The Rainwater Basin Joint Venture Implementation Plan

A regional contribution to the

North American Landbird Conservation Plan

North American Waterbird Conservation Plan

North American Waterfowl Management Plan

and

United States Shorebird Conservation Plan

By the

Rainwater Basin Joint Venture

RAINWATER BASIN

JOINT VENTURE

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Introduction

Formed over twenty years ago, the Rainwater Basin Joint Venture (RWBJV) has built partnerships, identified biological needs, and developed conservation delivery mechanisms to put conservation where it really matters: on the ground. Resource conservation requires a well-developed plan based on sound science and a vision.

Improving wetland conditions in the Rainwater Basin Wetland Complex (RWB) has been the principal aim of the RWBJV for the past twenty years and is expected to continue to be for years to come. But since the partnership's inception, changes have placed new demands on the RWBJV. New scientific information has led to finding new ways to deliver effective conservation. The need for all-bird conservation has increased. In addition, the need to address all species of birds has caused the RWBJV to expand its administrative area to include the central two-thirds of Nebraska.

This Implementation Plan marks the beginning of our next twenty years. Its purpose is to direct future conservation actions across a broader landscape for the benefit of all bird species. Sound science regarding bird species, their habitats, and their distribution will lead to more effective conservation. The plan's success depends on building cohesive partnerships -- partnerships that strive to treat both agriculture and wildlife as important parts of Nebraska's heritage.

It is expected that future emphasis will remain on waterfowl and wetland conservation in the RWB. But in doing a better job of planning and delivering conservation, we expect also to provide better habitat for waterbirds, shorebirds, and landbirds across the entire RWBJV Administrative Area.

The plan contains two parts: the overarching RWBJV Implementation Plan for the RWBJV Administrative Area and detailed individual plans for four distinct bird groups – landbirds, shorebirds, waterbirds, and waterfowl. The RWBJV is committed to updating and refining both the Implementation Plan and the associated bird plans as new information becomes available.

Administrative extent of the RWBJV

Vision

The RWBJV Administrative Area is a landscape encompassing the central portion of Nebraska that supports healthy agricultural communities, rich with wetlands, streams, and grasslands. It also provides essential habitat for millions of birds and other wildlife. The healthy ecological conditions of the region's biologically unique landscapes contribute to its overall economic, social, and environmental stability, creating a "sense of place" among the people of Nebraska and North America. Partnerships, which bond the social, economic, and environmental needs of the region, will use their collective talents and resources to maintain this sustainable landscape. Decisions and actions will be undertaken with a united voice, founded on common sense and science-based information.

Mission

The mission of the Rainwater Basin Joint Venture is to facilitate cooperation between government and private conservation actions, based on sound science, to advance bird populations and the quality and quantity of their habitats within the central region of Nebraska.

Goals

- Restore and maintain sufficient wetland habitat in the Rainwater Basin area of Nebraska to assist in meeting population objectives identified in the North American Waterfowl Management Plan.
- Restore and maintain sufficient bird habitats within the RWBJV Administrative Area to support the goals of the four established national bird plans: the North American Waterfowl Management Plan, the Partners in Flight North American Landbird Conservation Plan, the United States Shorebird Conservation Plan, and the North American Waterbird Conservation Plan.

Objectives

The RWBJV has two groups of objectives: comprehensive objectives relating to the entire RWBJV Administrative Area, and those specific to the Rainwater Basin.

RWBJV Comprehensive Objectives

- By 2015, develop specific conservation plans for each Geographic Focus Area within the RWBJV Administrative Area.
- By 2015, revise the RWBJV Landbird Plan to include additional priority species and geospatial Species Distribution Models to inform conservation of landbirds.
- By 2020, increase community support and understanding of the RWBJV's mission by 25%.
- By 2020, expand by 20% the existing network of conservation partners to include regional and community-based organizations, and make full use of each partner's capabilities to address the RWBJV's mission.
- By 2020, expand by 25% the level of outcome-based monitoring in support of established biological targets.
- By 2030, protect, restore, and enhance sufficient wetland habitat to support migrating shorebirds, waterbirds, and waterfowl in the RWB.
- By 2030, protect, restore, and enhance sufficient grassland habitat to support breeding bird population goals established for landbirds, shorebirds, waterbirds, and waterfowl within the RWBJV Administrative Area.

Rainwater Basin Objectives

- By 2015, develop a comprehensive water management plan to guide wetland and watershed restoration for optimal use of natural runoff and supplemental water supplies.

- By 2015, revise the Rainwater Basin Evaluation Plan to better measure relationships between waterfowl needs, habitat conditions, and management actions.
- By 2020, develop a broader financial base (including traditional and non-traditional funding sources) to ensure a more stable level of funding to complete conservation projects.
- By 2030, improve, maintain, and protect natural wetlands—through a voluntary, cooperative approach—which are capable of meeting the energetic needs of spring-migrating waterfowl (~ 4.4 billion kilocalories) under average weather conditions.

An Invitation to Participate

The natural resources within the RWBJV Administrative Area are like a collection of jewels representing great value—not only to the state of Nebraska, but to the nation. They provide food, rest, and a home for millions of birds, of species both abundant and rare.

The RWBJV has taken on the challenge of ensuring that these resources remain a part of Nebraska's wildlife habitat, while still providing economic opportunities for the people who live and work in the region. This Implementation Plan is written to identify the resources and actions that need to be taken to ensure this vision of the future. It is meant to be dynamic and adaptable to changing times. New scientific information and broad-based participation will lead us to new conservation strategies. Problems that now appear as barriers will be overcome when people with different perspectives join together to find workable solutions.

The Rainwater Basin Joint Venture Management Board, at their November 14, 2013 meeting in York, Nebraska approved this Implementation Plan to provide direction and guidance for delivering effective conservation in a landscape dominated by privately owned agricultural land.

Rainwater Basin Joint Venture Management Board

Peter Berthelsen, Pheasants Forever
Bob Bettger, Fillmore County Landowner
Steve Donovan, Ducks Unlimited
Ardell Epp, Hamilton County Landowner
Gloria Erickson, Phelps County Landowner
Ken Feather, Upper Big Blue Natural Resources District
Mace Hack, Ph.D., The Nature Conservancy
Tim McCoy, Ph.D., Chair, Nebraska Game and Parks Commission
Michael Onnen, Nebraska Association of Natural Resources Districts
Clint Riley, U.S. Fish and Wildlife Service
Greg Reisdorff, Farm Service Agency
Larry Reynolds/Dave Raffety, Tri-Basin Natural Resources District
Steve Shaw, Little Blue Natural Resources District
Mel Taylor, Fillmore County Landowner
Britt Weiser, Natural Resources Conservation Service

Executive Summary

The RWBJV was formed in 1992. The initial focus of the RWBJV was the RWB. This region contains a high density of playa wetlands and is the focal point of spring migration for waterfowl in the Central Flyway. Thus, conservation actions during the partnership's initial years were focused on protecting, restoring, and enhancing wetlands to support migrating waterfowl. The RWBJV Management Board embraced the 1999 North American Bird Conservation Initiative (NABCI) framework (NABCI 1999) and expanded the partnership's geographic and conservation focus. With adoption of NABCI, the RWBJV accepted the responsibility of implementing the conservation objectives outlined in the four national bird plans: the North American Landbird Conservation Plan (NALCP), the United States Shorebird Conservation Plan (USSCP), the North American Waterbird Conservation Plan (NAWCP), and the North American Waterfowl Management Plan (NAWMP). The expanded RWBJV Administrative Area includes the portions of Bird Conservation Regions 11 (BCR 11; Prairie Pothole Region) and 19 (BCR 19; Central Mixed-grass Prairies) that lie within Nebraska.

This second version of the RWBJV Implementation Plan builds on the first twenty years of collaborative conservation and provides a long-term vision for the next twenty years. It also builds on the RWBJV Landbird, Shorebird, Waterbird, and Waterfowl plans. These plans scaled down the population objectives outlined in the four national bird plans to describe the priority bird species and number of individuals that are believed to rely on the RWBJV Administrative Area. Since its inception, the RWBJV has striven to find viable opportunities to integrate wetland and upland habitats into this privately owned, agriculturally dominated landscape. This plan reflects the current science and describes a set of conservation opportunities that will complement the current habitat conditions in the RWBJV Administrative Area and, if implemented, will support the avian species that rely on this broad geographic landscape. The RWBJV Management Board views this not as a static plan, but rather as a living document that will be updated and modified with new scientific findings and as new conservation opportunities emerge.

To develop this Implementation Plan, the RWBJV adopted the Strategic Habitat Conservation (SHC) business model. The SHC model builds on the Department of Interior's Adaptive Resource Management framework. The four elements of the SHC business model are: 1) Biological Planning, 2) Conservation Design, 3) Conservation Delivery, and 4) Research/Inventory/Monitoring. In the biological planning phase, priority species are identified from the national bird plans, population objectives are established, and models or frameworks are developed to describe species-habitat relationships. In the conservation design element, current landscape carrying capacity is established, limiting factors are identified, habitat objectives are defined, and decision support tools (DSTs) are developed to guide conservation delivery to locations on the landscape that have the greatest potential to benefit priority species. Conservation delivery utilizes the DSTs to guide delivery of conservation programs in a manner that will achieve desired habitat conditions and, when necessary, to develop and implement new programs to address limiting factors. The research/inventory/monitoring element of the SHC uses directed research projects and monitoring to evaluate the key uncertainties identified in the planning and implementation, and to collect data needed to improve conservation delivery.

The RWBJV identified 19 priority landbird species that rely on the RWBJV Administrative Area. The Hierarchical All Bird System (HABS) database was used to establish current

landscape carrying capacity and species-specific desired carrying capacities. The HABS database incorporates density estimates by habitat and geographic information systems (GIS) landcover data to project landscape carrying capacity. The database estimated that at population goals, the RWBJV Administrative Area would support 16.6 million landbirds, approximately 94% of which are grassland obligates.

The RWBJV used bioenergetics models to guide planning for shorebirds, waterbirds, and waterfowl. We identified 24 priority shorebird species that rely on the RWBJV Administrative Area. At population goals, an estimated 1.7 million shorebirds would use the RWBJV Administrative Area during migration, and 400,000 shorebirds would breed in the Administrative Area. Shorebirds using the RWBJV Administrative Area would require 2.1 billion kilocalories (kcals) of foraging resources from wetland habitats.

