality. This could result in a small self-sustaining warm water sport fishery in the long-term for some of the larger ponds within current grazing pastures. This is already the case in the A-41 pasture where cattle are kept out of the larger pond. A reduction in the number and severity of gullies, cuts, and cattle paths in grazing units would improve soil erosion overall decreasing the runoff into wetlands as these areas are allowed to revegetate or are actively restored. A reduction is expected in excessive nutrients going into small ponds as cattle would no longer redistribute nutrients through their grazing pattern and time spent in and around water sources.

Wildlife and Upland Habitat

Affected Environment

Description of Relevant General Features of the Affected Environment

Thoroughly described in the 2018 Crab Orchard National Wildlife Refuge Agriculture Program Environmental Assessment (USFWS 2018; https://ecos.fws.gov/ServCat/DownloadFile/204848).

Description of Relevant Environmental Trends and Planned Actions

The 2018 Farming EA stated that the diversity of plants should be balanced with the needs of producers to provide adequate forage quality and prevent excessive abundance of plants poisonous to cattle. This has resulted in retention of existing fescue dominant pastures with little to no floral resources for pollinators and a degraded landscape void of the wildlife and plant diversity desired in many instances. Furthermore, fungal endophyte infected (*Neotyphodium coenophialum*) fescue leads to reduced plant diversity, which means fewer foods for wildlife. A solid stand of fescue fails to provide the variety of pollens, nectars, leaves, and seeds needed by the insects that are a critical link in the food chain for songbirds, quail chicks, turkey poults and other wildlife (Allegar 2003; Barnes et al. 1995). Furthermore, research has shown that Canada geese avoid foraging on endophyte-infected tall fescue; it is planted at airfields due to its minimal attractiveness to wildlife, such as geese, that are hazardous to aircraft (Washburn 2012). Endophyte-infected fescue can lead to fescue toxicosis in cattle; symptoms include rough hair coats, heat stress, suppressed appetite, poor growth, or reduced calving rates (Browning 2003). A secondary effect is cattle spend more time in water sources due to heat stress; this exacerbates the effects described in the water quality section. Producers desire to hay earlier or clip the seed heads of grasses to limit this fungal endophyte during the breeding season for grassland birds, which interrupts their nesting and reduces productivity. In addition, management of pastures for Canada goose browse has been discontinued and the long-term strategy of increasing the diversity of grasses and forbs within these units would continue to be an option to benefit a wide array of wildlife, especially grassland birds and pollinators.

Another recent trend is cattle predation by black vultures (*Coragyps atratus*). Black vultures habituate cows to their presence and actively attack live calves or cows that they eventually overtake and consume. A farmer witnessed a black vulture eat a calf that was still alive in 2020 on refuge. In states where this is more prevalent, take permits can be issued to farmers to kill black vultures, however, black vultures are protected by the Migratory Bird Treaty Act of 1918 (Bennett 2019). Although the Refuge is at the northern extent of the black vulture's range, their range has steadily marched northward over the last 40 years and climate change is expected to increase their range expansion (Bennett 2019). One farmer from southern Illinois estimated his

losses to be $20,000 in 2018 due to black vulture predation on cows and calves. The biology team will continue to monitor these areas for wildlife use and enhance upland habitat in accordance with refuge purposes and management goals.

Environmental Consequences

Impacts on Affected Resource

Alternative A

Under this alternative, upland habitat will continue to degrade and erode, supporting the growth of invasive plant species further limiting resources to wildlife and plant species richness in pastures. Cattle paths are the primary cause of erosion within fields and result from long travel distances between water sources. Most pastures have one to two water sources that show heavy use around margins, leading to further loss of upland habitat. In addition, cooperators have shown a mixed response to planting native warm-season grasses and the goal has not progressed; leaving fescue dominant pastures occasionally seeded with clover.

In addition, wildlife resources are affected by the amount of chain link fence and five to six strand barbwire fences that impede wildlife movements. Occasionally, deer have been found tangled and dead in the barbwire fencing. While wildlife does not seem to get tangled in the chain link fence, these fences substantially stop wildlife movement all together due to the eight foot height of the fence. Another concern is the livestock-wildlife interface when it comes to diseases. Due to the continuous grazing pattern and lack of control keeping cattle out of water sources, the conditions have increased the stressors on the landscape and livestock can exacerbate pathogen transmission between species. Pathogen transmission can occur bi-directionally between wildlife and livestock (Miller et al. 2013). Of the 53 diseases reportable to the World Organization for Animal Health present in the United States, 42 (79%) have a wildlife component to the pathogen transmission, maintenance, or life cycle. Furthermore, 21 (40%) of those diseases are known to be able to infect humans (zoonotic). Monitoring and detection of such events are difficult on refuge pastures due to the distance of these pastures from cooperators. When cattle are found deceased, often times wildlife such as vultures give away the presence of the carcass, which is in a state of decay that precludes determination of the cause of death. Several grazing pastures have experienced high mortality rates in recent years from unknown causes.

Alternative B

Under this alternative, several beneficial effects are expected including the reduction of fescue dominated grasslands and the establishment of red clover fields that will benefit multiple wildlife and pollinator species by increasing the floral component in these areas. The pressure on nesting birds would be lessened because these pastures would have a chance to rebound. The impacts to upland wildlife and native vegetation would be negligible during the removal of infrastructure. The impacts of operation of heavy equipment would be negligible and some of the removal will be done by hand due to UXO concerns and vegetation that has grown through fences. Vegetation removal would be limited primarily to invasive species or undesirable species in open grasslands such as autumn olive, eastern red cedar, etc. This alternative does not eliminate the potential for grazing in the future but would allow pastures to rebound ecologically and failed infrastructure to be removed and replaced if the refuge grazes these areas in the future. If grazing is reinstated as a management tool in the future, temporary infrastructure will be utilized to the maximum extent

possible, e.g. electric fencing that is installed at the beginning of the grazing season and removed at the end of the season. Pastures will be transitioned to row crop or haying where feasible, and native grasslands, savannas, or woodlands in other areas. However, agricultural program acreage overall will be reduced a negligible amount as heavily eroded or UXO contaminated areas are removed from the farm program. Other options would be for these areas to be reforested and conversion to native vegetation restoration. This alternative would completely move away from goose browse management and bolster the habitat requirements of other migratory birds such as passerines.

Threatened and Endangered Species, and Other Special Status Species

Affected Environment

Description of Relevant General Features of the Affected Environment

Two federally listed endangered species, the Indiana bat and whooping crane are known to occur on the refuge. In addition, one federally threatened species, the northern long-eared bat and one candidate species, the monarch butterfly, also occur on refuge. Whooping cranes are rare migratory visitors to the refuge with only two recent sightings. One pair stopping at the refuge in 2015 and three stopping in March 2022. Northern long-eared bats and Indiana bats roost under the peeling bark of dead and dying trees during the summer months and overwinter in large colonies in caves. Indiana bats eat a variety of flying insects and typically forage along rivers or lakes and in uplands, while northern long-eared bats primarily forage in the understory of forested areas. Even though the northern long-eared bat is listed as threatened, Section 4(d) of the Endangered Species Act directs the Service to issue regulations deemed "necessary and advisable to provide for the conservation of threatened species." It allows the Service to promulgate special rules for species listed as threatened (not endangered) that provide flexibility in implementing the Endangered Species Act. The monarch butterfly (adult form) utilizes a variety of habitats and geographic areas to meet its life history requirements. On refuge, the grassland habitats and forest edges with flowering plants and milkweeds are utilized during the day, while they roost in various types of deciduous and coniferous trees at night. The non-adult life forms exclusively utilize milkweed. They are present on the refuge during the warmer months, from April to October.

