Corn Ethanol and Wildlife

How increases in corn plantings are affecting habitat and wildlife in the Prairie Pothole Region

A University of Michigan study published by the National Wildlife Federation, **2009**

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This report is a summary of a University of Michigan, School of Natural Resources and the Environment Masters Project. The full report can be accessed at: http://hdl.handle.et/2027.42/62096. The National Wildlife Federation served as client for the project and is publishing this report with funding from the David and Lucile Packard Foundation. The authors would like to thank: Julie Sibbing and the National Wildlife Federation; our project advisors Professors Michael Moore, Steve Yaffee, and Johannes Foufopoulos; Professor Bobbi Low; The Education Fund of America; the Packard Foundation; Jim Ringelman and Scott Stephens at Ducks Unlimited; and the numerous practitioners from agencies and organizations who offered their time and expertise during interviews.

Front Cover: Upland Sandpiper courtesy of Jim Ringelman, Ducks Unlimited

Inside Cover: Photo by Stephen Ausmus, DOE

Introduction

Government incentives have led to skyrocketing growth in the U.S. corn ethanol industry over the past five years. This has contributed to major increases in corn prices and corn demand, ultimately resulting in increased corn plantings across the country. Total U.S. corn acreage increased 19 percent between 2006 and 2007, to a level not seen since the Dust Bowl. Though plantings decreased slightly in 2008, they remain higher than at any point in the last fifty years. About one-third of the nation's corn crop is now diverted to ethanol plants. Farmers have shifted land into corn production from other crops, idle agricultural land, and native prairie, thereby causing wildlife habitat loss and degradation. Given that current legislation mandates increases in corn ethanol production through 2015, these patterns are likely to continue.

This study analyzes the current and potential impacts of increased corn ethanol production on wildlife and habitat in four Midwestern states: Iowa, Minnesota, North Dakota, and South Dakota. In addition to experiencing dramatic increases in corn plantings over the last five years, these states encompass the majority of the U.S. portion of a unique wetland/grassland ecosystem known as the Prairie Pothole Region. This region contains important native prairie and wetland habitat, and thus holds special importance for a variety of wildlife species. The goal of this report is to provide policymakers and practitioners with both an assessment of the wildlife and habitat impacts of corn ethanol expansion and recommendations on mitigating these impacts.

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While many factors influence land-use changes, the relationship between ethanol incentives and habitat destruction is fairly clear. Ethanol incentives increase demand for corn, which in turn increases corn prices. Increased corn prices lead to land being converted from other uses to corn production.

Ethanol capacity increased at a steady but moderate rate from 1.7 to 3.6 million gallons per year between 2000 and 2005.[1] Upon passage of the 2005 Energy Bill, which mandated a large increase in domestic ethanol production, U.S. ethanol capacity has grown almost 200 percent to an anticipated 10.6 billion gallons in 2009.[2] Passage of the Energy Independence and Security Act of 2007 further increased the mandate for corn ethanol through 2015, when it will level off at 15 billion gallons. As a result of these and other incentives, national corn ethanol capacity has increased by 600 percent, from 175 million gallons a year in 1980 to 10.57 billion gallons a year at the beginning of 2009.[3] This means that, despite some current contraction within the industry, corn ethanol production will continue to increase, and the expansion of corn production will continue to drive habitat destruction.

Research Methods and Key Findings

This study was undertaken by a team of graduate students at the University of Michigan, School of Natural Resources and Environment, as a Masters project. We used several methods for our analysis. First, we used geographic information systems mapping to construct a series of maps revealing "hotspots" where increased corn plantings are coinciding with habitat loss. We also conducted a statistical analysis to quantify changes in grassland bird populations associated with increases in corn plantings. Through a review of current law and market data, we identified the main drivers of growth in the corn ethanol industry. Finally, we interviewed more than 30 conservation practitioners to assess the potential of federal and state conservation policies and programs to mitigate the impacts on wildlife.

This study addresses five specific research questions:

1. What is driving the market growth of corn ethanol?
2. What are the habitat and environmental impacts of corn ethanol production and associated corn expansion?
3. Where are increases in corn plantings coinciding with habitat loss?
4. What are the implications for wildlife populations in high-change areas?
5. What conservation programs and policies have the potential to mitigate the impacts of corn ethanol production?

Our research and analysis revealed that myriad and often redundant government incentives drive corn ethanol growth. Land-use changes related to increased corn plantings are already occurring, and we found that the greatest increases in corn plantings have occurred in areas important for wildlife. Yet there is no consistent national program to track agricultural land use changes impacting habitat. Our study demonstrates that wildlife populations have already been affected by these changes. Through a bird population analysis, we found that areas of high corn increases have had marked decreases, as large as 30 percent, in both the number of sensitive grassland species and the number of sensitive grassland individuals. Funding and resources for conservation programs have not kept pace with these increasing pressures on habitat and wildlife. If this trend is not reversed, we predict that expanding corn ethanol production will have an irreversible impact on habitat and wildlife across the Prairie Pothole Region.

Study Region: The Prairie Pothole Region

Globally Unique, Nationally Important

The Prairie Pothole Region is one of North America's iconic landscapes, characterized by expansive grasslands dotted with thousands of shallow wetlands, or "potholes." Thousands of years ago, retreating glaciers created these depressions across what is today Iowa, Minnesota, South Dakota, North Dakota, Montana, and the Canadian provinces of Alberta, Saskatchewan, and Manitoba. The prairie-wetland ecosystem of the Prairie Pothole Region is unlike any other ecosystem on the planet.

Prairie pothole habitat consists of tallgrass prairie, shortgrass prairie, and mixed prairie interspersed with temporary and semi-permanent wetlands. These prairies and associated wetlands support an array of treasured wildlife including waterfowl, shorebirds, and grassland birds. The Prairie Pothole ecosystem is worth saving for the entire nation's benefit:

- It is estimated that up to 75 percent of all North American waterfowl breed in the Prairie Pothole Region,[4] making it one of the most important areas for waterfowl production on the continent.[5]
- Of the 800 migratory bird species in North America, more than 300 rely on the Prairie Pothole Region for breeding and nesting, as well as for feeding and resting during spring and fall migrations.[6]

In addition to providing vital wildlife habitat, the region's rich prairie soils sequester vast amounts of carbon. When the region's undisturbed soil is put into cultivation, it releases up to half of its carbon over 50 years of cultivation, exacerbating climate change.[7] One 2008 study estimated that this conversion releases approximately 59.8 tons of CO_2 per acre over this time span.[8] For CRP land, there is a net release of carbon for 48 years, with an estimated release of 30.8 tons of CO_2 per acre into the atmosphere.[9,10]

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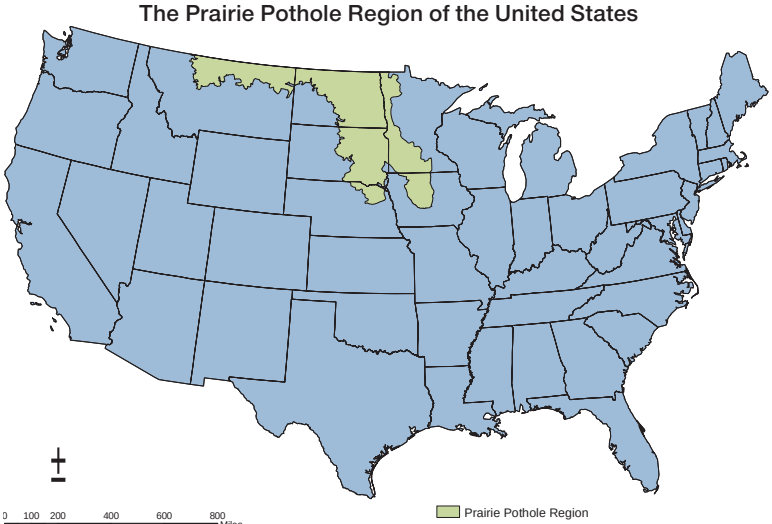
The Prairie Pothole Region of the United States