Waterbirds are probably the least understood of all the bird groups. The RWBJV identified 52 species that use the RWBJV Administrative Area, but only had sufficient information to plan for Interior Least Terns, Sandhill Cranes, and Whooping Cranes. The bioenergetics model estimated that the 560,000 Sandhill Cranes that use the Central and North Platte River Geographic Focus Area will require 10.8 billion kcals of foraging resources while staging in the RWBJV Administrative Area. The RWBJV assumed that if sufficient habitat were available for Sandhill Cranes along the Platte River, there would also be sufficient habitat for breeding Interior Least Terns and Piping Plovers, as well as for the millions of waterfowl and the endangered Whooping Cranes that also rely on this region.

To guide conservation planning for waterfowl, the RWBJV identified ten priority species. The bioenergetics model estimated that 8.6 million waterfowl migrating through the RWBJV Administrative Area would require 15.6 billion kcals, with 4.4 billion kcals coming from wetland-derived foraging resources. In addition to waterfowl that use migration habitat, an estimated 235,000 breeding waterfowl rely on Nebraska's Sandhills.

The RWBJV identified eight Geographic Focus Areas (GFAs) in the RWBJV Administrative Area. Defining GFAs allowed the partnership to describe relevant conservation strategies and targets at the local and Administrative Area scale. The GFAs identified were: Central Loess Hills, Central and North Platte River, Missouri River, Northeast Prairies/Elkhorn River, Rainwater Basin, Republican River/Blue River Drainages and Loess Canyons, Sandhills, and Verdigris – Bazile Creek Drainages. These regions were identified because they have similar topographies, soils, land use, threats to habitat, and conservation opportunities.

In the Central Loess Hills the primary focus is on: grasslands for grassland obligate bird species; playas wetlands to support migrating waterfowl, shorebirds, and Whooping Cranes; and the Loup rivers, which provide breeding habitat for Interior Least Terns and Piping Plovers. Habitat strategies and targets for the Central Loess Hills include 4,000 acres of playa wetlands, a hydrologically functioning Loup River system, and 134,500 acres of grassland restored and enhanced through removal of eastern red cedars and establishment of herbaceous grasslands.

In the Central and North Platte River GFA, the goals are to: remove 6,000 acres of forest and woodlands from the active channel and adjacent wet meadows; restore and protect 5,000 acres of functional wet meadows and associated uplands; provide habitat inventories to better define a functional riverine wetland system; and ensure the availability of 80,700 acres of cornfields with sufficient waste grain for migrating birds.

In the Missouri River GFA, the goal is to provide data and information to describe the habitat available under different flow regimes. This information will allow RWBJV partners to better describe desired hydrologic conditions for the Missouri River system.

In the Rainwater Basin GFA, the goal is to provide sufficient wetland habitat for the shorebirds, waterbirds, and waterfowl that rely on the public and private lands in this region. The RWBJV outlined initial goals of 12,515 acres of public land acquisitions, enrollment of 13,585 acres of private lands into long-term conservation programs, enrollment of 7,345 acres of private lands in short-term conservation programs, and watershed restoration and vegetation management to provide sufficient habitat for the shorebirds, waterbirds, and waterfowl that rely on this region.

In the Sandhills GFA, the goal is to enhance grassland habitats by removing 8,410 acres of eastern red cedar, while maintaining the current habitat base provided by the abundant wetlands and grasslands found in this region. Sustaining the current habitat conditions will provide sufficient habitat to support breeding population objectives for a majority of the landbirds, shorebirds, waterbirds, and waterfowl in the RWBJV Administrative Area.

In the Northeast Prairies/Elkhorn River, Republican River/Blue River Drainages and Loess Canyons, and Verdigris – Bazile Creek Drainages GFAs, the focus is on grassland birds. In these three GFAs the goal is to improve grassland bird habitat by enhancing 117,660 acres of grassland habitats. Conservation targets and strategies are outlined for each GFA. In summary, the actions in these GFAs will result in removal of 86,160 acres of eastern red cedar and reestablishment of 31,500 acres of grasslands through programs such as the Conservation Reserve Program (CRP). In addition to removal of eastern red cedar and re-establishment of grasslands, RWBJV partners will work with willing landowners to develop rotational grazing systems. These systems will improve the habitat quality of existing grasslands by increasing grassland structure and stature.

As each of the RWBJV bird plans was developed, key uncertainties and model assumptions were defined. Uncertainties ranged from forage availability (energetic resources) to local and landscape factors that influence habitat selection and use by different species. The RWBJV will work with universities and partners to implement directed research projects, continue long-term monitoring projects, and initiate baseline inventories to acquire the information needed to better address uncertainties. The RWBJV is committed to integrating new information to inform the objectives outlined in this Implementation Plan. The partnership's planning process is on a five-year revision cycle, whereby the Management Board and Technical Committee are currently scheduled to review the four bird plans and the Implementation Plan in 2015.

Conservation in the RWBJV Administrative Area will require a proactive approach that integrates wetland and upland habitat into the landscape. The RWBJV Administrative Area varies in ownership, but most of the GFAs have private ownership exceeding 99%. Achievement of the objectives outlined in this plan will require the conservation community to be flexible and focused on strategic delivery of programs in GFAs that have the greatest potential to contribute to population goals. All programs delivered by the RWBJV will be on a voluntary basis. This will require the RWBJV partners to continue to develop economically viable solutions that fit into this privately owned agricultural landscape.

Acknowledgements

The RWBJV Management Board would like to commend the efforts of the numerous partner staff who developed this Implementation Plan and the associated RWBJV Bird Plans. The Core Writing Team was comprised of Jonas Davis of Ducks Unlimited, Ted LaGrange and Mark Vrtiska of the Nebraska Game and Parks Commission, Rich Walters and John Heaston from The Nature Conservancy, Andy Bishop of the Rainwater Basin Joint Venture, and Kenny Dinan and Ronnie Sanchez of the U.S. Fish and Wildlife Service. The editors for the RWBJV Landbird Plan were Melissa Panella, Nebraska Game and Parks Commission, and Chris Jorgensen, Nebraska Cooperative Fish and Wildlife Research Unit. Joel Jorgensen, Nebraska Game and Parks Commission, provided guidance and oversight of the RWBJV Shorebird Plan, while Aaron Pearse of United States Geological Survey oversaw development of the RWBJV Waterbird Plan. Mark Vrtiska, Nebraska Game and Parks Commission, oversaw development of the RWBJV Waterfowl Plan. Special thanks to Gene Mack, U.S. Fish and Wildlife Service (retired) and Doreen Pfost, Rainwater Basin Joint Venture, for their contributions as compiling and technical editors.

The Rainwater Basin Joint Venture

History of the Organization

North American Waterfowl Management Plan

The Rainwater Basin Joint Venture (RWBJV) builds upon the work of a generation of conservationists in Nebraska and throughout North America who had the vision to create and put in motion a continent-wide approach to bird conservation. The North American Waterfowl Management Plan: A Strategy for Cooperation (NAWMP) (U.S. Fish and Wildlife Service and Canadian Wildlife Service, 1986) became the foundation of an international response to sharply declining waterfowl populations and habitats in many parts of the continent.

Between 1970 and 1979 the average annual continental breeding duck population was approximately 62 million. A 1985 survey showed that numbers had declined for almost all duck species. The most significant decreases were for Northern Pintails (more than 50%), Mallards (37%) and Blue-winged Teal (29%).

NAWMP acknowledged that the goal of providing habitat for waterfowl populations at 1970's levels would require changes in the way conservation was pursued. A cooperative effort by all state, federal, and private interests would be needed to address landscape issues. Furthermore, conservation would need to be done at the local level, but mindful of its collective effects on the broader landscape. The plan encouraged the formation of joint ventures, defined as cooperative partnerships of government and private organizations whose task is to work toward projects that preserve or enhance waterfowl habitat.

Congress advanced implementation of the plan's recommendations by passing the North American Wetlands Conservation Act in 1989. The act encouraged the formation of partnerships to develop and implement conservation projects consistent with NAWMP. It also established the North American Wetlands Conservation Fund to help support projects through grants.

Formation of the RWBJV

One year after the enactment of the North American Wetlands Conservation Act, the Nebraska Game and Parks Commission, U.S. Fish and Wildlife Service, and Ducks Unlimited submitted a concept plan for the Rainwater Basin (Gersib et al. 1990). The concept plan proposed the creation of the RWBJV. High concentrations of birds, extensive habitat losses, and the risks associated with overcrowding within the Rainwater Basin Wetland Compex (RWB) were presented as the basis for forming the RWBJV.

The RWBJV received official status from NAWMP in 1991 and completed its first Implementation Plan the following year (Gersib et al. 1992). The plan outlined the partnership's structure, goals and strategies. The focus was habitat management, primarily addressing wetland losses that had occurred between 1965 and 1983. A 1983 survey (Schildman and Hurt, 1984) reported that only 10% of the RWB's historic wetlands remained. Outbreaks of avian cholera, which began in the 1970s, seemed to indicate that wetland habitat within the Rainwater Basin had crossed a threshold during that period and that habitat loss was negatively impacting waterfowl that used the region. Over 250,000 waterfowl died of avian cholera in the RWB between 1975 and 1988 (Stutheit, 1988).

The initial RWBJV Implementation Plan posited that an additional 25,000 wetland acres and 25,000 upland acres needed protection and restoration to reverse the decline. It further recognized that development of reliable water sources would be needed to assure that the existing wetlands ponded water of adequate quality and quantity. Alterations within watersheds had seriously diminished the delivery of natural runoff as well as the quality of water reaching wetlands.

The plan advocated a voluntary approach, placing emphasis on programs that would improve and protect wetlands in private ownership. It was then, and still remains, infeasible, undesirable, and impractical for public agencies to acquire all remaining wetlands.