Description of Relevant Environmental Trends and Planned Actions

USFWS, state, and federal partners have developed management and recovery plans for each of the federal and state listed species found refuge. These plans provide land managers with guidance regarding conservation strategies that can be used in managing species and habitats. These plans establish regional population and habitat conservation objectives and provide estimates of the size and types of habitats required to increase and sustain wildlife populations at target levels. Species identified in these plans, and their associated objectives and strategies, were considered during evaluation specific to the refuge and in the development of the Habitat Management Plan (HMP) objectives and strategies. Refuge staff will continue to manage habitats on refuge for the benefit of threatened, endangered, and special status species. The refuge works to implement these plans to maintain and enhance grassland and forest habitats that benefit foraging, nesting, and roosting areas for Indiana bats, northern long-eared bats, and monarchs.

Environmental Consequences

Impacts on Affected Resources

Alternative A

Under this alternative, whooping cranes, Indiana bats and northern long-eared bats would have no impacts to their habitats. However, in the 2018 Crab Orchard National Wildlife Refuge Agriculture Program Environmental Assessment (USFWS 2018; https://ecos.fws.gov/ServCat/DownloadFile/204848), the grazing vegetation goal states "(plant) diversity should be balanced with the needs of producers to provide adequate forage quality and prevent excessive abundance of plants poisonous to cattle". This would promote the loss of milkweed in pastures due to their toxicity to cattle directly impacting monarchs. Adult monarchs are known to exclusively lay their eggs on milkweed plants. All parts of the milkweed plant are poisonous to cattle when eaten and the toxicity is retained when dried (University of Illinois 2020). While a small amount of milkweed ingested by cattle is not typically fatal, it can be dangerous if a large amount is consumed as would be the potential case in an overgrazed pasture with milkweed stands present (Monarch Joint Venture 2016).

Alternative B

Indiana bats likely forage over the wetlands in the grazing pastures but will not be negatively impacted by the proposed halt to grazing or change in agricultural use as adequate food will continue to be available across the refuge and may increase as native vegetation is restored. Northern long-eared bats utilize the forest understory, which will not be impacted by conversion of pastures. Grassland and forest edge habitats utilized by monarch butterflies on refuge will be positively impacted by increased flowering plant diversity and with the removal of fences and the invasive plant species that have overtaken edge habitats. Increases in milkweeds could be expected; adult monarchs are known to lay their eggs only on milkweed plants. Furthermore, the removal of any suitable roost trees associated with infrastructure would take place during the period of October 1 to March 31. Whooping cranes are rare visitors to the refuge; they do not nest here, and are not expected within the small grazing pasture ponds or lakes.

Any potential effects are consistent with those already outlined and covered in the environmental impact statement completed as part of the Refuge comprehensive conservation plan (USFWS 2007), and the associated biological assessment and biological opinion (USFWS 2006, [Appendix J in the 2007 Comprehensive Conservation Plan]). These were completed during formal consultation in accordance with Section 7 of the Endangered Species Act of 1973. Any activities that might affect the endangered Indiana bat or the threatened Northern long-eared bat will follow the most current Fish and Wildlife Service policies found at: https://www.fws.gov/midwest/endangered/mammals/nleb/4drule.html.

Therefore, a "No Effect" determination was made for both alternatives (Appendix B). Additionally, an official species list pursuant to Section 7 of the ESA was completed on November 18, 2021, confirming that no critical habitat designations exist within the project area. This is in fulfillment of the requirement that Federal agencies "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action". Considering these facts, no federally designated threatened, endangered, or special status species will be analyzed further as affected resources under either alternative.

Invasive Plant Species

Affected Environment

Description of Relevant General Features of the Affected Environment

Thoroughly described in the 2018 Crab Orchard National Wildlife Refuge Agriculture Program Environmental Assessment (USFWS 2018; https://ecos.fws.gov/ServCat/DownloadFile/204848).

Description of Relevant Environmental Trends and Planned Actions

Inventories of invasive plant species on refuge are used to develop restoration and treatment plans. These inventories provide insights into the threats posed on the landscape for any given management unit. This information is then used to prioritize invasive species treatments. Terrestrial invasive plants are evaluated and treated frequently on the refuge using mechanical, chemical, prescribed fire, and agricultural practices. Generally, invasive plant species in pastures are controlled through grazing, mowing, and chemical application. Invasive plant threats are a constant pressure for these pastures and the risk of cattle introducing other invasive species is an ever-present threat.

Environmental Consequences

Impacts on Affected Resource

Regardless of the alternative chosen, invasive species will likely continue to threaten the ecological integrity of the refuge's habitats and agricultural fields. Existing levels of invasive plant infestations are beyond the capabilities of the refuge to completely control and affect all agricultural habitats to some extent. An invasive species inventory completed from 2014-2017 indicates that the refuge contains over 17,000 acres of terrestrial habitats invaded by autumn olive (*Eleagnus umbellata*). The magnitude of that invasion indicates that short of biological control, autumn olive may always be present at the refuge. Prioritization and strategic treatments may reduce the distribution and abundance of invasive plants on the refuge; however, eradication is highly unlikely. A philosophical shift away from invasive species control toward native species promotion has been underway for several years and that trend would continue among both alternatives. Grazing is used to manage native stands in many locations throughout the Midwest and can have positive impacts in reducing invasive plants in certain instances. Currently, all pastures are overgrazed, and cattle leave certain plant species such as thistle and autumn olive. In addition, because cattle are not on refuge year-round and graze at other places, this elevates the risk of additional invasive species being introduced to the refuge. Lastly, the types of pesticides that can be safely used to combat some invasive plants are limited by the presence of cattle during the growing season. While this supports the need to pause grazing on the refuge, grazing can be beneficial to manage native stands and reduce invasive plants when properly monitored. Therefore, grazing maybe considered in the future, in new areas or once existing areas ecologically rebound, potentially using a diversity of grazing species such as cattle, goats, etc.

Alternative A

Thoroughly described in the 2018 Crab Orchard National Wildlife Refuge Agriculture Program Environmental Assessment (USFWS 2018; https://ecos.fws.gov/ServCat/DownloadFile/204848) as Alternative C.

Alternative B

Under this alternative, potential exists for invasive species to continue to spread into open areas even with the conversion from fescue-dominated pastures to native warm season grasses (NWSG) or red clover. The use of native species is preferred; however, prior uses of NWSG has proven to be ineffective in some locations due to severe invasive species pressures, an inability to properly manage and maintain the native grasses, or due to other constraints. Poor soil quality can lead to increased prevalence of undesirable and invasive species. Unit edges and fence lines were overtaken by autumn olive and light seeded tree species. The refuge will evaluate each unit individually to manage these areas effectively, with an overall objective to increase plant and wildlife diversity while maintaining compliance with biological integrity, diversity, and environmental health policy. By converting pastures to another use, such as row crops, the refuge would be able to combat weed pressures and restore some of the nutrient needs of the units. Removal of the fence lines would allow for the cleanup of field edges of invasive plants, something difficult to do with failing infrastructure and heavy erosion on frequent cattle paths. Additional chemicals could also be used, and row crop fields would be able to rest every three years. Once these fields recover, grazing could be used in the future to manage native stands and reduce invasive plants after a balance between invasive plant species, soil erosion, and nutrient maintenance has been restored.

