

Environmental Assessment

Use of Row Crop Farming and Genetically-modified, Glyphosate-tolerant Corn and Soybeans on National Wildlife Refuges and Wetland Management Districts

**Lead Agency: United States Fish and Wildlife Service
Midwest Region**

January 2011





United States Department of the Interior

FISH AND WILDLIFE SERVICE
Bishop Henry Whipple Federal Building
1 Federal Drive
Fort Snelling, MN 55111-4056

IN REPLY REFER TO:

NWRS/CP

January 10, 2011

Dear Reviewer:

We are pleased to provide you with this Environmental Assessment (EA) evaluating the use of farming as a habitat management tool and the use of genetically-modified, glyphosate-tolerant corn and soybeans on lands within the National Wildlife Refuge System in the Midwest Region of the U.S. Fish and Wildlife Service.

The Midwest Region currently manages 54 national wildlife refuges and 12 wetland management districts in eight states: Illinois, Iowa, Indiana, Michigan, Minnesota, Missouri, Ohio and Wisconsin. Of the 1.2 million acres included in these refuges and districts, 20,000 acres, or 1.6 percent, are planted in row crops. The Midwest Region has been steadily reducing its use of farming as a management tool, and all four of the alternatives considered in the EA call for continued reduction of farming.

The EA is available online at: <http://www.fws.gov/midwest/planning/FarmingNEPA> Please call Jane Hodgins in the Division of Conservation Planning at 612-713-5395 if you would like a paper copy. (TTY 1-800-877-8339 (Federal Relay))

Written comments are welcome during the 30-day comment period that ends on February 8, 2011. Address e-mail to r3planning@fws.gov, and please include the words "Farming EA" in the subject line. Please address comments sent through U.S. Mail to:

U.S. Fish and Wildlife Service
Division of Conservation Planning
Attention: Farming EA Comment
BHW Federal Building, Room 530
1 Federal Drive
Ft. Snelling, MN 55111

It's important to all of us at the Fish and Wildlife Service that you have an opportunity to be involved in planning for the National Wildlife Refuge System. Thank you for taking the time to review and comment on this document.

Sincerely,

Mike Brown
Refuge Manager, Cypress Creek NWR

Environmental Assessment for the Use of Row Crop Farming and Genetically-modified, Glyphosate-tolerant Corn and Soybeans on National Wildlife Refuges and Wetland Management Districts in the Midwest Region

Abstract: The Midwest Region of the U.S. Fish and Wildlife Service uses row crop farming on lands within the National Wildlife Refuge System to achieve a variety of management objectives. This environmental assessment evaluates the effects of the use of genetically-modified, glyphosate-tolerant corn and soybeans and the use of farming as a management tool for multiple objectives on National Wildlife Refuge System lands and three other alternatives: farming for habitat restoration purposes only using genetically-modified, glyphosate-tolerant corn and soybeans, farming for multiple objectives without allowing the use of genetically-modified, glyphosate-tolerant corn and soybeans, and limiting farming to only special circumstances on Refuge System lands without allowing the use of genetically-modified, glyphosate-tolerant corn and soybeans. The evaluation is based on the issues and concerns identified during the planning process. The purpose of the proposed action is to administer a farming program that contributes to achieving the establishing purposes for National Wildlife Refuge System lands or the mission of the National Wildlife Refuge System.

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U.S. Fish and Wildlife Service

National Wildlife Refuge System

Midwest Region

Environmental Assessment

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Summary

Managed by the U.S. Fish and Wildlife Service (Service), the National Wildlife Refuge System includes more than 150 million acres of public lands and waters dedicated to habitat and wildlife conservation. The Refuge System includes 553 national wildlife refuges and 38 wetland management districts throughout the United States. The mission of the National Wildlife Refuge System is:

...To administer a national network of land and waters for the conservation, management and where appropriate restoration of the fish, wildlife and plant resources and their habitats for the benefit of present and future generations of Americans.

The Midwest Region of the Fish and Wildlife Service manages lands in eight states: Illinois, Iowa, Indiana, Michigan, Minnesota, Missouri, Ohio and Wisconsin. There are 54 national wildlife refuges and 12 wetland management districts in the Midwest Region. The Service's policy is to manage Refuge System lands using the most natural means available that will achieve the purposes and wildlife objectives for the refuge or wetland management district.

Although Service policy is to use the most natural means available to meet Refuge or District purposes and wildlife objectives, policy allows the use of cropland management in situations where objectives cannot be met through maintenance of more natural ecosystems (USFWS 1985). Service policy stipulates that only the minimum acreage required to meet objectives should be devoted to croplands. In the Midwest Region, row crops on Refuge System lands cover 20,418 acres, or 1.6 percent of Refuge System lands.

Row crops have been farmed on national wildlife refuges and wetland management districts for decades, however changes in Service policies and the development of genetically modified crops, specifically glyphosate-tolerant corn and soybeans, have prompted the Service to review crop farming as a land management tool. This Environmental Assessment (EA) will evaluate the use of farming on lands managed by the National Wildlife Refuge System and the use of genetically modified, glyphosate-tolerant (GMGT) corn and soybeans on Refuge System lands within the Midwest Region.

Chapter 1 describes the purpose and need for an EA, provides background on the Midwest Region's farming program, summarizes applicable laws and policies, describes public outreach efforts for this EA, and describes the issues that were identified by the public, state and federal agencies, and by Service staff. Chapter 2 describes the alternatives that are evaluated in this EA and also describes alternatives that were considered but not evaluated. Chapter 3 describes the Midwest Region's physical environment and socioeconomic character. Chapter 4 includes an evaluation of the alternatives. Chapter 5 lists the Service staff who prepared this EA.

Alternative A: Continue Farming for Multiple Objectives, GMGT Corn and Soybeans Allowed (No Action) is the proposed preferred alternative. This alternative would allow the continued use of farming as a management practice and it would allow the continued use of GMGT corn and soybeans. The alternative was identified as the preferred alternative based on benefits to the natural resources and the desire to have the least impact to the environment.

Chapter 1: Purpose and Need

1.1 Purpose

The U.S. Fish and Wildlife Service is the primary federal agency responsible for the conservation of habitat and wildlife. The Service manages the National Wildlife Refuge System, which is the largest system of lands managed primarily for wildlife conservation in the world. The Refuge System's mission 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.”

The purpose of this Environmental Assessment (EA) is to review and evaluate current and alternative actions that use farming as a habitat management tool to support establishing purposes of Refuge System lands or the Refuge System's mission, including the use of genetically modified, glyphosate-tolerant (GMGT) corn and soybeans on National Wildlife Refuge System lands in the Midwest Region (Figure 1 on page 2), and to then select a preferred alternative. Each alternative is evaluated based on the environmental consequences, including biological and socioeconomic impacts, in accordance with the National Environmental Policy Act (NEPA). Alternatives are also evaluated based on how effectively they support the purposes for which Refuge System lands were established and the mission of the Refuge System.

1.2 Need for Action

The increased use of GMGT corn and soybean crops and revised Service policies regarding farming and genetically modified organisms warrant a reevaluation of farming as a tool for wildlife and habitat management and the use of GMGT corn and soybeans on Refuge System lands in the Midwest Region.

1.3 Decision Framework

The Regional Director for the Midwest Region will make two decisions based on this EA:

- select an alternative regarding farming on Refuge System lands in the Midwest Region.
- determine if the selected alternative is a major federal action significantly affecting the quality of the human environment, thus requiring preparation of an Environmental Impact Statement.

Alternative A: Continue Farming for Multiple Objectives, GMGT Corn and Soybeans Allowed (No Action) is identified as the preferred alternative.

1.4 Background

Thirty-one refuges and wetland management districts out of a total of 66 in the Midwest Region currently use farming as one method of managing wildlife habitat. In 2010, 20,418 acres of Refuge System lands were farmed in the Midwest Region, which is 1.6 percent of the Region's total of 1.2 million acres. Refuge farmland accounts for 0.02 percent of the total 116 million harvested farming acreage in the eight-state Region (USDA 2009). A large portion of Refuge System lands in the Midwest Region were farmland when the Service acquired them, and it is estimated that 40 percent of land acquired in the future will be farmland prior to acquisition by the Fish and Wildlife Service. The majority of Refuge System units use farming as part of the process of restoring native habitat.

The general trend on all Refuge System lands in the Midwest Region has been to convert farmland to natural habitat because natural habitats have greater value for wildlife (Tilman et al. 2001).

The use of genetically-engineered organisms in American agriculture has increased substantially over the past decade. Genetically-modified, herbicide-tolerant crops were planted on 92 percent of the United States soybean acres and 80 percent of the corn acres in 2008 (Brookes 2010).

Figure 1: National Wildlife Refuge System Lands, Midwest Region of the U.S. Fish and Wildlife Service



Agriculture will likely play a part in management of Refuge System lands indefinitely. For all but a handful of urban refuges in the Midwest Region, row crops border existing Refuge System lands and frequently occur on lands adjacent to refuges and wetland management districts. Existing plans call for most agricultural areas on Midwest Region Refuge System lands to be restored to natural habitats. Successful habitat restoration requires planning, site preparation, planting materials, equipment, and staffing. Current budget levels make it unlikely that the Service could immediately address all of the Refuge System lands that require restoration to natural habitat. In comparison to the cost of restoring land, agriculture is a less expensive method of preparing sites for restoration and managing invasive or unwanted plant species until restoration can begin.

Farming as a management tool is conducted in one of several ways. The most common method is to work with neighboring farmers, referred to as “cooperators,” to plant a crop using their seed, labor, equipment, and other supplies in exchange for a portion of the crop. Another method is to charge a rental rate for farming with the entire crop harvested by the renter. This method is most commonly used when the objective is to prepare a tract for restoration to native habitat or to control weeds. Refuge staff also plant crops for wildlife, which requires the Refuge to have equipment, an operator, and supplies.

Farming is used as a management tool in four primary categories:

- habitat restoration
- habitat management
- supplemental food for wildlife
- attracting wildlife for viewing and photography

1.4.1 Habitat Restoration

Farming is used on Refuge System lands to maximize the destruction of seeds and unwanted plant parts from invasive or unwanted plant species and to create less competition and purer stands of native species. Seeds are very resilient and remain in the soil for a long time. If new plants are continually set back by farming activities and herbicide, the number of seeds left in the soil is eventually reduced. Farming row crops also helps eliminate weeds and stubble that make it difficult to get equipment such as tree planters or native grass no-till drills into a field. After a new parcel is acquired, it is typically farmed for the next 3 to 5 years. Typically cooperators use glyphosate-tolerant corn then glyphosate-tolerant soybeans during the last two years of farming.

Glyphosate is a broad-spectrum, non-selective herbicide. It is probably the most widely used herbicide worldwide and is generally considered to be highly effective, but toxicologically and environmentally safe (Duke and Powles 2008).

1.4.2 Habitat Management

In some cases, land managers use farming to set back succession and remove invasive or even native plants and woody vegetation from wetlands, including wetlands managed for wildlife food production. While Service policy is to restore land to native habitat, natural succession isn’t always the best route to achieving wildlife and habitat objectives given that the natural system has been greatly disrupted by human uses. Refuge and wetland management district managers manage habitat via soil disruption and flooding to maintain preferred habitats such as wetlands, which are a vital habitat to diverse species of wildlife.

1.4.3 Supplemental Food for Wildlife

The Service has used crops to supplement wildlife diets for decades. The availability of native foods decreased in the past century as land was converted to farming, and the loss of habitat continues as land is converted to housing developments and other human uses. In an effort to meet waterfowl population objectives established by various agencies and organizations, the Service planted row crops on Refuge System lands as an additional source of food during migration and wintering periods, when waterfowl have a greater need for high energy foods.

Leaving crops standing for wildlife has also been used to help some resident wildlife species survive severe winters. Corn, soybeans, and winter wheat are typical crops used by wildlife.

1.4.4 Attracting Wildlife for Viewing and Photography

To a lesser extent than habitat restoration, habitat management and supplemental feeding, row crops have also been a useful tool for attracting wildlife to areas where people can view and photograph them. Some national wildlife refuges use a stand of row crops to create “watchable wildlife” areas along auto tour routes or other areas that are accessible for visitors.

1.5 Authority, Legal Compliance, and Compatibility

Refuge System lands are managed consistent with a number of federal statutes, regulations, policies, and other guidance. The National Wildlife Ref-

uge System Administration Act of 1966, as amended (NWRS Administration Act, 16 U.S.C. 668dd-668ee) is the core statute guiding management of the National Wildlife Refuge System. The National Wildlife Refuge System Improvement Act of 1997 (P.L. 105-57) made important amendments to the NWRS Administration Act, one of which was the mandate that a comprehensive conservation plan be completed for every unit of the Refuge System. Among other things, comprehensive conservation planning has required field stations to assess their current farming program and establish objectives for the future.

More information about the National Wildlife Refuge System Act and the National Wildlife Refuge System Improvement Act of 1997 and a list of other laws, regulations, policies and executive orders that influence the Refuge System can be found on-line at:
<http://www.fws.gov/midwest/planning/FarmingEA>

1.6 Coordination with Other Regions and Agencies

Preparation of this EA was coordinated with a similar effort in the Mountain-Prairie Region of the Fish and Wildlife Service and the Office of Science and Technology Policy in Washington, D.C.

1.7 Public Outreach

In April 2010, representatives of various Service programs were asked to comment on the Refuge System farming program. The next step was to seek comment on farming on Refuge System lands from the public. Service staff from the Midwest Region coordinated with staff in the Mountain-Prairie Region to seek public comment on the use of GMGT corn and soybeans on Refuge System lands in 16 states. The Mountain Prairie Region developed a separate EA evaluating the use of glyphosate-tolerant corn and soybeans for habitat restoration and management purposes. The Midwest Region includes Illinois, Indiana, Iowa, Michigan, Minnesota, Missouri, Ohio and Wisconsin. The Mountain-Prairie Region includes the states of Colorado, Kansas, Montana, Nebraska, North Dakota, South Dakota, Utah and Wyoming.

In the Midwest Region, public outreach efforts included sending news releases to more than 790 media outlets, posting information at refuges and wetland management districts throughout the Midwest Region, providing information to local farming interests, and providing information to 107 congressional staff within the eight-state Region. In addition, the Midwest Region posted information on a website (<http://www.fws.gov/midwest/planning/>

[farmingNEPA/index.html](http://www.fws.gov/midwest/planning/NEPA/index.html)) throughout the planning process. Staff in the Mountain-Prairie Region sent information to 1,290 news outlets, posted information at Refuge headquarters bulletin boards and posted information on the internet. Three public meetings were held in the two regions, a total of 10 people attended. Open house events were held in Fergus Falls, Minnesota, Aberdeen, South Dakota, and Hartford, Kansas. Outreach efforts ended in early July 2010.

More than 30 written comments and e-mails were received from farmers participating in the Refuge System farming program, neighboring landowners, agricultural organizations, non-governmental organizations and biochemical interests for the Midwest Region scoping. These comments are summarized into three general categories:

1.7.1 Wildlife Issues

1. Use of GMGT corn and soybeans could provide an alternative for farming with less risk to wildlife.
2. Agricultural herbicides may be toxic to wildlife.
3. Refuge System units need to provide high energy food for migrating and resident wildlife.
4. Refuge System units need to provide concentrated food sources to attract wildlife for wildlife-dependent recreation.
5. Farming negatively impacts wildlife.

1.7.2 Habitat Issues

6. Farming and genetically modified crops (GMCs) can make habitat restoration and management more efficient and economical. Increased cost to the Refuge System for restoration and maintenance of habitats could make it more difficult to support diverse natural habitats.
7. Farming is an effective way to control invasive plants and invasion of woody species.
8. The Service should use conservation tillage practices to minimize soil erosion on cultivated lands.
9. Concern exists for developing herbicide resistance by using GMCs.

1.7.3 Socioeconomic Issues

10. Non-genetically modified seeds are becoming less available in local communities.
11. Not being able to use GMCs could make farming more costly for cooperators. Local farming cooperators will lose income if farming is reduced or eliminated.
12. Changing farming of Refuge System lands will impact the economy.

13. Use of GMGT corn and soybeans on Refuge System lands could impact neighboring organic farmers due to inadvertent gene flow from GM to organic crops.

Two comments were received on inadvertent crop-to-weed gene flow and possible negative effects of GM crops on human health and safety; they are addressed in Section 2.3.1 on page 7.

1.8 Issues Beyond the Scope of This EA

This EA is focused on the use of row crop farming as a management tool, and the use of GMGT corn and soybeans on National Wildlife Refuge System lands. It does not evaluate other issues, including:

- managed grazing of Refuge System lands
- haying on Refuge System lands
- genetically modified organisms other than GMGT corn and soybeans

Chapter 2: Description of the Alternatives

2.1 Formulation of Alternatives

Alternatives were developed based on a review of authorities, policies, and regulations as well as review of the comments received during the initial public comment period held to determine what issues should be addressed in this EA. This chapter describes the four alternatives:

1. Alternative A: Continue Farming for Multiple Objectives, GMGT Corn and Soybeans Allowed (No Action) (Preferred Alternative)
2. Alternative B: Farming for Habitat Restoration Objectives Only, GMGT Corn and Soybeans Allowed
3. Alternative C: Farming for Multiple Objectives, No GMGT Corn and Soybeans
4. Alternative D: Limited Row Crop Farming, No GMGT Corn and Soybeans

Development of the alternatives considered:

- The National Wildlife Refuge System Improvement Act of 1997
- Reasons for farming on Refuge System lands
- Refuge or wetland management district establishing purposes
- The availability and effectiveness of alternative management tools
- Benefits and impacts to wildlife
- Current goals and objectives identified in completed 15-year comprehensive conservation plans.

2.2 Alternatives Considered but Not Developed

2.2.1 No Farming

Row crop farming will remain an issue with the management of Refuge System lands since:

- Crab Orchard National Wildlife Refuge has agriculture as one of its legislated establishing

purposes (see “2.3.8 Crab Orchard NWR Farming Program” on page 9).

- About 40 percent of any new lands added to the Refuge System in the Midwest Region in the future will probably be row crop land. Most of these acres will need to be prepared for restoration to natural habitats. The Service lacks the resources to restore all of these acres without the use of row crop farming. Fields that are abandoned and left to undergo unmanaged succession are unlikely to result in desirable vegetation (see Section 2.2.2 in this section).

Immediate elimination of row crop farming was not carried forward for evaluation in this EA because it would not be likely to fulfill the establishing purposes of refuges and wetland management districts.

2.2.2 Unmanaged Succession

Unmanaged succession occurs when land is allowed to grow back with no human land management. This approach to restoration takes more time when compared to active management methods and typically results in a stand of vegetation dominated by undesirable, non-native plants. This is particularly true for lands that have been farmed for many years; the longer a tract is farmed, the less likely it is for native plant species to remain. This strategy for managing land is less efficient than active restoration because native plant species are competing with invasive plants. Not only can unmanaged succession be unpopular with local weed boards, it can result in violations of local and state laws pertaining to control of noxious weeds.

Unmanaged succession was not carried forward for evaluation in this EA because its results are not normally adequate to fulfill the establishing purposes of refuges and wetland management districts.

2.3 Elements Common to All Alternatives

Several elements are common to all four alternatives evaluated in this EA. These elements are listed here and are discussed in more detail in the following paragraphs.