Expansion of the RWBJV's Geographic Boundary

At the national level, work had begun to coordinate the efforts of four bird conservation plans: NAWMP, the North American Landbird Conservation Plan (NALCP) (established in 1990), the U.S. Shorebird Conservation Plan (USSCP) (established in 1996), and the North American Waterbird Conservation Plan (NAWCP) (established in 1998). The habitat needs addressed by the individual plans often overlapped, requiring a coordinated approach. In 1999, the North American Bird Conservation Initiative (NABCI) Committee was formed. The Committee is a coalition of government agencies, private organizations, and bird initiatives. Their goal is "To deliver the full spectrum of bird conservation through regionally based, biologically driven, landscape-oriented partnerships."

NABCI divided North America into 62 ecologically distinct regions called Bird Conservation Regions (BCRs). Each BCR is a region with similar bird communities, habitats, and resource management issues. Portions of five BCRs lie within Nebraska (Figure 1). They are:

BCR-11 Prairie Potholes, located in the far northeast
BCR-17 Badlands and Prairies, located in the far northwest portion of the panhandle
BCR-18 Shortgrass Prairie, covering most of the remaining panhandle
BCR-19 Central Mixed-grass Prairie, covering most of the state
BCR-22 Eastern Tallgrass Prairie, located along the eastern edge

NABCI identified joint ventures to be the most effective means of carrying out all-bird conservation plans. Existing joint ventures were encouraged to broaden their responsibilities both by increasing their geographic area (to cover those portions of the nation not already covered by joint ventures) and by extending their management actions beyond waterfowl to include all birds.

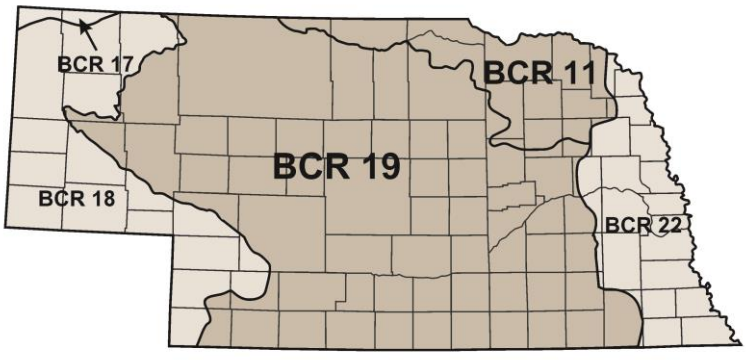


Figure 1. Bird Conservation Regions (BCRs) within Nebraska. Darker shaded portion is the Rainwater Basin Joint Venture Administrative Area.

After 1999 the RWBJV began expanding its responsibilities to include conservation actions for

all bird habitats within a larger geographic region—consisting of the Nebraska portions of BCR 11 and BCR 19. By confining its administrative area to just Nebraska, the RWBJV reduced the number of potential partners, but allowed the partnership to remain focused on bird conservation in a relatively small geography. Although the RWBJV expanded its administrative boundary, it continues to recognize the RWB as its primary focus for conservation delivery.

Adoption of Strategic Habitat Conservation

The RWBJV evolved further with its decision to use "Strategic Habitat Conservation" (National Ecological Assessment Team, 2006) as its basis for conservation. Strategic Habitat Conservation (SHC) is a science-based framework for making management decisions, especially at a landscape level. Four elements make up the framework: 1) Biological Planning, 2) Conservation Design, 3) Conservation Delivery, and 4) Research/Inventory/Monitoring.

SHC shifts the focus away from achieving projects, acres, and management for the sake of increased numbers, toward a focus on quantifying the landscape's ability to sustain priority species. Biological planning is driven by acquiring scientific information needed to better deliver conservation. Conservation design results in spatially explicit tools that guide conservation delivery to the areas within the landscape that have the greatest potential to positively influence priority species. Research/Inventory/Monitoring activities provide feedback on the effects of management actions. The feedback, in turn, leads to better biological planning and conservation design. The cycle repeats itself, but at a more informed and effective level.

Biological planning and conservation design are more efficiently accomplished on a larger landscape scale and require direct involvement by the RWBJV staff to ensure consistency across the region. In contrast, conservation delivery and research/inventory/monitoring are better accomplished at a local level by conservation partners. For example, biological and technical support are provided by the RWBJV to identify Whooping Crane habitat within the Central Loess Hills. Conservation delivery and planning, however, are dependent on partner objectives, delivery capacity, and opportunities.

RWBJV Past Accomplishments

Since its inception, the RWBJV has been oriented toward improving waterfowl habitat within the RWB. Today the focus remains the same, but the work of the RWBJV has benefited habitats outside the RWB.

In the RWBJV's initial decade, a Geographic Information Systems (GIS) office was created to provide accurate assessments of wetland and grassland habitats. Annual spring aerial surveys collected digital photography to document water conditions throughout the Rainwater Basin. The aerial surveys, combined with waterfowl surveys, helped to define wetland suitability. They also helped document and assess changes in vegetative communities and water conditions on an annual basis. The information collected was shared at research symposiums and was used to establish wetland priorities and management actions.

At a statewide scale, the RWBJV GIS office has created a GIS landcover to describe the distribution of important bird habitats. This dataset has been processed to develop habitat indexes that describe the abundance of various habitat types at multiple spatial scales. The data have been analyzed in conjunction with species occurrence data to inform conservation actions across the RWBJV Administrative Area.

A better understanding of RWB wetlands effected a change in the public's perception of wetlands. For much of the twentieth century, wetlands were commonly perceived as nuisance areas that reduced the value of agricultural land. However, education and outreach achieved by news articles, congressional tours, informational seminars, websites, and one-on-one discussions have resulted in significant changes. For example, the first RWBJV Informational Seminars were attended primarily by representatives of conservation organizations. In recent years, attendance has grown significantly, and about one-third of those attending are landowners. The RWBJV continues to tailor the seminars toward topics that help landowners better understand wetlands and identify what assistance is available.

Growth of the RWBJV has occurred at all levels. Since its beginning, with zero funding and staff, it has grown to a staff of five full-time personnel. It has used the partnering approach to obtain additional staff that, without partnerships, would not have been possible. A base level of operating funds has been secured, with additional funding obtained annually for acquisition, restoration, research, and monitoring.

Habitat Successes

During the RWBJV's 20 years of existence, it has progressed toward the habitat goals outlined in the original Implementation Plan. The number of wetland acres that have protected status has increased from 12,000 to 22,260. An additional 16,000 acres of associated upland habitat have been acquired. The upland acres are directly adjacent to protected wetlands and provide a critical buffer needed to filter agricultural runoff. Protection has occurred through voluntary sales, both by fee-title and conservation easements. Short-term (less than 30 years) conservation programs have improved wetland function and habitat availability on an additional 2,550 acres of privately owned wetlands.

The majority of the newly protected 10,260 wetland acres had lost most of their wetland function at the time of acquisition, and would need restoration. To date, RWBJV partners have restored or improved about 7,000 of those acres. Restoration is still needed on the remaining acres.

Efforts to ensure reliable water sources for protected wetland acres have included installation of high-volume wells on protected wetlands. The existing 120 wells can provide supplemental water to over half of the public wetlands. However, budget restrictions have limited agencies' ability to pump water, which has led the RWBJV to focus instead on restoring watershed runoff.

On an annual basis, public land managers map and assess the effects of management treatments on vegetative communities. The information collected has shown that timing, intensity, and duration of treatments need to be adjusted in response to changes in vegetation and water conditions. The data are being incorporated into a Structured Decision Making (SDM) framework, which allows managers to better understand vegetative responses, and the cost/benefit of different treatments. SDM also allows managers to correlate management actions with natural wetland forage production—one of the RWBJV goals.

The RWBJV Administrative Area

Approximately 90% of the RWBJV Administrative Area is in Bird Conservation Region 19 (BCR 19), the Central Mixed-grass Prairies Region, while 10% is in BCR 11, the Prairie Pothole

Region, (North American Bird Conservation Initiative 1999). The area of BCR 11 that is administered by the RWBJV is at the southern edge of the Prairie Pothole Region. This area has no true prairie pothole wetlands, and the landscape is dominated by land uses and habitats characteristic of BCR 19. In Nebraska, BCR 11 is dominated by row-crop agriculture, while the wetlands and grasslands generally are confined to the drainages of the Missouri and Niobrara rivers (Bishop et al. 2009; Bishop et al. 2011). To define the RWBJV Administrative Area, all of BCRs 11 and 19 were therefore combined into a single unit.

The RWBJV Administrative Area is part of the Great Plains, a region known for its wide variations in temperature and precipitation. West of the 100th meridian, evaporation and transpiration exceed precipitation, commonly drying up wetlands even in wetter years. Precipitation occurs sporadically, which results in variable amounts of water in wetland systems. In some years, precipitation and snow melt may come early and be abundant enough to fill most palustrine wetlands and sustain flows in riverine wetlands. In other years, the greatest precipitation occurs as a result of summer thunderstorms. This temporal variation of precipitation alters the phenology, species composition, and structure of the wetland vegetation communities.

A wide variety of human alterations that impact the palustrine and riverine wetlands are found in the RWBJV Administrative Area. Modifications include water concentration pits, land leveling, culturally accelerated sedimentation, road ditches, drainage ditches, invasive species, stream channelization and degradation, dams, diversions, water withdrawals, and other watershed modifications. These modifications directly impact wetland numbers, size, and function (LaGrange 2005; LaGrange et al. 2011).

Grasslands dominated by mixed-grass, tallgrass, and sandhill prairie communities once occupied a majority of the RWBJV Administrative Area. Outside of the Sandhills, many of the grasslands have been converted to row-crop agriculture. The grasslands that survive are generally associated with the region's riverine systems or lands not suitable for row-crop agriculture because of the potential for wind and/or water erosion. The remaining grasslands are often integrated into agricultural operations and used for grazing or haying, which, depending on timing and intensity, can significantly impact the habitat values these lands provide to wildlife.

Woodlands are generally confined to the drainages of the major river systems found in the RWBJV Administrative Area. Along the Loup, Missouri, Platte and Republican rivers, the woodlands are generally composed of deciduous species. Russian olive and eastern red cedar are the primary invasive species impacting these woodlands. Along the Niobrara River there is a greater diversity of species, including both deciduous and coniferous woodlands. Invasion by eastern red cedar is a major threat to these communities as well.