Visitor Use and Experience

Affected Environment

Description of Relevant General Features of the Affected Environment

The lakes on Crab Orchard National Wildlife Refuge provide for a majority of the Refuge visits, both wildlife related and non-wildlife related. This environment is thoroughly described in the 2007 Comprehensive Conservation Plan and accompanying Environmental Impact Statement (USFWS 2007). Most grazing pastures are in closed areas except for three grazing units. Grazing unit 8 (Figure 3 and 4) has walking access to fishing ponds that are heavily used by visitors. Most visitors walk along the roadway to access the shoreline. To date, no aggressive cattle-visitor interactions have occurred on refuge, however, cattle have been known to be protective when calves are present in the spring and summer months. Furthermore, bulls have also been known to be aggressive when present for breeding activity in pastures. Grazing units 4 and 6 (Figure 3 and 4) are located along wolf creek road with a lot of visitor traffic that comment on the calves. Frequent phone calls and visitor observations of small calves going in and out of fences is a regular occurrence during this time.

Description of Relevant Environmental Trends and Planned Actions

The refuge has experienced heavy visitation since its establishment. In 1956, the refuge reached a milestone of one million annual visitors. Nine years later visitation surpassed 2 million annual visits. During the 1970s and 80s visitation fell as additional State and Federal recreational areas were constructed in Southern Illinois. In recent years, the refuge has averaged more than 850,000 visits per year (USFWS 2019a) and is steadily approaching 1,000,000 annual visitors again. The majority of visitors recreate on or near Crab Orchard Lake. However, management goals outlined in the refuge comprehensive conservation plan (USFWS 2007) to increase quality recreational opportunities indicates that while many of the grazing pastures are currently in closed areas, this may change. More acreage is being opened to hunting and fishing opportunities and construction plans are underway to build a bike trail that will cross through grazing unit 1. In

addition, the auto tour route will be expanded past current grazing units. Gates and fences may need to be removed to improve access for users of all abilities.

Environmental Consequences

Impacts on Affected Resource

Alternative A

Under this alternative, the potential visitor safety risk walking through grazing unit 8 would still be present. In addition, visitors and bunker tenants must maintain situational awareness to avoid eroded areas and cattle manure while in these units. Visitors must be aware as they drive along wolf creek road for the potential of escaped calves. In general, a majority of visits to the refuge are not because of grazing, so regardless of the alternative selected, there will be little impact to overall refuge visitor use.

Alternative B

Under this alternative, user conflicts with public fishing use and industrial bunker tenants would be eliminated. Recreational fishing users would no longer have to cross through a grazing pasture to get to A-41 fishing pond and the industrial tenants in Area 6 would be able to air out their rented bunkers without cattle potentially entering. Furthermore, the accidental occurrence of gates being left open and cattle escaping onto a major roadway or into standing row crops would be eliminated. The elimination of grazing would improve the esthetic of the new bike trail being constructed through grazing unit 1 and the walking path visitors use to fish at A-41. Visitors would no longer have to contend with gates, large animal exclusion gates, cattle, manure, or eroded areas. While no severe incidents have occurred with the public and cattle, some bulls have shown aggression towards visitors during the season and a potential hazard exists if a visitor accidentally gets in-between a calf and cow pair. Furthermore, this would eliminate the staff resources required to respond to frequent phone calls from visitors, security, and industrial tenants when small calves get through the fences. In addition, these areas will provide more hunting and fishing opportunities that are currently closed to the public and eliminate the accidental take of cattle that has occurred in the past. While Alternative B would improve the visitor experience, it also provides for nearly the same agricultural acreage with improved habitat conditions. As outlined in the refuge comprehensive conservation plan (USFWS 2007), the refuge attempts to balance all purposes and while agricultural use is a mandated purpose, it is not specific to grazing. This alternative would allow for a more integrated approach to all four purposes: agriculture, industry, conservation of wildlife, and recreation.

Refuge Management and Operations

Affected Environment

Description of Relevant General Features of the Affected Environment

The costs of administering and enforcing the refuge's agriculture, fishing, hunting, visitor use, maintenance, and water management programs comes out of the refuge's annual budget. Expenses include program management (reviewing bids, issuing permits, etc.), staff resources, boundary posting, signage, facility maintenance, and other management activities. The refuge also has a cash bid process for each agricultural unit where in-kind services can be completed in lieu of cash payment. Although two members of the refuge staff are dedicated to managing the farm program as a whole, grazing presents a burden on a wide array of refuge staff. Maintenance

and biology staff annually address infrastructure issues, road washouts, and levee repairs. Staff regularly deal with beaver dams and beaver control within grazing ponds. Visitor center staff regularly deal with phone calls from tenants and the public regarding reporting of escaped cattle. Law enforcement and other staff are often required to respond to escaped cattle. Compliance from cooperators regarding dead and escaped cattle have required substantial time and involvement from multiple staff members and refuge management in recent years. The fire crew has been heavily utilized in cutting fallen trees or invasive species entangled within the fences. Additionally, one staff member is on call from April-November to respond quickly to any cattle emergencies outside of the normal working hours. That staff member also spends a majority of the field season monitoring field conditions, water access and delivery systems, fences, escaped cattle, and compliance with spraying, mowing, and stocking rates.

Description of Relevant Environmental Trends and Planned Actions

Compliance checks conducted by staff, include checking: the number of cattle within pastures, spraying and maintenance of fence lines, annual mowing of units, and ensuring materials provided are used on the grazing unit. Typically, the refuge provides the materials for fence maintenance and the cooperator completes the work. This has led to varying levels of compliance based on the abilities of the cooperators. As infrastructure has degraded, staff are frequently called due to escaped cattle, often conducting emergency fence repairs. Most of the time this is due to calves that are small enough to fit through the fence. There is also growing concern over the number of dying ash trees falling on fences and the amount of fence (Table 1, ~100, 881 linear feet of barbwire and ~8,300 linear feet of World War II fencing) that must be maintained. In addition, anytime a cow is loose, a staff member is called and must respond immediately in case there is a major hole in the fence or if a cooperator cannot be reached. This leads to a staff member being on call 24/7. The refuge has a large number of visitors and tenants that use these areas in addition to major highways (Highway 13 and 148) that border the refuge; the risk of a major safety incident is possible. With ash trees dying, there is a higher probability that these calls will become even more frequent with increased visitor use in these areas.

Environmental Consequences

Impacts on Affected Resources

Alternative A

Under this alternative, a staff member must always be reachable during the season to respond immediately to loose cattle. In addition, staff efforts must be allocated to checking fence lines and maintaining signage to remind visitors and tenants that they are in a cattle pasture and to close gates behind them. Staff must count the numbers of cows and monitor grass height to determine if overgrazing is occurring. With over a thousand pasture acres spaced out across eight pastures in the northern half of the refuge, this takes a substantial amount of time per season. Oftentimes, this occurs once per season due to the time constraints which has proven to not be enough.