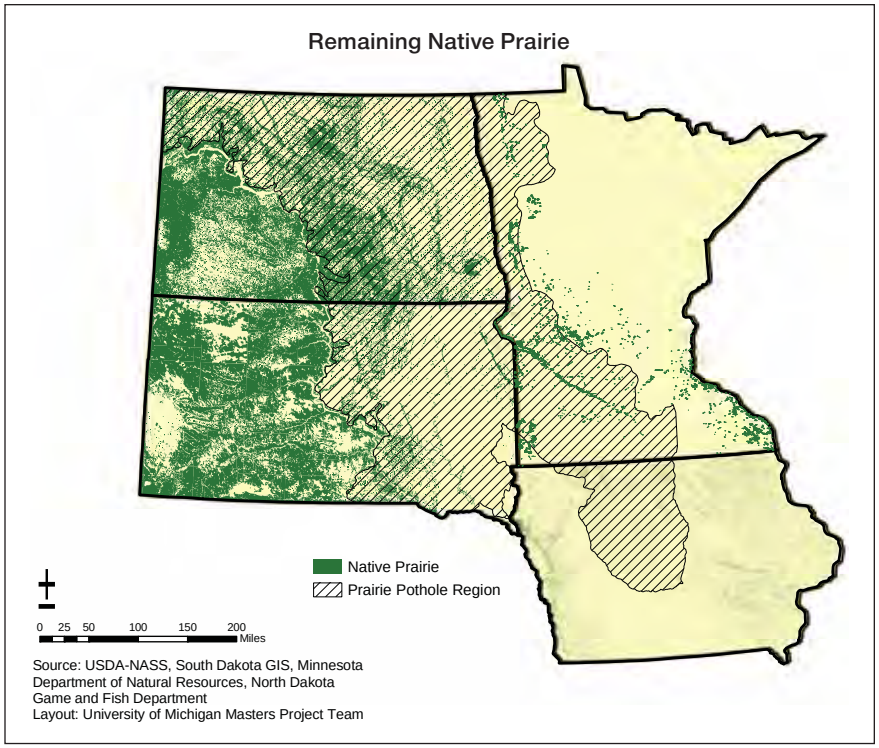
Source: Ducks Unlimited
Layout: University of Michigan Masters Project Team

GOVERNMENT INCENTIVES FOR CORN ETHANOL PRODUCTION

The U.S. Government has implemented many incentives for corn ethanol production over the past two decades, creating an expansive ethanol industry. Demand for corn ethanol is largely driven by the Renewable Fuel Standard (RFS), which sets a floor for the amount of ethanol that must be blended with gasoline each year. It requires corn ethanol production to increase from 10.57 billion gallons in 2009 to 15 billion gallons in 2015. We predict that this 4.47 billion gallon increase in corn ethanol production will create demand for an additional 10.69 million acres of corn plantings a year (based on a conversion rate of 2.75 bushels of corn per gallon ethanol[16] and an average yield of 150.68 bushels of corn per acre[17]).

In addition to the RFS, the federal Volumetric Ethanol Excise Tax Credit (VEETC) provides a 45 cent tax credit for every gallon of ethanol blended with gasoline. A recent report by the Center for Agricultural and Rural Development at Iowa State University points out that the VEETC is redundant of the RFS in that they both are able to set the demand for ethanol.[18] Thus, eliminating the VEETC will not change ethanol demand; it will simply raise the cost of the credits used to meet the RFS. Eliminating the VEETC would ease the burden on taxpayers and make the cost of meeting the RFS more transparent. It should be noted that in 2008, the VEETC cost the U.S. Treasury $4 billion, nearly as much as the entire amount spent on all USDA conservation programs that year ($4.185 billion).

Additionally, tariffs on foreign ethanol protect the domestic industry from lower-priced competition. As a result of these and other incentives, national corn ethanol capacity has increased by 600 percent since 1980.[19]



An Imperiled Ecosystem

For decades the Prairie Pothole Region's grasslands and wetlands have been plowed and drained for crop production. Historically, the region was an expansive, continuous landscape, but now its outline on the map seems misleading. For centuries, farm fields have steadily replaced the native grasslands and wetlands of the region, fragmenting habitat and imperiling native wildlife. The fragments of remaining prairie pothole habitat face a spectrum of evolving threats. Combined, these factors create a "perfect storm" of incentives that encourage the conversion of thousands of acres of habitat to cropland.

Before European settlement, the Prairie Pothole Region consisted of approximately 25 million wetlands.[11] Today, over 50 percent of this area has been drained for agricultural development[12] and the region has experienced extreme losses of native prairie habitat. Both Minnesota and Iowa have only small fragments of native prairie remaining. Iowa had 23 million acres of native prairie in 1780, only 30,000 of which are left today.[13] Similarly, Minnesota has only 170,000 acres of native prairie, from over 18 million acres of native prairie in 1850.[14] North and South Dakota have each lost about half of their native prairie over the past 200 years.[15]

Recent dramatic increases in corn plantings have been heavily concentrated in the Prairie Pothole Region, displacing other crops as well as sensitive prairie pothole habitat. The pressure to produce more corn for ethanol is only expected to grow. Therefore, it is critical to investigate the past impacts and potential consequences of corn expansion and to adjust federal policies to protect this nationally important ecosystem from further destruction.

Over 475,000 acres in North and South Dakota were broken between 2002 and 2007.

Effects of Increased Corn Plantings on Wildlife Habitat

Between 2005 and 2007, an additional 4.15 million acres were put into corn production in Iowa, Minnesota, North Dakota, and South Dakota.[20] More than 3.2 million of these corn acres were in the Prairie Pothole Region. These new corn acres have mostly come from three major sources: crop switching, conversion of native grassland to cropland, and removal of land from the Conservation Reserve Program. Crop switching refers to land that was previously planted with other crops being planted with corn. Nationally, the most common crops displaced by corn are soybeans, cotton, and wheat.[21]

Conversion of Grassland and Pastureland

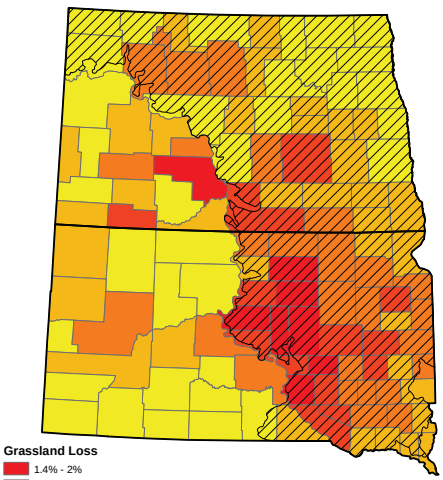
Habitat loss occurs when native grassland is "broken," or plowed for crop production (this is frequently called *sodbusting*). Similarly, pastureland, which is more intensively managed forage land that may have been previously cropped but is now used for grazing, is often plowed and put into crop production. Most often, the grassland being converted in the Prairie Pothole Region is land that had been used to graze livestock or deemed unsuitable for growing crops.

Multiple factors drive sodbusting in the Prairie Pothole Region: high commodity prices, the limited profitability of ranching, new farming technologies and genetically modified crop varieties that make new land suitable for production, economic incentives offered by crop insurance and disaster payments, and the lack of disincentives to discourage the plowing of prairie. Loss of native prairie is devastating for the many species of wildlife that depend on this habitat for breeding, migration, and food. Once native prairie is plowed, its soil structure is permanently altered and the ecosystem can never be fully restored. It is sometimes assumed that if prairie is plowed for production and is found not to be ideal for planting, it can simply be restored to its natural state. Unfortunately, restoration efforts are difficult and expensive and can only restore a fraction of the land's original ecological diversity and function.[22] Therefore, even though land enrolled in the Conservation Reserve Program provides important wildlife habitat, it can never truly replace native prairie.