Geographic Focus Areas in the RWBJV Administrative Area

For planning purposes the RWBJV Administrative Area is divided, based on landscape characteristics, into eight Geographic Focus Areas (GFAs, Figure 2): 1) Central Loess Hills, 2) Central and North Platte River, 3) Missouri River, 4) Northeast Prairies/Elkhorn River, 5) Rainwater Basin 6) Republican River/Blue River Drainages and Loess Canyons, 7) Sandhills, and 8) Verdigris – Bazile Creek Drainages.

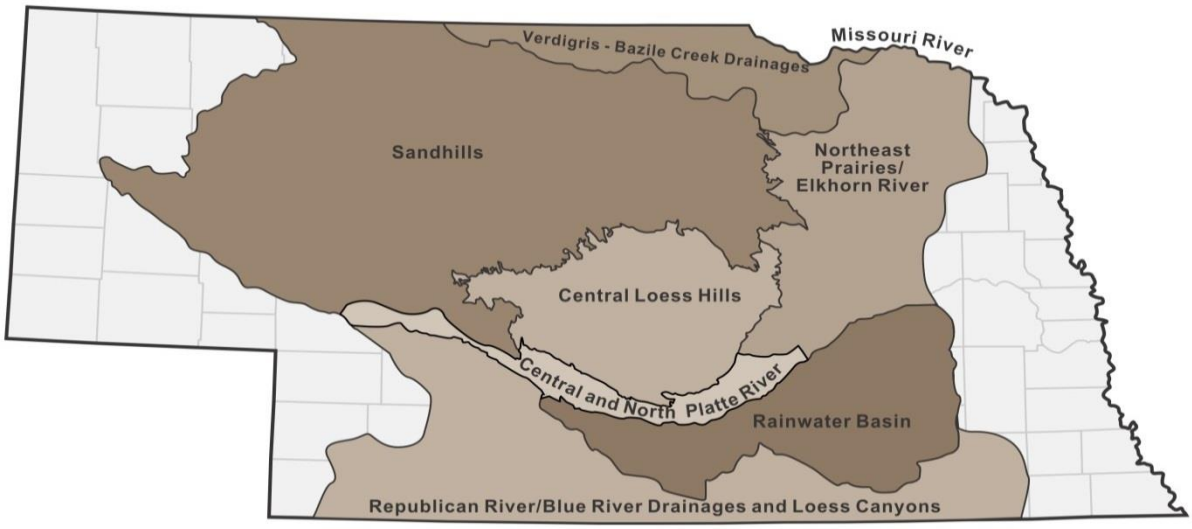


Figure 2. Geographic Focus Areas in the RWBJV Administrative Area.

In order for states to receive federal funds through the Wildlife Conservation and Restoration Program and the State Wildlife Grants Program, Congress charged each state to develop a State Wildlife Action Plan. Nebraska's plan is known as the *Nebraska Natural Legacy Project* (Schneider et al. 2011), which was developed as a state-wide plan to direct and focus the actions of conservation partners in Nebraska. To provide geographic focus, Biologically Unique Landscapes (BULs) were identified, including 23 located in the RWBJV Administrative Area (Figure 3). BULs were determined to have the highest probability of meeting the criteria of representing the various habitats within the state, and keeping common species common, while not overlooking pockets of habitat that support at-risk species.

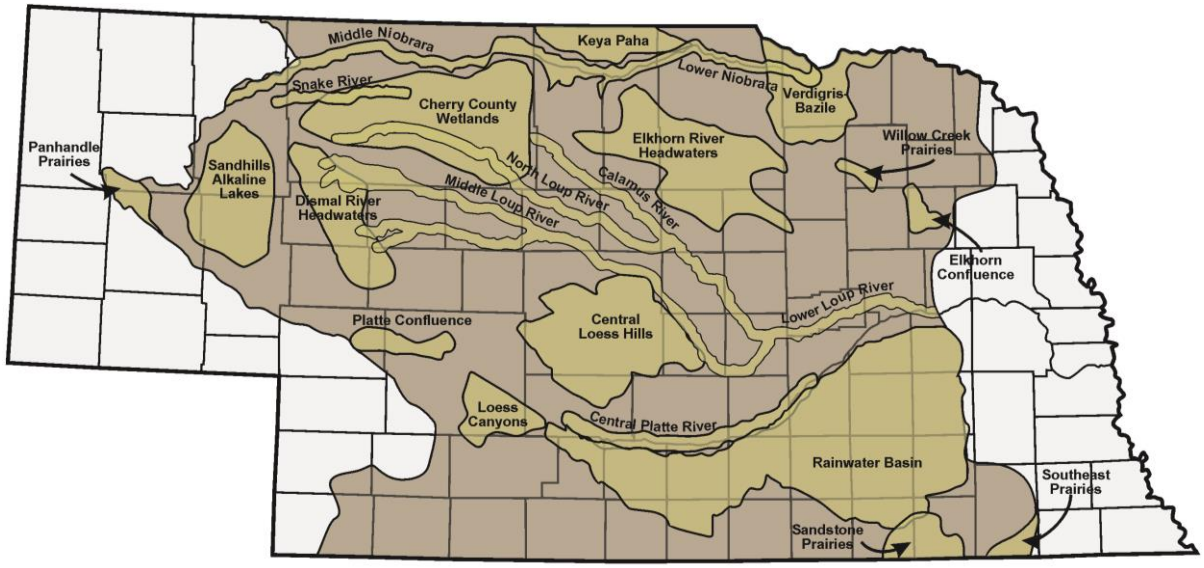


Figure 3. Biologically Unique Landscapes in the RWBJV Administrative Area (Source: Nebraska Legacy Plan).

The 23 BULS in the RWBJV Administrative Area are:

Calamus River	Elkhorn Confluence	Middle Niobrara	Sandstone Prairies
Central Loess Hills	Keya Paha	North Loup River	Snake River
Central Platte River	Loess Canyons	Panhandle Prairies	Southeast Prairies
Cherry County Wetlands	Lower Loup River	Platte Confluence	Verdigris-Bazile
Dismal River Headwaters	Lower Niobrara River	Rainwater Basin	
Elkhorn River Headwaters	Middle Loup River	Sandhills Alkaline Lakes	

The RWBJV Administrative Area encompasses approximately 35 million acres and contains over 2.3 million acres of wetland habitats and over 20 million acres of grasslands (Table 1). Wetlands comprise nearly 7% of the RWBJV Administrative Area, while grasslands cover approximately 60% of the landscape. Each GFA contains a variety of wetland, grassland, and woodland habitats. Over half of the wetlands found within the RWBJV Administrative Area are located in the Sandhills, with a majority of these acres classified as sub-irrigated wet meadows (palustrine wetlands). The RWB GFA contains the highest density of playa wetlands (palustrine wetlands), followed by the Central Loess Hills (Central Table Playa Complex), Northeast Prairies/Elkhorn River (Todd Valley Wetland Complex), and Republican River/Blue River Drainages and Loess Canyons (Southwest Playa Wetland Complex). The Republican River/Blue River Drainages and Loess Canyons GFA contains the most human-made wetland features (reservoirs, stock dams, and irrigation reuse pits; Table 1). Outside of the Sandhills, grasslands are generally confined to the floodplains of the major river systems or on environmentally sensitive lands. The primary GFAs with significant grasslands are the Central Loess Hills, Northeast Prairies/Elkhorn River, Republican River/Blue River Drainages and Loess Canyons, Sandhills, and Verdigris-Bazile Creek Drainages (Table 1).

Table 1. Wetland and grassland acres and their distribution by Geographic Focus Area (Bishop et al. 2011).

Geographic Focus Area	Geographic Focus Area (Acres)	Total Wetland (Acres)	Lakes & Reservoirs (Acres)	Palustrine Wetlands (Acres)	Riverine Wetlands (Acres)	Lacustrine Wetlands (Acres)	Grassland (Acres)
Central Loess Hills	3,598,453	169,185	20,504	12,473	136,209	0	2,166,456
Central and North Platte River	1,035,879	107,514	6,597	1,590	99,327	0	160,448
Missouri River	77,852	40,858	12,309	7,714	20,835	0	6,279
Northeast Prairies/ Elkhorn River	4,792,660	339,339	19,676	16,774	302,889	0	1,320,359
Rainwater Basin	3,830,130	120,852	25,703	44,198	50,950	0	677,965
Republican River/Blue River Drainages and Loess Canyons	5,826,800	226,427	60,937	5,437	160,054	0	3,140,230
Sandhills	13,587,519	1,253,724	25,719	1,120,700	22,331	84,974	11,535,386
Verdigris – Bazile Creek Drainages	2,004,581	91,833	7,766	4,770	79,297	0	1,383,183
Total	**34,753,873**	**2,349,733**	**179,212**	**1,213,656**	**871,891**	**84,974**	**20,390,306**

Central Loess Hills

The Central Loess Hills GFA, located in the center of the RWBJV Administrative Area, contains rolling to steep loess hills dissected by the valleys of the North, Middle, and South Loup rivers. Ridge tops (tables) are nearly level to gently sloping and covered with loess soils. Scattered across these table lands are numerous playa wetlands referred to as the Central Table Playas (LaGrange 2005). Based on hydric soil mapping units (polygons) and depressional wetland points defined in the Soil Survey Geographic Database (SSURGO), as well as the palustrine wetlands delineated in the National Wetlands Inventory (NWI; Cowardin et al. 1979), it is estimated that there were once over 6,300 playas covering more than 18,000 acres. Based on an assessment of aerial photography completed in 2010, just over half of the playas (3,470 individual wetland footprints) continue to demonstrate some level of function, such as ponding water or growing hydric vegetation (Bishop et al. 2011). These playa wetlands are generally smaller than the playas found in the RWB and are characterized by seasonal and temporary water regimes.

The steep, erodible side slopes of the Central Loess Hills drop off into the broad floodplains of the Loup rivers. The Central Loess Hills GFA contains the lower reaches of the Middle Loup, North Loup, and South Loup rivers, all of which are spring-fed and originate in the Sandhills. These broad and shallow sand-bed rivers maintain relatively constant year-round stream flow.

Sandbars and shallow side channels are typical features within and adjacent to the active river channels.