Alternative B

Under this alternative, all associated infrastructure and grazing would be removed. Initially, this would require time to remove fencing and other infrastructure, and to convert pastures to other habitats or agricultural uses. This conversion of use and removal of infrastructure could occur simultaneously and would approximately take one season for some units. Other units may take several years; for example, UXO areas have more complicated restoration requirements and are

dependent on funding and scheduling of UXO removal teams. Additional planning documents may be required for some restorations. Prescribed fire will be utilized to manage areas in the interim and to manage native habitats following restorations. Restoration or conversion is expected to be complete for all units within three to five years. However, over time the associated cost and time required to maintain these areas would be dramatically less. Furthermore, it is likely that most refuge fences are susceptible to falling ash trees. Many ash trees are dead or dying due to the emerald ash borer and create a falling hazard. This alternative approach is proactive versus reactive and reduces the safety concerns for cooperators and staff working underneath dead ash stands to repair damaged fences. Additionally, this alternative removes concerns associated with increasing occurrences of escaped cattle and the potential for further incidents as stands of dying ash fall along the fenced edges of pastures. Staff time will be substantially reduced as grazing compliance checks are more time consuming compared to row crop, hay use or other habitat type. There would no longer be a need for ensuring compliance with stocking rates, removal of dead cows, fence line maintenance and spraying, or staff call backs and response to escaped cattle. In comparison, hay fields are only checked a few times a year to ensure bales are removed and that fields are mowed. Overall the cost in staff time to administer, monitor, operate, and maintain facilities and services on refuge would be decreased by the removal of grazing pastures.

Socioeconomics

Affected Environment

Description of Relevant General Features of the Affected Environment

Local and regional economies

Located west of Marion, Illinois, on the northern edge of the Ozark foothills, the refuge is one of the largest refuges in the Service's Great Lakes Region at 45,446 acres. The refuge is unique in having an industrial program that generates $40 million annually to the local economy. Additionally, the refuge is an attraction for anglers, hunters, campers, boaters, bird watchers and other outdoor enthusiasts. Recreation results in large expenditures for both travel-related goods and services and activity-related equipment purchases. Refuge hunting opportunities provide benefits to the local economy through the sales of food, gas, supplies, or lodging. According to research on economic effects, hunting on the refuge resulted in $684,000 in hunting expenditures for both travel-related goods and services and activity related equipment purchases (USFWS 2019b). Furthermore, the grazing program on refuge provided ~9.4% of the grazing acreage for Williamson County in 2017 (USDA 2017). This generated ~$596,288.89 annually to the local economy. Annual rent payments from grazing cooperators totaled $22,206.00 in 2017.

Employment

In 2019, there were 24,460 full- and part-time jobs in Williamson County (US Census Bureau 2019). Healthcare, retail trade and educational services occupations accounted for about 43.2% of the jobs across the area followed by food serving and law enforcement occupations (10.4%) (U.S. Census Bureau 2010).

Income and Education

The median household income in Williamson County is $45,902, just less than $14,000 below the state average and approximately $10,000 below the national average (2016 U.S. Census Bureau). The percent of population below the federal poverty line is an indicator of the economic

distress within a community. The percent below poverty in Williamson County, 14.9%, is just higher than the national average of 14.0%.

In Williamson County, approximately 92.3% of residents over the age of twenty-five were high school graduates and 24.3% have earned a bachelor's or advanced degree (2019 U.S. Census Bureau).

Description of Relevant Environmental Trends and Planned Actions

Williamson County has slightly decreased in population size by just under 1% since 2010. In 2021, the median household income in Williamson County is $50,734, an increase of $4,832 since the 2016 census. The percent of population below the federal poverty line is an indicator of the economic distress within a community. The percent below poverty in Williamson County, 13.9%, down one percent since 2016.

In 2021 in Williamson County, approximately 92% of residents over the age of twenty-five were high school graduates and 24.3% have earned a bachelor's or advanced degree. These figures were both slight increases since the 2016 census.

Environmental Consequences

Impacts on Affected Resources

Description of Affected Resource

Spending associated with recreation can generate a substantial amount of economic activity in local and regional economies. Refuge visitors spend money on a wide variety of goods and services. Trip-related expenditures may include expenses for food, lodging, and transportation. Anglers, hunters, boaters, and wildlife watchers also buy equipment and supplies for their particular activity. Because this spending directly affects towns and communities where these purchases are made, recreational visitation can have a major impact on local economies, especially in small towns and rural areas. These direct expenditures are only part of the total picture, however. Businesses and industries that supply the local retailers where the purchases are made also benefit from recreation spending. Each dollar of local retail expenditures can affect a variety of businesses at the local, regional, and national level. Consequently, increases or decreases in availability of recreational uses and associated consumer spending can have a major impact on economic activity, employment, household earnings and local, state, and Federal tax revenue. A study was conducted in 2017 to evaluate the economic contribution of Crab Orchard National Wildlife Refuge to the local economy (USFWS 2019b). Based on that study, recreational spending in local communities was associated with about 315 jobs, $8.37 million in employment income, $2.3 million in tax revenue, and 29.2 million in economic output. In 2007, the economic value of crops produced on the Refuge was more than ten percent of the total economic value of all Williamson County crops. The economic value of grazing on the Refuge was about eight percent of the total economic value of grazing for Williamson County. For commercial and industrial space, the Refuge accounts for just over one percent of industrial/ commercial site acreage in the Greater Marion area (USFWS 2007).

Alternative A

Consultation with the Natural Resource Conservation Service (NRCS) from 2015-2017 indicated that most Refuge grazing pastures have restoration and repair needs that far exceed the amount of revenue generated from grazing fees. Annual revenue the refuge receives from grazing cooperators is usually enough to cover fence repair supplies, some herbicide, and occasionally a very small amount of the soil amendment needs. In 2014, one grazing unit was converted from fescue/clover to native warm season grasses and was divided into a paddock system as directed in the Comprehensive Conservation Plan. However, the revenue generated from the grazing program does not cover the additional fencing requirements or the creation of additional water supply needs to accommodate the paddock system. The analysis below further discusses the use of in-kind services to maintain and meet the current needs of the grazing program as described in the 2014 Region 3 Grazing and Haying Program Guidance (USFWS 2014). The conclusion of this analysis shows that the program is not financially sustainable long-term and requires additional refuge funds at a higher rate than any other agricultural use on refuge. Due to failing infrastructure, it is reasonable that this will only be exacerbated as time goes on.

Over the past 5 years, the grazing program has provided a refuge grazing value of $128,641.42 to farmers with $27,781.26 total paid to the refuge, Table 2. This means that $100,860.16 went to in-kind services provided by the farmer for services such as inter-seeding, mowing, gravel, fertilizer, etc.

- A total of $22,232.00 was spent in 2020 for fencing materials and to repair/build cattle ramps in some units. Approximately four years of grazing revenues would be needed to cover these expenses. This cost estimate did not include employee time, employee safety supplies, or equipment time and gas to build cattle ramps. Nor does it include the equipment time used to clean up fence lines of invasive species in 2020. Even with these monetary inputs, significant erosion, overuse, and failing infrastructure is still an issue.
- While the grazing program is now in a bid system, this only increased the grazing value by around $11,443.80 in 2020 from the average price of $23,439.53/year from 2016-2019.
- This analysis indicates revenues are not commensurate with expenses and program needs even under the bid system.