Data are not systematically collected on the extent and location of "new breakings" or plowing of previously untilled land. The available data are either several years old or cover small geographic areas.[23] However, several studies reveal that habitat loss in the form of sodbusting is significant in the study region, particularly in North and South Dakota. Data collected by the U.S. Farm

Loss of native prairie is devastating for the many species of wildlife that depend on this habitat for breeding, migration, and food. Once native prairie is plowed, its soil structure is permanently altered and the ecosystem can never be fully restored.

Conversion of Native Grassland as Percent of County Area, 2004 to 2007



The pesticides applied to corn are, on average, more environmentally harmful and more persistent than those used on soybeans and other crops.

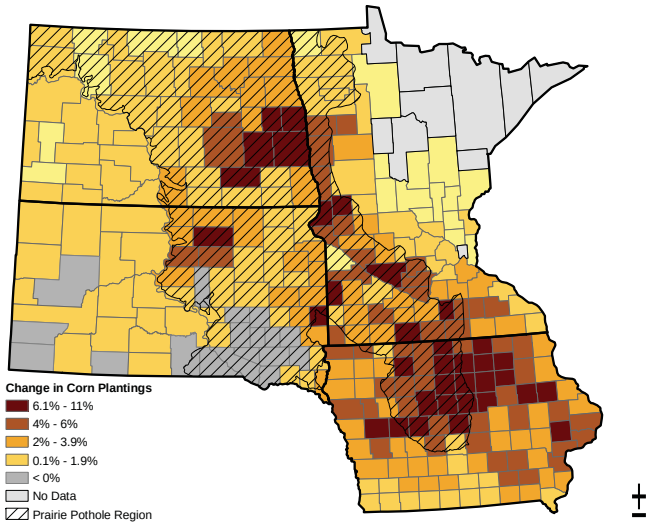
Service Agency (FSA) suggest that over 475,000 acres in North and South Dakota were broken between 2002 and 2007.[24] Of this land, over 350,000 acres were in counties within the Prairie Pothole Region. Sodbusting is even more difficult to quantify in Iowa and Minnesota, as FSA has not collected new breakings data for these states and there is very little prairie left to plow. Nonetheless, practitioners we spoke with stated that breaking native prairie is still a concern in these states. Losing pastureland is an even greater concern. Even though pasture is non-native habitat and has a lower ecological value than prairie, it provides important water quality and habitat benefits in a landscape otherwise dominated by row crops.

The map of grassland conversion illustrates the most recent county-level FSA sodbusting data for North and South Dakota from 2004 to 2007, with the Prairie Pothole Region highlighted. Although some have questioned whether these data were collected using the same methods across counties, conversations with practitioners in these states confirmed that they have seen these same general trends on the ground.

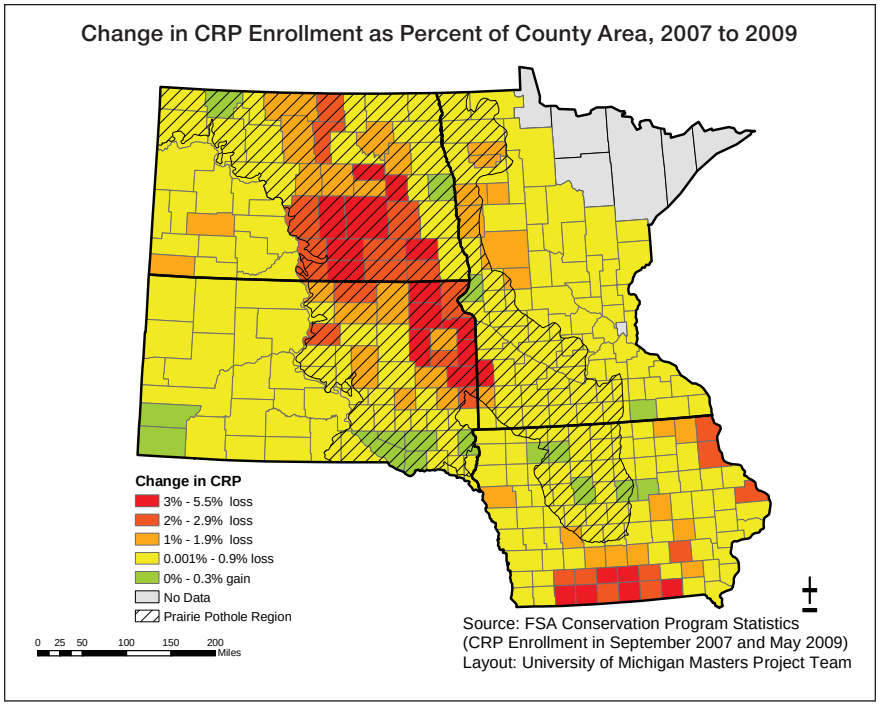
Loss of Conservation Reserve Program Land

In addition to sodbusting, habitat loss also occurs when land is removed from the Conservation Reserve Program (CRP). Conservation Reserve Program losses since 2007 occurred throughout the four-state region, but were concentrated in the Prairie Pothole Regions of North and South Dakota. Given the high value of CRP for habitat and wildlife, these losses have serious implications for wildlife in the states. Even before the losses occurred, South Dakota had the fewest CRP acres of the four states. Thus, losses in South Dakota have the potential to cause an even greater impact on the landscape. Additionally, the limited and fragmented nature of Iowa and Minnesota's remaining grassland makes the CRP losses in these states especially serious for wildlife populations. As with the conversion of grassland to cropland, farmers are taking their land out of CRP primarily for economic reasons. When crop prices are high and CRP rental rates are low, farmers can often make more money converting their land to crop production than keeping it enrolled in CRP. With the high availability of crop insurance and disaster payments, there is little risk in putting even marginal land back into production.

Change in Corn Plantings as Percent of County Area, 2004 to 2007

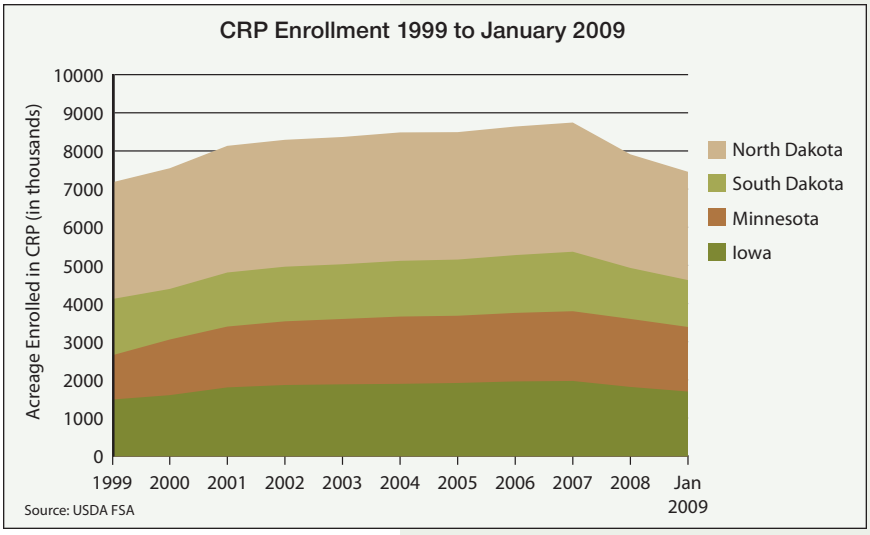


Source: USDA-NASS Agriculture Statistics Database
Layout: University of Michigan Masters Project Team