- Issues Receiving Extensive Analysis During Comprehensive Assessments by the U.S. Department of Agriculture
- Adherence to the National Wildlife Refuge System Administration Act, as Amended by the National Wildlife Refuge System Improvement Act of 1997
- Adherence to FWS Appropriate Use and Compatibility Policies
- Agricultural Lands Will Decrease on Refuge System Lands
- Procedures and Limits on Herbicide Use
- Integrated Pest Management
- Adherence to Midwest Region Refuge System Farming Policy
- Crab Orchard NWR Farming Program

2.3.1 Issues Receiving Extensive Analysis During Comprehensive Assessments by the U.S. Department of Agriculture

Since 1986, the U.S. Department of Agriculture (USDA), the Environmental Protection Agency (EPA) and Food and Drug Administration (FDA) have been the federal agencies responsible for assessing the safety of products of modern biotechnology. Assessments are based on the biological characteristics of each new organism. The USDA's Animal and Plant Health Inspection Service (APHIS) has completed comprehensive assessments of GMGT corn and soybeans through National Environmental Policy Act (NEPA) review. This review did not find significant impacts regarding:

- *Weediness*

Corn and soybeans have been grown throughout the world without any report that they are serious weeds. They are not generally persistent in undisturbed environments without human intervention. In the year following cultivation, they may grow as a volunteer only under specific conditions and can be easily controlled by herbicides or mechanical means. They do not compete effectively with cultivated plants or primary colonizers.

- *Human health and safety*

The engineered proteins in GMGT corn and soybeans are not known to have any toxic properties and have minimal potential to be food allergens.

- *Non-target species*

The engineered proteins in GMGT corn and soybeans are not known to have any toxic properties and have minimal potential to be food allergens.

- *Inadvertent crop-to-weed gene flow*

There are no known species of weeds that are sexually compatible with corn or soybeans.

The most recent EAs by APHIS that assess GMGT corn and soybeans may be found at the following web addresses:

http://www.aphis.usda.gov/brs/aphisdocs2/06_17801p_com.pdf

http://www.aphis.usda.gov/brs/aphisdocs2/00_01101p_com.pdf

2.3.2 Adherence to the National Wildlife Refuge System Administration Act, as Amended by the National Wildlife Refuge System Improvement Act of 1997

The National Wildlife Refuge System Improvement Act of 1997 amended the National Wildlife Refuge System Act of 1966 and created comprehensive legislation spelling out how the Refuge System would be managed and how it could be used by the public. All of the alternatives evaluated in this EA are consistent with the main points of the Improvement Act:

- Wildlife conservation comes first on national wildlife refuges.
- The Service will adhere to biological integrity, diversity and environmental health of the Refuge System.
- Compatibility determinations will guide uses of Refuge System lands.
- Six wildlife-dependent recreational uses are priority public uses of the Refuge System: hunting, fishing, wildlife observation and photography, environmental education and interpretation.
- A comprehensive conservation plan will be prepared for every refuge and wetland management district.

2.3.3 Adherence to FWS Appropriate Use and Compatibility Policies

All of the alternatives evaluated in this environmental assessment would adhere to two policies guiding decisions on activities allowed on lands managed by the National Wildlife Refuge System: Appropriate Use and Compatibility.

The Appropriate Refuge Uses policy describes the initial decision process a refuge or district manager follows when first considering whether or not to allow a proposed use on a national wildlife refuge or wetland management district. The manager must find a use appropriate before undertaking a compatibility review of the use. An appropriate use, as defined by the Appropriate Use Policy (603 FW 1 of the Service Manual), is a proposed or existing use on a refuge that meets at least one of the following four conditions:

- The use is a wildlife-dependant recreational use as identified in the Improvement Act.
- The use contributes to the fulfilling of the refuge purpose(s), the Refuge System mission, or goals or objectives described in a refuge management plan approved after October 9, 1997, the date the Improvement Act was signed into law.
- The use involves the take of fish and wildlife under State regulations.
- The use has been found to be appropriate as specified in section 1.11 (603 FW 1 of the Service Manual).

Lands within national wildlife refuges are different from other multiple-use public lands in that they are closed to all public uses unless specifically and legally opened. Unlike national wildlife refuges, the waterfowl production areas that make up wetland management districts are considered open to hunting unless posted “closed.” The Improvement Act states “. . . the Secretary shall not initiate or permit a new use of a Refuge or expand, renew, or extend an existing use of a Refuge, unless the Secretary has determined that the use is a compatible use and that the use is not inconsistent with public safety.” The Improvement Act also states that “. . . compatible wildlife-dependent recreational uses (hunting, fishing, wildlife observation and photography, or environmental education and interpretation) are the priority general public uses of the System and shall receive priority consideration in Refuge planning and management.”

In accordance with the Improvement Act, the Service has adopted a Compatibility Policy (603 FW 2) that includes guidelines for determining if a use proposed on a national wildlife refuge or wetland management district is compatible with the pur-

poses for which the refuge or district was established. A compatible use is defined in the policy as a proposed or existing wildlife-dependent recreational use or any other use of National Wildlife Refuge System lands that, based on sound professional judgment, will not materially interfere with or detract from the fulfillment of the NWRs mission or the purposes of the Refuge. The policy also includes procedures for documentation and periodic review of existing refuge uses.

A compatibility determination evaluates a proposed use and shows whether it has been determined to be “compatible” or “not compatible.” The public has an opportunity to review and comment on draft compatibility determinations, often during the comprehensive conservation planning process.

2.3.4 Agricultural Lands Will Decrease on Refuge System Lands

Under all alternatives evaluated, the amount of Refuge System lands that are planted in row crops will diminish as land is restored to natural habitat. How quickly the farming program decreases varies with each alternative.

The Service’s Biological Integrity, Diversity and Environmental Health policy (601 FW3) provides direction on the use of farming (including row crops) and directs land managers to restore land to native habitats. Individual refuge and wetland management district farming programs have been reviewed in comprehensive conservation plans and in many cases are being greatly reduced or entirely phased out. Farming currently occurs on 1.6 percent of lands within the Refuge System in the Midwest Region. Over the next 15 years, we expect to reduce row crop farming to 0.8 percent to meet planned restoration objectives.

2.3.5 Procedures and Limits on Herbicide Use

Under all of the alternatives evaluated, protective measures will be followed to ensure the proper use of herbicides on Service lands. Service policy requires that land managers complete a Pesticide Use Proposal, or PUP, before applying herbicide on Service lands. Each PUP must be approved by Environmental Contaminant staff or National Wildlife Refuge staff at the field, regional and national levels, depending on the pesticide being proposed for use. Only a limited number of herbicide can be approved for use at the refuge or district level. Requiring PUPs helps ensure that product label instructions are followed, that pesticides are used effectively and safely, that the lowest risk products are selected, and that buffers are maintained.

2.3.6 Integrated Pest Management

All alternatives considered would adhere to the Service's Integrated Pest Management guidance.

Integrated pest management, or IPM, is "a sustainable approach to managing pests by combining biological, cultural, physical, and chemical tools in a way that minimizes economic, health, and environmental risks" (7 USC 136r-1). Integrated pest management coordinates the use of pest biology, environmental information, and available technology to prevent unacceptable levels of pest damage by the most economical means, while posing the least possible risk to people, property, resources, and the environment.

More information on integrated pest management is available in Service guidance issued on preparing and implementing IPMs: <http://www.fws.gov/contaminants/Issues/IPM.cfm>

2.3.7 Adherence to Midwest Region Refuge System Farming Policy

All of the alternatives developed in this EA would adhere to national and regional policy related to farming on National Wildlife Refuge System lands.

Nationally, the Fish and Wildlife Service policy related on Biological Integrity, Diversity and Environmental Health (601 FW 3, 2001; Amendment 1, 2006) states:

We do not allow Refuge System uses or management practices that result in the maintenance of non-native plant communities unless we determine there is no feasible alternative for accomplishing refuge purposes(s). For example, where we do not require farming to accomplish refuge purpose(s), we cease farming and strive to restore natural habitat. Where feasible and consistent with refuge purpose(s), we restore degraded or modified habitats in the pursuit of biological integrity, diversity, and environmental health. We use native seed sources in ecological restoration. We do not use genetically modified organisms in refuge management unless we determine their use is essential to accomplishing refuge purpose(s) and the Regional Chief or the Assistant Manager, California/Nevada Operations Office (CNO), National Wildlife Refuge System, approves the use.

The Midwest Region incorporated national policy into the Region's policy on farming in 2010:

Where feasible and consistent with Refuge purpose(s), Region 3 staff (we) restore and manage degraded or modified habitats in the pursuit of biological integrity, diversity, and environmental

health. We do not allow Refuge uses or management practices that result in the maintenance of non-native plant communities unless we determine there is no feasible alternative for accomplishing the Refuge purpose(s). Where farming is not required for Refuge purpose(s), we cease farming and strive to restore natural habitats. We do not use genetically modified organisms in Refuge management unless we determine their use is essential to accomplishing Refuge purpose(s) and the Chief of Refuges for Region 3 approves the use. The use of genetically modified organisms is limited to herbicide-resistant crops only (September 24, 2010, Notice from Midwest Regional Refuge Chief).

2.3.8 Crab Orchard NWR Farming Program

Under all alternatives evaluated, including Alternative D: Limited Row Crop Farming Allowed Only in Special Circumstances, row crop farming would continue at Crab Orchard NWR. The use of GMGT corn and soybeans at Crab Orchard NWR varies among the alternatives.

Established in 1947, Crab Orchard NWR is a 45,456-acre refuge located in southern Illinois. Public Law 80-361 mandated that the lands transferred from the Department of War and Soil Conservation Service be administered by the Secretary of the Interior through the Fish and Service "for the conservation of wildlife, and for the development of the agricultural, recreational, industrial, and related purposes specified in this Act."

The Crab Orchard NWR Environmental Impact Statement/Comprehensive Conservation Plan was approved in 2006. As part of the planning process, Refuge staff established a farming program that includes farming approximately 4,400 acres of row crops. As mandated by the National Wildlife Refuge System Improvement Act of 1997, the Refuge will be managed according to its approved EIS/CCP and the farming program developed in that planning process will be followed.

2.4 Alternatives Considered

2.4.1 Alternative A: Continue Farming for Multiple Objectives, GMGT Corn and Soybeans Allowed (No Action) (Preferred Alternative)

Under Alternative A, the use of GMGT corn and soybeans on Refuge System lands in the Midwest Region would continue. Farming would continue to be used for multiple objectives, including but not limited to the following:

- Provide supplemental foods for wildlife

- Manage invasive species
- Prepare land for restoration and maintenance of native plant communities
- Attracting wildlife for the purpose of enhancing wildlife observation opportunities.

Currently, farming programs involve either Service staff and equipment or a third party, often referred to as a “cooperator,” who farms under the terms and conditions of a cooperative farming agreement or special use permit issued by the refuge or district manager. Refuge and District managers establish how long farming would be allowed on a specific tract, establish the crops and crop rotation that will be used, define the process of selecting cooperators, and determine payment rates. The terms and conditions typically include a provision for leaving some percentage of the crops in the field as food for wildlife, primarily migrating birds. The farming activities would have to be found compatible through a compatibility determination.

Refuge and district staffs work with farming cooperators to use best management farming practices to improve soils, reduce pest issues, lessen impacts to wildlife, and to prevent sediment, chemical and nutrient runoff. These practices include crop rotation, cover crops, no-till planting, and use of herbicides with low environmental impact. Crop type is determined by the refuge and district staffs and is based on wildlife needs, soil types, and integrated pest management. The most commonly planted crops are corn, soybeans, and winter wheat.

Farming would continue to be allowed using either conventional farming techniques or no-till (conservation) farming. The Service prefers conservation tillage, also called no-till farming, because it only minimally disturbs the soil through tillage. Using traditional farming techniques, mechanical equipment such as tractors, plows, disks, harrows, and seeders would typically be used on a parcel several days each year. Farming activities could include: soil preparation, planting, nutrient management, pest management, and harvesting (<http://www.epa.gov/oecaagct/ag101/crop.html>).

Conditions outlined in the Service’s cooperative agreement would be followed. Many of these conditions relate to the Environmental Protection Agency’s CORE 4 conservation practices :

- Conservation tillage
- Crop nutrient management
- Pest management
- Conservation buffers

2.4.2 Alternative B: Farming for Habitat Restoration Objectives Only, GMGT Corn and Soybeans Allowed

Under Alternative B, the use of GMGT corn and soybeans on Refuge System lands in the Midwest Region would continue. Beginning in 2012, as Refuge and District comprehensive conservation plans are revised, the use of farming as a management tool would be limited to the restoration of native habitats only. Future newly purchased lands could be farmed for 3 years until being restored to native habitat. Crop farming would decrease at a greater rate than it is currently because it would no longer be used for habitat management, supplemental wildlife food, or attracting wildlife for observation and photography. As habitat restoration objectives are met, row crop farming would disappear from all but newly acquired lands where habitat restoration has not occurred.

Like Alternative A, this alternative retains the option to use genetically-modified, glyphosate-tolerant corn and soybeans as a management tool for preparing farm land for conversion to native habitats. Refuge and wetland management district managers would have to verify that farming is essential to meet refuge purposes and would obtain approval through the Midwest Refuge Chief.

Like Alternative A, farming for multiple purposes would continue at Crab Orchard NWR.

Like Alternative A, either Service staff and equipment or a third party, often referred to as a “cooperator,” would plant corn and soybeans under the terms and conditions of a cooperative farming agreement or special use permit issued by the refuge manager. Refuge and District managers establish how long farming would be allowed on a specific tract, establish the crops and crop rotation that would be used, define the process of selecting cooperators, and determine payment. Farming activities would have to be found compatible through a compatibility determination.

As in Alternative A, farming would continue to be allowed using either conventional farming techniques or no-till (conservation) farming. The Service prefers conservation tillage, also called no-till farming, because it only minimally disturbs the soil through tillage. Using traditional farming techniques, mechanical equipment such as tractors, plows, disks, harrows, and seeders would typically be used on a parcel several days each year. Farming activities could include: soil preparation, planting, nutrient management, pest management, and harvesting (<http://www.epa.gov/oecaagct/ag101/crop.html>).

Like Alternative A, conditions outlined in the Service's cooperative agreement would be followed. Many of these conditions relate to the Environmental Protection Agency's CORE 4 conservation practices:

- Conservation tillage
- Crop nutrient management
- Pest management
- Conservation buffers

2.4.3 Alternative C: Farming for Multiple Objectives, No GMGT Corn and Soybeans

Two years after approval of this EA, the use of GMGT corn and soybeans would no longer be allowed on Refuge System lands in the Midwest Region under Alternative C. As in Alternative A, farming would be used for multiple management purposes, including but not limited to the following:

- Provide supplemental foods for wildlife
- Manage invasive species
- Prepare land for restoration and maintenance of natural habitat
- Attracting wildlife for the purpose of enhancing wildlife observation opportunities.

Like Alternative A, refuge and wetland management district managers would have to verify that farming is essential to meet refuge purposes and would obtain approval through the Midwest Refuge Chief.

The farming program at Crab Orchard NWR would continue, however GMGT corn and soybeans would not be allowed.

Also like Alternative A, either Service staff or a third party cooperator would farm under the terms and conditions of a cooperative farming agreement or special use permit issued by the Refuge or District Manager. Refuge and District managers would establish how long farming would be allowed on a specific tract, establish the crops and crop rotation that would be used, define the process of selecting cooperators, and determine payment. Farming activities would have to be found compatible through a compatibility determination.

As in Alternative A, farming would continue to be allowed using either conventional farming techniques or no-till (conservation) farming. The Service prefers conservation tillage, also called no-till farming, because it only minimally disturbs the soil through tillage. Using traditional farming techniques, mechanical equipment such as tractors, plows, disks, harrows, and seeders would typically be used on a parcel several days each year. Farming activities could include: soil preparation, planting,

nutrient management, pest management, and harvesting (<http://www.epa.gov/oecaagct/ag101/crop.html>).

Like Alternative A, conditions outlined in the Service's cooperative agreement would be followed. Many of these conditions relate to the Environmental Protection Agency's CORE 4 conservation practices:

- Conservation tillage
- Crop nutrient management
- Pest management
- Conservation buffers

2.4.4 Alternative D: Limited Row Crop Farming, No GMGT Corn and Soybeans

Two years after approval of this EA, the use of GMGT corn and soybeans would no longer be allowed on Refuge System lands in the Midwest Region under Alternative D. Under this alternative, the Fish and Wildlife Service would discontinue the use of row crop farming on Refuge System lands within 5 years of the approval of this EA except of the following special circumstances:

1. As noted in Section 2.3.8: Crab Orchard NWR Farming Program on page 9, row crop farming would continue to be allowed at Crab Orchard NWR because the Refuge's establishing purposes include supporting agriculture.
2. Farming could occur on newly purchased lands for no more than 3 years if those lands were being farmed at the time of purchase. This exception would allow the Service time to prepare for restoration to natural habitat, give the individual farming the land at the time of the sale a period for planning and transition, and could facilitate Service land purchases.
3. Farming would continue on land not owned by the Service, but managed as part of the Refuge System, when farming is required by the signed agreement.
4. Farming could occur on a case-by-case basis for human health or environmental emergencies, for example control of serious disease vectors. Each case would require approval by the Regional Chief of Refuges.

The farming program at Crab Orchard NWR would continue, however GMGT corn and soybeans would not be allowed 2 years after approval of this EA.

Like Alternative A, Refuge and District Managers would have to verify that farming is essential to meet Refuge purposes and would obtain approval through the Midwest Refuge Chief.

Also like Alternative A, either Service staff or a third party cooperator would farm under the terms and conditions of a cooperative farming agreement or special use permit issued by the Refuge and District Manager. Refuge and District Managers would establish how long farming would be allowed on a specific tract, establish the crops and crop rotation that would be used, define the process of selecting cooperators, and determine payment rates. All farming activity would have to be found compatible through a compatibility determination.

In the limited situations in which it's allowed, either conventional farming techniques or no-till (conservation) farming would occur. The Service prefers conservation tillage, also called no-till farming, because it only minimally disturbs the soil through tillage. Using traditional farming techniques, mechanical equipment such as tractors, plows, disks, harrows, and seeders would typically be used on a parcel several days each year. Farming activities could include: soil preparation, planting, nutrient management, pest management, and harvesting (<http://www.epa.gov/oecaagct/ag101/crop.html>).

Like Alternative A, conditions outlined in the Service's cooperative agreement would be followed. Many of these conditions relate to the Environmental Protection Agency's CORE 4 conservation practices:

- Conservation tillage
- Crop nutrient management
- Pest management
- Conservation buffers

Chapter 3: Physical and Social Environment

3.1 Introduction

In the Midwest Region, the National Wildlife Refuge System includes 54 national wildlife refuges and 12 wetland management districts. The Midwest Region is comprised of eight states:

- Iowa
- Illinois
- Indiana
- Michigan
- Minnesota
- Missouri
- Ohio
- Wisconsin

While there is some topographical variation, these states can be characterized as being flat to either rolling or small hills. The Great Lakes Basin, the Ozark Mountains of southern Missouri, the rugged topography of southern Indiana and southern Illinois, and the rolling hills of southwestern Wisconsin and southeastern Minnesota are all exceptions.

The climate varies from Missouri, where the average high summer temperature is 90.5 and the average low winter temperature is 19.4 degrees Fahrenheit (http://netstate.com/states/alma/mo_alma.htm), to Minnesota, where the average high summer temperature is 83.4 degrees Fahrenheit and the average low winter temperature is -2.9 degrees Fahrenheit (http://netstate.com/states/alma/mn_alma.htm). Across the entire region, the average high summer temperature is 86 degrees Fahrenheit and the average low winter temperature is 10.4 degrees Fahrenheit. Precipitation ranges from 42.2 inches a year in Missouri to 27.4 inches in Minnesota. The average precipitation is 36.1 inches.