Alternative B

The refuge does not have an objective of profiting from grazing but needs to balance revenue with the costs of running the program. The refuge's grazing program has not proven to be cost effective or efficient and there are other ways to meet refuge purposes and objectives related to agriculture. Socioeconomic impacts under this alternative are expected to be highly beneficial because the cost to operate this program is more than the revenue generated. Furthermore, the in-kind services are not keeping up with the costs to operate or maintain the grazing program. However, over time, increased visitor use along the bike trail, increased fishing and hunting opportunities is expected to lead to increased visitor use in these areas and a larger impact outside of the refuge. In addition, an increase in row crop opportunities would lead to a substantially higher economic value to the local community and refuge than the refuge provides with grazing. This increased value can be used to remediate the damage that has been caused due to overgrazing and erosion.

Environmental Justice

Affected Environment

Description of Relevant General Features of the Affected Environment

Thoroughly described in the 2018 Crab Orchard National Wildlife Refuge Agriculture Program Environmental Assessment.

Description of Relevant Environmental Trends and Planned Actions

Environmental Consequences

Impacts on Affected Resource

Alternatives A and B

The Service has not identified any potential disproportionately high and adverse environmental or human health impacts from this proposed action to minorities or low-income populations or communities. Approximately 8.4% and 14% of the total population are minority or persons in poverty, respectively, within the impact area. Minority or low-income communities will not be disproportionately affected by any impacts from any of the alternatives due to the small number of cooperators (n=8) and acres impacted. Grazing cooperators on refuge represent 0.012% of the entire Williamson County population (U.S. Census Bureau 2019). Additionally, refuge grazing acres only account for a small percentage, less than 10%, available within the county.

Monitoring

Monitoring will occur regardless of the alternative selected to ensure that the alternatives continue to have no adverse impacts on the environment beyond those already described. The refuge uses an adaptive approach as part of all management programs to address impacts to the extent possible. Impacts from the elimination of grazing to refuge management, visitor services, fish, wildlife, erosion, soil nutrients, invasive species, infrastructure maintenance, CERCLA safety guidelines, and user conflicts will continue to be monitored through our ongoing efforts. Furthermore, vegetative response monitoring may be increased under alternative B, especially regarding invasive species as described previously. Additional follow-up monitoring of invasive species populations will be implemented to ensure success following any invasive species treatments prescribed resulting from monitoring under alternative B.

Summary of Analysis

Alternative A – No Action

Under this alternative, grazing units will continue to degrade over time due to erosion, over-grazing issues, and lack of soil nutrient inputs. Furthermore, the overall financial cost to maintain the grazing program outweighs the financial revenue generated in regards to infrastructure. There will be continued overlap and safety issues with UXO contaminated fields and recreational/industrial user conflicts within grazing units. Overall, there will be a lack of habitat management direction due to the past goal of providing goose browse and a lack of developed alternatives to this reduced goose use.

Alternative B –Complete Removal of Grazing Pastures

This alternative would eliminate user conflicts between visitors, tenants, and cooperators. It would reduce or stop erosion that has formed due to over-grazing, address invasive plant

concerns, increase water quality in ponds, and eliminate failing infrastructure concerns due to age, dying ash trees and associated fence maintenance, and slow or remediate soil nutrient losses. This is the most cost-effective alternative to provide long-term benefits to over 1,000 acres of refuge lands in the northern half of the refuge. The agricultural program is not being reduced in acreage with the proposed pause in grazing except for acreage with extreme erosion and within UXO contaminated areas. This alternative helps meet the purpose and needs of the Service as described in the refuge comprehensive conservation plan (USFWS 2007). Furthermore, this alternative leads to additional management strategies that maintain wildlife habitat for priority species such as pollinators, provide wildlife-dependent recreational opportunities, and maintain compliance with biological integrity, diversity, and environmental health policy. As outlined in the refuge comprehensive conservation plan, the refuge attempts to balance all purposes and while agricultural use is a mandated purpose, it is not specific to grazing. This alternative would allow for a more integrated approach to all four purposes: agriculture, industry, conservation of wildlife, and recreation.

List of Sources, Agencies and Persons Consulted

U.S. Fish and Wildlife Service Staff: Cathy Nigg, Refuge Area Supervisor; Jeanne Holler, Division of Conservation Planning Chief; Kristin Rasmussen, Conservation Planner

List of Preparers

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Tribal Consultation

Tribes and tribal members are welcome to provide comments during the public comment period. Formal tribal consultation was not required during this process as there are no federally recognized tribes active in the area to consult.

Public Outreach

The draft environmental assessment was made available to the public for review for a period of 21 days and one public meeting was held during the public review period. The draft environmental assessment was posted on the refuge website, Facebook page, a hard copy provided at the refuge's headquarters, and a press release went to 30 media outlets. Public comments were solicited from **March 15 through April 5, 2022**. Comments or requests for additional information could be submitted in person at the public meeting or through any of the following methods:

- **Email:** cassandra_skaggs@fws.gov or craborchard@fws.gov. Include "Crab Orchard Grazing Program Environmental Assessment" in the subject line of the message.
- **Mail:** U.S. Fish and Wildlife Service,
  Attn: Cassandra Skaggs
  6987 Headquarters Road
  Marion, Il 62959

All comments received from individuals became part of the official public record. All requests for such comments were handled in accordance with the Freedom of Information Act and National Environmental Policy Act regulations in 40 CFR 1506.6(f). The Service's practice is to make comments, including names and home addresses of respondents, available for public review during regular business hours. Individual respondents were able to request that we withhold their home address from the record, which we will honor to the extent allowable by law. Individuals wishing to withhold their name and/or address, were asked to state this prominently at the beginning of their comments. Individual comments were categorized and summarized in Appendix C, Public Comments Analysis Report. Individuals were not identified in the summary document. Service response to comments can also be found in Appendix C and are reflected in edits made to this final environmental assessment in the section on invasive species and air quality.