Based on a 2011 habitat assessment, the Central Loess Hills GFA contains approximately 12,500 acres of palustrine wetlands, 136,000 acres of wet meadows and other riverine wetlands, and approximately 2.2 million acres of grasslands (Table 1). The playa wetlands found in this GFA provide important migration stopover habitat for the endangered Whooping Crane (Austin and Richert 2001), as well as numerous other species of migratory waterbirds (e.g., waterfowl, shorebirds, and wading birds). The riverine wetlands associated with the Loup rivers provide breeding habitat for the threatened Northern Great Plains population of Piping Plover and endangered Interior Least Tern. The wet meadows and associated grasslands found in the Central Loess Hills currently support an estimated 875,000 grassland nesting birds (RWBJV 2013*a*).

Row-crop agriculture and ranching are dominant land uses within the Central Loess Hills. Row-crop agriculture is generally confined to the river valleys and areas of limited topographic relief. Crops generally include alfalfa, corn, milo, soybeans, and wheat. Most of the steep, more erodible slopes remain as native grasslands dominated by mixed-grass prairie communities. Higher commodity prices, plus the guaranteed income provided by the Federal Crop Insurance Program, have contributed to the conversion of environmentally sensitive grasslands and wetlands to row-crop agriculture. This conversion has reduced the quantity and distribution of grassland, wetland, and wet-meadow habitats found throughout the Central Loess Hills. The encroachment of undesirable plant species (i.e., eastern red cedar, Russian olive, smooth brome, etc.) has occurred on thousands of acres of native habitats. Fire suppression is believed to be a major factor that has contributed to the expansion of invasive species throughout this GFA.

Central and North Platte River

The Central Platte River is a 90-mile segment of the Platte River, extending from Lexington, Nebraska to Chapman, Nebraska. Historically, the Platte River was a wide, shallow river with multiple channels that meandered across an expansive floodplain. Large, scouring floods regularly set back vegetation succession and maintained a diversity of habitats across the floodplain. Following European settlement, the Platte River was extensively regulated, and the flood pulses and river flows that once shaped the ecosystem were greatly reduced. As a result, the areas of active floodplain and associated wet meadows were reduced, the river channels narrowed and deepened, and extensive riparian forests became established on islands and along river banks. For example, a comparison of average annual discharge levels at the city of North Platte, Nebraska, before 1930 and after 1930, shows a 70% reduction in river flows (U.S. Fish and Wildlife Service 1981). At the same monitoring location, the channel width narrowed from nearly 2,950 ft. to less than 330 ft. between 1870 and 1970. Similarly, the average channel width near Overton, Nebraska, declined from 4,800 ft. in 1865 to 740 ft. in 1998 (Murphy et al. 2004). Sidle et al. (1989) reported that 60% to 80% of the open riverine/sandbar habitat and 55% of wet meadow habitat had been lost in this reach of the Platte River because of agricultural conversion, development, and hydrologic changes.

Despite the highly altered nature of this system, the combination of broad, braided river channels, adjacent wet meadows, and abundant food supplies continues to attract millions of wetland-dependent migratory birds each year. The 60,000 acres of palustrine and riverine

wetlands and over 140,000 acres of grassland that occur along the Central Platte River (Table 1) continue to provide necessary roosting, loafing, and foraging habitat for millions of migratory birds. These habitats are used by endangered Whooping Cranes (USFWS 1978) and approximately 90% of the world's population of Sandhill Cranes, and serve as migration and wintering habitat for millions of waterfowl. They also provide stopover habitat for a myriad of waterbirds and non-breeding habitat for numerous shorebirds. In addition to migration habitat, the Central Platte River provides breeding habitat for the threatened Northern Great Plains population of Piping Plover and endangered Interior Least Tern, and for an estimated 160,000 priority grassland-nesting birds (Rainwater Basin Joint Venture 2013*a*).

Today, the Central Platte River valley is intensely cultivated. Based on the 2009 United States Department of Agriculture (USDA) Cropland Data Layer, over 60% of the historic floodplain is planted to corn, soybeans, or alfalfa (USDA 2009). In 2004, because of the diversion of water for irrigation, much of the Platte River was declared over-appropriated by the Nebraska Department of Natural Resources (DNR). This designation required new groundwater and surface water depletions to be offset, with the intent of managing the system in a sustainable manner. Although cropland conversion has slowed, gravel mining and residential and commercial development continue to result in the loss of riverine and wet-meadow habitats. Invasive plant species also continue to degrade in-channel habitats and adjacent wet meadows. Primary threats include: eastern red cedar, Kentucky bluegrass, *Phragmites*, purple loosestrife, reed canary grass, and smooth brome.

The North Platte River is one of the two tributaries that form the Platte River. The North Platte River originates in Colorado and flows through Wyoming before entering Nebraska. The stretch of the North Platte River within the Central and North Platte River GFA is located approximately 60 miles upstream from the river stretch designated as the Central Platte River. This stretch of river has a high density of palustrine and riverine wetland habitats, including approximately 36,000 acres of wet meadows and 16,000 acres of grasslands dominated by mixed-grass prairie species (Bishop et al. 2011).

The wetland and grassland habitats in this 80-mile stretch of river from Lewellen, Nebraska to North Platte, Nebraska have also been negatively impacted by the extensive regulation of North Platte River flows since European settlement. It is estimated that 25% of the historic wet meadows have been converted to row-crop agriculture (LaGrange 2005). The altered flow regimes have resulted in an increase of scrub-shrub and forested wetlands at the expense of riverine and emergent wetlands (LaGrange 2005).

Despite the negative impacts of land-use conversion and altered flow regimes, this stretch of river contains a diverse mix of riverine and marsh-like wetlands within the historic floodplain and river channel. Approximately 80% of the wetlands are either temporary or seasonal in nature (LaGrange 2005). This area is extremely important to the portion of the mid-continent population of Sandhill Cranes (approximately 56,000 individuals) that do not stage in the Central Platte River valley (Krapu et al. 2011).

Although the conversion of grasslands and wet meadows to row-crop agriculture has slowed as a result of the moratorium on new irrigated acres, these habitats continue to be converted for gravel mining operations and urban/suburban/commercial development. Wet meadows and grasslands in the North Platte River valley are also being invaded by eastern red cedar, Kentucky bluegrass, *Phragmites*, purple loosestrife, reed canary grass, Russian olive, and smooth brome.

Missouri River

The Missouri River GFA forms the northeast boundary of the RWBJV Administrative Area. This 125-mile stretch of river, between Ponca and Spencer, Nebraska, is the southernmost unchannelized portion of the Missouri River. Because it remains unchannelized, the active channel and associated floodplain contain a myriad of riverine and palustrine wetlands.

Prior to the 1930s, the Missouri was an unmanaged, natural river that supported a tremendous number and diversity of fish and wildlife. The river occupied a sandy channel and flowed between erodible banks, from 1,500 feet to over one mile apart, with braided, sinuous channels twisting among sheltered backwaters, sloughs, chutes, oxbows, gravel bars, sandbars, mudflats, snags, alluvial islands, deep pools, marshland, and shallow-water areas (U.S. Fish and Wildlife Service 1980). The character of the Missouri was drastically altered between 1930 and 1970 as channelization and main-stem dams narrowed and deepened the river channel, and associated floodplain wetlands disappeared. The six main-stem dams in the Dakotas, Montana, and Nebraska have changed water quality, quantity, and timing throughout the Missouri River system (LaGrange 2005). The controlled release of water from the upstream dams has reduced the flood pulse that was a key factor in maintaining the in-channel habitat and adjacent floodplain wetlands. Although the stretch of the Missouri River within the GFA is not channelized, it is still negatively impacted by the upstream dams. Reduced sediment loads negatively influence channel morphology, while controlled releases from upstream dams reduce scouring and in-channel habitat maintenance (LaGrange 2005). Many of the off-channel wetlands historically associated with this system have been altered to increase row-crop agriculture. Today 18,000 acres, or 25% of the landscape, are under row-crop agriculture production (USDA 2009).

Based on a 2011 habitat assessment, the Missouri River GFA contains approximately 28,500 acres of palustrine and riverine wetlands and just over 6,000 acres of grassland (Table 1). Despite the numerous alterations to the system, these wetlands still provide vital stopover habitat for numerous migratory waterfowl and shorebirds, as well as breeding habitat for the threatened Northern Great Plains population of Piping Plover and endangered Interior Least Tern.

The greatest threat to the unchannelized portion of the Missouri River is riverbed degradation (LaGrange 2005). Other key threats include residential/agricultural/commercial development, transportation, water pollution, water development projects, stream bank stabilization, drainage, and filling (LaGrange 2005). Projects associated with each of these threats have both direct and indirect impacts that cumulatively impair river functions by isolating the floodplain from the river and reducing the natural dynamics. Invasive vegetation also threatens habitat for migrating waterfowl, shorebirds, and other wetland-dependent species. Purple loosestrife and *Phragmites* have become established throughout this stretch of the Missouri River, including the confluence of the Niobrara River. Expansion of these species into the backwaters of Lewis and Clark Lake and the Niobrara and Missouri rivers is a threat to native plants and habitat.

Northeast Prairies/Elkhorn River

The Northeast Prairies/Elkhorn River GFA is located in the northeastern portion of the RWBJV Administrative Area. The GFA is intensely farmed and has a higher human population density than other GFAs in the RWBJV Administrative Area, creating a fragmented landscape. At one time, the uplands were dominated by grasslands with a diverse assemblage of tallgrass and

mixed-grass prairie species (Schneider et al. 2011). Some localized regions in this GFA contained a high density of playa wetlands. The playa wetland complex associated with this GFA is described as the Todd Valley Playa Wetland Complex (LaGrange 2005).

Today the mesic floodplains and steeper drainages associated with the Elkhorn River contain savannahs, woodlands, and densely forested habitats. Remnant tallgrass prairies are scattered across the region. The remaining playa wetlands contain a diverse mix of early successional wetland vegetation communities.

Despite the intensive row-crop and agricultural/urban/suburban development, this GFA contains significant grassland and wetland acres. Approximately 320,000 acres of palustrine and riverine wetlands and over 1.3 million acres of grassland occur throughout the Northeast Prairies/Elkhorn River GFA (Table 1). This landscape provides breeding habitat for numerous grassland-nesting birds, while the Elkhorn River provides breeding habitat for the threatened Northern Great Plains population of Piping Plover and the endangered Interior Least Tern. The Elkhorn River and Todd Valley wetlands provide secondary habitat for migrating wetland-dependent species (shorebirds, waterbirds, and waterfowl).