This chapter will provide only general environmental information about lands within the Midwest Region Refuge System. More specific information on specific refuges or wetland management districts is available on the station's web page: <http://www.fws.gov/midwest/refuges>

Information is also available in completed comprehensive conservation plans for Midwest Region refuges and wetland management districts:

<http://www.fws.gov/midwest/planning/completed-plans.html>

3.2 Habitat

Two hundred years ago, America's Midwest was characterized by vast prairies, forests, and wetlands. We know this by recreating landcover from historical surveyor notes, but differing classifications make it difficult to summarize forest acreages, especially where woody wetlands are mixed with upland forest. Figure 2 on page 14 shows estimates for historic woodland and prairie in the Midwest Region. Historical wetland data has been compiled for the nation using soils information, and Table 1 on page 15 depicts the historic versus current wetland acreages in the Midwest Region.

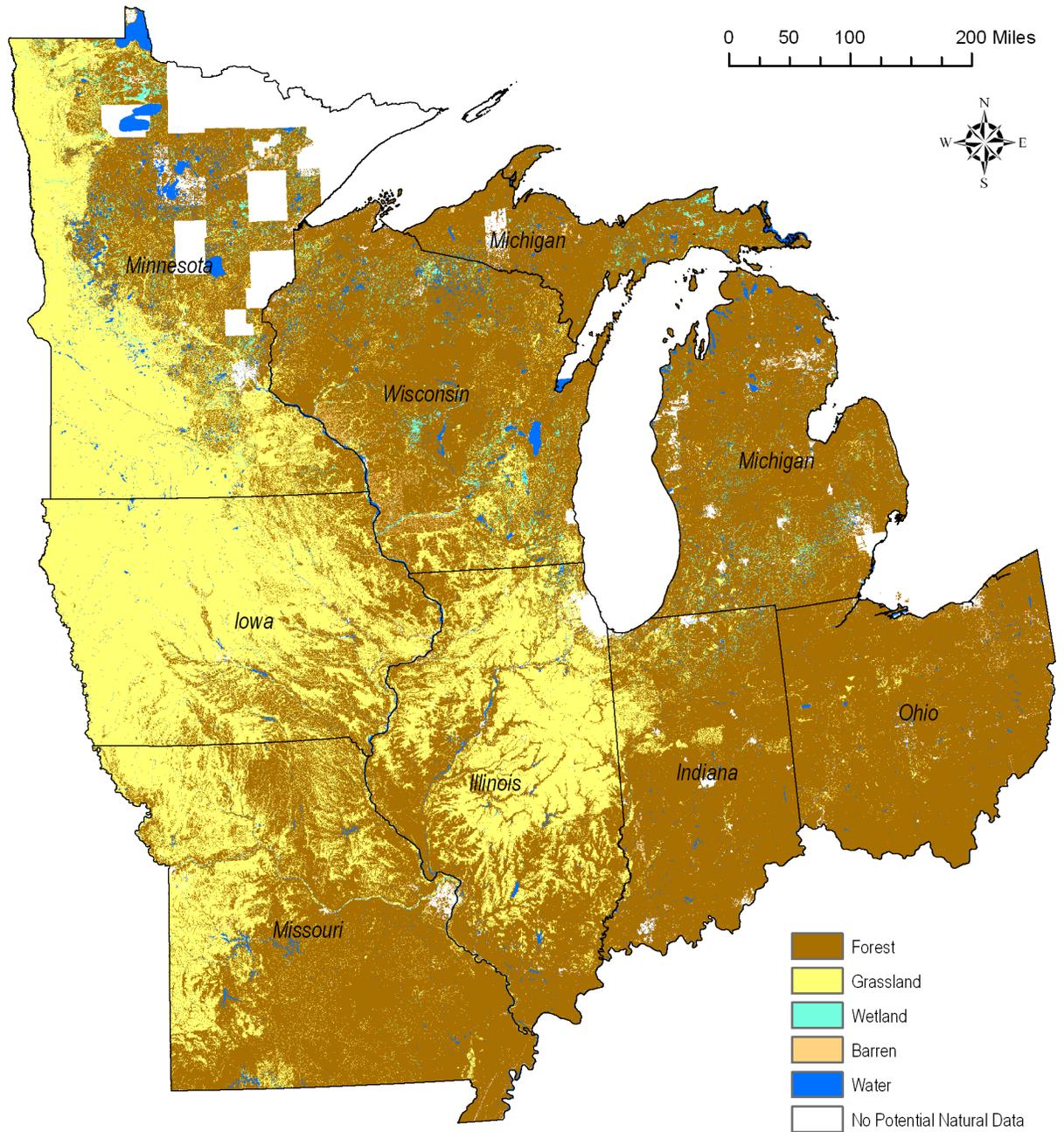
Today, agriculture is the dominant land use in the eight-state region (see Figure 3 on page 16). At least some portion of all eight states of the Region is within the area known as the "corn belt;" an estimated 50 percent of all corn grown in the U.S. comes from Iowa, Indiana, Illinois and Ohio. Cropland in these eight states accounts for approximately 29 percent of the nation's cropland.

As of 2010, the Refuge System included about 1.2 million acres in the Midwest Region of the Fish and Wildlife Service. Habitats include wetland, grassland, shrubland, woodlands with some agriculture. These lands can be characterized as:

- 41 percent upland
- 48 percent wetlands
- 11 percent percent of open water

Active management occurs on approximately 32 percent of the lands with 10 percent not requiring management and 58 percent of management deferred due to time or funding constraints. (USFWS 2010).

Figure 2: Potential Historic Natural Habitats in the Midwest Region ^a



a. Figure 2 is derived from SSURGO Soils data. It is important to note that even though some wetlands are mapped, the vast majority of the actual wetlands are included in the basic "Forest" and "Prairie" cover types. This makes it difficult to compare historic acres with today's land cover data.

Table 1: Wetland Loss, FWS Midwest Region

State	Size	Historic Wetland	Percent Loss	Current Wetland
Illinois	36,031,296	12,000,000	90%	1,260,000
Indiana	23,296,002	5,420,000	85%	813,000
Iowa	36,004,599	3,960,000	90%	432,000
Michigan	37,054,886	11,200,000	50%	5,558,000
Minnesota	54,091,771	19,000,000	50%	9,500,000
Missouri	44,692,764	4,843,000	87%	643,000
Ohio	26,363,888	5,000,000	90%	483,000
Wisconsin	35,895,698	10,800,000	50%	5,400,000
Totals:	293,430,904	72,223,000	67%	24,089,000
Source: http://water.usgs.gov/nwsum/WSP2425/state_highlights_summary.html 1997				

The Service acquires land for the National Wildlife Refuge System on a willing-seller-only basis, which means that refuges and wetland management districts grow slowly with numerous pockets of privately owned land referred to as “inholdings” occurring within acquisition boundaries (Table 2 on page 17).

3.3 Existing Management of Refuge System Lands

The Fish and Wildlife Service uses a variety of techniques to manage lands within the National Wildlife Refuge System, depending on the habitat, the presence of endangered species, and other factors. Habitat management tools include prescribed burning, mechanical and chemical treatment to manage invasive species, and managing water levels via impoundments to promote aquatic vegetation.

Row crop farming has been used to accomplish habitat restoration and management objectives, to attract wildlife for viewing and photography, and to provide supplemental high-energy food for migratory waterfowl and resident wildlife. Farming activities on refuges and wetland management districts are almost always a small part of the local farming economy. See Figure 4 on page 17 for an illustration of Refuge System farming activities compared to agricultural activities on a regional basis.

Land managers have steadily reduced the amount of cropland on refuges and wetland management districts over a number of years. Of the 1.2

million acres in the Refuge System in the Midwest Region, an estimated 20,418 acres was farmed for corn and soybeans in 2010, 5,775 fewer acres than were farmed in 2005 (see “Appendix A: Midwest Region Farming Information” on page 43).

3.4 Wildlife

A wide array of wildlife occurs on Refuge System lands in the Midwest Region. Species managed on these lands include migratory birds, threatened and endangered species, and fish. A variety of mammals, reptiles, amphibians, and insects also depend on Refuge System lands for food and cover. Refuge System lands in the Midwest Region support birds primarily from the Mississippi Flyway. This flyway is a natural path of bird migration from wintering grounds in the Gulf of Mexico or further south, then flights along the Mississippi tributaries obtaining sustenance along the way, and to nesting grounds in the Midwest Region or into Canada. In the fall, birds return south to their wintering ground. Migratory birds use Refuge System lands for resting, feeding and nesting.

Interjurisdictional fish follow the waterways in the region and may frequent waters on or adjacent to Refuge System lands. A variety of small and large mammals also inhabit Refuge System land and management of these resident species is shared with the respective state wildlife agency.

Figure 3: Current Land Cover in the Midwest Region of the FWS

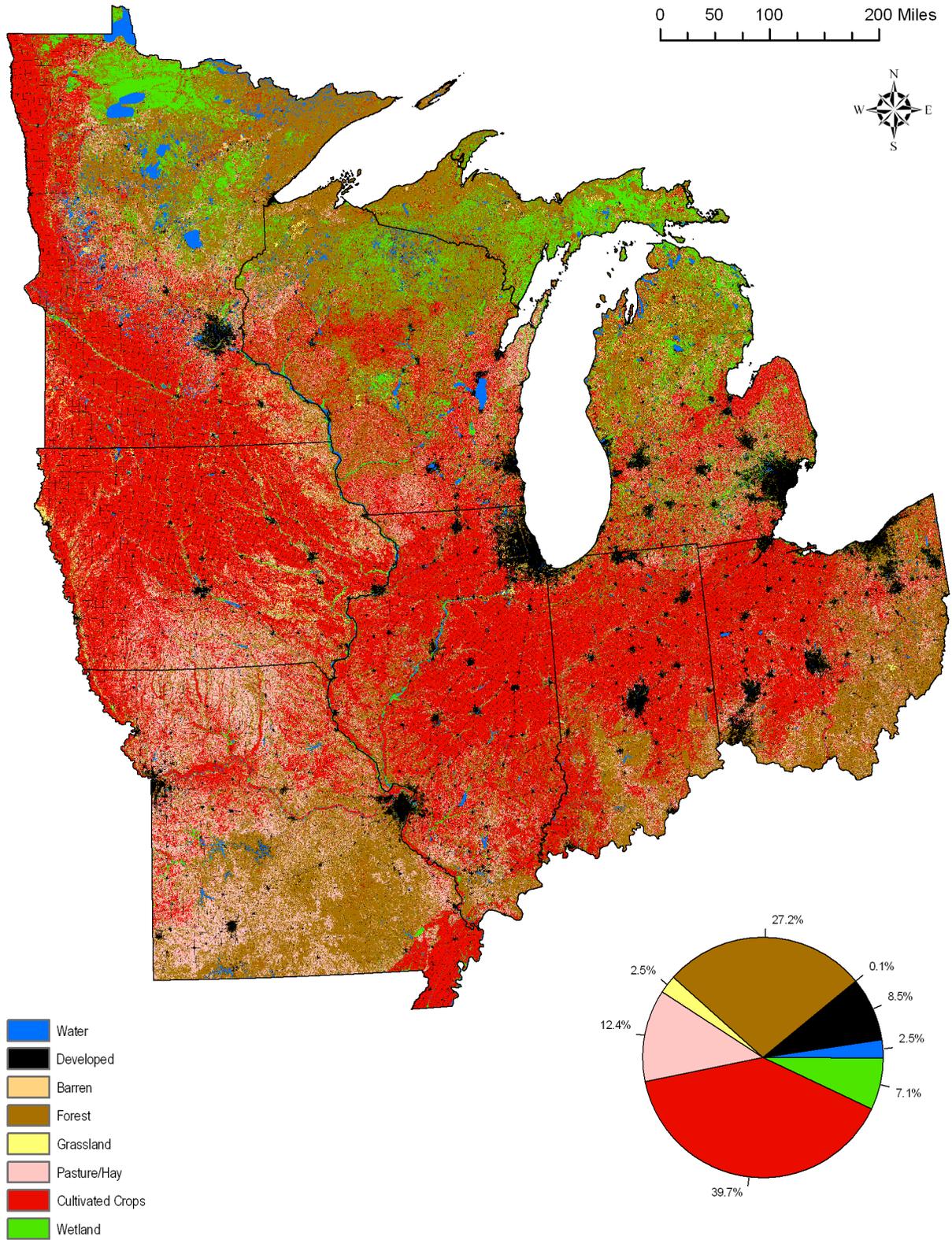


Figure 4: Agriculture on Refuge System Lands in the Midwest Region

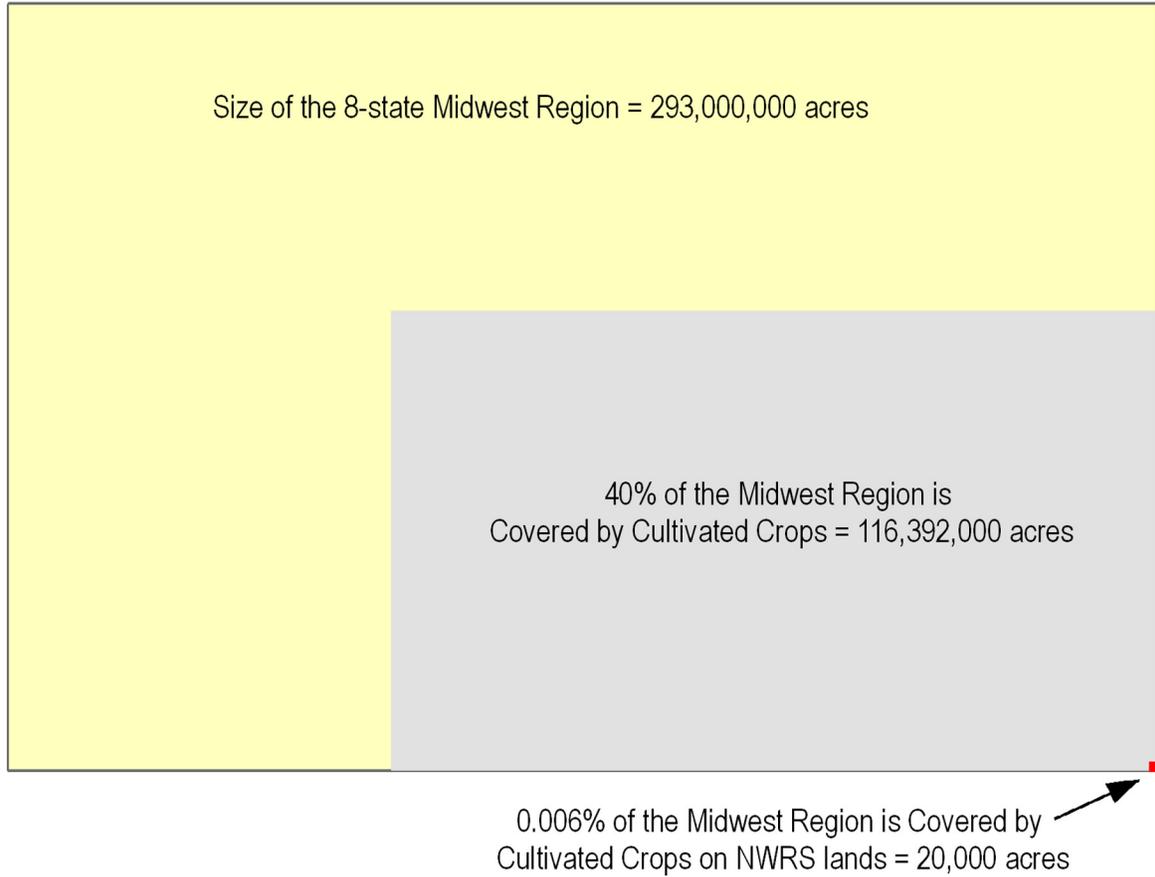


Table 2: Land Cover Within Inholdings, Midwest Region Refuge System Lands

Habitat Type	Percent of Total Inholding Acres	Acres Remaining
Water	12.0	39,491
Developed	4.1	13,396
Barren	0.3	1,127
Forest	11.9	39,162
Grassland	5.3	17,386
Pasture/Hay	4.6	15,278
Cultivated Crops	38.0	125,174
Wetland	23.7	77,987
Total Acres		329,000

3.5 Threatened and Endangered Species

Seventy threatened, endangered, candidate and experimental species are known to occur on Refuge System lands in the Midwest Region (see “Appendix B: Threatened and Endangered Species of the Midwest Region” on page 46). In general, the majority of these species will be found in more natural habitats rather than in the farmed lands. Occasionally some species may visit the fields for incidental feeding during migratory periods. More detailed information for each species listed can be found online at: <http://www.fws.gov/endangered/>

Refuge specific species can be found by searching the following database: http://www.fws.gov/refuges/databases/ThreatenedEndangeredSpecies/ThreatenedEndangered_Search.cfm

3.6 Invasive Species

Invasive species are defined as “non-native species whose introduction does, or is likely to cause economic or environmental harm or harm to human health” (National Invasive Species Council, www.invasivespecies.gov/). Invasive species can be plants, animals, and microbes, but discussion of invasive species in this EA refers to plant species.

Invasive species are a growing issue on Refuge System lands. Estimates of the number of invasive plant species in the Midwest Region reach up to 255 (Czarapata 2005). Invasive plants can spread quickly, displace native species, and create significant changes in natural environments. Some invasive plant species can affect the severity and frequency of wildfire. Some interfere with water flow, and others can alter nutrient availability and water quality.

While overall damages are difficult to determine, estimates of damage from invasive species in the U.S. have been as high as \$120 billion per year (Pimental et al. 2005).

3.7 Socioeconomic

The U.S. Census of 2000 counted 61,440,709 people living in the eight states that comprise the Midwest Region. According to Census data, 629,809 people operate farms in the eight-state region.

The value of agricultural production in the United States is concentrated into a few regions: the Midwest, the Mississippi Delta, California and the Atlantic Coast. Four of the states in the Fish and Wildlife Service’s Midwest Region are among the nine states that account for 50 percent of the total value of agricultural products: Iowa, Illinois, Minnesota, and Wisconsin (USDA Census 2007).

3.8 Cultural Resources

Both prehistoric and historical cultural resources are distributed throughout the eight-state Midwest Region. The majority of the areas that are farmed are located in previously disturbed areas which have very little likelihood of finding cultural resources.

Chapter 4: Environmental Consequences

This chapter discusses the potential effects of the actions proposed in the alternatives. Included in the discussion are the effects to the environment and human communities associated with the use of farming and GMGT corn and soybeans in the Midwest Region Refuge System lands.

4.1 Effects Common to All Alternatives

4.1.1 Endangered and Threatened Species

The use of GMGT corn and soybeans on Refuge System lands will not affect any threatened or endangered species. None of the plants and only a few of the animals that are listed as threatened or endangered in the Midwest Region (Appendix B) spend any time in corn or soybean fields. The USDA's APHIS completed environmental assessments of the use of GMGT corn and soybeans (USDA 2000, USDA 2007) and concluded:

1. There are no significant differences between the chemical compositions of GMGT and non-GMGT corn and soybeans. Contact with, or ingestion of, GMGT corn and soybeans are very unlikely to have any effect on any plant and animal.
2. Feeding experiments with chickens failed to detect any differences between GMGT and non-GMGT corn and soybeans regarding mortality rates, weight gain, and reproductive rates.
3. There are no known species of weeds that are sexually compatible with corn or soybeans, so there is no likelihood that there can be an unintended transfer of genes to a threatened or endangered species.
4. Corn and soybeans are very unlikely to escape into natural habitats because corn and soybeans can only persist with intensive human management, so there is no chance they will escape into native habitats occupied by threatened or endangered species.
5. Use of GMGT corn and soybeans will not significantly alter cultivation practices. Grain production in the Midwest Region will be dominated

by corn and soybeans that are treated with herbicides and synthetic fertilizers.