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Tables and Figures

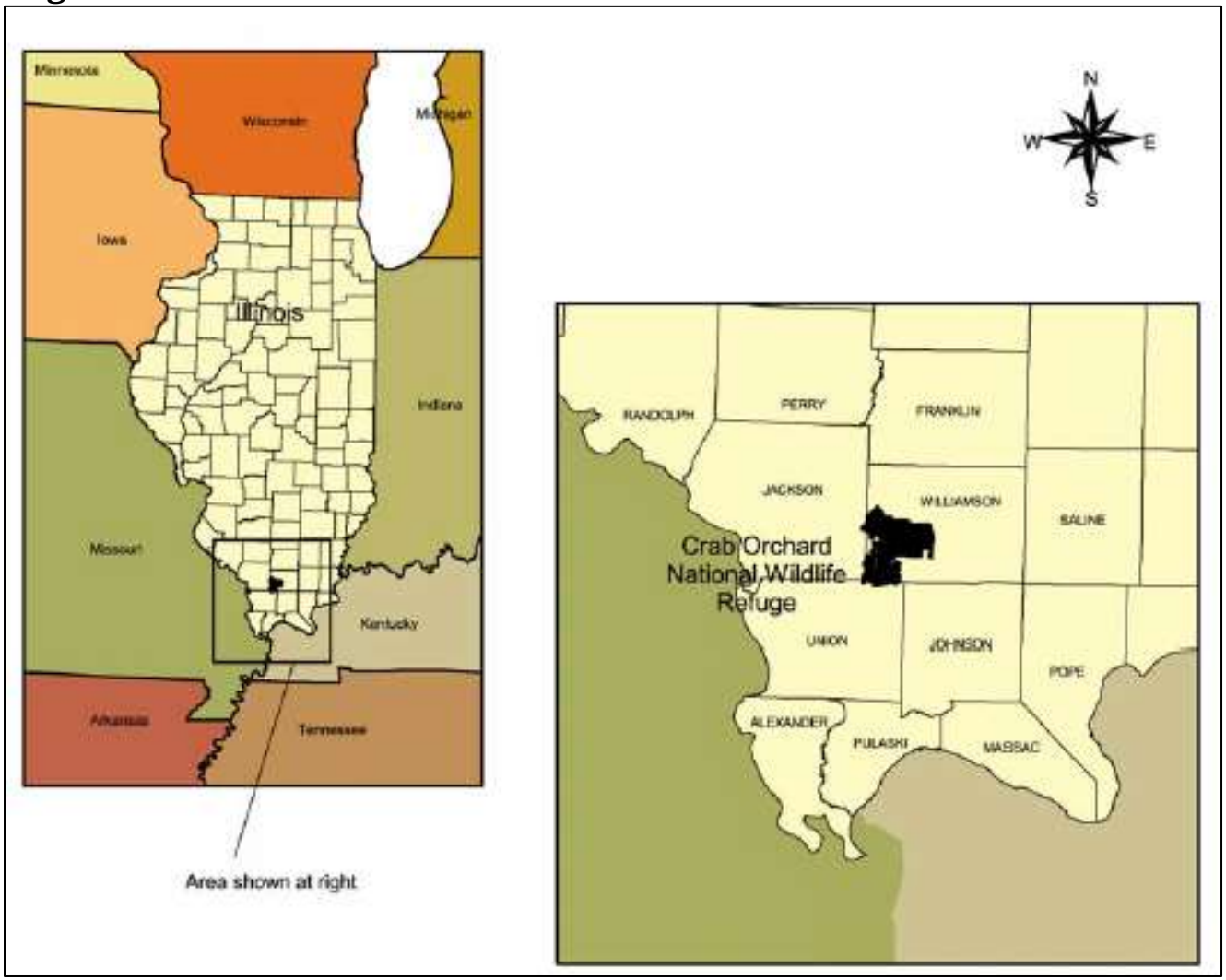

Figure 1. Location of Crab Orchard National Wildlife Refuge (refuge). The refuge is in southern Illinois within Williamson, Jackson, and Union counties.

Table 1. 2021 Grazing Farm Units with a total of ~100,881 linear ft of barbwire and ~8,300 linear ft of World War II fencing.

UNIT	ACRES	MAX AUMs	GRASS	FENCE	LINEAR FT.	# of Paddocks	WATER	ISSUES
Unit 1	104	42	Cool season dominant	Barbwire	13,164	1	1 unfenced pond (4.7 ac), intermittent streams	autumn olive encroachment, access route degrading, erosion around pond
Unit 2	274	110	Cool season dominant	WWII era 8 ft. chain-link/ Barbwire	5,600 chain-link/12,079 barbwire	2	2 fenced ponds (0.6 ac and 0.8ac), 1 unfenced pond(0.7ac), intermittent streams	autumn olive encroachment, poor chain-link fence condition, degraded cattle ramps (n=2), heavy erosion around ponds, recent sinkhole opened w/ unidentified boxes inside, buried explosives but CERCLA not sure where
Unit 3	94	38	Cool season dominant	WWII era 8 ft. chain-link/ Barbwire	1,200 chain-link/13,600 barbwire	1	1 fenced pond (7.7ac), 1 line to trough	severe erosion gullies along outside pond levee, phragmites on pond levee, beaver dams in pond overflow, extremely poor condition of chain-link fences, difficult to access south half of field in wet conditions
Unit 4	88	35	Cool season dominant	Barbwire	10,707	1	1 unfenced pond (2.2ac)	pond levee washout potential due to beaver dams, fence in forest may be absent, working with CERCLA to move fence (expensive), erosion along pond and levee
Unit 5	147	59	Cool season dominant	Barbwire	17,520	1	2 fenced ponds (0.9ac and 1.1ac), intermittent streams	UXO potential, no ground disturbance allowed, fence posts must be replaced in existing post holes, 2/3 of fence posts are likely 50+ yrs.

UNIT	ACRES	MAX AUMs	GRASS	FENCE	LINEAR FT.	# of Paddocks	WATER	ISSUES
								old, sink holes and erosion along 1,500 ft. of old drain tile which cannot be removed but filled with rock, extremely poor sections of fence, inaccessible portions of fence in forest section
Unit 6	109	44	Cool and warm season paddocks	Barbwire and electric	12,796 barbwire; electric dependent on permittee	2 barbwire, up to 5 with electric fencing	2 fenced ponds (0.5ac and 0.3ac) with 1 solar pump and underground lines to 2 water tanks, 1 intermittent shallow pond	water availability in drought years may require hauling of water; water systems require regular maintenance and inspection to ensure functionality, extensive erosion along ponds
Unit 7	86	34	Cool season dominant	Barbwire	9,265	1	2 fenced ponds (3ac and 2.5ac), intermittent stream	autumn olive, drawdown of northern pond occurs in summer for waterfowl food production, erosion along pond and near stream that cuts through unit
Unit 8	147	59	Cool season/ warm season mix	WWII era 8 ft. chain-link/ Barbwire	1,500 chain-link/11,750 barbwire	1	1 fenced pond(2.5ac), 1 unfenced pond(7ac), intermittent streams	autumn olive, public access on foot through the unit to fishing ponds, occasional cattle escape due to public access, some erosion

Table 2. Summation from 2016 to 2020 (5 years) of grazing values at the refuge by Grazing Unit.

Overall from 2016-2020 by Unit						
Graze	**Grazing Value**	**Paid**	**In Kind Services**	**Average Ac**	**$/acre value**	**$/acre paid**
Unit 1	$12,260.84	$1,475.14	$10,785.70	109.80	$111.67	$13.43
Unit 2	$31,846.70	$1,001.47	$30,845.23	278.80	$114.23	$3.59
Unit 3	$13,012.94	$329.09	$12,683.85	88.60	$146.87	$3.71
Unit 4	$14,872.44	$3,371.94	$11,500.50	92.20	$161.31	$36.57
Unit 5	$14,292.00	$807.59	$13,484.41	145.40	$98.29	$5.55
Unit 6	$14,779.59	$2,687.45	$12,092.14	105.80	$139.69	$25.40
Unit 7	$11,968.80	$2,596.49	$9,372.31	93.20	$128.42	$27.86
Unit 8	$15,608.11	$442.91	$15,165.20	149.40	$104.47	$2.96
Subtotal	**$128,641.42**	**$12,712.08**	**$115,929.34**	**1,063.20**	**$120.99**	**$11.96**