Habitat Degradation

In addition to reducing available habitat, converting grassland, pastureland, and CRP acres to cropland incr eases soil erosion and surface runoff, degrading and filling nearby wetlands and streams with sediment.[27] The pesticides and fertilizers used to grow corn also degrade habitat. Most of the new corn acreage in the Prairie Pothole Region comes from changing soy-corn rotations or replacing other crops with corn. While such crop switching does not reduce the quantity of available habitat, the input-intensive nature of corn production contributes to increased degradation of remaining habitat. Corn requires more pesticide input per acre than soy and most other food crops. Further, the pesticides applied to corn are, on average, more environmentally harmful and more persistent than those used on soybeans and other crops.[28] In addition to increased pesticide input, expansion of corn acreage results in increased fertilizer application and, thus, an increased volume of nutrients in the environment.[29] In landscapes dominated by corn, estimates suggest that around 17.8 to 35.7 lbs of the nitrogen applied per acre is transported to downstream aquatic ecosystems each year.[30] The amount of phosphorous lost from corn fields can range from 1.8 to 13.4 lbs per acre in a year.[31]



THE CONSERVATION RESERVE PROGRAM (CRP)

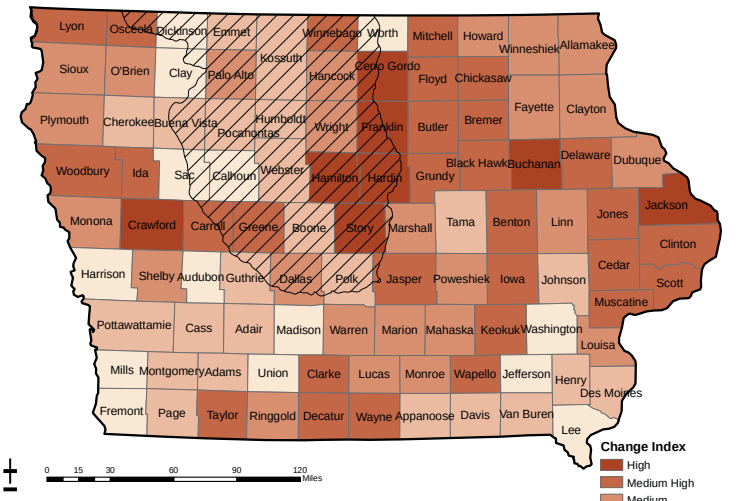
This USDA Conservation Reserve Program pays landowners to retire environmentally sensitive agricultural land and plant vegetative cover for a specified length of time. CRP fields reduce soil erosion, protect water quality, sequester carbon from the atmosphere, and provide important wildlife habitat. For the past two decades, CRP has played a critical role in maintaining the ecological health of the Prairie Pothole Region.

CRP land provides important wildlife habitat for many species of conservation concern, including critical nesting habitat for grassland birds, many of which are declining. Many of these birds, such as pheasants, grouse, and prairie chickens, are game birds, which bring valuable recreation dollars to local economies. Yet CRP enrollment in the region has declined rapidly with the corn ethanol boom. Between 2007 and 2009, North Dakota, South Dakota, Iowa, and Minnesota together lost 1.3 million acres, or about 14.8 percent of land enrolled in CRP. Studies have shown that CRP lands shifting in and out of cultivation are generally located in areas with more imperiled plants and animals.[25] Loss of CRP land has the potential to reverse habitat gains in these critical areas. Researchers estimate that in some parts of the Prairie Pothole Region, converting CRP habitat to cropland could reduce populations of certain at-risk species by as much as 25 percent.[26]

Land-Use Change Hotspots

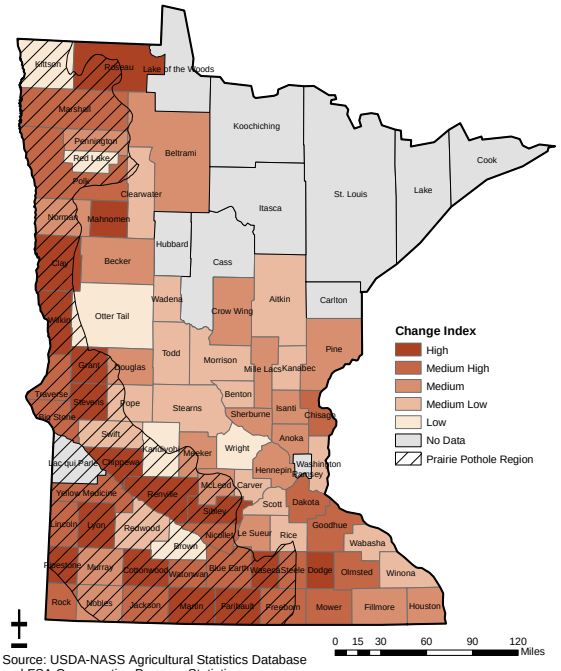
Given the potential negative impacts of corn production on habitat, we sought to determine where relevant land-use changes have occurred most dramatically—where there are hotspots of increased corn plantings and habitat loss. We combined data on corn plantings, CRP enrollment, and first-time crop production on native prairie (available only for North and South Dakota) from 2004 to 2007 to create a "change index" for each state. This change index highlights counties in which the relevant land-use changes have been highest, revealing hotspots of change within each state. The resultant state maps clearly illustrate that areas of high change are concentrated in the ecologically significant Prairie Pothole Region.

Iowa Land-Use Change Index 2004 to 2007



Source: USDA-NASS Agricultural Statistics Database
and FSA Conservation Program Statistics
Analysis and Layout: University of Michigan Masters Project Team

Minnesota Land-Use Change Index 2004 to 2007



Source: USDA-NASS Agricultural Statistics Database
and FSA Conservation Program Statistics
Analysis and Layout: University of Michigan Masters Project Team

Methodology Overview

To calculate change index values, we used publicly available corn planting data from the USDA National Agricultural Statistics Service and CRP enrollment data from the Farm Service Agency (FSA) Conservation Programs Statistics website. For North and South Dakota, new breakings data obtained from FSA were also included in the change indexes. All land-use measurements were normalized by county area and given equal weight in the resultant change index. Differences in data availability required that each state's change index be calculated individually, and therefore the values are not intended for comparison across states. Higher change index scores are associated with negative impacts. For the time period considered, CRP enrollment was generally increasing, and the change index scores reflect this. In counties where CRP enrollment increased between 2004 and 2007, the CRP value had the effect of decreasing a county's change index score. Conversely, CRP loss between 2004 and 2007 increased a county's change index score.

Iowa's change index reveals that several high-change counties—Cerro Gordo, Franklin, Hamilton, Hardin, and Story—are located within the Prairie Pothole Region of Iowa. Total CRP enrollment increased in these counties between 2004 and 2007; therefore corn increases in these counties were most likely mainly accommodated by crop switching. Practitioners confirmed that pastureland is being converted to cropland throughout Iowa, although spatially explicit data are not available. Therefore, it is difficult to analyze the overlap of increased corn production and habitat conversion.

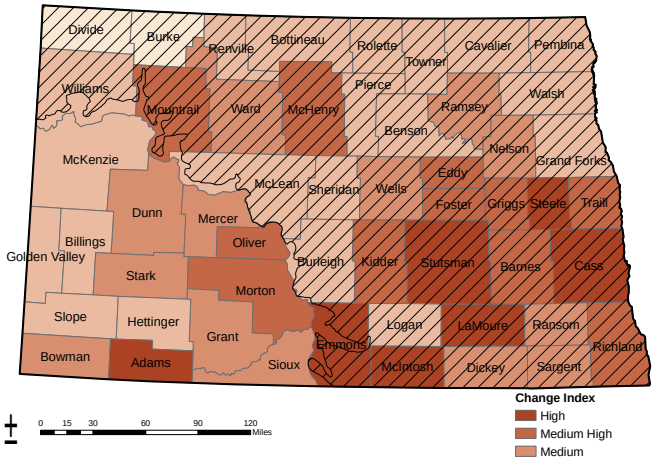
Minnesota's change index reveals that high-change counties are dispersed across the Prairie Pothole Region rather than clustered in a particular area of the state. The high-change counties closely correspond with Minnesota's five prairie subregions, specifically, the Inner Coteau, the Coteau Moraines, the Minnesota River Prairie, the Red River Prairie, and the Tallgrass Aspen Parklands.