The USDA's APHIS routinely reviews potential impacts for proposals of the general release of genetically modified crops. In that agency's Environmental Assessment of GMGT soybeans and corn, APHIS included an evaluation on threatened and endangered species prior to general release. The final EAs and Findings of No Significant Impact (FONSI) for both crops concluded that no effect is expected on federally listed threatened and endangered species, species proposed for listing, or their proposed or designated critical habitats from exposure to GMGT corn or soybeans or from exposure to label rates of glyphosate expected to be used in conjunction with GMGT soybeans and corn. In addition, the U.S. Environmental Protection Agency has not received any reported adverse effects on threatened or endangered species or their habitats from exposure to glyphosate or GMGT soybeans and corn.

The use of farming as a management tool on NWRS lands will not affect any threatened or endangered species. None of the plants and only a few of the animals that are listed as threatened or endangered in the Midwest Region (Appendix B) spend any time in row crop fields. Endangered and threatened plant species listed would be negatively affected if exposed to herbicides during the growing season and this would need to be considered prior to spraying if threatened or endangered plants are located in the vicinity. Using herbicides will not impact threatened or endangered plants if:

1. Herbicides are applied following pesticide label instructions. These instructions include information regarding the use of a particular herbicide around water, near sensitive habitats, and near threatened and endangered species (<http://www.cdms.net/LabelsMsds/LMDefault.aspx?pd=6935&t=1,2,3,4>).

2. Conditions outlined in the Service's cooperative farming agreement are followed. Many of these conditions relate to best management practices designs to protect soil and water; and to manage pest and nutrients (<http://www.epa.gov/owow/watershed/wacademy/acad2000/agmodule/>).
3. Pesticide Use Proposals are completed, as required by Service policy. Pesticide Use Proposals are required before the application of pesticides on Service lands. Impacts to threatened or endangered species are considered during this annual review. (<http://www.fws.gov/contaminants/pdf/PUP.pdf>) or (<http://www.fws.gov/contaminants/Documents/7RM14.pdf>)
4. Integrated Pest Management Plans (<http://www.fws.gov/contaminants/Issues/IPM.cfm>) and Comprehensive Conservation Plans (website citation) that analyze the potential impacts of herbicide use on threatened or endangered species are completed for each NWRS unit.

4.1.2 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 Refuge or District Manager review, as well as review by the Service's 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 will occur.

4.1.3 Organic Soybeans

Organic farming is managed in accordance with the Organic Foods Production Act of 1990 to respond to site-specific conditions by integrating cultural, biological, and mechanical practices that foster cycling of resources, promote ecological balance, and conserve biodiversity. The USDA National Organic Program develops, implements, and administers national production, handling, and labeling standards (<http://www.ams.usda.gov/AMSv1.0/nop>). The use of genetic engineering is prohibited in the production of organic crops.

A review of potential impacts of glyphosate-tolerant soybeans and corn to Certified Organic Farmers was completed by APHIS prior to general release (USDA 2000, USDA 2007). The conclusion made

was that for soybeans, there should be no apparent potential for significant impact on organic farming through deregulation and general release. Soybeans are highly self-pollinated with large, heavy seeds that are not easily dispersed. Therefore minimal buffer zones are needed to prevent cross-pollination to other soybeans or contamination of adjacent agricultural land (USDA 2007).

No negative impacts on organic soybean farming are anticipated under any of the four alternatives evaluated.

4.2 Effects of Management Alternatives

This analysis of effects compares how each of the four alternatives adheres to Service policy and how they affect the environmental issues developed during public outreach and listed in Section 1.7: Public Outreach on page 4. The analysis for each alternative addresses the issues in the following outline:

Wildlife Issues

1. Use of GMGT corn and soybeans could provide an alternative for farming with less risk to wildlife.
2. Agricultural herbicides may be toxic to wildlife.
3. Refuge System units need to provide high energy food for migrating and resident wildlife.
4. Refuge System units need to provide concentrated food sources to attract wildlife for wildlife-dependent recreation.
5. Farming negatively impacts wildlife.

Habitat Issues

6. Farming and genetically modified crops (GMCs) can make habitat restoration and management more efficient and economical. Increased cost to the Refuge System for restoration and maintenance of habitats could make it more difficult to support diverse natural habitats.
7. Farming is an effective way to control invasive plants and invasion of woody species.
8. The Service should use conservation tillage practices to minimize soil erosion on cultivated lands.
9. Concern exists for developing herbicide resistance by using GMCs.

Socioeconomic Issues

10. Non-genetically modified seeds are becoming less available in local communities.
11. Not being able to use GMCs could make farming more costly for cooperators. Local farming cooperators will lose income if farming is reduced or eliminated.

12. Changing farming on Refuge System lands will impact the economy.
13. Use of GMGT corn and soybeans on Refuge System lands could impact neighboring organic farmers due to inadvertent gene flow from GM to organic crops.

4.2.1 Alternative A: Continue Farming for Multiple Objectives, GMGT Corn and Soybeans Allowed (No Action) (Preferred Alternative)

4.2.1.1 Summary of Alternative A Effects

Under Alternative A, the use of GMGT corn and soybeans on Refuge System lands in the Midwest Region would continue. Currently, about 50 percent of farmed Refuge System lands are scheduled to be restored to natural habitats over the next 15 years. Under Alternative A, the Service would adhere to the present schedule for restoring farmland to native habitat. Future newly purchased lands could also be farmed until being restored to native habitat.

Beyond 15 years, it is expected that significant decreases will continue in row crop acreage as Refuge and District comprehensive conservation plans (CCPs) are revised. The amount and extent of this decrease will be determined as these CCPs are updated.

Alternative A has wildlife advantages because: it encourages conservation tillage, and it is an efficient, cost-effective method of producing supplemental food for wildlife and preparing farm land for conversion to natural habitats. Alternative A would also provide an efficient, cost-effective method of growing food to attract wildlife for viewing, photography, and other wildlife-dependent recreation. Alternative A would have no effect on seed availability, cooperative farmers, or the Midwest farm economy. Alternative A would not increase the threat of herbicide toxicity to wildlife, but of the four alternatives, it has the highest risk of developing herbicide (glyphosate) resistance in weeds. Use of farming or genetically modified crops on Refuge System lands must be determined to be required to accomplish the establishing purpose of the refuge or district where it is used. Use also requires specific concurrence through the Midwest Region Refuge Chief

4.2.1.2 Wildlife Issues

Issue 1: Use of GMGT crops could provide an alternative for farming with less risk to wildlife.

Growing GMGT corn and soybeans has some conservation advantages over growing non-GM hybrids. The use of glyphosate-tolerant crops increases the chances that conservation tillage can

be successfully used (Towery and Werblow 2010). Conservation tillage results in reduced soil disturbance and increased crop residue which decrease soil erosion. Reduced soil erosion results in more productive land and cleaner water. Glyphosate is also relatively environmentally benign, especially when compared to most other herbicides (Duke and Powles 2008). Field and laboratory studies show it does not leach appreciably, has low potential for runoff (Shipitalo et al. 2006), is nontoxic to honeybees, practically nontoxic to fish, may be slightly toxic to aquatic invertebrates, is slightly toxic to wild birds, and has no significant potential to accumulate in animal tissue

(<http://extoxnet.orst.edu/pips/glyphosa.htm>).

Use of GMGT corn and soybeans does offer some conservation advantages over non-GM hybrids, but there are also some potential risks involved to aquatic species when some commercial formulations of glyphosate are applied too closely to water. Commercial formulations of glyphosate often contain additional chemicals (surfactants) that are added to increase its effectiveness. Some research indicates that there are commercial formulations of glyphosate that can negatively impact amphibians (Dinehart et al. 2010) and aquatic communities in general (Relyea 2005, Vera et al. 2010) and it is likely these additional chemicals that cause the toxicity (Mann et al. 2009). These impacts can be minimized by applying glyphosate following label instructions like “Do not apply directly to water” or “to areas where surface water is present.” Because there is a wide range of toxicity exhibited by different formulations of glyphosate (Langeland 2006), these impacts can also be managed by using less toxic formulations.

When applied according to label instructions, there is a reasonable certainty that no harm to the environment will occur.

Issue 2: Agricultural herbicides may be toxic to wildlife.

There is wide variation in toxicity of herbicides and some have been banned by the US EPA (<http://wsprod.colostate.edu/cwis79/Factsheets/Sheets/141BannedPesticides.pdf>).

The Service has implemented a Pesticide Use Proposal program (<http://www.fws.gov/contaminants/pdf/PUP.pdf> or <http://www.fws.gov/contaminants/Documents/7RM14.pdf>) that requires approval before application of a pesticide on Service land. In the Midwest Region, Refuge System unit managers have a limited list of herbicides that they can approve for use. Herbicides not on the list require approval at the regional or national level.

Using herbicides will not impact wildlife when:

Alternative A

1. Herbicides are applied following label instructions. These instructions include information regarding the use of a particular herbicide around water; near sensitive habitats, and near threatened and endangered species (<http://www.cdms.net/LabelsMsds/LMDe-fault.aspx?pd=6935&t=1,2,3,4>).
2. Conditions outlined in the Service's cooperative farming agreement are followed. Many of these conditions relate to best management practices designs to protect soil and water; and to manage pest and nutrients (<http://www.epa.gov/owow/watershed/wacademy/acad2000/agmodule/>).
3. Pesticide Use Proposals are completed, as required by Service policy. Pesticide Use Proposals are required before the application of pesticides on Service lands. Impacts to threatened or endangered species are considered during this annual review. (<http://www.fws.gov/contaminants/pdf/PUP.pdf> or <http://www.fws.gov/contaminants/Documents/7RM14.pdf>)
4. Integrated Pest Management Plans (<http://www.fws.gov/contaminants/Issues/IPM.cfm>) and Comprehensive Conservation Plans (web-site citation) that analyze the potential environmental impacts of herbicide use are completed for each NWRS unit.

Issue 3: Refuge System units need to provide high-energy food for migrating and resident wildlife.

Natural resource managers have long used cultivated crops as a method of supplementing natural foods available for wildlife. The focus was traditionally on migrating and wintering game species, but there is recognition that this source of food can be valuable for nongame species too (Donalty et al. 2003). Many wildlife species have adapted to the loss of natural food sources by feeding on cultivated grains (Foster et al. 2010). However, more efficient harvesting equipment and more farm land planted in soybeans have resulted in a reduction in the amount waste grain available for wildlife (Krapu et al. 2004). Large-scale plans to conserve waterfowl populations consider the availability of cultivated grains when determining if enough food exists to support desired population levels (U.S. Department of the Interior and Environment Canada 1986). Cultivated grains are often used in waterfowl management because agricultural seeds tend to have greater energy than many natural seeds (Kaminski et al. 2003) and agricultural crops have higher yield per unit area than natural wetland plants (Kross et al. 2008). Some waterfowl biologists recommend providing unharvested grain fields and natural wet-

lands for migrating and wintering waterfowl because seed resources are low in harvested agricultural fields (Foster et al. 2010).

Many Refuge System units were established to support population of waterfowl or migratory birds. Providing food for large populations of waterfowl is often accomplished by managing natural wetlands, moist soil impoundments, and cultivated grains. Currently, about 4,000 acres of Refuge System lands are farmed to provide food for wildlife. This practice would continue under this alternative. Because it is now the dominant type of corn planted in the Midwest Region, it will be most cost effective and productive to provide high-calorie food (corn) using GMGT corn.

Issue 4: Refuge System units need to provide concentrated food sources to attract wildlife for wildlife-dependent recreation.

Although used minimally, natural resource managers have long grown food plots (cultivated stands of corn, milo, sunflowers, millet, etc.) as a method to attract wildlife for increased viewing opportunities for the public. This has also been an historic activity on Refuge System lands that is used to encourage wildlife observation, wildlife photography, environmental education, and environmental interpretation. The National Wildlife Refuge System Improvement Act (1997) directs that compatible wildlife-dependent recreational uses including wildlife observation and photography, and environmental education and interpretation receive enhanced consideration in planning and management over all other general public uses of the Refuge System. When compatible, these wildlife-dependent recreational uses are to be strongly encouraged.

Because it is now the dominant variety of corn planted in the Midwest Region, it will be most cost effective and productive to provide concentrated food sources to attract wildlife for wildlife-dependent recreation using GMGT corn and soybeans.

Issue 5: Farming negatively impacts wildlife.

While some species in the Midwest Region have readily adapted to the large scale conversion of native habitats to cultivated farmland, many wildlife species have been negatively impacted by farming. Farming has a great impact on biodiversity and impacts ecosystems by replacing natural habitats with vegetation that is nearly monotypic, globally removes about 30 percent of primary production for human use, uses and adds water and fertilizers on a scale that influences ecosystem functioning, and adds pesticides that directly affect plants and animals (Firbank et al. 2008, Tilman et al. 2001).

The Service has long recognized the importance of natural habitat to wildlife. A large portion of the Refuge System lands in the Midwest Region were being farmed before they became part of the Refuge System. Currently, 1.6 percent of Refuge System lands are farmed. About 50 percent of farmed Refuge System lands are scheduled to be restored to natural habitats over the next 15 years. Future newly purchased lands could also be farmed until land is restored.

Beyond 15 years, it is expected that significant decreases will continue in row crop acreage as Refuge and District CCPs are revised. The amount and extent of this decrease will be determined as these CCPs are updated.

4.2.1.3 Habitat Issues

Issue 6: There is a need to restore and maintain more native habitats in an efficient manner. Farming and GMCs can make habitat restoration and management more efficient and economical. Increased cost to the Refuges for restoration and maintenance of habitats could make it more difficult to support diverse natural habitats.

Restoration of natural habitats is a Service priority:

Where feasible and consistent with refuge purpose(s), we restore degraded or modified habitats in the pursuit of biological integrity, diversity, and environmental health. (Improvement Act)

In the Midwest Region, this usually means converting farmland to prairie, forest or wetland. As mentioned in Chapter 2, farm fields that are left to grow unmanaged would end up with vegetation that does not meet the purposes of Refuge System lands. The typical restoration technique includes the continuation of farming and herbicide use until just before restoration planting occurs. Continued farming and herbicide use minimizes the number of residual weeds and weed seeds that will compete with the native vegetation to be planted. The use of herbicide-resistant genetically modified crops results in timely and cost-effective restoration of habitat as the associated seed and herbicides are readily available (Brookes 2010, Helzer 2010). Excess vegetation can also make it difficult or impossible to operate the equipment used to plant native vegetation. Lastly, using farming to maintain sites in good condition for restoration makes restoration more economically feasible.

Because they are now the dominant type of corn and soybeans planted in the Midwest Region, it will be most cost effective to prepare farm land for conversion to native habitats using GMGT corn and soybeans.

Issue 7: Farming is an effective way to control invasive plants and invasion of woody species.

Invasive species of plants and animals are a growing problem on a global, national, and regional scale (Pimentel et al. 2005). Invasive species are a threat to agricultural and native habitats (<http://www.fws.gov/invasives/>). The Service often continues farming land until just before restoration in order to discourage invasive plants.

Because they are now the dominant hybrids of corn and soybeans planted in the Midwest Region, it will be most cost effective to prevent invasive plants from becoming established in areas that will be restored to native habitat by using GMGT corn and soybeans.

Issue 8: The Service should use conservation tillage practices to minimize soil erosion on cultivated lands.

Conservation tillage results in reduced soil disturbance and increased crop residue which decrease soil erosion. Reduced soil erosion results in more productive land and cleaner water. Glyphosate-tolerance increases the chances that conservation tillage can be successfully used (Towery and Werblow 2010).

Issue 9: Concern exists for developing herbicide resistance in weeds by using GMCs.

There are almost 200 species of herbicide resistant plants worldwide and many glyphosate-resistant weeds in the Midwest Region (Heap 2010: www.weedscience.org). Herbicide resistance is a growing problem. For example, glyphosate resistance in horseweed (*Conyza canadensis*) was first identified in Maryland in 2001 (VanGessel 2001). Glyphosate-resistant horseweed is now found in five of eight Midwest Region states (www.weedscience.org). Almost 90 percent of all herbicide-tolerant crops are glyphosate-tolerant. The use of glyphosate is being threatened by the evolution of glyphosate-resistant weeds (Duke and Powles 2008). Currently, more than 90 percent of the soybeans and 80 percent of the corn planted in North America is glyphosate tolerant. Regular, wide spread use of the same herbicide increases the risk of developing herbicide resistance. Integrated pest management techniques minimize the likelihood of herbicide resistance by regularly changing the technique used to control weeds: rotating type of herbicide used, rotating crop planted, and using mechanical methods.

In theory, using GMGT corn and soybeans should help manage herbicide resistance because it would be an additional technique to use in weed management. In practice, GMGT corn and soybeans are so widely used on a regular basis, that their use actu-

ally encourages herbicide resistance (Duke and Powles 2008). Effective use of Integrated Pest Management (<http://www.fws.gov/contaminants/Documents/IPMfinal.pdf>) will help manage herbicide resistance.

4.2.1.4 Socio-economic Issues

Issue 10: Non-genetically modified seeds are becoming less available in local communities.

GM herbicide-tolerant crops were planted on 92 percent of the U.S. soybean acres and 80 percent of the corn acres in 2008 (Brookes 2010). Alternative A would have no effect on seed availability since both GM and non-GM seed could still be used in Refuge System farming operations.

Issue 11: Not being able to use GMCs could make farming more costly for cooperators. Local farming cooperators will lose income if farming is reduced or eliminated.

Farmers could continue to use GMGT corn and soybeans under Alternative A. Under Alternative A, local farming cooperators will lose farming opportunities as 50 percent of Refuge System row crop lands are restored to natural habitats in the next 15 years.

Issue 12: Changing farming on Refuge System lands will impact the economy.

Farming priorities would continue unchanged under Alternative A. Considering the small amount of land farmed and the continual reduction in that total as land is restored to natural habitat, changes in farming on Refuge System lands can be expected to have a negligible impact on the economy.

The 0.02 percent of lands farmed within the Refuge System in the Midwest Region is spread out among 54 national wildlife refuges and 12 wetland management districts, further reducing the economic impact of any change to farming activities on Refuge System lands.

Issue 13: Use of GMGT corn and soybeans on Refuge System lands could impact neighboring organic farmers due to inadvertent gene flow from GM to organic crops.

The USDA National Organic Program lists 2,800 Certified Organic Operations (farmers) in the Midwest Region (<http://apps.ams.usda.gov/nop/>). About 60 percent of these farmers raise organic corn. Corn is currently raised on 31 refuges and wetland management districts in the Midwest Region.

Review of the potential impacts of glyphosate-tolerant corn to Certified Organic Farmers was completed by APHIS prior to general release (USDA 2000, USDA 2007). The conclusion made for corn was that all corn, whether genetically engineered or

not, can transmit pollen to nearby corn fields. A small influx of pollen originating from a given corn variety does not appreciably change the characteristics of corn in adjacent fields. The frequency of occurrence decreases with increasing distance from the pollen source such that it is negligible by 660 feet, the isolation distance considered safe for certified corn seeds (USDA 2000).

Under Alternative A, the use of GMGT corn on Refuge System lands has the potential to negatively affect organic farmers who have fields within 660 feet. Typically, organic farmers are responsible for providing their own buffers to ensure that they meet organic farming standards. If Refuge or District Managers are made aware of adjacent Certified Organic farm acres for corn, they may take measures to address neighboring landowner concerns and assist in providing required buffers.