Grazing value- is the sum value of the unit each year from 2016 to 2020. This is the amount charged to the farmer before in kind service deductions and was based on the AUMs for each year prior to the bid system and in 2020 was the farmer's bid.
Paid- The amount the farmer paid to the USFWS
IKS on Unit- Amount the farmer had deducted from their rent to complete in kind services such as mowing, applying fertilizer and gravel, etc.
Average Ac- Average acreage of each unit that the farmer grazed
$/acre value-Average grazing value per acre based on total bid or amount paid during priority system
$/acre paid-Average amount paid per acre to the refuge

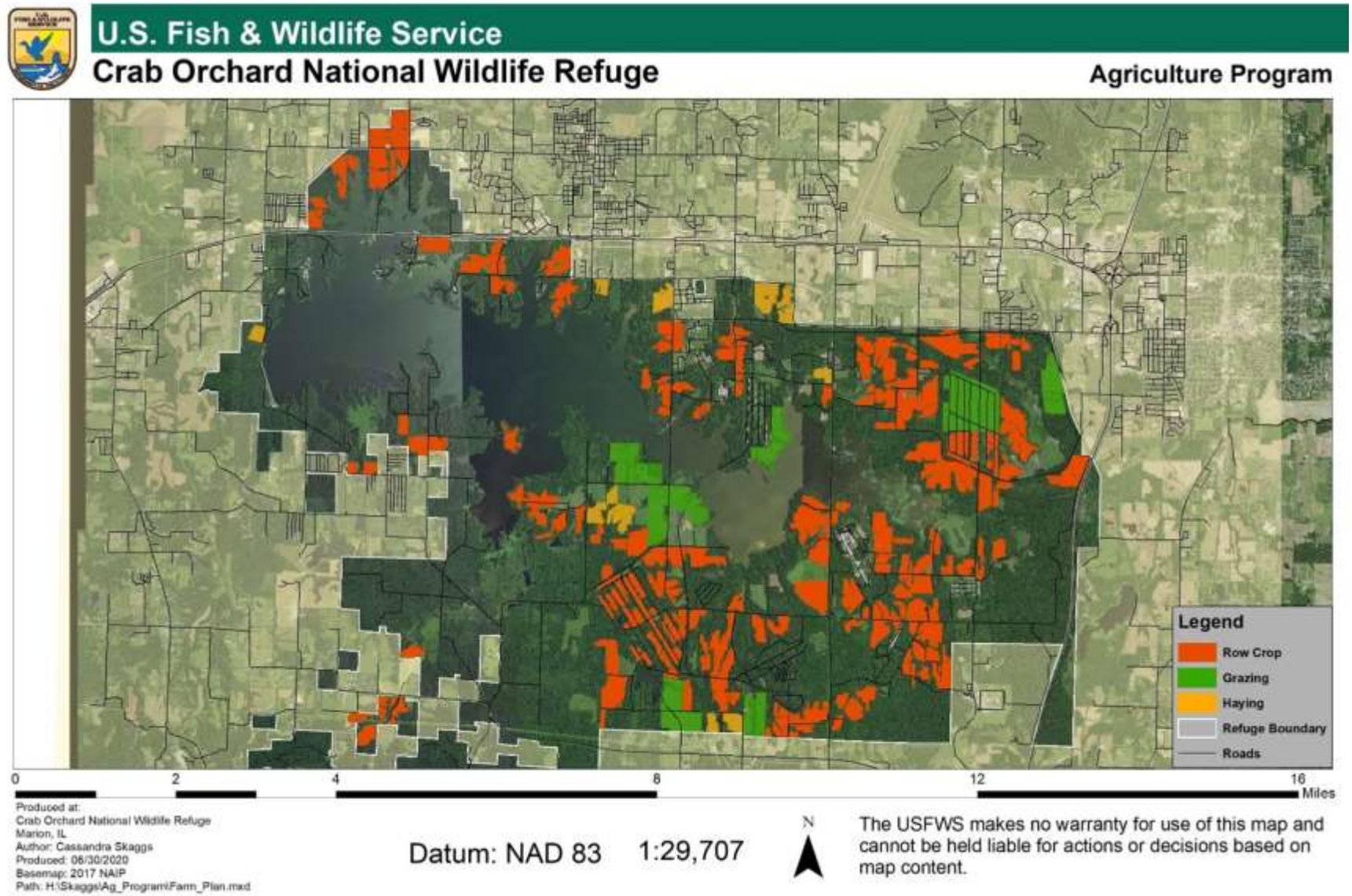

Figure 2. Location of Crab Orchard National Wildlife Refuge (refuge) entire agricultural program.