When crop prices are high and CRP rental rates are low, farmers can often make more money converting their land to crop production than keeping it enrolled in CRP.

North Dakota's change index reveals a hotspot of land-use change in the southeastern portion of the state, within the Prairie Pothole Region. The counties with the highest change index scores are Adams, Cass, Emmons, LaMoure, McIntosh, Steele, and Stutsman counties. All of these counties experienced increases in corn plantings. The high scores for Adams, Emmons, McIntosh, and Stutsman counties are also due to the high percentage of county area converted from native grassland to cropland between 2004 and 2007. Adams, Emmons, LaMoure, and McIntosh counties also ranked highly in terms of the amount of CRP conversion during that time. The high-change values for Emmons, Kidder, McIntosh, and Stutsman counties are of particular concern because these counties contain some of the highest quality prairie and wetland habitats in the Prairie Pothole Region.

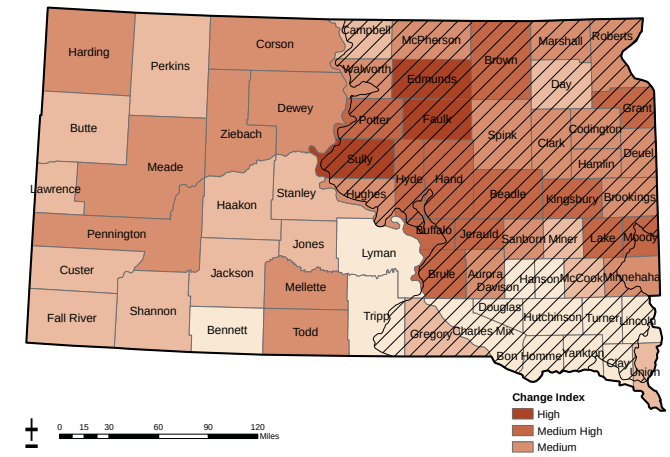
South Dakota's change index reveals a hotspot of land-use change east of the Missouri River, particularly in the high-quality, mixed-grass prairie region of the state. The counties with the highest change index scores are Edmunds, Faulk, and Sully counties. Beadle, Grant, Hand, Jerauld, and Kingsbury counties also ranked very highly. All of these counties experienced increases in corn plantings. The high scores for Edmunds, Faulk, Hand, Jerauld, and Sully counties are due to the high percentage of county area converted from native grassland to cropland between 2004 and 2007. Beadle, Faulk, and Sully counties also ranked highly in CRP loss during that time.

North Dakota Land-Use Change Index 2004 to 2007



Source: USDA-NASS Agricultural Statistics Database, FSA Conservation Program Statistics, and FSA New Breakings Data Analysis and Layout: University of Michigan Masters Project Team

South Dakota Land-Use Change Index 2004 to 2007



Source: USDA-NASS Agricultural Statistics Database, FSA Conservation Program Statistics, and FSA New Breakings Data Analysis and Layout: University of Michigan Masters Project Team

Bird Population Analysis: Changing Land, Changing Populations

Recent increases in corn plantings, driven in part by increased corn ethanol demand, threaten both the quantity and quality of remaining grassland and wetland habitats in Iowa, Minnesota, North Dakota, and South Dakota. Intense agricultural development in the Prairie Pothole Region has led to declines in grassland bird populations over the past 25 years that are steeper and more consistent than the declines seen in any other North American bird group.[32] Conversion of native prairie and Conservation Reserve Program (CRP) land to cropland has decreased available grassland, while the application of pesticide, fertilizer, and water inputs and the erosion and sedimentation associated with increased corn plantings have degraded the habitat that remains. These impacts have been especially significant in the Prairie Pothole Region, an ecologically important wetland and grassland landscape that is now increasingly dominated by intensive row-crop farming.

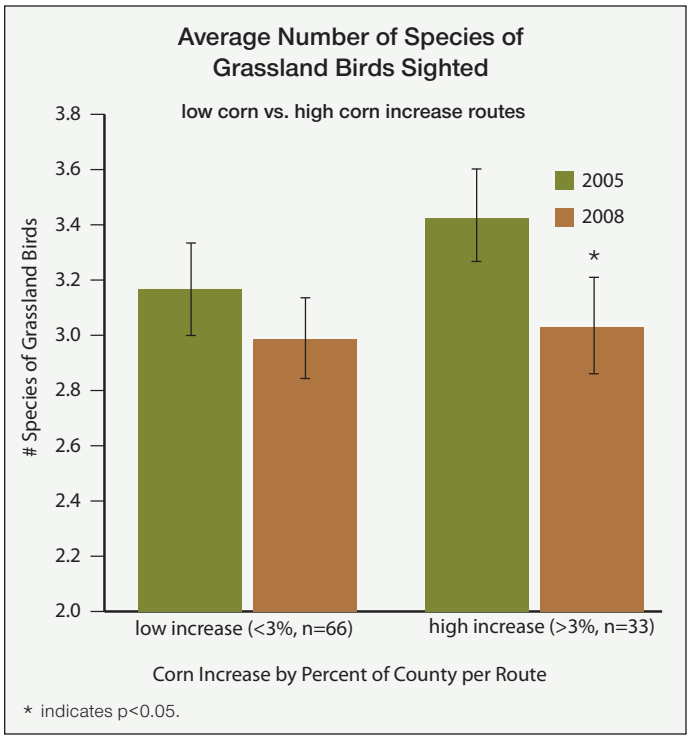
Intense agricultural development in the Prairie Pothole Region has led to declines in grassland bird populations over the past 25 years that are steeper and more consistent than the declines seen in any other North American bird group.

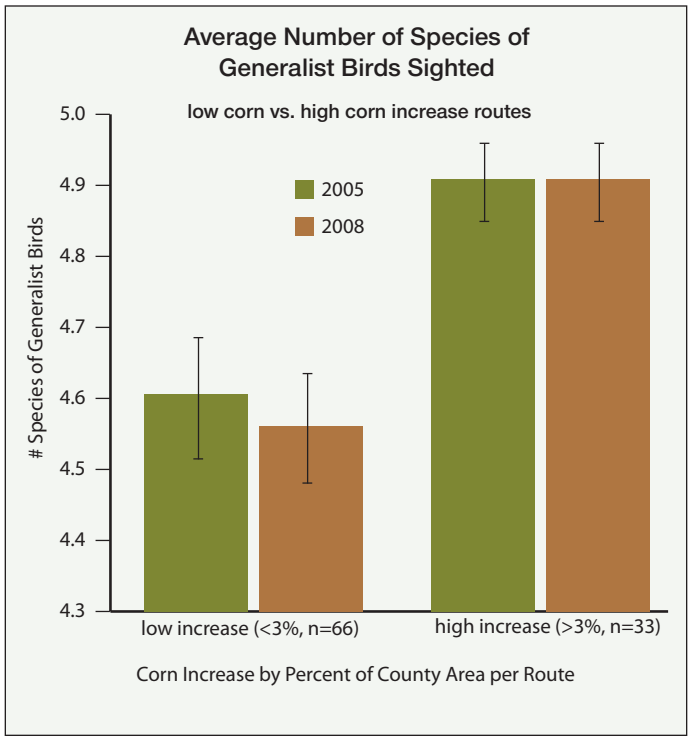
Methodology:

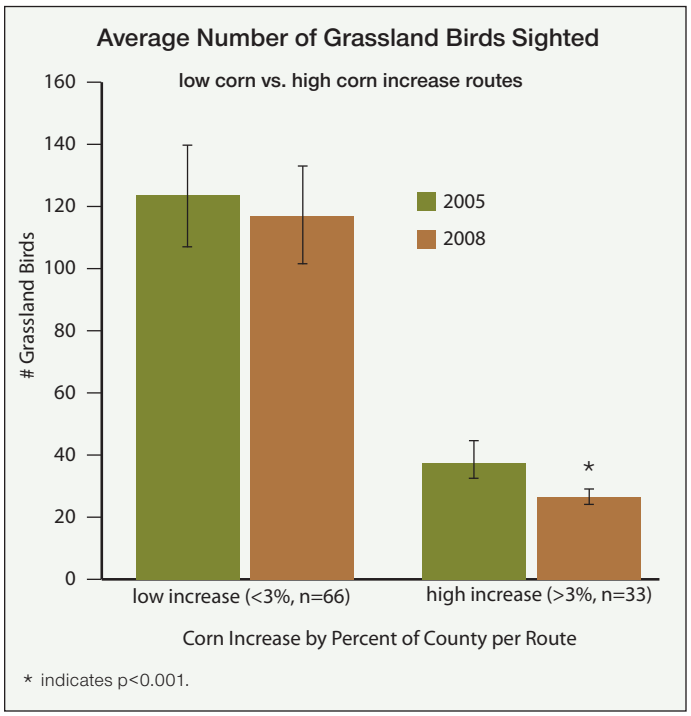
In order to better understand the effects of land-use changes driven by increased corn plantings on wildlife populations within the Prairie Pothole Region, we analyzed the relationship between corn plantings and grassland bird populations in our four-state study area. Using publicly available Breeding Bird Survey data (a large-scale and long-standing survey of bird abundance compiled annually by volunteers who count bird calls and sightings along established roadside survey routes at the height of the breeding season) and National Agricultural Statistics Service corn plantings data, we analyzed how recent changes in land use, as indicated by increased corn plantings, are affecting bird populations.

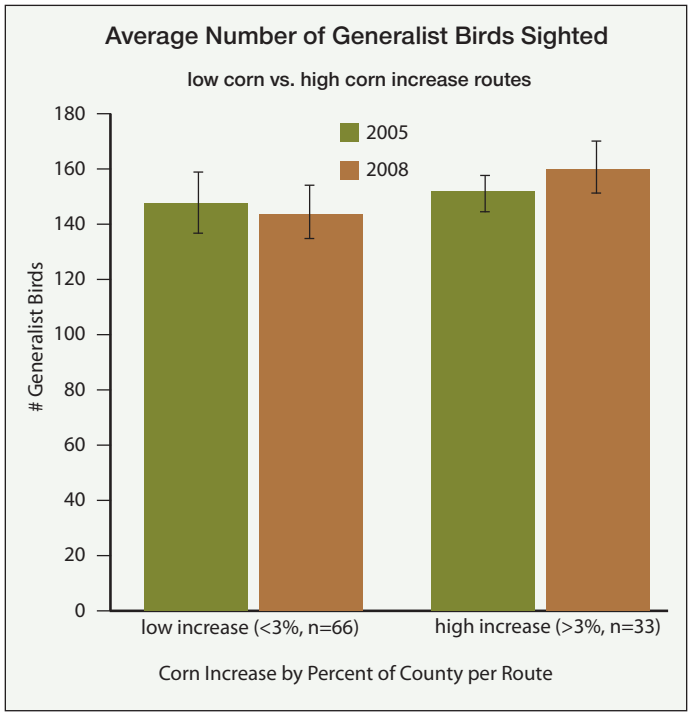
We focused on a set of sensitive grassland species most likely to be affected by decreased grassland habitat and compared them to a set of common and broadly distributed generalist species, as a control group. We examined whether birds in areas experiencing the greatest increases in corn plantings have suffered population declines. This was done by looking at the affect of land-use changes on number of species and number of individual sightings between 2005 and 2008 for both grassland and generalist bird populations. We compared land use changes between 2004 and 2007 with bird population changes between 2005 and 2008. This is because bird populations do not respond to changes in habitat immediately; rather, habitat losses may affect breeding and reproductive success, and thus the effects of habitat losses in one year are best observed in the subsequent year.

Our five grassland species were Dickcissels, Grasshopper Sparrows, Sedge Wrens, Upland Sandpipers, and Western Meadowlarks. These are species that depend on grasslands for successful breeding, and are typically sensitive to habitat changes. The majority of these species are also listed as species of conservation concern by state wildlife agencies, meaning that there is significant concern that these birds may be threatened or in decline. Our five generalist control species were American Crows, American Robins, Bank Swallows, Brown-headed Cowbirds, and Mourning Doves. These are extremely common species, and there is little concern about their population levels. To understand the effect of land-use change on these species, we examined population changes between 2005 and 2008 for each species on Breeding Bird Survey routes that were categorized by amount of increased corn acreage.









Results:

Our study analyzed changes to both the number of species and number of individual birds of each species in areas of low corn increases versus areas of high corn increases. The results showed that the average number of grassland species in areas with low corn increases was not significantly different between 2005 and 2008 ($p=0.11$). However, in counties with high corn increases, the average number of grassland species was found to decline significantly between 2005 and 2008 ($p=0.046$, Figure X).

With declines of sensitive grassland birds between 2005 and 2008 reaching nearly 30 percent in areas with high corn increases, additional increases in corn expansion can be expected to continue to cause detrimental impacts to sensitive grassland species.

To determine whether the trends we observed were specific to obligate grassland breeders (those that breed only in grasslands) or occurred across all bird populations in the region, we ran the same analysis on the five previously selected generalist control species. The results for the control species were very different than those for the sensitive species. The average number of generalist species per route did not significantly change between 2005 and 2008 for either the low corn increase or the high corn increase routes.

In addition to looking at whether the grassland species were present or absent on each route, we compared the number of individuals for all grassland species and all generalist species as they changed over time. We found similarly significant trends. The average number of individual birds from all five grassland species significantly decreased between 2005 and 2008 in areas of high corn increase, while there was no significant change in bird counts in areas of low corn increases. The average number of grassland individuals on routes in counties with high corn increase was found to decline significantly, from 37.4 grassland birds per route to 26.4 grassland birds per route between 2005 and 2008 ($p=0.0005$, Figure X). This was a decrease of 29.4 percent in high corn increase areas, compared to a non-significant decrease of 5.3 percent in low corn increase areas.

While we found significant decreases in the number of grassland birds on high corn increase routes between 2005 and 2008, we found no significant trends for generalist birds in either high corn increase or low corn increase areas over the same time period.

Interestingly, the number of grassland birds on low corn increase routes was significantly higher than on high corn increase routes, independent of period. This is likely a reflection of the amount of available habitat in these counties; counties with high corn increase may be counties that have had previously high levels of agriculture and thus might have supported fewer birds to begin with.

Conclusions

The results of our grassland bird analysis demonstrate that areas of high corn increase showed marked decreases in both the number of sensitive grassland species and the number of sensitive grassland individuals between 2005 and 2008. Our five generalist control species showed no changes in that time period in areas of high corn increase, indicating that this is not a trend across all bird species, only obligate grassland breeding species.

In light of the fact that grassland birds are among the fastest and most consistently declining birds in North America, the finding that corn expansion may be further contributing to this decline is especially worrisome. With declines of sensitive grassland birds between 2005 and 2008 reaching nearly 30 percent in areas with high corn increases, additional increases in corn expansion can be expected to continue to cause detrimental impacts to sensitive grassland species.

Conservation Tools

To better understand the capacity of government agencies and conservation groups to protect prairie pothole habitat in response to increased corn ethanol production, we conducted interviews with more than 30 practitioners at nongovernmental conservation groups, wildlife agencies, USDA field offices, and agriculture agencies and organizations. The interviews revealed that these practitioners use a diverse conservation toolbox to achieve significant conservation goals in the Prairie Pothole Region but that agencies and organizations are limited in their ability to respond to additional threats such as those posed by corn ethanol production.

USDA CONSERVATION MECHANISMS

Interviews revealed that the USDA conservation programs authorized under the federal Farm Bill play a critical role in preserving habitat in the Prairie Pothole Region, but each mechanism has limitations that leave prairie pothole habitat vulnerable to conversion and degradation.