The potential for row crop farming on Refuge System lands to conflict with organic farming operations will decrease over the next 15 years as 50 percent of Refuge System row crop lands are restored to natural habitats.

4.2.2 Alternative B: Farming for Habitat Restoration Objectives Only, GMGT Corn and Soybeans Allowed

4.2.2.1 Summary of Alternative B Effects

Under Alternative B, the use of GMGT corn and soybeans on Refuge System lands in the Midwest Region would continue. Currently, about 50 percent of farmed Refuge System lands are scheduled to be restored to natural habitats over the next 15 years. Under Alternative B, the Service would restore between 50 percent and 80 percent of Refuge System lands in the next 15 years. Beginning in 2012, as Refuge and District comprehensive conservation plans are revised, row crop farming would be limited to meeting habitat restoration objectives only. Farming could continue at Crab Orchard NWR because it is a legislated purpose. Future newly purchased lands could also be farmed for 3 years until being restored to native habitat. Alternative B has wildlife advantages because: it encourages conservation tillage, and it is an efficient, cost-effective method of preparing farm land for conversion to natural habitats. Compared to Alternative A, Alternative B would be a less efficient, cost-effective method of producing supplemental food for wildlife and growing food to attract wildlife for viewing, photography, and other wildlife-dependent recreation. Alternative B would have no effect on seed availability or the Midwest farm economy. Local cooperative farmers would be affected because, ultimately, fewer acres would be farmed. Alternative B would not increase the threat of herbicide toxicity to wild-

life, and it has a lower risk of developing herbicide (glyphosate) resistance in weeds because fewer acres would be planted with GMGT corn and soybeans. Use of farming or genetically modified crops on Refuge System lands must be determined to be required to accomplish the establishing purpose of the refuge or district where it is used. Use also requires specific concurrence through the Midwest Region Refuge Chief.

4.2.2.2 Wildlife Issues

Issue 1: Use of GMGT crops could provide an alternative for farming with less risk to wildlife.

The effects under this alternative are the same as the effects under Alternative A.

Growing GMGT corn and soybeans has some conservation advantages over growing non-GM hybrids. The use of glyphosate-tolerant crops increases the chances that conservation tillage can be successfully used (Towery and Werblow 2010). Conservation tillage results in reduced soil disturbance and increased crop residue which decrease soil erosion. Reduced soil erosion results in more productive land and cleaner water. Glyphosate is also relatively environmentally benign, especially when compared to most other herbicides (Duke and Powles 2008). Field and laboratory studies show it does not leach appreciably, has low potential for runoff (Shipitalo et al. 2006), is nontoxic to honeybees, practically nontoxic to fish, may be slightly toxic to aquatic invertebrates, is slightly toxic to wild birds, and has no significant potential to accumulate in animal tissue (<http://extoxnet.orst.edu/pips/glyphosa.htm>).

Commercial formulations of glyphosate often contain additional chemicals (surfactants) that are added to increase its effectiveness. Some research indicates that there are commercial formulations of glyphosate that can negatively impact amphibians (Dinehart et al. 2010) and aquatic communities in general (Relyea 2005, Vera et al. 2010) and it is likely these additional chemicals that cause the toxicity (Mann et al. 2009). These impacts can be minimized by applying glyphosate following label instructions like “Do not apply directly to water” or “to areas where surface water is present.” Because there is a wide range of toxicity exhibited by different formulations of glyphosate (Langeland 2006), these impacts can also be managed by using less toxic formulations.

Use of GMGT corn and soybeans does offer some conservation advantages over non-GM hybrids, but there are also some potential risks involved to aquatic species when some commercial formulations of glyphosate are applied too closely to water. These

risks can be minimized by following glyphosate label instructions and using commercial formulations that are known to have lower toxicity.

Issue 2: Agricultural herbicides may be toxic to wildlife.

The effects under this alternative are the same as the effects under Alternative A.

There is wide variation in toxicity of herbicides and some have been banned by the US EPA (<http://wsprod.colostate.edu/cwis79/Factsheets/Sheets/141BannedPesticides.pdf>).

The Service has implemented a Pesticide Use Proposal program (<http://www.fws.gov/contaminants/pdf/PUP.pdf> or <http://www.fws.gov/contaminants/Documents/7RM14.pdf>) that requires approval before application of a pesticide on Service land. In the Midwest Region, Refuge System unit managers have a limited list of herbicides that they can approve for use. Herbicides not on the list require approval at the regional or nation level.

Using herbicides will not impact wildlife:

1. Herbicides are applied following label instructions. These instructions include information regarding the use of a particular herbicide around water, near sensitive habitats, and near threatened and endangered species (<http://www.cdms.net/LabelsMsds/LMDefault.aspx?pd=6935&t=1,2,3,4>).
2. Conditions outlined in the Service’s cooperative farming agreement are followed. Many of these conditions relate to best management practices designs to protect soil and water, and to manage pest and nutrients (<http://www.epa.gov/owow/watershed/wacademy/acad2000/agmodule/>).
3. Pesticide Use Proposals are completed, as required by Service policy. Pesticide Use Proposals are required before the application of pesticides on Service lands. Impacts to threatened or endangered species are considered during this annual review. (<http://www.fws.gov/contaminants/pdf/PUP.pdf> or <http://www.fws.gov/contaminants/Documents/7RM14.pdf>)
4. Integrated Pest Management Plans (<http://www.fws.gov/contaminants/Issues/IPM.cfm>) and Comprehensive Conservation Plans (<http://www.fws.gov/midwest/planning/completedplans.html>) that analyze the potential environmental impacts of herbicide use are completed for each NWRS unit.

Issue 3: Refuge System units need to provide high-energy food for migrating and resident wildlife.

This alternative would provide supplemental foods to migrating and wintering wildlife only during the time land was being prepared for restoration to natural habitat. Currently, about 4,000 acres of Refuge System lands are farmed to provide food for wildlife.

Natural resource managers have long used cultivated crops as a method of supplementing natural foods available for wildlife. The focus was traditionally on migrating and wintering game species, but there is recognition that this source of food can be valuable for nongame species too (Donalty et al. 2003). Some refuges and wetland management districts may find it difficult to meet their establishing purposes without the ability to provide supplemental food for migratory birds.

Issue 4: Refuge System units need to provide concentrated food sources to attract wildlife for wildlife-dependent recreation.

Although used minimally, natural resource managers have long grown food plots (cultivated stands of corn, milo, sunflowers, millet, etc.) as a method to attract wildlife for increased viewing opportunities for the public. This has also been an historic activity on Refuge System lands that is used to encourage wildlife observation, wildlife photography, environmental education, and environmental interpretation. The National Wildlife Refuge System Improvement Act (1997) directs that compatible wildlife-dependent recreational uses including wildlife observation and photography, and environmental education and interpretation receive enhanced consideration in planning and management over all other general public uses of the Refuge System. When compatible, these wildlife-dependent recreational uses are to be strongly encouraged.

Under this alternative, Refuge System lands farmed to attract wildlife for wildlife-related recreational purposes would be restored to natural habitat within the next 15 years.

Issue 5: Farming negatively impacts wildlife.

While some species in the Midwest Region have readily adapted to the large scale conversion of native habitats to cultivated farmland, many wildlife species have been negatively impacted by farming. Farming has a great impact on biodiversity and impacts ecosystems by replacing natural habitats with vegetation that is nearly monotypic, globally removes about 30 percent of primary production for human use, uses and adds water and fertilizers on a

scale that influences ecosystem functioning, and adds pesticides that directly affect plants and animals (Firbank et al. 2008, Tilman et al. 2001).

The Service has long recognized the importance of natural habitat to wildlife. Approximately half of the Refuge System lands in the Midwest Region were being farmed before they became part of the Refuge System. Currently, 1.6 percent of Refuge System lands are farmed. About 50 percent of farmed Refuge System lands are scheduled to be restored to natural habitats over the next 15 years. Under Alternative B, the Service would restore between 50 percent and 80 percent of Refuge System lands in the next 15 years. Beginning in 2012, as Refuge and District comprehensive conservation plans are revised, row crop farming would be limited to meeting habitat restoration objectives only. Farming could continue at Crab Orchard NWR because it is a legislated purpose. Future newly purchased lands could also be farmed for 3 years until being restored to native habitat.

4.2.2.3 Habitat Issues

Issue 6: Farming and GMCs can make habitat restoration and management more efficient and economical. Increased cost to the Refuges for restoration and maintenance of habitats could make it more difficult to support diverse natural habitats.

The effects under this alternative are the same as the effects under Alternative A, except that because the Region would no longer allow farming for purposes other than habitat restoration, ultimately, more acres would be restored to natural habitat under this alternative.

Restoration of natural habitats is a Service priority:

Where feasible and consistent with refuge purpose(s), we restore degraded or modified habitats in the pursuit of biological integrity, diversity, and environmental health. (Improvement Act)

In the Midwest Region, this usually means converting farmland to prairie, forest or wetland. As mentioned in Chapter 2, farm fields that are left to grow unmanaged would end up with vegetation that did not meet the purposes of Refuge System lands. The typical restoration technique includes the continuation of farming and herbicide use until just before restoration planting occurs. Continued farming and herbicide use minimizes the number of residual weeds and weed seeds that will compete with the native vegetation to be planted. The use of herbicide-resistant genetically modified crops results in timely and cost-effective restoration of habitat as the associated seed and herbicides are readily available (Brookes 2010, Helzer 2010).

Excess vegetation can also make it difficult or impossible to operate the equipment used to plant native vegetation. Lastly, using farming to maintain sites in good condition for restoration makes restoration more economically feasible.

Because they are now the dominant variety of corn and soybeans planted in the Midwest Region, it will be most cost effective to prepare farm land for conversion to native habitats using GMGT corn and soybeans.

Issue 7: Farming is an effective way to control invasive plants and invasion of woody species.

The effects under this alternative are the same as the effects under Alternative A.

Invasive species of plants and animals are a growing problem on a global, national, and regional scale (Pimentel et al. 2005). Invasive species are a threat to agricultural and native habitats (<http://www.fws.gov/invasives/>). The Service often continues farming land until just before restoration in order to discourage invasive plants.

Because they are now the dominant hybrids of corn and soybeans planted in the Midwest Region, it will be most cost effective to prevent invasive plants from becoming established in areas that will be restored to native habitat by using GMGT corn and soybeans.

Issue 8: The Service should use conservation tillage practices to minimize soil erosion on cultivated lands.

The effects under this alternative are the same as the effects under Alternative A.

Conservation tillage results in reduced soil disturbance and increased crop residue which decrease soil erosion. Reduced soil erosion results in more productive land and cleaner water. Glyphosate-tolerance increases the chances that conservation tillage can be successfully used (Towery and Werblow 2010).

Issue 9: Concern exists for developing herbicide resistance in weeds by using GMCs.

The effects under this alternative are the same as the effects under Alternative A.

There are almost 200 species of herbicide resistant plants worldwide and many glyphosate-resistant weeds in the Midwest (Heap 2010: www.weedscience.org). Herbicide resistance is growing problem. For example, glyphosate resistance in horseweed (*Conyza Canadensis*) was first identified in Maryland in 2001 (VanGessel 2001). Glyphosate-resistant horseweed now found in five of eight Midwest Region states (www.weedscience.org). Almost 90 percent of all herbicide

resistant crops are glyphosate-resistant. The use of glyphosate is being threatened by the evolution of glyphosate-resistant weeds (Duke and Powles 2008). Currently, more than 90 percent of the soybeans and 80 percent of the corn planted in North America is glyphosate-tolerant. Regular, widespread use of the same herbicide increases the risk of developing herbicide resistance. Integrated pest management techniques minimize the likelihood of herbicide resistance by regularly changing the technique used to control weeds: rotating type of herbicide used, rotating crop planted, and using mechanical methods.

In theory, using GMGT corn and soybeans should help manage herbicide resistance because it would be an additional technique to use in weed management. In practice, GMGT corn and soybeans are so widely used on a regular basis, that their use actually encourages herbicide resistance (Duke and Powles 2008). Effective use of Integrated Pest Management (<http://www.fws.gov/contaminants/Documents/IPMfinal.pdf>) will help manage herbicide resistance. Use of genetically modified crops on Refuge System lands must be determined to be essential to accomplishing the establishing purpose of the refuge or district where it is used. Use also requires specific concurrence through the Midwest Region Refuge Chief.

4.2.2.4 Socio-economic Issues

Issue 10: Non-genetically modified seeds are becoming less available in local communities.

GM herbicide-tolerant crops were planted on 92 percent of the U.S. soybean acres and 80 percent of the corn acres in 2008 (Brookes 2010). Like Alternative A, Alternative B would have no effect on seed availability since both GM and non-GM seed could still be used in Refuge System farming operations.

Issue 11: Not being able to use GMCs could make farming more costly for cooperators. Local farming cooperators will lose income if farming is reduced or eliminated.

Farmers could continue to use GMGT corn and soybeans under Alternative B. Under Alternative B, local farming cooperators will lose farming opportunities as 50 percent of Refuge System row crop lands are restored to natural habitats in the next 15 years. Newly acquired lands would be farmed only to prepare them for restoration to natural habitats.

Issue 12: Changing farming on Refuge System lands will impact the economy.

Currently, about 50 percent of the 20,000 acres currently farmed Refuge System lands are scheduled to be restored to natural habitats over the next 15 years. Under Alternative B, the Service would restore between 50 percent and 80 percent of Ref-

Alternative C

Refuge System lands in the next 15 years. Beginning in 2012, as Refuge and District comprehensive conservation plans are revised, they would limit row crop farming to meeting habitat restoration objectives only. Farming could continue when it is a legislated purpose, as at Crab Orchard NWR. Future newly purchased lands could also be farmed for habitat restoration objectives until being restored to native habitat. Because of the small size of the farming operations on Refuge System lands relative to the size of the Midwest farming economy, the economic effect of gradually eliminating long-term farming will be negligible (Table 3 on page 36).

Issue 13: Use of GMGT corn and soybeans on Refuge System lands could impact neighboring organic farmers due to inadvertent gene flow from GM to organic crops.

The USDA National Organic Program lists 2,800 Certified Organic Operations (farmers) in the Midwest Region (<http://apps.ams.usda.gov/nop/>). About 60 percent of these farmers raise organic corn. Corn is currently raised on 31 refuges and wetland management districts in the Midwest Region.

Review of the potential impacts of glyphosate-tolerant corn to Certified Organic Farmers was completed by APHIS prior to general release (USDA 2000, USDA 2007). The conclusion made for corn was that all corn, whether genetically engineered or not, can transmit pollen to nearby corn fields. A small influx of pollen originating from a given corn variety does not appreciably change the characteristics of corn in adjacent fields. The frequency of occurrence decreases with increasing distance from the pollen source such that it is negligible by 660 feet, the isolation distance considered safe for certified corn seeds (USDA 2000)

Under Alternative B, the use of GMGT corn on Refuge System lands has the potential to negatively affect organic farmers who have fields within 660 feet. Typically, organic farmers are responsible for providing their own buffers to ensure that they meet organic farming standards. If Refuge or District Managers are made aware of adjacent Certified Organic farm acres for corn, they may take measures to address neighboring landowner concerns and assist in providing required buffers.

4.2.3 Alternative C: Farming for Multiple Objectives, No GMGT Corn and Soybeans

4.2.3.1 Summary of Alternative C Effects

Two years after approval of this EA, the use of GMGT corn and soybeans would no longer be allowed on Refuge System lands in the Midwest Region under Alternative C. Currently, about 50 percent of farmed Refuge System lands are sched-

uled to be restored to natural habitats over the next 15 years. Under Alternative C, the Service would adhere to the present schedule for restoring farmland to native habitat. Future newly purchased lands could also be farmed until being restored to native habitat.

Beyond 15 years, it is expected that significant decreases will continue in row crop acreage as Refuge and District CCPs are revised. The amount and extent of this decrease will be determined as these CCPs are updated.

Alternative C would lack some wildlife advantages because: conservation tillage is less likely to be used, and it is a less efficient and cost-effective method of producing supplemental food for wildlife and preparing farm land for conversion to natural habitats. Alternative C would also be a less efficient and cost-effective method of growing food to attract wildlife for viewing, photography, and other wildlife-dependent recreation. Alternative C would have no effect on the Midwest farm economy, but cooperative farmers would be negatively affected because seed would be less available and more expensive and profitability may be impacted. Effects of herbicide toxicity would be unchanged from Alternative A because the Service restricts the types and application of herbicides used on Refuge System lands. Alternative C would have a lower threat of developing herbicide (glyphosate) resistance in weeds than Alternative A. Use of farming on Refuge System lands must be determined to be required to accomplish the establishing purpose of the refuge or district where it is used. Use also requires specific concurrence through the Midwest Region Refuge Chief.

4.2.3.2 Wildlife Issues

Issue 1: Use of GMGT crops could provide an alternative for farming with less risk to wildlife.

Growing GMGT corn and soybeans has some conservation advantages over growing non-GMGT varieties. The use of glyphosate-tolerant crops increases the chances that conservation tillage can be successfully used (Towery and Werblow 2010). Conservation tillage results in reduced soil disturbance and increased crop residue which decrease soil erosion. Reduced soil erosion results in more productive land and cleaner water. Glyphosate is also relatively environmentally benign, especially when compared to most other herbicides (Duke and Powles 2008). Field and laboratory studies show it does not leach appreciably, has low potential for runoff (Shipitalo et al. 2006), is nontoxic to honeybees, practically nontoxic to fish, may be slightly toxic to aquatic invertebrates, is slightly toxic to wild birds, and has no significant potential to accumulate in animal tissue (<http://extoxnet.orst.edu/pips/glyphosa.htm>).

Commercial formulations of glyphosate often contain additional chemicals (surfactants) that are added to increase its effectiveness. Some research indicates that there are commercial formulations of glyphosate that can negatively impact amphibians (Dinehart et al. 2010) and aquatic communities in general (Relyea 2005, Vera et al. 2010) and it is likely these additional chemicals that cause the toxicity (Mann et al. 2009). These impacts can be minimized by applying glyphosate following label instructions like “Do not apply directly to water” or “to areas where surface water is present.” Because there is a wide range of toxicity exhibited by different formulations of glyphosate (Langeland 2006), these impacts can also be managed by using less toxic formulations.

Under this alternative, there will likely be a reduction in conservation tillage on Refuge System lands (Towery and Werblow 2010). This could result in increases in soil disturbance and reductions in crop residue which tend to increase soil erosion. Soil erosion results in less productive land and cleaner water.

Issue 2: Agricultural herbicides may be toxic to wildlife.

The effects under this alternative are the same as the effects under Alternative A because the Service restricts and types and applications of herbicides used on Refuge System lands.

There is wide variation in toxicity of herbicides and some have been banned by the U.S. EPA (<http://wsprod.colostate.edu/cwis79/Factsheets/Sheets/141BannedPesticides.pdf>).

The Service has implemented a Pesticide Use Proposal program (<http://www.fws.gov/contaminants/pdf/PUP.pdf> or <http://www.fws.gov/contaminants/Documents/7RM14.pdf>) that requires approval before application of a pesticide on Service land. In the Midwest Region, Refuge System unit managers have a limited list of herbicides that they can approve for use. Herbicides not on the list require approval at the regional or nation level.