As with most of eastern Nebraska, this region is intensely cultivated. Nearly all of the grasslands have been converted and many of the embedded playa wetlands drained to promote row-crop agriculture. Based on the 2009 USDA Cropland Data Layer, 55% of this landscape is cultivated to corn, soybeans, or alfalfa (USDA 2009; Bishop et al. 2011). Nearly 10% of the grassland cover has been re-established through the Conservation Reserve Program (CRP). Although many of these acres were not planted exclusively to native species, the acres complement the native tallgrass remnants scattered throughout the region. A majority of the CRP contracts are expiring, and current high commodity prices, plus the safety net provided by the Federal Crop Insurance Program, are accelerating conversion of these acres back to row-crop agriculture.

Invasive plant species, such as eastern red cedar, Kentucky bluegrass, *Phragmites*, purple loosestrife, reed canary grass, and smooth brome, continue to degrade wet meadows and adjacent mesic floodplains in this region. The loss of grasslands in the region has resulted in higher stocking rates and a shift to year-long grazing regimes. The transitions in grazing practices, as well as fire suppression, are believed to be a major factor contributing to the encroachment of undesirable plant species (i.e., Kentucky bluegrass, eastern red cedar, and smooth brome, etc.).

Rainwater Basin

The RWB encompasses 6,150 square miles, including parts of 21 counties in the south-central portion of the RWBJV Administrative Area. Condra (1939) identified this landscape as the Loess Plains Region of Nebraska. The region has expansive rolling loess plains formed by deep deposits of wind-blown silt with a high density of clay-pan playa wetlands. Overland runoff from intense summer storms and melting winter snowfall fill the playa wetlands.

Analysis of historic soil surveys (1910–1917), NWI (1980–1982), and SSURGO data (1961–2004) indicates that playa wetlands were once a prominent feature of this landscape. Combined, these datasets identified approximately 11,000 individual playa wetlands (204,000 acres) that were historically part of the landscape. It has been estimated that there were over 1,000 semi-permanent and seasonal wetlands, which covered over 70,000 acres, and more than 10,000 temporary wetlands that accounted for an additional 134,000 acres.

The Nebraska Game and Parks Commission (NGPC) conducted a breeding waterfowl habitat survey (McMurtrey et al. 1972) and used the historic soil surveys as a reference to evaluate the distribution of remaining wetlands. McMurtrey et al. (1972) reported that 82% of the major wetlands had been converted to agriculture, removing approximately 63% of the total wetland acres from the landscape. The fast-paced degradation continued, and by 1985 only 10% of the surveyed wetlands remained. The remaining wetlands represented only 22% of the original surveyed acres, and virtually all were hydrologically impaired (Schildman and Hurt 1984). Because of the extensive wetland loss and continued degradation, RWB wetlands were given a Priority 1 ranking, the most imperiled status, in the Nebraska Wetlands Priority Plan (Gersib 1991).

Land use in the RWB is dominated by row-crop agriculture (70% of the acres), predominantly in a corn and soybean rotation. Grassland habitats make up approximately 20% of the region, while 3% of the area is covered by savannahs, woodlands, and forest communities that are confined to the steeper drainages associated with the Republican and Blue river systems. Riverine wetlands associated with these systems comprise about 2% of the landscape. Of the historic 204,000 RWB wetland acres, roughly 40,000 acres remain, or about 17% of the historic distribution. Today, playa wetlands in the RWB make up less than 1% of the total landscape (Bishop and Vrtiska 2008; Bishop et al. 2011).

Approximately 44,000 acres of palustrine wetlands, 51,000 acres of riverine wetlands, and 678,000 acres of grassland now exist throughout the RWB GFA (Table 1). Despite the extensive wetland loss, this region still hosts one of the greatest wildlife migration spectacles on earth. During spring migration, the RWB provides roosting, loafing, and foraging habitat for millions of migratory waterfowl and other wetland-dependent species. The RWB provides essential staging habitat for an estimated 8.6 million waterfowl (RWBJV 2013*d*) and nearly 600,000 shorebirds (RWBJV 2013*b*), as well as vital stopover habitat for the endangered Whooping Crane (RWBJV 2013*c*).

Over the years, a variety of wetland rules and laws have helped to significantly reduce active wetland drainage; however, wetland function across the landscape continues to decline as a result of intentional human activity, such as active drainage, and through ecological processes, including natural and culturally accelerated sedimentation (LaGrange et al. 2011). In addition, wetland modifications, including water concentration/irrigation reuse pits, land leveling, culturally accelerated sediment, and drainage ditches, directly impact the wetlands or limit the amount of runoff that reaches the wetlands. Furthermore, the combination of sedimentation and altered watershed hydrology contributes to conditions that promote invasive species. Depending on the water regime and the duration of saturated conditions, primary threats include reed canary grass, hybrid cattail (Grace and Harrison 1986), and river bulrush (Kaul et al. 2006, Rolfsmeier and Steinauer 2010).

Republican River/Blue River Drainages and Loess Canyons

The Republican River/Blue River Drainages and Loess Canyons GFA lies along the southern boundary of the RWBJV Administrative Area. A limited surface and groundwater supply differentiates the region from other GFAs within the RWBJV Administrative Area. As a result, a significant proportion of the cropland is cultivated with dry-land farming practices. Despite the limited ground- and surface-water resources, significant irrigation development occurred in the

Republican River drainage through 2004. The unsustainable irrigation development ultimately led the Nebraska DNR to designate the Republican River drainage as an over-appropriated river basin. This designation led to a combination of restrictions on new acres developed for irrigation and on irrigation water allocations. The Blue River basins are defined by the drainage area of the Big and Little Blue rivers. At this time, the Blue river basins have no limitations on groundwater development, but triggers are in place should further groundwater depletions occur.

In the western portion of this region, there are numerous playa wetlands that are part of the Southwest Playa complex (LaGrange 2005). These freshwater wetlands receive water from runoff and are small (mostly less than 5 acres), temporarily and seasonally flooded wetlands. Most have no natural outlet for water. In most years, these wetlands dry up early enough in the growing season to be farmed. Southwest Playa wetlands are similar to RWB wetlands farther east, except that the RWB complex receives greater rainfall, and the wetlands there tend to be larger (LaGrange 2005).

The topography and soils of this GFA vary from steep hills and canyons with highly erodible soils in the west, to relatively flat and highly productive plains, rolling hills, and breaks in the east. Stream flows vary and are dependent on precipitation. Grasslands are dominated by mixed-grass prairie communities, with tallgrass prairies occurring along the eastern boundary. Fire suppression and year-long grazing regimes are believed to be major factors contributing to the establishment of invasive species in many of the grasslands in this GFA.

Approximately 5,000 acres of palustrine wetlands, 160,000 acres of riverine wetlands, 61,000 acres of lakes and reservoirs, and 3.1 million acres of grassland occur throughout the Republican River/Blue River Drainages and Loess Canyons GFA (Table 1). With the exception of Harlan County Reservoir, a 16,000 acre flood-control reservoir, water bodies are typically associated with small watershed impoundments created for flood control, grade stabilization, and livestock water. These man-made wetland features (reservoirs and stock ponds) provide migration, and at times wintering, habitat for waterfowl, as well as stopover habitat for numerous species of shorebirds. The grasslands in this GFA provide breeding habitat for an estimated 1.5 million grassland nesting birds (RWBJV 2013*a*).

Habitat loss from grassland conversion and wetland drainage for row-crop agriculture has occurred to varying degrees throughout this GFA. Row-crop agriculture development has been slower in the Republican River Basin, primarily because of a limited groundwater aquifer and moratoriums on irrigation development. Invasive species continue to threaten habitat quality of both wetlands and uplands in this GFA. *Phragmites*, purple loosestrife, and reed canary grass have played a role in reducing habitat, constricting river channel widths, and depleting surface water flows.

Sandhills

The Sandhills are a 19,300 square-mile sand dune formation located in north-central Nebraska. Although located in a semi-arid climate, the Sandhills contain an abundance of lakes, wetlands, wet meadows, and spring-fed streams scattered across the largest contiguous grass-stabilized dune system in North America (Schneider et al. 2011).

Between the dune formations are long, gently sloping valleys containing spring-fed meandering streams, lakes, wetlands, and wet meadows. Groundwater recharge is the prominent

characteristic of the sands, creating a vast aquifer that stores 700-800 million acre-feet of groundwater (Keech and Bentall 1971). This volume represents twice the volume of Lake Erie. Most of the area's lakes, wetlands, and streams are sustained by groundwater discharge from adjoining dunes. About 90 % of the stream flow (2.4 million acre-feet) comes from groundwater discharge (Bentall 1990). The Niobrara River flows along the Sandhills' northern border, and the North Platte and Platte rivers flow along part of the southern boundary. The Calamus, Cedar, Dismal, Elkhorn, and Loup rivers originate within the Sandhills.

Approximately 1.1 million acres of palustrine and riverine wetlands, 85,000 acres of lacustrine wetlands, and over 11.5 million acres of grassland occur throughout the Sandhills GFA (Table 1). The mosaic of wetlands and grasslands was identified by Bellrose (1980) as the most significant waterfowl nesting habitat outside of the Prairie Pothole Region. Vrtiska and Powell (2011) estimated that 275,000 waterfowl annually nest in the Sandhills. The larger Sandhills lakes provide nesting habitat for a majority of the High Plains flock of Trumpeter Swans (Grosse et al. 2012). The wet meadows and grasslands provide vital nesting habitat for an estimated 4 million grassland birds (RWBJV 2013*a*). A significant proportion of the estimated 400,000 breeding shorebirds found in the RWBJV Administrative Area occur in the Sandhills (RWBJV 2013*b*). Nearly all of the nesting waterbirds in the RWBJV Administrative Area occur in the Sandhills (RWBJV 2013*c*).