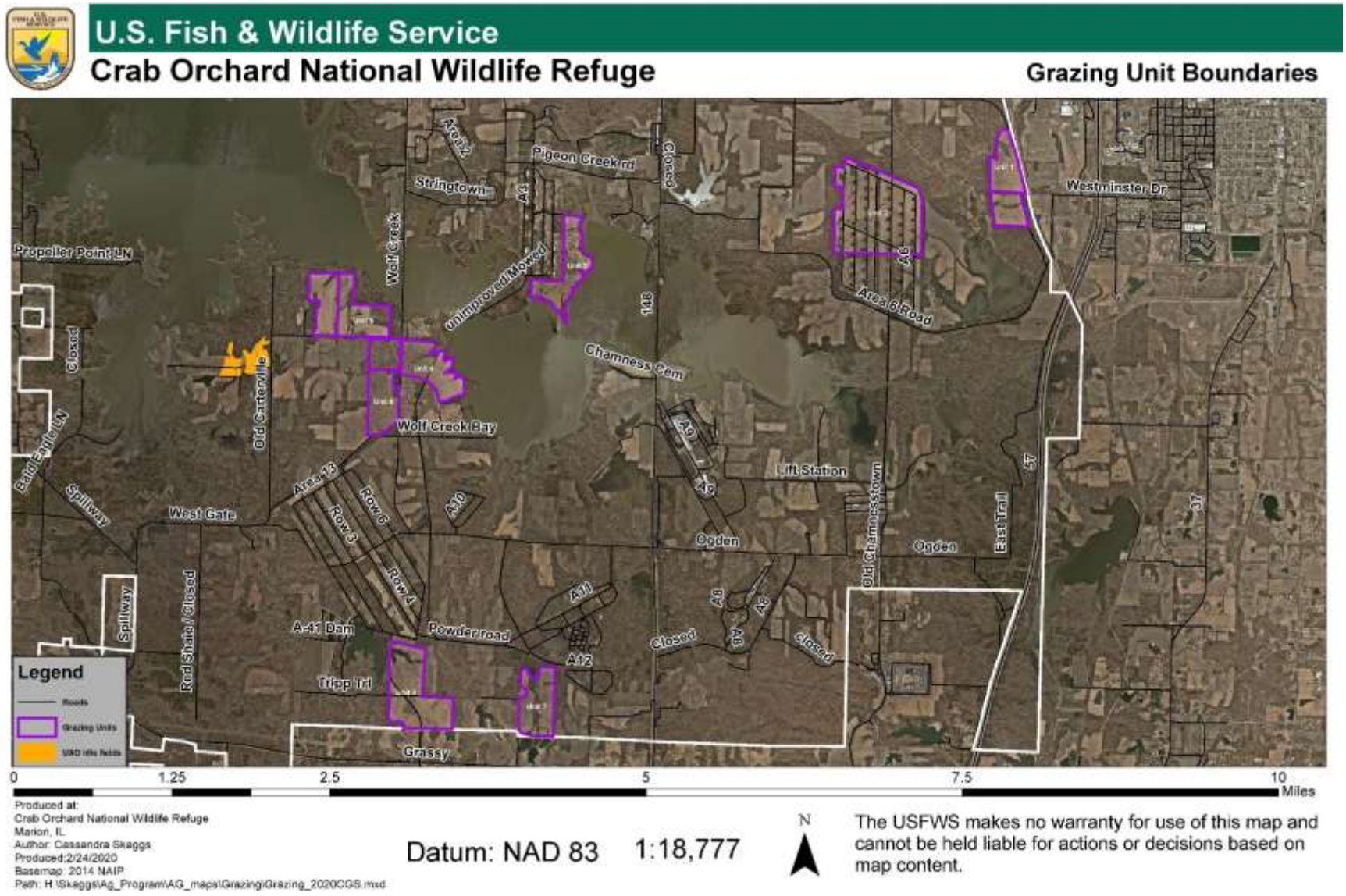

Figure 3. Location of Crab Orchard National Wildlife Refuge (refuge) grazing pastures.

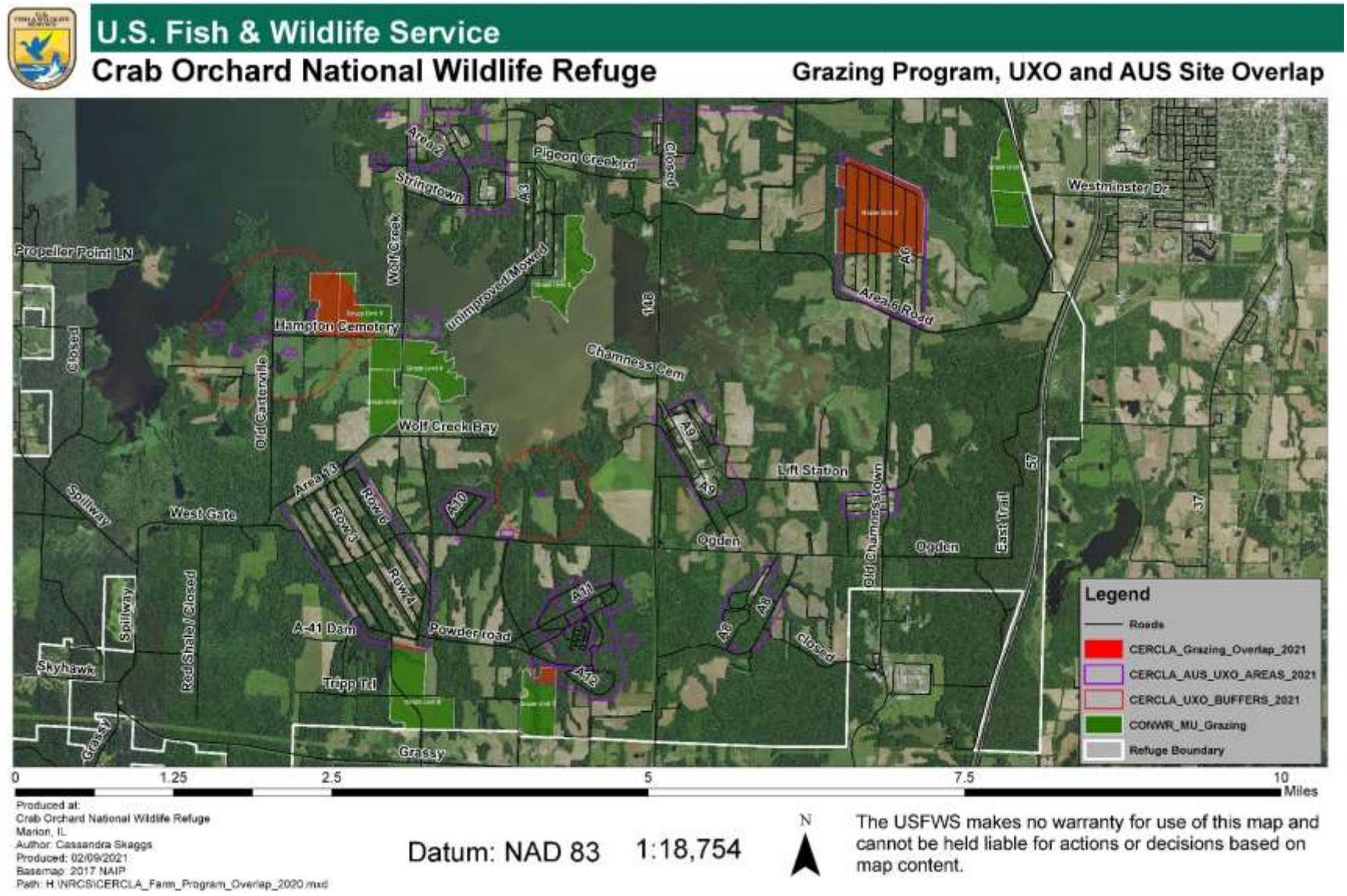

Figure 4. Location of Crab Orchard National Wildlife Refuge (refuge) grazing pastures and overlap with CERCLA area use restrictions.

Table 3. CERCLA restriction acres of overlap by grazing unit. Please note current Illinois Ordnance Plant site wide restrictions state, "No production water wells shall be installed, and residential use and camping are prohibited."

UNIT	PPE	ACRES	PERIM.	RxUnit	CERCLA_ID	LABEL	LUC
Unit 2	NO	263.42	14221.37		26	AREA-6	Access restricted, no soil removal w/o OSHA certified person, do not use soil for borrow material, no digging, trenching unless for facility operation
Unit 5	NO	110.64	10188.71		38, 39	UXO Buffers	No Rx Burns, CERCLA consult, No soil disturbance, No soil removal w/o OSHA certified person, No digging, trenching, **No AG Uses**
Unit 6	NO	0.40	614.09	II-903-G	39	COC2 500' Buffer	No Rx Burns, CERCLA consult, No soil disturbance, No soil removal w/o OSHA certified person, No digging, trenching, **No AG Uses**
Unit 7	YES	10.01	3187.70		23	AREA-12	No Rx Burns, No Hunting, CERCLA consult for earthmoving activity, Access restricted, no soil removal w/o OSHA certified person, do not use soil for borrow material, no digging, trenching unless for facility operation, **No AG Uses**
Unit 8	NO	3.47	3084.26		0	AREA-13	CERCLA consult for earthmoving activity, Access restricted, no soil removal w/o OSHA certified person, do not use soil for borrow material, no digging, trenching unless for facility operation

Figure 5. Location of Crab Orchard National Wildlife Refuge (refuge) grazing pastures (red star) in reference to the Illinois Agronomy Handbook subsoil phosphorus-supplying power (Fernández and Hoeft 2009).

Figure 6. Location of Crab Orchard National Wildlife Refuge (refuge) grazing pastures (red star) in reference to the Illinois Agronomy Handbook cation-exchange capacity of Illinois soils. The darkest areas are sands with low capacity (Fernández and Hoeft 2009)