Land Retirement Programs

Land retirement programs have historically made up the largest part of the Conservation Title of the Farm Bill and have provided significant benefits to wildlife in the Prairie Pothole Region. Under these programs, landowners receive payments to voluntarily sign a contract with a government agency, typically the USDA Farm Service Agency (FSA), to remove land from production for a specified number of years. The land retirement programs relevant to prairie pothole habitat are the Conservation Reserve Program (CRP) and the Wetland Reserve Program (WRP). In the 2008 Farm Bill, Congress decreased the emphasis on land retirement programs in favor of working land programs.

The interviews revealed that these practitioners use a diverse conservation toolbox to achieve significant conservation goals in the Prairie Pothole Region but that agencies and organizations are limited in their ability to respond to additional threats such as those posed by corn ethanol production.

KEY INTERVIEW FINDINGS

SUCCESSES

- Conservation of millions of acres through federal and state programs
- Measurable wildlife population benefits
- Diverse conservation toolbox
- Effective state-federal conservation partnerships
- High demand for many conservation programs

CHALLENGES

- No disincentives for converting native prairie to crop production
- Lack of programs aimed at conserving habitat in perpetuity
- Lack of resources and short timetables for obligating funds
- Landowner demand for enrollment exceeds supply of contracts
- CRP rental rates cannot compete with high commodity prices
- No CRP general signup since 2006, contributing to enrollment declines

Working Land Programs

The majority of new conservation spending in the 2008 Farm Bill is allocated to working lands programs.[33] Working lands programs are run by the Natural Resources Conservation Service and provide incentives for farmers to improve conservation practices on cropland and grazing land that remains in production. Incentives include payment programs, cost-share agreements, and technical assistance. Specific programs include the Environmental Quality Incentive Program, Conservation Stewardship Program, Wildlife Habitat Incentives Program, Grasslands Reserve Program, Conservation on Private Grazing Lands, and Technical Assistance. Of the working land programs, the Grassland Reserve Program is particularly relevant to protecting prairie pothole habitat from conversion. It has cost share, rental agreements, and easement options for grassland areas, which can remain in use for grazing, haying, and hunting. Unfortunately, the program, initiated in the 2002 Farm Bill and reauthorized in the 2008 bill, has never received significant funding, which has limited its ability to protect grassland habitats.

Compliance Mechanisms

Farm Bill "compliance" mechanisms deny farm program benefits to producers who fail to meet applicable conservation requirements. The "Swampbuster" mechanism has prevented drainage of thousands of wetlands in the Prairie Pothole Region that otherwise would have been converted to agricultural production. While the provision was largely considered a success, some interviewees noted that unregulated wetland drainage still occurs, and a 2003 study by the General Accountability Office found enforcement and penalties sorely lacking.[34] Another mechanism, the "Sodbuster" provision, requires producers growing crops on highly erodible land to implement a soil conservation plan, but it is considered a failure by most conservation organizations because it does not prevent the loss of native prairie. A new compliance mechanism proposed for the 2008 Farm Bill, termed "Sodsaver," was designed to prevent the conversion of native prairie into crop production by making newly-plowed lands ineligible for crop insurance or disaster payments for at least five years. However, conservation practitioners explained that what could have been a powerful tool for protecting native prairie was weakened in the final version and ultimately became defunct as the final provision required governors of Prairie Pothole Region states to opt in—which none did.

U.S. FISH AND WILDLIFE SERVICE PROGRAMS

Interviewees also highlighted programs implemented by the U.S. Fish and Wildlife Service (USFWS) that help protect native prairie habitat in the Prairie Pothole Region. While successful in many ways, these programs do not achieve the widespread protection of native prairie that conservation practitioners believe is necessary.

Grassland Easement Program

Implemented in North and South Dakota, the USFWS grassland easement program is one of the only programs in the region that help make preserving native prairie financially feasible. This program is immensely popular among landowners because the easement allows grazing, haying, and hunting while preserving the land's ecological health in perpetuity. It also helps ranching families protect the rangeland that is integral to their livelihoods and lifestyles. Interviews revealed that this program is severely underfunded relative to demand. Practitioners predict that many applicants will be forced to lease or sell their native prairie for crop production before being accepted into the program.

Grazing Management Plans

The USFWS Partners of Fish and Wildlife has found that grazing management plans and cost-share assistance have been important tools in improving the profitability of rangeland, thus increasing the likelihood that the land will not be plowed to grow crops. However, while these improvements are helpful, they are often not sufficient to compete with the economic benefits of selling the land or converting it to crop production.

While successful in many ways, these programs do not achieve the widespread protection of native prairie that conservation practitioners believe is necessary.

STATE HIGHLIGHTS

The following are a few examples of how conservation successes and challenges are playing out in the states that comprise the Prairie Pothole Region.

Multiple respondents stated that the limited number of acres under conservation was the greatest threat to wildlife in Iowa.

Iowa

Given that Iowa's land is predominantly used for agricultural production, interviewees stressed that working land programs are essential for improving habitat suitability and protecting water quality in the state. The Environmental Quality Incentive Program is both popular and effective, but one agency practitioner noted that the Natural Resources Conservation Service receives far more applications than it can accept at current funding levels.

Multiple respondents stated that the limited number of acres under conservation was the greatest threat to wildlife in Iowa. In addition to general CRP, several small programs help maintain wildlife habitat in the state, among them the State Acres For Wildlife Enhancement program (a continuous CRP program designed to protect high-value wildlife species specific to each participating state or region) and the Conservation Reserve Enhancement Program (CREP) (a voluntary land-retirement program that targets specific geographic areas and conservation objectives within a state). Respondents explained that while these programs are clearly valuable for wildlife and habitat conservation, they cannot compensate for recent CRP declines and are only partial solutions to an immense problem.

Minnesota

The Wetland Reserve Program (WRP) is a particularly important conservation mechanism in Minnesota. There are over 600 WRP easements on more than 70,000 acres in the state, making it one of the country's most active for WRP enrollment. According to one official, funding for this program has not kept up with the number of landowners interested in enrolling their land.

Unique to Minnesota is a state-run program that combines WRP and CREP short-term easements with perpetual easements under the Reinvest in Minnesota (RIM) program. Under RIM, landowners receive payments to permanently retire cropland from production and to plant native vegetation and restore previously drained wetlands. Eligible landowners therefore receive easement payments under both programs, providing additional economic incentives to retire their land.

North Dakota

CRP has been very successful in preserving North Dakota's prairie pothole habitat. In fact, most of the CRP acreage within the Prairie Pothole Region lies in North Dakota. However, North Dakota has also experienced the greatest CRP declines: in the state's Prairie Pothole Region alone, more than 480,000 acres of CRP land were returned to production between 2007 and 2009.

The USFWS grassland easement program is an important tool for permanently protecting the state's native prairie and is extremely popular among landowners. However, funding levels do not match demand. One official estimates that as of early 2009, about 100 landowners in North Dakota remained on the waiting list, representing about 47,000 acres of grassland.

North Dakota faces a unique conservation challenge: state policies prevent landowners from donating or selling perpetual land conservation easements without approval from the governor.[35] Organizations interested in acquiring land must go before the local county commission and the state's Natural Areas Acquisition Advisory Committee, both of which advise the governor on whether to approve sales. This time-consuming process often ends in disappointment. Ducks Unlimited, for example, has worked tirelessly to acquire important habitat from willing sellers,

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only to have its efforts negated during the approval process. North Dakota is the only state with such restrictions on selling land for conservation and the only state without any land trusts.[36]

South Dakota

The USFWS grassland easement program is a popular and effective program for preserving South Dakota's native prairie. Funding, however, has not kept up with demand, leading to a backlog of willing sellers. One official estimated that about 700 South Dakota landowners, who represent roughly 210,000 acres of grassland, are waiting to enroll, but the agency can only fund about 50 easements a year.