Wetland loss in the Sandhills has occurred primarily through draining by surface ditches, beginning as early as 1900 (U.S. Fish and Wildlife Service 1960; McMurtrey et al. 1972; LaGrange 2005). With the introduction of center-pivot irrigation systems to the Sandhills in the early 1970s, land leveling/shaping and local water-table declines resulted in extensive wetland losses in some areas. While quantifiable data are not available for the Sandhills, estimates of wetland acres drained range from 15% (McMurtrey et al. 1972) to 46% (U.S. Fish and Wildlife Service 1986). Sandhills wetlands were given a Priority 1 ranking, the most imperiled status in the Nebraska Wetlands Priority Plan, because of very extensive past losses (Gersib 1991). Wetlands in the Sandhills continue to be threatened by drainage ditches, generally created to increase hay acreage. This drainage directly impacts the lake or wetland where the project occurs and also can lead to cumulative wetland loss, both downstream and upstream, as the channel becomes entrenched, lowering the water table, and causing lateral drainages that impact adjacent wetlands. Many smaller wetlands are also threatened by conversion from ranching to irrigated row-crop agriculture. Concentrated, large-scale irrigation development can result in long-term effects on wetland communities by lowering the groundwater table. Many of the lands originally developed for row-crop production have been planted back to grasslands. This was incentivized by the CRP program. However, CRP acres could be rapidly converted to row-crop agriculture. As CRP contracts expire, there are multiple factors that could influence conversion of these lands back to row-crop agriculture. For example, current commodity prices, land values, and cash rent remain at all-time highs, and the Federal Crop Insurance Program provides a source of guaranteed income for cultivation of these environmentally sensitive lands.

Verdigris-Bazile Creek Drainages

This landscape, located in the northern portion of the RWBJV Administrative Area, is defined by the watersheds of Verdigris and Bazile creeks, which originate in and flow through Cedar, Knox,

Holt, and Antelope counties, emptying into the Niobrara and Missouri rivers in northeast Nebraska.

Topography is variable, resulting in a mosaic of cropland, grasslands, and woodlands. This GFA is located at the transition zone between the tallgrass and mixed-grass prairie eco-regions. As a result, the grasslands contain a diverse assemblage of tallgrass and mixed-grass prairie communities. Tallgrass prairie communities dominate the native grasslands along the eastern boundary, while species strongly associated with mixed-grass prairie prevail in grasslands along the western border. Woodlands are generally confined to the drainages and bluffs associated with the major riverine systems (Verdigris Creek, Bazile Creek, Missouri River bluffs and breaks) (Schneider et al. 2011). These woodlands are dominated by deciduous species. The dominant cultivated crops in this region include corn, soybeans, and alfalfa (Bishop et al. 2009).

Approximately 4,800 acres of palustrine wetlands, 79,000 acres of riverine wetlands, 7,800 acres of lakes and reservoirs, and 1.4 million acres of grassland occur throughout the Verdigris-Bazile Creek Drainages GFA (Table 1). The CRP program has been utilized to re-establish grasslands on former row-crop acres with steeper topography and water erosion problems. Although many of these acres were not planted exclusively to native species, the re-established grassland acres complement the native tallgrass and mixed-grass remnants scattered throughout the region. It is estimated that this landscape provides nesting habitat for 600,000 grassland breeding birds (RWBJV 2013*a*). The Niobrara River provides breeding habitat for the threatened Northern Great Plains population of Piping Plover and endangered Interior Least Tern.

A majority of the CRP contracts are expiring, and current high commodity prices, plus the safety net provided by the Federal Crop Insurance Program, are accelerating conversion of these acres back to row-crop agriculture. Grassland conversion is also occurring as a result of current farm economics and farm policy. Fire suppression and year-long grazing regimes are suspected of creating conditions that allow eastern red cedars, Kentucky bluegrass, and smooth brome to invade grasslands. Eastern red cedars have also invaded the woodlands and forests associated with the Verdigris - Bazile Creek Drainages GFA.

Issues

The RWBJV recognizes a range of issues that affect birds and their habitats. Some impacts are direct and others are subtle. Many of the issues cannot be eliminated, but efforts are needed to reduce or mitigate their effects.

The *Nebraska Natural Legacy Project* lists, for each BUL, the factors that the public identified as stresses on wildlife populations. Those identified for all or a portion of the RWBJV Administrative Area included:

- Wetland and wet meadow drainage
- Altered hydrology and channel degradation of rivers and streams
- Spread of invasive species
- Conversion and fragmentation of natural habitats
- Altered natural frequency of burning and grazing
- Lack of awareness and knowledge about the region's biological diversity and ecological processes
- Lack of trust and collaboration between the agricultural and conservation communities
- Loss of lands enrolled in conservation programs
- Ranching economics
- Sedimentation of rivers, streams, and wetlands
- Poorly sited utility-scale wind turbines
- Inter-basin water transfer

In addition, the following are emerging issues that are expected to have new or growing impacts on bird populations and habitats.

Water Use and Policies

Nebraska's wealth of water is hidden in the huge Ogallala Aquifer, which extends under nearly all of the RWBJV Administrative Area. The Sandhills are the most significant source of groundwater recharge, with 12.4 million acres of sand dune formations. The porous sands allow large amounts of the region's precipitation to percolate downward. While the Sandhills region adds water to this underground reservoir, other parts of the state are extracting from it for use in irrigation and municipalities.

At present, not all water that percolates through the sands is added to the groundwater. A certain amount, equal to about 2.4 million acre-feet is discharged into the streams and rivers flowing through the Sandhills (Bentall, 1990). The streams exit the Sandhills along the eastern edge, supplying water to farmland and population centers. The balance between the dunes' ability to recharge the groundwater and the state's water needs is not secure. If the demand for water exceeds the dunes' capacity for recharge, the region's streams and wetlands will decline.

Row crop agriculture in all but the easternmost parts of Nebraska is largely dependent on irrigation. According to the 2007 Census of Agriculture report, Nebraska ranks first in the nation, with about 8.5 million irrigated acres, most of which receive groundwater. By 2007, over 90,000 active wells existed in Nebraska (University of Nebraska 2012). The highest density of wells lies along the eastern edge of the RWBJV Administrative Area, primarily in the Rainwater Basin. Intense agriculture within the Rainwater Basin has resulted in 70% of the land being used as cropland—65% of that is irrigated. This represents about 1.92 million acres.

Groundwater withdrawals for irrigation have caused local groundwater declines, primarily in the western third of the state. Legislation passed in 2004 recognized the interconnection between groundwater and surface water and required Natural Resources Districts containing over-

appropriated or fully appropriated streams to develop groundwater management plans. Districts outside the Sandhills have begun to monitor water usage and water table elevations.

Within the RWBJV Administrative Area, in the counties through which the Platte River and Republican River flow, water supplies have been delcared over–appropriated by the Nebraska Department of Natural Resources. All other counties in the RWBJV Administrative Area lie outside "over appropriated" designations.

The growing demand for water and the concern over declining groundwater levels have led producers and Natural Resources Districts to explore ways to reduce water usage. These include conversion from gravity irrigation to center pivot irrigation, and conversion of marginal irrigated cropland to dry-land farming. Marginal irrigated croplands include drained or semi-drained wetlands that pool water after large precipitation events. United States Department of Agriculture (USDA) conservation programs such as the Wetlands Reserve Program (WRP) and the RWBJV's Working Landscapes Initiative are working toward converting these flood-prone lands back to wetlands and grassland.

Although state legislation is directed toward protecting groundwater resources and their inherent benefits to communities and agriculture, it does not extend protection to spring-fed wetlands and wet meadows (common in the Sandhills). Irrigation wells located in proximity to wet meadows can lower the water table enough to shift local plant composition and shorten the longevity of water in shallow wetlands. Likewise, allowing the use of surface and groundwater until a stream reaches "fully appropriated" status will limit the benefits that the stream provides to bird habitats.

Nebraska law gives landowners a limited right to capture, divert, and use runoff water before it reaches streams. This creates the potential for irrigators within the Rainwater Basin to capture runoff before it reaches wetlands,. as is being done with water concentration pits and irrigation reuse pits. Although the current trend is to remove pits, future demand for water may encourage producers not only to keep existing pits, but to increase their capture of runoff.

Invasive Plant Species

Invasive species are having a damaging effect on bird habitats throughout the RWBJV Administrative Area. In grasslands, smooth brome, Kentucky bluegrass, leafy spurge, musk thistle, and eastern red cedar have reduced the abundance and diversity of native plants. Wetland habitats are being degraded by reed canary grass, hybrid cattail, river bulrush, *Phragmites*, and woody plants.

The increase in invasive species is often associated with improper management of the native vegetation. Proper management is a challenge. The same management practices that encourage native plant communities can encourage invasive plants if applied at the wrong time or with the wrong intensity. For example, prolonged grazing of grasslands can reduce native plants and encourage non-natives such as Kentucky bluegrass and smooth brome. In contrast, under-grazing in temporary wetlands will cause non-natives, such as reed canary grass, to overtake native annual plants.

Within the RWBJV Administrative Area, Rainwater Basin wetlands are the most prone to invasion by non-native plants. The seasonal flooding, followed by drying, causes frequent shifts in plant communities. Wetlands that are frequently disturbed or set back in natural succession

are more likely to produce native annual plants. Wetlands that are left undisturbed for a number of years generally become dominated by stands of hybrid cattail, bulrush, or reed canary grass.

In the eastern portion of the RWBJV Administrative Area, eastern red cedar is steadily encroaching on pastureland. The trees gain a foothold on steeper slopes where active control is costly and the land's agricultural value is low. Mature trees provide a local seed source, causing the trees to grow more densely and spread across open grassland.

Renewable Energy Development

The Energy Policy Act of 2005 is affecting Nebraska's landscape. Ethanol and wind energy production are the most prominent issues. National demand for ethanol and its production have grown exponentially since 2005. Production increased from 3.4 billion gallons in 2004 to 13.95 billion gallons in 2010 (Renewable Fuels Association, 2012). Nebraska ranks second in ethanol production (Nebraska Energy Office, 2012), using 35% of its corn crop for ethanol. Changes in corn prices reflect this demand. In 2005, the average corn price was about $2 per bushel. In 2011, the price was close to $6.25 per bushel (Kansas State University Department of Agricultural Economics, 2012). Increased profits have resulted in more marginal lands (including wetlands) being planted. The sequence of events has caused land prices to grow exponentially as well—making it more difficult to purchase wetlands for long-term protection. Wetlands that would previously have been considered for conservation programs are now seen as profitable cropland.