Using herbicides will not impact wildlife:

1. Herbicides are applied following label instructions. These instructions include information regarding the use of a particular herbicide around water, near sensitive habitats, and near threatened and endangered species (<http://www.cdms.net/LabelsMsds/LMDefault.aspx?pd=6935&t=1,2,3,4>).
2. Conditions outlined in the Service’s cooperative farming agreement are followed. Many of these conditions relate to best management practices designs to protect soil and water, and to manage pest and nutrients (<http://www.epa.gov/owow/watershed/wacademy/acad2000/agmodule/>).
3. Pesticide Use Proposals are completed, as required by Service policy. Pesticide Use Proposals are required before the application of pesticides on Service lands. Impacts to threatened or endangered species are considered during this annual review. (<http://www.fws.gov/contaminants/pdf/PUP.pdf> or <http://www.fws.gov/contaminants/Documents/7RM14.pdf>)
4. Integrated Pest Management Plans (<http://www.fws.gov/contaminants/Issues/IPM.cfm>) and Comprehensive Conservation Plans (website citation) that analyze the potential environmental impacts of herbicide use are completed for each NWRS unit.

Issue 3: Refuge System units need to provide high-energy food for migrating and resident wildlife.

Natural resource managers have long used cultivated crops as a method of supplementing natural foods available for wildlife. The focus was traditionally on migrating and wintering game species, but there is recognition that this source of food can be valuable for nongame species too (Donalty et al. 2003). Many wildlife species have adapted to the loss of natural food sources by feeding on cultivated grains (Foster et al. 2010). However, more efficient harvesting equipment and more farm land planted in soybeans has resulted in a reduction in the amount of waste grain available for wildlife (Krapu et al. 2004). Large-scale plans to conserve waterfowl populations consider the availability of cultivated grains when determining if enough food exists to support desired population levels (U.S. Department of the Interior and Environment Canada 1986). Cultivated grains are often used in waterfowl management because agricultural seeds tend to have greater energy than many natural seeds (Kaminski et al. 2003) and agricultural crops have higher yield per unit area than natural wetland plants (Kross et al. 2008). Some waterfowl biologists recommend providing unharvested grain fields and natural wetlands for migrating and wintering waterfowl because seed resources are low in harvested agricultural fields (Foster et al. 2010).

Many Refuge System units were established to support populations of waterfowl or migratory birds. Providing food for large populations of waterfowl is often accomplished by managing natural wetlands, moist soil impoundments, and cultivated grains. Currently, about 5,000 acres of Refuge System lands are farmed to provide food for wildlife. This practice would continue under this alternative, but it would be more costly and less productive.

Alternative C

Because GMGT corn has become so dominant in the Midwest, it may become difficult to find farmers with interest in farming on Refuge System lands.

Issue 4: Refuge System units need to provide concentrated food sources to attract wildlife for wildlife-dependent recreation.

Although used minimally, natural resource managers have long grown food plots (cultivated stands of corn, milo, sunflowers, millet, etc.) as a method to attract wildlife for increased viewing opportunities for the public. This has also been an historic activity on Refuge System lands that is used to encourage wildlife observation, wildlife photography, environmental education, and environmental interpretation. The National Wildlife Refuge System Improvement Act (1997) directs that compatible wildlife-dependent recreational uses including wildlife observation and photography, and environmental education and interpretation receive enhanced consideration in planning and management over all other general public uses of the Refuge System. When compatible, these wildlife-dependent recreational uses are to be strongly encouraged.

Growing crops to attract wildlife for wildlife-dependent recreation would continue under this alternative, but it would be more costly and less productive. Because GMGT corn has become so dominant in the Midwest, it may become difficult to find farmers with interest in farming on Refuge System lands.

Issue 5: Farming negatively impacts wildlife.

The effects under this alternative are the same as the effects under Alternative A.

While some species in the Midwest have readily adapted to the large scale conversion of native habitats to cultivated farmland, many wildlife species have been negatively impacted by farming. Farming has a great impact on biodiversity and impacts ecosystems by replacing natural habitats with vegetation that is nearly monotypic, globally removes about 30 percent of primary production for human use, uses and adds water and fertilizers on a scale that influences ecosystem functioning, and adds pesticides that directly affect plants and animals (Firbank et al. 2008, Tilman et al. 2001).

The Service has long recognized the importance of natural habitat to wildlife. Approximately half of the Refuge System lands in the Midwest were being farmed before they became part of the Refuge System. Currently, only 1.6 percent of Refuge System lands are farmed. Currently, about 50 percent of farmed Refuge System lands are scheduled to be restored to natural habitats over the next 15 years. Under Alternative C, the Service would adhere to the present schedule for restoring farmland to

native habitat. Future newly purchased lands could also be farmed until being restored to native habitat.

Beyond 15 years, it is expected that significant decreases will continue in row crop acreage as Refuge and District CCPs are revised. The amount and extent of this decrease will be determined as these CCPs are updated.

4.2.3.3 Habitat Issues

Issue 6: Farming and GMCs can make habitat restoration and management more efficient and economical. Increased cost to the Refuges for restoration and maintenance of habitats could make it more difficult to support diverse natural habitats.

Restoration of natural habitats is a Service priority:

Where feasible and consistent with refuge purpose(s), we restore degraded or modified habitats in the pursuit of biological integrity, diversity, and environmental health. (Improvement Act)

In the Midwest Region, this usually means converting farmland to prairie, forest or wetland. As mentioned in Chapter 2, farm fields that are left to grow unmanaged would end up with vegetation that did not meet the purposes of Refuge System lands. The typical restoration technique includes the continuation of farming and herbicide use until just before restoration planting occurs. Continued farming and herbicide use minimizes the number of residual weeds and weed seeds that will compete with the native vegetation to be planted. The use of herbicide-resistant genetically modified crops results in timely and cost-effective restoration of habitat as the associated seed and herbicides are readily available (Brookes 2010, Helzer 2010). Excess vegetation can also make it difficult or impossible to operate the equipment used to plant native vegetation. Lastly, using farming to maintain sites in good condition for restoration makes restoration more economically feasible.

Under this alternative, GMGT corn and soybeans would not be used. Because non-GMGT seed is becoming more difficult to find and farming without GMGT is less profitable, this would make it more costly to prepare Refuge System lands for restoration to natural habitats. This makes it likely that some refuges and districts would not meet planned habitat restoration goals.

Issue 7: Farming is an effective way to control invasive plants and invasion of woody species.

Invasive species of plants and animals are a growing problem on a global, national, and regional scale (Pimentel et al. 2005). Invasive species are a threat to agricultural and native habitats (<http://www.fws.gov/invasives/>). The Service often continues farming land until just before restoration in order to discourage invasive plants. The ability to apply a broad spectrum herbicide (glyphosate) over multiple years results in a great reduction of invasive plants and seeds in areas scheduled for restoration. This alternative would make it more expensive to restore farmed Refuge System lands to natural habitats because GMGT corn and soybeans are now the dominant hybrids of corn and soybeans planted in the Midwest. It will be more difficult for farmers to find non-GM seed, the profitability of farming on Refuge System lands is likely to decline, and some farmers may choose to not farm on Refuge System lands.

Issue 8: The Service should use conservation tillage practices to minimize soil erosion on cultivated lands.

Conservation tillage results in reduced soil disturbance and increased crop residue which decrease soil erosion. Reduced soil erosion results in more productive land and cleaner water. Glyphosate-tolerance increases the chances that conservation tillage can be successfully used (Towery and Werblow 2010).

There would be less conservation tillage used under this alternative. This may increase the soil erosion rates.

Issue 9: Concern exists for developing herbicide resistance in weeds by using GMCs.

There are almost 200 species of herbicide resistant plants worldwide and many glyphosate-resistant weeds in the Midwest (Heap 2010: www.weedscience.org). Herbicide resistance is a growing problem. For example, glyphosate resistance in horseweed (*Conyza Canadensis*) was first identified in Maryland in 2001 (VanGessel 2001). Glyphosate-resistant horseweed is now found in five of eight Midwest Region states (www.weedscience.org). There are 33 species of herbicide-tolerant plants in the Midwest Region, six of these are glyphosate-tolerant (www.weedscience.org). Almost 90 percent of all herbicide resistant crops are glyphosate resistant. The use of glyphosate is being threatened by the evolution of glyphosate-resistant weeds (Duke and Powles 2008). Currently, more than 90 percent of the soybeans and 80 percent of the corn planted in North America is glyphosate-tolerant. Regular, wide spread use of the same herbicide increases the risk of developing herbicide

resistance. Integrated pest management techniques minimize the likelihood of herbicide resistance by regularly changing the technique used to control weeds: rotating type of herbicide used, rotating crop planted, and using mechanical methods.

Under this alternative, GMGT corn and soybeans would not be allowed. This would result in a decrease in the amount of glyphosate being used on Refuge System lands. This should reduce the likelihood of developing a glyphosate-resistant weed on Refuge System lands.

4.2.3.4 Socioeconomic Issues**Issue 10: Non-genetically modified seeds are becoming less available in local communities.**

GM herbicide-tolerant crops were planted on 92 percent of the U.S. soybean acres and 80 percent of the corn acres in 2008 (Brookes 2010). Under this alternative, GMGT corn and soybeans would not be used. The availability of non-genetically modified seed can be limited in some areas of the Midwest Region. Availability is likely to decrease over time as it appears that GM crops will continue to dominate the seed market. Under Alternative C, cooperating farmers are likely to have increasing difficulties finding corn and soybean seeds that are not genetically modified.

Issue 11: Not being able to use GMCs could make farming less profitable for cooperators. Local farming cooperators will lose income if farming is reduced or eliminated.

Under Alternative C, local farming cooperators will lose farming opportunities as 50 percent of Refuge System row crop lands are restored to natural habitats in the next 15 years. Not being able to use GMCs could make farming less profitable for cooperators. Currently, farming with non-GM crops results in higher annual pesticide costs to farmers and farm income is reduced due to higher production costs (Brookes 2010). The profitability of farming on Refuge System lands is likely to decline, and some farmers may choose to not farm on Refuge System lands. The Service can compensate for at least some of the increased operating costs by charging lower rental rates or requiring a smaller share of crops.

Issue 12: Changing farming on Refuge System lands will impact the economy.

As in all alternatives, about half of farmed Refuge System lands are scheduled to be restored to natural habitats over the next 15 years. Because GMGT corn and soybeans would not be used under this alternative, the profitability of farming on Refuge System lands is likely to decline, and some farmers may choose to not farm on Refuge System lands. Because of the small size of the farming operations

on Refuge System lands relative to the size of the Midwest farming economy, the economic effect of gradually eliminating long-term farming would be negligible.

Issue 13: Use of GMGT corn and soybeans on Refuge System lands could impact neighboring organic farmers due to inadvertent gene flow from GM to organic crops.

The USDA National Organic Program lists 2,800 Certified Organic Operations (farmers) in the Midwest Region (<http://apps.ams.usda.gov/nop/>). About 60 percent of these farmers raise organic corn. Corn is currently raised on 31 refuges and wetland management districts in the Midwest Region. Under Alternative C, there would be no effect on organic farming operations because GMGT corn and soybeans would not be used on Refuge System lands.

4.2.4 Alternative D: Limited Row Crop Farming, No GMGT Corn and Soybeans

4.2.4.1 Summary of Alternative D Effects

Two years after approval of this EA, the use of GMGT corn and soybeans would no longer be allowed on Refuge System lands in the Midwest Region under Alternative D. Currently, about 50 percent of farmed Refuge System lands are scheduled to be restored to natural habitats over the next 15 years. Under Alternative D, farming would cease on about 80 percent of currently farmed Refuge System lands within 5 years. Forty to 60 percent of these lands would be left to unmanaged succession. Farming would continue on the remaining 20 percent because agriculture is a specific legislated establishing purpose at Crab Orchard NWR. Future newly purchased lands could also be farmed for up to 3 years for habitat restoration objectives. Alternative D lacks some wildlife advantages when compared to Alternative A because an efficient, cost-effective method of producing supplemental food for wildlife and preparing farm land for conversion to natural habitats would not be used. Farming to produce food to attract wildlife for viewing, photography, and other wildlife-dependent recreation would not occur. Alternative D would have no effect on the Midwest farm economy, but cooperative farmers would be negatively affected because seed would be less available and more expensive, profitability may be impacted, and Alternative D has the fewest acres farmed of any alternative. Alternative D would not increase the threat of herbicide toxicity to wildlife, and it has the lowest risk of developing herbicide (glyphosate) resistance in weeds because the fewest acres would be farmed and GMGT corn and soybeans would not be used. Use of farming on Refuge System lands must be determined to be required to accomplish the estab-

lishing purpose of the refuge or district where it is used. Use also requires specific concurrence through the Midwest Region Refuge Chief.

4.2.4.2 Wildlife Issues

Issue 1: Use of GMGT crops could provide an alternative for farming with less risk to wildlife.

Growing GMGT corn and soybeans has some conservation advantages over growing non-GM hybrids. The use of glyphosate-tolerant crops increases the chances that conservation tillage can be successfully used (Towery and Werblow 2010). Conservation tillage results in reduced soil disturbance and increased crop residue which decrease soil erosion. Reduced soil erosion results in more productive land and cleaner water. Glyphosate is also relatively environmentally benign, especially when compared to most other herbicides (Duke and Powles 2008). Field and laboratory studies show it does not leach appreciably, has low potential for runoff (Shipitalo et al. 2006), is non-toxic to honeybees, practically nontoxic to fish, may be slightly toxic to aquatic invertebrates, is slightly toxic to wild birds, and has no significant potential to accumulate in animal tissue (<http://extoxnet.orst.edu/pips/glyphosa.htm>).

Commercial formulations of glyphosate often contain additional chemicals (surfactants) that are added to increase its effectiveness. Some research indicates that there are commercial formulations of glyphosate that can negatively impact amphibians (Dinehart et al. 2010) and aquatic communities in general (Relyea 2005, Vera et al. 2010) and it is likely these additional chemicals that cause the toxicity (Mann et al. 2009). These impacts can be minimized by applying glyphosate following label instructions like “Do not apply directly to water” or “to areas where surface water is present.” Because there is a wide range of toxicity exhibited by different formulations of glyphosate (Langeland 2006), these impacts can also be managed by using less toxic formulations.

Under this alternative, farming on Refuge System lands would continue on Crab Orchard NWR and for up to 3 years on newly purchased land that was farmed prior to purchase. On the land that is farmed, there would likely be a reduction in conservation tillage (Towery and Werblow 2010), however there would be less farming overall. Under Alternative A, 10,000 acres would still be farmed at the end of 15 years. Under Alternative D, only 4,000 acres at Crab Orchard NWR and newly purchased land would be farmed. This could result in increases in soil disturbance and reductions in crop residue, which tend to increase soil erosion. Soil erosion results in less productive land and cleaner water.

Issue 2: Agricultural herbicides may be toxic to wildlife.

Under this alternative, farming on Refuge System lands would occur only for up to 3 years on newly purchased land that was farmed prior to purchase.

There is wide variation in toxicity of herbicides and some have been banned by the US EPA (<http://wsprod.colostate.edu/cwis79/Factsheets/Sheets/141BannedPesticides.pdf>).

The Service has implemented a Pesticide Use Proposal program (<http://www.fws.gov/contaminants/pdf/PUP.pdf> or <http://www.fws.gov/contaminants/Documents/7RM14.pdf>) that requires approval before application of a pesticide on Service land. In the Midwest Region, Refuge System unit managers have a limited list of herbicides that they can approve for use. Herbicides not on the list require approval at the regional or nation level.

Using herbicides will not impact wildlife:

1. Herbicides are applied following label instructions. These instructions include information regarding the use of a particular herbicide around water, near sensitive habitats, and near threatened and endangered species (<http://www.cdms.net/LabelsMsds/LMDe-fault.aspx?pd=6935&t=1,2,3,4>).
2. Conditions outlined in the Service's cooperative farming agreement are followed. Many of these conditions relate to best management practices designs to protect soil and water, and to manage pest and nutrients (<http://www.epa.gov/owow/watershed/wacademy/acad2000/agmodule/>).
3. Pesticide Use Proposals are completed, as required by Service policy. Pesticide Use Proposals are required before the application of pesticides on Service lands. Impacts to threatened or endangered species are considered during this annual review. (<http://www.fws.gov/contaminants/pdf/PUP.pdf> or <http://www.fws.gov/contaminants/Documents/7RM14.pdf>)
4. Integrated Pest Management Plans (<http://www.fws.gov/contaminants/Issues/IPM.cfm>) and Comprehensive Conservation Plans (<http://www.fws.gov/midwest/planning/completed-plans.html>) that analyze the potential environmental impacts of herbicide use are completed for each NWRS unit.

Issue 3: Refuge System units need to provide high-energy food for migrating and resident wildlife.

Natural resource managers have long used cultivated crops as a method of supplementing natural foods available for wildlife. The focus was traditionally on migrating and wintering game species, but there is recognition that this source of food can be valuable for nongame species too (Donalty et al. 2003). Many wildlife species have adapted to the loss of natural food sources by feeding on cultivated grains (Foster et al. 2010). However, more efficient harvesting equipment and more farm land planted in soybeans has resulted in a reduction in the amount waste grain available for wildlife (Krapu et al. 2004). Large-scale plans to conserve waterfowl populations consider the availability of cultivated grains when determining if enough food exists to support desired population levels (U.S. Department of the Interior and Environment Canada 1986). Cultivated grains are often used in waterfowl management because agricultural seeds tend to have greater energy than many natural seeds (Kaminski et al. 2003) and agricultural crops have higher yield per unit area than natural wetland plants (Kross et al. 2008). Some waterfowl biologists recommend providing unharvested grain fields and natural wetlands for migrating and wintering waterfowl because seed resources are low in harvested agricultural fields (Foster et al. 2010).

Many Refuge System units were established with the purpose to support population of waterfowl or migratory birds. Providing food for large populations of waterfowl is often accomplished by managing natural wetlands, moist soil impoundments, and cultivated grains. This alternative would provide supplemental foods to migrating and wintering wildlife only during the time land was being prepared for restoration to natural habitat. Currently, about 5,000 acres of Refuge System lands are farmed to provide food for wildlife. Under this alternative, most these acres would be abandoned to natural succession or restored to natural habitat within the next 5 years. Some refuges and districts may find it difficult to meet their establishing purposes without the ability to provide supplemental food for migratory birds.

Issue 4: Refuge System units need to provide concentrated food sources to attract wildlife for wildlife-dependent recreation.

Although used minimally, natural resource managers have long grown food plots (cultivated stands of corn, milo, sunflowers, millet, etc.) as a method to attract wildlife for increased viewing opportunities for the public. This has also been an historic activity on Refuge System lands that is used to encourage wildlife observation, wildlife photography, environ-

mental education, and environmental interpretation. The National Wildlife Refuge System Improvement Act (1997) directs that compatible wildlife-dependent recreational uses including wildlife observation and photography, and environmental education and interpretation receive enhanced consideration in planning and management over all other general public uses of the Refuge System. When compatible, these wildlife-dependent recreational uses are to be strongly encouraged.

Under this alternative, Refuge System lands farmed to attract wildlife for wildlife-related recreational purposes would be abandoned to natural succession or restored to natural habitat within the next 5 years.

Issue 5: Farming negatively impacts wildlife.

While some species in the Midwest have readily adapted to the large scale conversion of native habitats to cultivated farmland, many wildlife species have been negatively impacted by farming. Farming has a great impact on biodiversity and impacts ecosystems by replacing natural habitats with vegetation that is nearly monotypic, globally removes about 30 percent of primary production for human use, uses and adds water and fertilizers on a scale that influences ecosystem functioning, and adds pesticides that directly affect plants and animals (Firbank et al. 2008, Tilman et al. 2001).