Unique to South Dakota is the state-run Farmable Wetlands Program (FWP), which was described in several interviews as being one of the most used programs under continuous CRP sign-up. FWP is a voluntary program that restores farmable wetlands and associated buffers under contracts that last from 10 to 15 years. One restriction of FWP is that enrolled wetlands must be 10 acres or smaller, and only the first 5 acres receive payment. To encourage enrollment of wetlands larger than 5 acres, the South Dakota Department of Game, Fish and Parks provides a one-time incentive payment for any wetland acres enrolled in FWP between the 5 and 10 acre limit.

Key Findings, Outlook, and Recommendations

An Urgent Need for Action

Without changing the policies that drive conversion of Prairie Pothole grassland, the area's unique wildlife will suffer and the outdoor culture that defines the region may be lost. Partnerships between conservation groups, state agencies, and national agencies have led to the permanent protection of some prairie and wetlands in the region. However, the vast majority of natural habitat in the Prairie Pothole Region is still at risk of being converted to crop production, and millions of acres enrolled in the Conservation Reserve Program could also be lost.

Outlook and Recommendations for Prairie Pothole Protection

If we proceed along the current trajectory without changing federal policies, the prairie pothole ecosystem may be further degraded and fragmented, and the many services it provides will be impossible to restore. The region will no longer be able to support the waterfowl cherished by hunters and wildlife enthusiasts across the country. Grassland bird populations, already declining, will be unable to rebound as nesting sites are turned into row crops. Water will become increasingly polluted and costly to clean as the grasslands and wetlands that once filtered contaminants disappear.

However, it is not too late to preserve the ecological integrity of the Prairie Pothole Region. Wise policy responses could turn the tide on prairie and wetland loss before this iconic landscape is lost forever.

Recommendations

Because there are numerous, compounding threats to prairie pothole habitat, addressing one threat in isolation will not be sufficient. Policy changes must both reduce the drivers of agricultural expansion onto grasslands and strengthen conservation mechanisms that protect prairie pothole habitat. Further, additional research into the exact cost of corn ethanol subsidies and extent of grassland loss across the country will help inform these critical policy decisions.

RECONSIDER GOVERNMENT MANDATES AND FINANCIAL SUPPORT FOR CORN ETHANOL

- **Allow cellulosic ethanol to replace corn ethanol as technology improves.**

  Currently, the RFS does not provide for the replacement of corn ethanol by cellulosic ethanol. It mandates that corn ethanol production increase from 10.5 billion gallons in 2009 to 15 billion gallons in 2015, after which production will level off—not decrease.

- **Phase out federal and state incentives for corn ethanol production.**

  A large number of both federal and state laws, incentives, and programs drive market demand for corn ethanol. The sheer array and scope of such initiatives should be re-assessed. Some of these programs are redundant. For example, the Volumetric Ethanol Excise Tax (VEETC) pays blenders to meet the RFS even though the RFS is mandatory. This type of redundant incentive should be phased out over time and the funding saved should be applied to conservation efforts.

NO RELIEF IN SIGHT

Corn ethanol expansion exacerbates habitat loss and degradation in an already fragile ecosystem. Although it is just one pressure on the Prairie Pothole Region, that pressure is only expected to increase. There is a common misconception that cellulosic ethanol will replace corn ethanol as soon as technological improvements make cellulosic ethanol cost competitive.

In reality, the Renewable Fuel Standard requires corn ethanol production to increase from 10.5 billion gallons in 2009 to 15 billion gallons in 2015. This 4.5 billion gallon increase in corn ethanol production will create demand for an additional 10.69 million acres of corn plantings each year (based on a conversion rate of 2.75 bushels of corn per gallon ethanol[37]) and an average yield of 150.68 bushels of corn per acre[38]. Such increases in corn production have serious implications for wildlife and habitat, particularly because there is no state or federal legislation that penalizes or discourages conversion of native prairie into cropland. Furthermore, if corn ethanol demand spurs high corn prices and CRP rental rates remain low, many farmers will continue to convert CRP land into cropland.

Policy changes must both reduce the drivers of agricultural expansion onto grasslands and strengthen conservation mechanisms that protect prairie pothole habitat.

PROTECT PRAIRIES AND WETLANDS FROM CONVERSION

- **Disqualify landowners who plow native prairie from receiving federal financial support on that land.**

  Most of the remaining native prairie in the Prairie Pothole Region is not ideal for growing crops. However, the Farm Bill provides subsidies and risk protection that virtually eliminate the economic consequences of cultivating unproductive or disaster-prone land. Many farmers have chosen to plow extremely marginal land knowing that federal payments will make the venture profitable, regardless of the yield. To avoid this problem, landowners who choose to convert native prairie to cropland should be disqualified from receiving federal financial support. Many conservation practitioners agree that this is the best way to curb grassland loss in the region, and it will also benefit taxpayers. Landowners would still have the freedom to break native prairie but without the financial safety net provided by federal programs.

- **Help willing landowners preserve native prairie and wetlands in perpetuity.**

  Landowner demand for permanent conservation easements through USDA's Wetland Reserve Program and Grasslands Reserve Program and USFWS's grassland easement program far exceeds the supply of contracts. For instance, hundreds of landowners in North and South Dakota are interested in protecting their grassland—amounting to thousands of acres of valuable habitat—under grassland easements, but the programs are underfunded. These programs should be given the resources necessary to help willing landowners permanently protect habitat on their property.

STRENGTHEN THE CONSERVATION RESERVE PROGRAM

- **Increase the CRP acreage cap to prevent dramatic CRP losses.**

The 2008 Farm Bill lowered the CRP cap from 39.2 million acres to 32 million acres (effective October 1, 2009). The program had declined to 34.7 million acres in 2008, from 36.7 million acres in 2006. The additional loss of millions of acres of conservation land will have both ecological and economic repercussions in the Prairie Pothole Region and across the country. Furthermore, the USDA hasn't held a general sign-up for CRP since April 2006. In place of a general sign-up, the agency has enrolled land through "continuous sign-up," which is aimed at promoting specific conservation practices. A general sign-up is scheduled for 2010, but without an increase in the CRP acreage cap, the sign-up will allow few acres to be enrolled.

- **Improve the flexibility and responsiveness of CRP rental rates.**

Many conservation practitioners argue that CRP rental rates are not updated on a frequent enough basis to keep up with crop price volatility and remain competitive in attracting farmers. As one South Dakota USDA official explains, "you are always behind." In other words, producers have less incentive to enroll in CRP if they can make more money by farming their marginal land. Rental rates should be regularly reviewed and adjusted to be competitive with current land values and crop prices.

PURSUE ADDITIONAL RESEARCH

- **Collect and make available data measuring conversion of grassland to cropland.**

Although the USDA has collected informal data on grassland loss in North Dakota, South Dakota, and Montana, these data are clearly insufficient for understanding grassland conversion across the country. Furthermore, these data were collected individually by county USDA offices, which may not have used consistent methods to determine the extent of conversion in their counties. Without consistent, comprehensive, spatially-allocated data on sodbusting of native prairie, researchers will not be able to quantify the effects of conversion of grassland to cropland on wildlife populations. The USDA should develop and implement uniform county-level data collection practices. The results of this monitoring should be publicly available in order to improve transparency and facilitate research into the impacts of these land-use changes on wildlife populations.

- **Initiate a U.S. General Accountability Office study of the full cost of government incentives for corn ethanol.**

Given the quantity and variety of federal and state incentives for corn ethanol, it is difficult to determine where federal and state support for corn ethanol may be overlapping in unintended ways, or to assign a total dollar value to the amount of government funds going to support this industry. Program-specific funding information is not readily available on government websites, and often difficult to obtain even through direct requests to government offices, particularly on the state level. A comprehensive study on state and federal corn ethanol subsidization would allow the public to fully understand the direct costs of corn ethanol incentives.

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