The Service has long recognized the importance of natural habitat to wildlife. Approximately half of the Refuge System lands in the Midwest were being farmed before they became part of the Refuge System. Currently, only 1.6 percent of Refuge System lands are farmed. About 80 percent of farmed Refuge System lands would be abandoned to natural succession or restored to natural habitats over the next 5 years. Farming would continue at Crab Orchard NWR because of its specific legislated establishing purpose. Newly acquired land could be farmed for up to 3 years in order to prepare it for restoration to natural habitat.

4.2.4.3 Habitat Issues

Issue 6: Farming and GMCs can make habitat restoration and management more efficient and economical. Increased cost to the Refuges for restoration and maintenance of habitats could make it more difficult to support diverse natural habitats.

Restoration of natural habitats is a Service priority:

Where feasible and consistent with refuge purpose(s), we restore degraded or modified habitats in the pursuit of biological integrity, diversity, and environmental health. (Improvement Act)

In the Midwest Region, this usually means converting farmland to prairie, forest or wetland. As mentioned in Chapter 2, farm fields that are left to grow unmanaged would end up with vegetation that did not meet the purposes of Refuge System lands. The typical restoration technique includes the continuation of farming and herbicide use until just before restoration planting occurs. Continued farming and herbicide use minimizes the number of residual weeds and weed seeds that will compete with the native vegetation to be planted. The use of herbicide-resistant, genetically modified crops results in timely and cost-effective restoration of habitat as the associated seed and herbicides are readily available (Brookes 2010, Helzer 2010). Excess vegetation can also make it difficult or impossible to operate the equipment used to plant native vegetation. Lastly, using farming to maintain sites in good condition for restoration makes restoration more economically feasible.

Currently, 50 percent of farmed Refuge System lands are scheduled to be restored to natural habitats over the next 15 years. Under Alternative D, farming would cease on about 80 percent of currently farmed Refuge System lands within 5 years. Forty to 60 percent of these lands would be left to unmanaged succession. Farming would continue on the remaining 20 percent because agriculture is a specific legislated establishing purpose at Crab Orchard NWR. Newly acquired land could be farmed for up to 3 years in order to prepare it for restoration to natural habitat. Farming would continue at Crab Orchard NWR because of its specific legislated establishing purpose.

Because they are now the dominant hybrid of corn and soybeans planted in the Midwest, it would be most cost effective to provide prepare farm land for conversion to native habitats using GMGT corn and soybeans.

Issue 7: Farming is an effective way to control invasive plants and invasion of woody species.

This alternative has the greatest limitations on the use of growing row crops on Refuge System lands. In terms of supporting the Refuge System mission of restoring land to natural habitat, Alternative D is less efficient and less cost-effective than other alternatives. A significant portion of Refuge System lands have large infestations of exotic, invasive plants, lack diverse natural vegetation, or are otherwise in degraded condition. Farming provides

a method to remove existing, undesirable vegetation and prepare land for restoration to diverse, natural vegetation communities.

Invasive species of plants and animals are a growing problem on a global, national, and regional scale (Pimentel et al. 2005). Invasive species are a threat to agricultural and native habitats (<http://www.fws.gov/invasives/>). The Service often continues farming land until just before restoration in order to discourage invasive plants.

In many situations, row crop farming is the most effective and cost-efficient method available for converting invasive plant-infested habitat into diverse natural habitats. Because they are now the dominant hybrids of corn and soybeans planted in the Midwest, it would be most cost effective to prevent invasive plants from becoming established in areas that will be restored to native habitat by using GMGT corn and soybeans.

Issue 8: The Service should use conservation tillage practices to minimize soil erosion on cultivated lands.

Conservation tillage results in reduced soil disturbance and increased crop residue which decrease soil erosion. Reduced soil erosion results in more productive land and cleaner water. Glyphosate-tolerance increases the chances that conservation tillage can be successfully used (Towery and Werblow 2010).

About 80 percent of farmed Refuge System lands will be abandoned to natural succession or restored to natural habitats over the next 5 years. Newly acquired land could be farmed for up to 3 years in order to prepare it for restoration to natural habitat. Farming would continue at Crab Orchard NWR because of its specific legislated establishing purpose.

Issue 9: Concern exists for developing herbicide resistance in weeds by using GMCs.

Under this alternative, after 5 years farming would stop on Refuge System lands with the exception of Crab Orchard NWR and on newly purchased land, would could be farmed for two 3 years. GMGT corn and soybeans would not be used. The likelihood of developing weed resistance on Refuge System lands would be minimal.

4.2.4.4 Socio-economic Issues

Issue 10: Non-genetically modified seeds are becoming less available in local communities.

GM herbicide-tolerant crops were planted on 92 percent of the U.S. soybean acres and 80 percent of the corn acres in 2008 (Brookes 2010). Under Alternative D, GMGT corn and soybeans would not be

used. The availability of non-genetically modified seed can be limited in some areas of the Midwest Region. Availability is likely to decrease over time as it appears that GM crops will continue to dominate the seed market. As in Alternative C, cooperating farmers are likely to have increasing difficulties finding corn and soybean seeds that are not genetically modified.

Issue 11: Not being able to use GMCs could make farming less profitable for cooperators. Local farming cooperators will lose income if farming is reduced or eliminated.

Under Alternative D, local farming cooperators will lose farming opportunities as 80 percent of Refuge System row crop lands are restored to natural habitats in the next 15 years. Currently, farming with non-GM crops results in higher annual pesticide costs to farmers and farm income is reduced due to higher production costs (Brookes 2010). The profitability of farming on Refuge System lands is likely to decline, and some farmers may choose to not farm on Refuge System lands. The Service can compensate for at least some of the increased operating costs by charging lower rental rates or requiring a smaller share of crops.

Issue 12: Changing farming on Refuge System lands will impact the economy.

In this alternative, 80 percent of farmed Refuge System lands would be abandoned to natural succession or restored to natural habitats over the next 5 years. Because GMGT corn and soybeans would not be used under this alternative, the profitability of farming on Refuge System lands is likely to decline, and some farmers may choose to not farm on Refuge System lands. Because of the small size of the farming operations on Refuge System lands relative to the size of the Midwest Region's farming economy, the economic effect of reducing long-term farming would be negligible.

Issue 13: Use of GMGT corn and soybeans on Refuge System lands could impact neighboring organic farmers due to inadvertent gene flow from GM to organic crops.

The USDA National Organic Program lists 2,800 Certified Organic Operations (farmers) in the Midwest Region (<http://apps.ams.usda.gov/nop/>). About 60 percent of these farmers raise organic corn. Corn is currently raised on 31 refuges and wetland management districts in the Midwest Region. Under Alternative D, there would be no effect on organic farming operations because GMGT corn and soybeans would not be used on Refuge System lands.

Table 3: Comparison of Impacts by Issue

Issue	Alternative A: Continue Farming for Multiple Objectives, GMGT^a Corn and Soybeans Allowed (No Action) (Preferred Alternative)	Alternative B: Farming for Habitat Restoration Objectives Only, GMGT Corn and Soybeans Allowed	Alternative C: Farming for Multiple Objectives, No GMGT Corn and Soybeans	Alternative D: Limited Row Crop Farming, No GMGT Corn and Soybeans
Wildlife Issues				
Issue 1: GMGT crops could benefit wildlife	Extensive use of conservation tillage.	Same as Alternative A.	Less conservation tillage.	Less conservation tillage, many fewer acres farmed.
Issue 2: Toxicity of Herbicides to Wildlife	Low. Label instructions, PUPs ^b , and BMPs ^c .	Same as Alternative A.	Same as Alternative A.	Same as Alternative A.
Issue 3: High energy waterfowl food	Crops grown for waterfowl.	No farming for waterfowl.	Less effective, more costly waterfowl foods without GMGT corn and soybeans.	Same as Alternative B.
Issue 4: Attractant for Wildlife-dependent recreation	Crops grown to attract wildlife for viewing, etc.	No farming to attract wildlife for viewing, etc.	Less effective, more costly without GMGT corn and soybeans.	No farming to attract wildlife for viewing, etc.
Issue 5: Row crops are poor wildlife habitat	50% reduction in row crops in 15 years.	50-80% reduction in row crops in 15 years.	50% reduction in row crops in 15 years.	80% reduction in row crops in 5 years.
Row Crops on Refuge System Lands				
Current Acres (2010)	20,000	20,000	20,000	20,000
2025	10,000 ^d	4,000-10,000	10,000	4,000 ^e
Habitat Issues				
Issue 6: Farming is a Useful Habitat Restoration Tool	Farming and GMGT corn and soybeans available tool for habitat restoration.	Same as Alternative A.	Restoration less effective, more costly without GMGT corn and soybeans.	More costly. May not be feasible to meet refuge and district purposes.
Issue 7: Control of invasive plants	Partial control in areas scheduled for restoration.	Same as Alternative A.	Same as Alternative A.	Less control in areas scheduled for restoration.
Issue 8: Tillage/soil erosion	More use of conservation tillage, less soil erosion.	Same as Alternative A.	Less use of conservation tillage, more soil erosion.	Less conservation tillage, on fewer acres.
Issue 9: Herbicide resistance	Higher risk with much use of glyphosate on GMGT corn and soybeans.	Much use of glyphosate on GMGT corn and soybeans, fewer acres farmed.	Lower risk since no use of GMGT corn and soybeans will mean less use of glyphosate.	Lowest risk since no use of GMGT corn and soybeans on fewer acres.
Socio-economic Issues				
Issue 10: Seed availability	Readily available in all areas.	Same as Alternative A.	Limited availability of non-GMGT seeds.	Same as Alternative C.

Table 3: Comparison of Impacts by Issue (Continued)

Issue	Alternative A: Continue Farming for Multiple Objectives, GMGT^a Corn and Soybeans Allowed (No Action) (Preferred Alternative)	Alternative B: Farming for Habitat Restoration Objectives Only, GMGT Corn and Soybeans Allowed	Alternative C: Farming for Multiple Objectives, No GMGT Corn and Soybeans	Alternative D: Limited Row Crop Farming, No GMGT Corn and Soybeans
Issue 11: Impacts on cooperative farmers	GMGT corn and soybeans allowed, 50% reduction in row crops in 15 years.	GMGT corn and soybeans allowed, 50-80% reduction in row crops in 15 years.	GMGT corn and soybeans prohibited, 50% reduction in row crops in 15 years.	GMGT corn and soybeans prohibited, 80% reduction in row crops in 5 years.
Issue 12: Impacts on economy	Activities on 0.02% of the total row crop acreage in the Service's eight-state Midwest Region would have a negligible impact on the region's economy.	Same as Alternative A.	Same as Alternative A.	Same as Alternative A.
13. Impacts on organic crops	Localized negative impacts are possible but unlikely; potential would be reduced as 50% of existing acres farmed on Refuge System land are converted to native habitat.	Localized negative impacts are possible but unlikely; potential would be reduced as 50-80% of existing acres farmed on Refuge System land are converted to native habitat.	No impacts since GMGT corn and soybeans will not be used.	No impacts since GMGT corn and soybeans will not be used.

- a. Genetically-modified, glyphosate-tolerant corn and soybeans.
- b. Pesticide Use Proposal.
- c. Best Management Practices
- d. 10,000 acres of Refuge System lands are currently scheduled to be converted from farm land to natural habitats in the next 15 years.
- e. Farming would cease on Refuge System lands after 5 years, except for Crab Orchard NWR and newly purchased lands, which could be farmed for up to 3 years.

4.3 Environmental Justice

Executive Order 12898 "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations" was signed by President Clinton on February 11, 1994. Its purpose was to focus the attention of federal agencies on the environmental and human health conditions of minority and low-income populations with the goal of achieving environmental protection for all communities. The Order directed federal agencies to develop environmental justice strategies to aid in identifying and addressing disproportionately high and adverse human health or environmental effects of their programs, policies, and activities on minority and low-income populations. The Order is also intended to promote nondiscrimination in federal

programs substantially affecting human health and the environment, and to provide minority and low-income communities access to public information and participation in matters relating to human health or the environment.

None of the management alternatives described in this EA would disproportionately place any adverse environmental, economic, social, or health impacts on minority and low-income populations.

4.4 Cumulative Impacts Analysis

Cumulative effects are effects on the environment that result from the incremental impact of an action when added to other past, present, and reasonably foreseeable future actions. Potential cumulative effects for the alternatives are described in

this section. The discussion considers the interaction of activities on Midwest Region Refuge System lands with other actions occurring over a larger spatial and temporal frame of reference.

Service policy states:

We do not allow refuge uses or management practices that result in the maintenance of non-native plant communities unless we determine there is no feasible alternative for accomplishing refuge purpose(s). (601 FW 3 Biological Integrity, Diversity, and Environmental Health).

This policy and trends in land management practices indicate that future actions will result in more restoration of crop land to natural habitats on Refuge System lands. This trend is unlikely to have any significant impacts on a regional (eight-state) scale when Refuge System lands currently cover only 0.4 percent of the Midwest Region. If all Midwest refuges and districts purchased all the land currently authorized (Chapter 2, Table 2), Refuge System lands would cover 0.5 percent of the Midwest Region. Conversion of farm land to natural habitats is likely to have only modest impacts on the National Wildlife Refuge System in the Midwest Region, since farm land currently makes up only 1.6 percent of Refuge System lands. Restoration to natural habitats could have a more significant impact as future land is added to the Refuge System since about 40 percent of the land that could be purchased is currently farmed (Table 2 on page 17).

4.4.1 Alternative A: Continue Farming for Multiple Objectives, GMGT Corn and Soybeans Allowed (No Action) (Preferred Alternative)

4.4.1.1 Wildlife Issues

In general, the cumulative effect of the Midwest Region's farming program is that there will be fewer farmed acres and more restored natural areas. On an eight-state regional scale, most wildlife-related issues are unlikely to be effected by Alternative A because:

- Refuge System lands currently cover only 0.4 percent of the eight-state region and are unlikely to increase to more than 0.5 percent in the foreseeable future.
- Row crops cover only 1.6 percent of Refuge System lands and will decrease to 0.8 percent within the next 15 years.

Given the small percentage of land affected by the farming program on an eight-state regional scale, Alternative A is unlikely to have an effect on most wildlife issues. However, providing food for

waterfowl on Refuge System lands may become more critical as agricultural techniques intensify leaving less waste grain available (Krapu et al. 2004). As more of the eight-state region is developed, Refuge System lands could become more critical for the protection of threatened and endangered species. Alternative A allows the use of row crop farming and GMGT corn and soybeans as an effective and cost efficient method of growing supplemental food for wildlife and restoring disturbed areas to natural habitats that are more likely to support threatened and endangered species.

Refuge System lands could continue to provide concentrated food sources to attract wildlife for wildlife-dependent recreation such as wildlife observation, wildlife photography, and environmental interpretation. Wildlife-dependent recreation has growing economic and social values.

4.4.1.2 Habitat Issues

The loss of natural habitats in the eight-state region continues and some habitats are becoming very rare (Noss et al. 1995). Alternative A allows the continued use of row crop farming and GMGT corn and soybeans as an effective and cost efficient method of restoring disturbed areas to diverse, natural habitats. Because row crops on Refuge System lands are such a small part (0.02 percent) of the row crop acreage in the eight-state region (Figure 4 on page 17), it's unlikely that they would contribute significantly to regional/national issues like herbicide resistance in weeds and water quality issues related to soil erosion.

4.4.1.3 Socio-economic Issues

Because row crops on Refuge System lands are such a small part (0.02 percent) of the row crop acreage in the eight-state region, it's unlikely that they would impact the larger economy. Compared to the other alternatives, Alternative A has the least short-term impact on cooperative farmers. Some cooperative farmers will lose farming opportunities under this alternative as about 50 percent of Refuge System farm lands are converted to natural habitats over the next 15 years. Although U.S. cropland acreages have remained relatively stable over the last 50 years (<http://www.ers.usda.gov/Briefing/LandUse/urbanchapter.htm>), small decreases in future row crop acreages are possible in the Midwest Region. The relatively small amount (20,000 acres) of Refuge System row crops spread over the eight Midwest Region states provides only a very small proportion of the farming opportunities in the Midwest Region, which has 116,000,000 acres of row crops. Potential impacts on organic farming are unlikely and the likelihood will decline as farming acreage will decrease by 50 percent over the next 15 years.

4.4.2 Alternative B: Farming for Habitat Restoration Objectives Only, GMGT Corn and Soybeans Allowed

4.4.2.1 Wildlife Issues

The cumulative effect of the Midwest Region's farming program is that there will be fewer farmed acres and more natural areas. On an eight-state regional scale, most wildlife-related issues are unlikely to be effected by Alternative B because:

- Refuge System lands currently cover only 0.4 percent of the eight-state region and are unlikely to increase to more than 0.5 percent in the foreseeable future.
- Row crops cover 1.6 percent of Refuge System lands and will decrease to 0.8 percent within the next 15 years.

On an eight-state regional scale, Alternative B is unlikely to have an effect on most wildlife issues. However, providing food for waterfowl on Refuge System lands may become more critical as agricultural techniques intensify leaving less waste grain available. Alternative B would not allow growing row crops on Refuge System lands for the purpose of providing supplemental food for wildlife. As more of the eight-state region is developed, Refuge System lands could become more critical for the protection of threatened and endangered species. Alternative B allows the use of row crop farming and GMGT corn and soybeans as an effective and cost efficient method of restoring disturbed areas to natural habitats that are more likely to support threatened and endangered species.

Under Alternative B, Refuge System lands would not continue to provide concentrated food sources to attract wildlife for wildlife-dependent recreation such as wildlife observation, wildlife photography, and environmental interpretation. Wildlife-dependent recreation has growing economic and social values.

4.4.2.2 Habitat Issues

The loss of natural habitats in the eight-state region continues and some habitats are becoming very rare. Alternative B allows the continued use of row crop farming and GMGT corn and soybeans as an effective and cost efficient method of restoring disturbed areas to diverse, natural habitats. Because row crops on Refuge System lands are such a small part (0.02 percent) of the row crop acreage in the eight-state region, it's unlikely that they would contribute significantly to regional/national issues like herbicide resistance in weeds and water quality issues related to soil erosion.

4.4.2.3 Socio-economic Issues

Because row crops on Refuge System lands are such a small part (0.02 percent) of the row crop acreage in the eight-state region, it's unlikely that they would impact the larger economy. Compared to Alternative A, this alternative has more short-term impacts on cooperative farmers because more farm land will be converted to natural habitats. Some cooperative farmers will lose farming opportunities under this alternative as 50-80 percent of Refuge System farm lands will be converted to natural habitats over the next 15 years. Although U.S. cropland acreages have remained relatively stable over the last 50 years (<http://www.ers.usda.gov/Briefing/LandUse/urbanchapter.htm>), small decreases in future row crop acreages are possible in the Midwest Region. The relatively small amount (20,000 acres) of Refuge System row crops spread over the eight Midwest Region states provides only a very small proportion of the farming opportunities in the Midwest Region, which has 116,000,000 acres of row crops. Potential impacts on organic farming are unlikely and the likelihood will decline as farming acreage will decrease by 50-80 percent over the next 15 years.

4.4.3 Alternative C: Farming for Multiple Objectives, No GMGT Corn and Soybeans

4.4.3.1 Wildlife Issues

The cumulative effect of the Midwest Region's farming program is that there will be fewer farmed acres and more natural areas. On an eight-state regional scale, most wildlife-related issues are unlikely to be effected by Alternative C because:

- Refuge System lands currently cover only 0.4 percent of the eight-state region and are unlikely to increase to more than 0.5 percent in the foreseeable future.
- Row crops cover only 1.6 percent of Refuge System lands and will decrease to 0.8 percent within the next 15 years.

On an eight-state regional scale, Alternative C is unlikely to have an effect on most wildlife issues. However, providing food for waterfowl on Refuge System lands may become more critical as agricultural techniques intensify leaving less waste grain available. As more of the eight-state region is developed, Refuge System lands could become more critical for the protection of threatened and endangered species. Alternative C allows the use of row crop farming as a useful method of growing supplemental food for wildlife and restoring disturbed areas to natural habitats that are more likely to support threatened and endangered species. The prohibition

against the use of GMGT corn and soybeans will cause this method to be less effective and cost efficient.

Refuge System lands could continue to provide concentrated food sources to attract wildlife for wildlife-dependent recreation such as wildlife observation, wildlife photography, and environmental interpretation. Wildlife-dependent recreation has growing economic and social values. The prohibition against the use of GMGT corn and soybeans would cause this method to be less effective and cost efficient.

4.4.3.2 Habitat Issues

Alternative C allows the use of row crop farming as a useful method of restoring disturbed areas to diverse, natural habitats. The prohibition against the use of GMGT corn and soybeans would cause this method to be less effective and cost efficient. Because row crops on Refuge System lands are such a small part (0.02 percent) of the row crop acreage in the eight-state region, it's unlikely that they would contribute significantly to regional/national issues like herbicide resistance in weeds and water quality issues related to soil erosion.

4.4.3.3 Socio-economic Issues

Because row crops on Refuge System lands are such a small part (0.02 percent) of the row crop acreage in the eight-state region, it's unlikely that they would impact the larger economy. Since GMGT corn and soybeans would not be allowed under Alternative C, there is no potential for inadvertent gene flow from GM to organic crops. The prohibition against the use of GMGT corn and soybeans is likely to negatively impact the profitability of farming in Refuge System lands. Genetically modified crops dominate agriculture in the eight-state region and their importance would likely continue to grow. It's likely that new GM crops and other changes in agricultural practices would occur faster than the Service's ability to assess their potential impacts on Refuge System lands. Cooperative farmers would lose farming opportunities under this alternative as about 50 percent of Refuge System farm lands are converted to natural habitats. Although U.S. cropland acreages have remained relatively stable over the last 50 years (<http://www.ers.usda.gov/Briefing/LandUse/urbanchapter.htm>), small decreases in future row crop acreages are possible in the Midwest Region. The relatively small amount (20,000 acres) of Refuge System row crops spread over the eight Midwest Region states provides only a very small proportion of the farming opportunities in the Midwest Region, which has 116,000,000 acres of row crops.

4.4.4 Alternative D: Limited Row Crop Farming, No GMGT Corn and Soybeans

4.4.4.1 Wildlife Issues

The cumulative effect of the Midwest Region's farming program is that there will be fewer farmed acres and more natural areas. On an eight-state regional scale, most wildlife-related issues are unlikely to be effected by Alternative D because:

- Refuge System lands currently cover only 0.4 percent of the eight-state region and are unlikely to increase to more than 0.5 percent in the foreseeable future.
- Row crops cover only 1.6 percent of Refuge System lands and will decrease to 0.8 percent within the next 15 years.

On an eight-state regional scale, Alternative D is unlikely to have an effect on most wildlife issues. However, providing food for waterfowl on Refuge System lands may become more critical as agricultural techniques intensify leaving less waste grain available. As more of the eight-state region is developed, Refuge System lands could become more critical for the protection of threatened and endangered species. Alternative D allows the use of row crop farming at Crab Orchard NWR to meet the Refuge's establishing purposes, however the use of GMGT corn and soybeans would be prohibited. Row crop farming would be allowed for up to 3 years on newly purchased lands, and GMGT corn and soybeans would not be allowed. The Service would lack this effective and cost efficient method of growing supplemental food for wildlife and restoring disturbed areas to natural habitats.

Refuge System lands would not continue to provide concentrated food sources to attract wildlife for wildlife-dependent recreation such as wildlife observation, wildlife photography, and environmental interpretation. Wildlife-dependent recreation has growing economic and social values.

4.4.4.2 Habitat Issues

Alternative D does not allow the use of row crop farming as a method of restoring disturbed areas to diverse, natural habitats. Because row crops on Refuge System lands are such a small part (0.02 percent) of the row crop acreage in the eight-state region, it's unlikely that they would contribute significantly to regional/national issues like herbicide resistance in weeds and water quality issues related to soil erosion.

4.4.4.3 Socio-economic Issues

Because row crops on Refuge System lands are such a small part (0.02 percent) of the row crop acreage in the eight-state region, it's unlikely that they

would impact the larger economy. Since GMGT corn and soybeans will not be allowed under Alternative D, there is no potential for inadvertent gene flow from GM to organic crops. The prohibition against the use of GMGT corn and soybeans is likely to negatively impact the profitability of farming in Refuge System lands. Genetically modified crops dominate agriculture in the eight-state region and their importance will likely continue to grow. It's likely that new GM crops and other changes in agricultural practices will occur faster than the Service's ability to assess their potential impacts on Refuge System lands. Cooperative farmers will lose farming opportunities under this alternative as about 80 percent of Refuge System farm lands are converted to natural habitats within 5 years. Although U.S. cropland acreages have remained relatively stable over the last 50 years (<http://www.ers.usda.gov/Briefing/LandUse/urbanchapter.htm>), small decreases in future row crop acreages are possible in the Midwest Region. The relatively small amount (20,000 acres) of Refuge System row crops spread over the eight Midwest Region states provides only a very small proportion of the farming opportunities in the Midwest Region, which has 116,000,000 acres of row crops.

Chapter 5: Consultation and Coordination

5.1 Planning Team and Contributors

The Planning Team is made up of representatives from both the Midwest Region (R3) and Region 6. Team members are Kevin Brennan and Doug Wells from Fergus Falls Wetland Management District, Mike Brown, Refuge Manager at Cypress Creek NWR, Mike Artmann from Region 6 Regional Office, and Tom Koerner from Sand Lake National Wildlife Refuge Complex.

Sandra Siekaniec, formerly Assistant Refuge Supervisor in the Midwest Region, was the Regional Office representative until October 2010.

All members of the Planning Team contributed to the development of this EA. Activities included public scoping, reviewing comments, researching and reading literature, interviewing Refuge Managers, producing maps, and writing and editing the EA.

Other individuals also contributed to the Draft Environmental Assessment:

- Tom Larson, Chief of the Division of Conservation Planning in the Midwest Region
- Jane Hodgins, Technical Writer/Editor with the Division of Conservation Planning
- Gabriel DeAlessio, GIS Specialist/Biologist with the Division of Conservation Planning
- Sean Killen, Cartographer with the Division of Realty, National Wildlife Refuge System, in the Midwest Region

5.2 Agencies Consulted

- USDA/APHIS's Biotechnology Regulatory Services
- EPA's Biopesticides and Pollution Prevention Division
- FDA's Center for Food Safety and Applied Nutrition
- Office of Science and Technology Policy

Appendix A: Midwest Region Farming Information

Refuge or Wetland Management District	State	Total Refuge or District Acres	2005 RAPP ^a Crop Management Acres	2010 RAPP Crop Management Acres	Change in Crop Management Acres (2010 - 2005)
Agassiz NWR ^b	MN	61,500	155	155	0
Big Muddy NWR	MO	16,139	1,190	600	-590
Big Oaks NWR	IN	50,900	0	0	0
Big Stone NWR	MN	11,586	532	295	-237
Big Stone WMD ^c	MN	4,986	204	15	-189
Boyer Chute NWR	NE	429	18	0	-18
Cedar Point NWR	OH	2,598	0	0	0
Chautauqua NWR	IL	6,198	0	0	0
Clarence Cannon NWR	MO	3,750	562	700	138
Crab Orchard NWR	IL	45,456	4,704	4,704	0
Crane Meadows NWR	MN	1,761	30	0	-30
Cypress Creek NWR	IL	16,250	1,767	1,567	-200
DeSoto NWR	IA	8,355	1,495	1,010	-485
Detroit Lakes WMD	MN	58,004	2,263	776	-1,487
Detroit River International Wildlife Refuge	MI	5,657	70	290	220
Driftless Area NWR	IA	911	49	50	1
Emiquon NWR	IL	2,514	62	317	255
Fergus Falls WMD	MN	72,187	115	400	285

Refuge or Wetland Management District	State	Total Refuge or District Acres	2005 RAPP ^a Crop Management Acres	2010 RAPP Crop Management Acres	Change in Crop Management Acres (2010 - 2005)
Fox River NWR	WI	1,054	0	0	0
Glacial Ridge NWR	MN	7,337	0	0	0
Gravel Island NWR	WI	35	0	0	0
Great River NWR	MO	12,330	947	423	-524
Green Bay NWR	WI	336	0	0	0
Hamden Slough NWR	MN	3,210	246	218	-28
Harbor Island NWR	MI	695	0	0	0
Horicon NWR	WI	22,000	0	0	0
Huron NWR	MI	147	0	0	0
Iowa WMD	IA	24,327	3,797	3,451	-346
Kirtlands Warbler WMA ^d	MI	6,684	0	0	0
LaCrosse District UMNWFR ^e	WI	47,557	0	117	117
Leopold WMD	WI	12,790	318	188	-130
Litchfield WMD	MN	49,061	0	0	0
McGregor District UMNWFR	IA	91,772	296	0	-296
Meredosia NWR	IL	3,582	135	0	-135
Michigan WMD	MI	535	0	0	0
Michigan Islands NWR	MI	619	0	0	0
Middle Mississippi River NWR	IL, MO	8,348	0	0	0
Mille Lacs NWR	MN	1	0	0	0
Mingo NWR	MO	21,519	624	315	-309
MN Valley NWR	MN	12,500	0	0	0
MN Valley WMD	MN	6,319	0	0	0
Morris WMD	MN	80,715	1,128	346	-782
Muscatatuck NWR	IN	7,802	344	258	-86
Neal Smith NWR	IA	5,383	0	0	0
Necedah NWR	WI	43,696	0	0	0
Northern Tallgrass Prairie NWR	IA, MN	4,897	59	431	372
Ottawa NWR	OH	6,546	442	210	-232
Ozark Cavefish NWR	MO	42	0	0	0
Patoka River NWR	IN	7,121	739	615	-124
Pilot Knob NWR	MO	90	0	0	0

Refuge or Wetland Management District	State	Total Refuge or District Acres	2005 RAPP ^a Crop Management Acres	2010 RAPP Crop Management Acres	Change in Crop Management Acres (2010 - 2005)
Port Louisa NWR	IA	15,297	80	45	-35
Rice Lake NWR	MN	20,194	0	0	0
Rydell NWR	MN	2,174	0	0	0
Savanna District UMNWFR	IA	64,393	0	0	0
Seney NWR	MI	96,524	0	0	0
Sherburne NWR	MN	30,700	0	0	0
Shiawassee NWR	MI	9,437	1,270	1,146	-124
Squaw Creek NWR	MO	6,517	502	354	-148
St. Croix WMD	WI	8,174	700	172	-528
Swan Lake NWR	MO	10,611	750	1,115	365
Tamarac NWR	MN	42,738	15	15	0
Tamarac WMD	MN	881	0	0	0
Trempealeau NWR	WI	6,226	0	0	0
Two Rivers NWR	IL	12,485	436	0	-436
Union Slough NWR	IA	3,334	0	0	0
West Sister Island NWR	OH	77	0	0	0
Whittlesey Creek NWR	WI	298	0	0	0
Windom WMD	MN	16,828	149	120	-29
Winona District UMNWFR	MN	37,517	0	0	0
TOTAL		1,242,636	26,193	20,418	-5,775

a. RAPP: Refuge Annual Performance Plan

b. NWR: National Wildlife Refuge

c. WMD: Wetland Management District

d. WMA: Wildlife Management Area

e. UMNWFR: Upper Mississippi River National Wildlife and Fish Refuge

Appendix B: Threatened and Endangered Species of the Midwest Region

Common Name	Latin Name	IL	IN	IA	MI	MN	MO	OH	WI
(No common name)	<i>Geocarpon minimum</i>						T ^a		
American chaffseed	<i>Schwalbea americana</i>				T				
American hart's-tongue fern	<i>Asplenium scolopendrium</i> var. <i>americanum</i>				T				
Decurrent false aster	<i>Boltonia decurrens</i>	T					T		
Dwarf lake iris	<i>Iris lacustris</i>				T				T
Eastern prairie fringed orchid	<i>Platanthera leucophaea</i>	T	T	T	T			T	T
Fassett's Locoweed	<i>Oxytropis campestris</i> var. <i>chartacea</i>								T
Houghton's goldenrod	<i>Solidago houghtonii</i>				T				
Lakeside Daisy	<i>Hymenoxys herbacea</i>	T			T			T	
Leafy prairie clover	<i>Dalea foliosa</i>	E ^b							
Leedy's roseroot	<i>Sedum integrifolium</i> ssp. <i>leedyi</i>					T			
Mead's milkweed	<i>Asclepias meadii</i>	T	T	T			T		
Michigan monkey-flower	<i>Mimulus glaberatus</i> var. <i>michiganensis</i>				E				
Minnesota dwarf trout lily	<i>Erythronium propullans</i>					E			
Missouri bladderpod	<i>Lesquerella filiformis</i>						T		
Northern wild monkshood	<i>Aconitum noveboracense</i>			T				T	
Pitcher's thistle	<i>Cirsium pitcheri</i>	T	T		T				T
Pondberry	<i>Lindera melissifolia</i>						T		
Prairie bush clover	<i>Lespedeza leptostachya</i>	T		T		T			T
Price's potato-bean	<i>Apios priceana</i>	T							

Common Name	Latin Name	IL	IN	IA	MI	MN	MO	OH	WI
Running buffalo clover	<i>Trifolium stoloniferum</i>		E				E	E	
Small whorled pogonia	<i>Isotria medeoloides</i>	T			T		T	T	
Virginia sneezeweed	<i>Helenium virginicum</i>						T		
Virginia spiraea	<i>Spiraea virginiana</i>							T	
Western prairie fringed orchid	<i>Platanthera praecleara</i>			T		T	T		
American burying beetle	<i>Nicrophorus americanus</i>				E		E	E	
Canada lynx	<i>Lynx Canadensis</i>				T	T			T
Clubshell	<i>Pleurobema clava</i>	E	E		E				
Copperbelly water snake	<i>Nerodia erythrogaster neglecta</i>		T		T			E	
Curtis pearlymussel	<i>Epioblasma florentina curtisii</i>						E		
Eastern Massasauga	<i>Sistrurus catenatus</i>	C ^c							
Fanshell	<i>Cyprogenia stegaria</i> (= <i>c.irrorata</i>)	E	E						
Fat pocketbook	<i>Potamilus capax</i>	E	E				E		
Gray bat	<i>Myotis grisescens</i>	E	E				E		
Gray wolf	<i>Canis lupis</i>				E	T			T
Higgins eye pearlymussel	<i>Lampsilis higginsii</i>	E		E		E	E		E
Hine's emerald dragonfly	<i>Somatochlora hineana</i>	E							E
Hungerford's crawling water beetle	<i>Brychius hungerfordi</i>				E				
Illinois cave amphipod	<i>Gammarus acherondytes</i>	E							
Indiana bat	<i>Myotis sodalis</i>	E	E	E	E		E	E	
Iowa Pleistocene snail	<i>Discus macclintocki</i>	E		E					
Karner Blue Butterfly	<i>Lycæides Melissa samuelis</i>	E	E		E	E		E	E
Kirtland's warbler	<i>Dendroica kirtlandii</i>				E				
Lake Erie water snake	<i>Nerodia sipedon insularum</i>							T	
Least tern	<i>Sterna antillarum</i>	E	E	E					
Least Tern (Interior)	<i>Sterna antillarum</i>						E		
Mitchell's satyr butterfly	<i>Neonympha mitchellii</i>		E		E				
Neosho madtom	<i>Noturus placidus</i>						T		
Niangua darter	<i>Etheostoma nianguae</i>						T		
Northern Riffleshell	<i>Epioblasma torulosa rangiana</i>		E		E			E	
Orange-footed pimpleback pearlymussel	<i>Plethobasus copperianus</i>	E	E						
Ozark big-eared bat	<i>Corynorhinus townsendii ingens</i>						E		
Ozark cavefish	<i>Amblyopsis rosea</i>						T		
Pallid sturgeon	<i>Scaphirhynchus albus</i>	E		E			E		
Pink mucket pearlymussel	<i>Lampsilis abrupta</i>	E	E				E	E	
Piping plover	<i>Charadrius melodus</i>	E	E	T	T	E	T	E	E

Common Name	Latin Name	IL	IN	IA	MI	MN	MO	OH	WI
Purple cat's paw pearl mussel	<i>Epioblasma obliquata obliquata</i>							E	
Rabbitsfoot	<i>Quadrula cylindrical cylindrical</i>	C							
Rough pigtoe	<i>Pleurobema plenum</i>		E						
Scaleshell mussel	<i>Leptodea leptodon</i>						E		
Scioto madtom	<i>Noturus trautmani</i>							E	
Sheepnose	<i>Plethobasus cyphus</i>	C							
Spectaclecase	<i>Cumberlandia monodonta</i>	C							
Topeka shiner	<i>Notropis Topeka</i>			E		E	E		
Tumbling Creek covesnail	<i>Antrobia culveri</i>						E		
White Catspaw pearl mussel	<i>Epioblasma obliquata perobliqua</i>		E					E	
White wartyback pearl mussel	<i>Plethobasus cicatricosus</i>		E						
Winged Entire Mapleleaf	<i>Quadrula fragosa</i>					E	E		E

- a. Threatened species
- b. Endangered species
- c. Candidate species

Appendix C: References

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Appendix D: Glossary

Comprehensive Conservation Plan

The National Wildlife Refuge System Improvement Act of 1997 requires that each refuge and wetland management district must be managed in accordance with an approved CCP that will guide management decisions and set forth strategies for achieving station purposes and contributing to the mission of the Refuge System.

Environmental Assessment

A concise public document, prepared in compliance with NEPA, that briefly discusses the purpose and need for an action, alternatives to such action, and provides sufficient evidence and analysis of impacts to determine whether to prepare an environmental impact statement or finding of no significant impact (40 CFR 1508.9).

Farming

For the purposes of this Environmental Assessment, “farming” refers to planting and harvesting row crops.

Genetically Modified/Engineered Organism/Transgenic Organism

Contains a gene or genes that have been artificially inserted instead of the plant acquiring the gene or genes through pollination. The inserted gene or genes may come from an unrelated plant or from a completely different species.

Glyphosate

Glyphosate is a broad-spectrum, non-selective herbicide. It is probably the most widely used herbicide worldwide and is generally considered to be highly effective, but toxicologically and environmentally safe.

National Wildlife Refuge

A national wildlife refuge is land or water acquired or held in easement by the U.S. Fish and Wildlife Service for the purpose of habitat and wildlife conservation. Refuges range in size from half an acre (Mille Lacs NWR in Minnesota) to more than 19 million acres (Arctic NWR in Alaska).

National Wildlife Refuge System

All lands, waters, and interests therein administered by the U.S. Fish and Wildlife Service as wildlife refuges, wildlife ranges, wildlife management areas, wetland management districts, waterfowl production areas, and other areas for the protection and conservation of fish, wildlife and plant resources.

No Action Alternative

The alternative where current conditions and trends are projected into the future without another proposed action (40 CFR 1502.14(d)).

Waterfowl Production Area

Upland grasslands and wetlands that are purchased by the federal government to provide nesting habitat for waterfowl and hunting areas for waterfowl and upland game hunters.

Wetland Management District

The federal administrative unit that is charged with acquiring, overseeing and managing the Waterfowl Production Areas and easements within a specified group of counties. Most Districts are large, covering several counties.