In addition to ethanol production, the large expanse of sparsely populated landscape and the dependable occurrence of wind make the RWBJV Administrative Area susceptible to development of large wind farms. The conflict between wind development and migratory birds is real. The RWBJV Administrative Area represents the Central Flyway portion of Nebraska. Millions of waterfowl and other migratory birds traverse this region during the spring and fall. Direct effects, such as birds striking wind turbines, are a main concern, as are indirect impacts. Loss or degradation of habitat can occur with construction of access roads, turbine farms, and transmission lines. A number of studies have demonstrated the negative reaction of birds, including several grassland bird species (Leddy et al. 1999), to the presence of wind towers (Stewart et al. 2005).

The publication, "Guidelines for Wind Energy and Wildlife Resource Management in Nebraska" was developed by the Nebraska Wind and Wildlife Working Group (2011) to identify environmental concerns and recommendations that developers should consider to reduce wind development's impact on the environment. A similar document is being drafted by the U.S. Fish and Wildlife Service (2011). Although not specifically identified in the Nebraska guidelines, the RWB is the area in which wind development would pose the greatest conflict.

Connection to the Land

With each succeeding generation, Americans have less direct connection to the land and its natural resources. Even in a rural state like Nebraska this trend occurs. Television and video entertainment are quickly identified as the common cause. Recent studies have shown that youth, ages 3-12, are spending 27 percent of their time with electronic media and only one percent in the outdoors (Nebraska Forest Service, 2012). However, other causes play significant roles. Children are spending more of their outdoor time participating in structured outdoor sports

such as soccer and baseball, which keep them on manicured fields with no exposure to the natural flora and fauna. Parents' fears of such hazards as lyme disease, poison ivy, and abductions reduce their willingness to encourage unstructured play and exploration of the outdoors. As people become disconnected from natural resources, their commitment to stewardship of our natural legacy diminishes.

The America's Great Outdoors Initiative, ordered by President Obama, recognizes that families are spending less time enjoying their natural surroundings. One of the initiative's goals is to reconnect Americans, especially children, to America's rivers, waterways and landscapes of national significance. Many conservation organizations and agencies, including RWBJV partners, have developed outdoor education programs for young people as an integral part of their long-term conservation strategy.

Increasing Demands on the Landscape

The drive in agriculture is to produce, whether through better crop genetics, farming practices, or increases in farmland acres. Throughout the RWBJV Administrative Area the number of acres of cropland continues to increase. Farming efficiency has grown through consolidation of smaller fields into larger ones. Often that includes bringing shallow wetlands into production.

Conservation actions designed to protect, restore, or enhance wetlands are commonly met with local resistance. Local residents view the benefits of wetlands to be of lower importance than crop production. Crop production provides direct, measurable benefits to producers and local businesses. In contrast, the benefits provided by wetlands are indirect and difficult to measure. Rural communities commonly view outside revenue derived from hunting and bird watching as little compensation.

Wetland acquisition is commonly blamed for reducing the number of farm families and local commerce—resulting in school and business closures. What is not as readily recognized is the continual shift to larger farms, fewer families, and declining community services. Collectively, the agricultural community opposes these trends. But individual actions contribute to the cause. Productive farms commonly purchase adjoining farmland—reducing the number of neighboring farm families. Rural consumers are choosing to drive greater distances to shop larger markets. And residents are moving to larger communities that offer better jobs, education, and health services. The emigration from small towns is expected to continue.

Some who fight to save the small town commonly see the solution to be increased crop production and crop prices—believing more farm revenue will mean more money in small communities. However, much of the increased farm revenue goes to purchase items that small communities cannot provide, such as farm equipment, vehicles, and household appliances.

As the number of residents in small towns declines, the taxable assets in the county decline as well, shifting more of the tax burden onto agricultural lands to support county services. The farmers' tax share increases, causing public ownership of wetlands to be seen as a factor that adds to their tax liability.

Farm Bill Program

Farm legislation is shifting. It once was a vehicle for rural development, income support, and control of crop production. Now it is comprehensive legislation which includes food safety,

nutrition, and environmental conservation. The Farm Bill is passed every five years, with the fate of each farm program being reconsidered every time. Changes in demographics have caused fewer congressional members to represent farming-dependent states—a situation that greatly affects the content of the legislation.

The current Farm Bill supports conservation through such programs as the CRP, WRP, the Wetland Habitat Incentives Program (WHIP), and the Environmental Quality Incentives Program (EQIP). These programs have restored and conserved thousands of acres within the RWBJV Administrative Area.

Past trends in legislation have been to increase conservation. However, large budget deficits and increasing food prices may influence future legislation toward reducing conservation funding.

Climate Change

Climate change poses a threat to the function and availability of wetlands throughout the RWBJV Administrative Area, especially during migration. It is generally expected that this portion of the Great Plains will be warmer and drier, with a significant increase in average temperatures during the winter months and annually. Winter precipitation is expected to increase, with summer precipitation decreasing. Intense precipitation events are projected to increase, causing more runoff, pollution, and soil erosion problems.

The possibility of increased winter temperatures could significantly reduce snow accumulations, increase evaporation, and ultimately reduce the surface runoff that fills wetlands prior to spring migration. Less runoff and higher evaporation mean wetlands will pond water less frequently, and over shorter periods.

Climate models predict that the conditions on waterfowl wintering grounds will decline. Millions of birds are expected to arrive in poorer body condition, placing greater demand on the RWBJV Administrative Area, especially the RWB. The ability of the RWB to provide sufficient migration habitat in the face of climate changes will require two significant conservation initiatives: 1) increase the acreage of wetlands distributed across the landscape, and 2) improve the ability of these wetlands to pond water – both in area and in frequency.

The RWBJV and Its Partners

Organizational Structure and Standing Committees

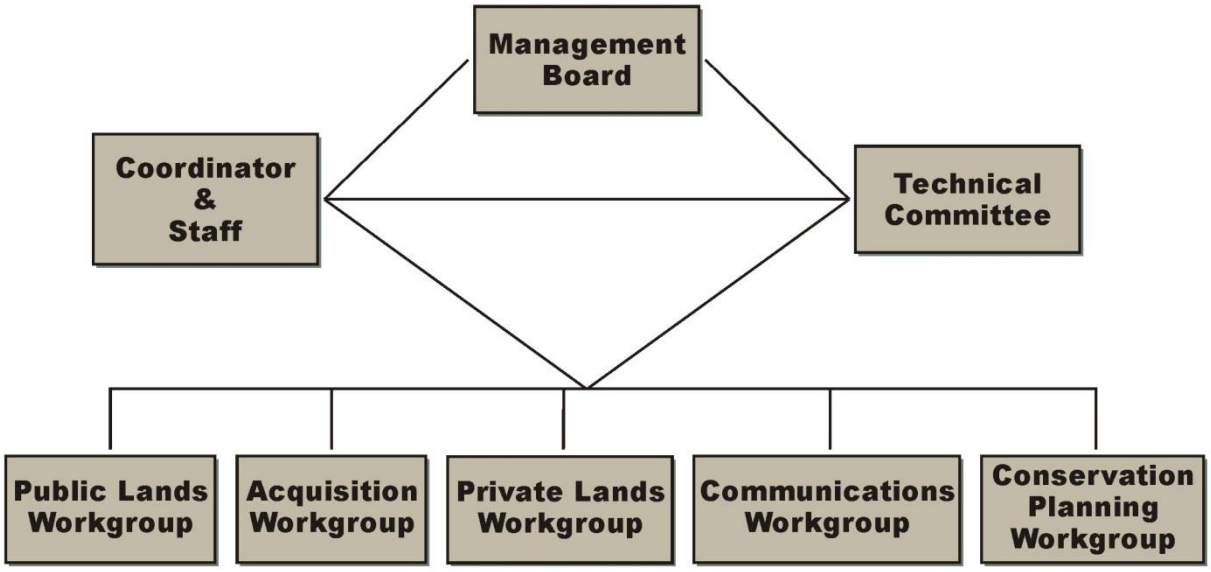
The RWBJV's organizational structure (Figure 4) and operations are guided by approved bylaws. The head of the organization is the Management Board, which presently consists of seven landowners or agriculture producers and eight representatives from government and conservation organizations. The landowners or producers often serve as independent voices. Some serve as representatives from their respective Natural Resources Districts, at their district's request. Board members who represent agencies and organizations are upper-level administrators who have authority to commit financial and staff resources to the partnership. The role of the Management Board is to serve as visionaries to provide direction and leadership, and to serve as liaisons for the interests of their respective organizations.

The Technical Committee serves under the Management Board. Its purpose is to provide technical expertise and recommendations to the Management Board and to carry out decisions of the Board. The Technical Committee works closely with the Coordinator on tasks assigned to it by the Management Board. The core membership consists of mid-level managers or professionals from partner agencies and organizations. The number of members is fluid, as individuals with additional expertise are often added to address specific projects or initiatives.

The Coordinator oversees and directs the general operation of the organization. The Coordinator answers directly to the Management Board but uses his or her position to ensure that the staff, Technical Committee and workgroups are working together toward established goals.

The Coordinator serves as the sparkplug, ensuring that all partners and projects are working collectively. The current Coordinator is an employee of the U.S. Fish and Wildlife Service but Service affiliation is not a requirement of the position. Future coordinators may or may not be affiliated with an organization or agency. Responsibilities of the Coordinator include

Figure 4. Organizational chart of the Rainwater Basin Joint Venture.



supervision of the science coordinator, office administrator, communications specialist, and the Geographic Information Systems office.

Five workgroups exist to implement on-the-ground projects. The members of each workgroup are those who can effectively accomplish each workgroup's tasks. It is common for the work performed by one workgroup to overlap with another. For example, a landowner may wish to restore a wetland and then place a conservation easement on the property. This requires close working relations between the Private Lands and Acquisition workgroups. The functions of the various workgroups are as follows:

The **Public Lands Workgroup** brings public-land managers together to discuss future management plans, and to review the performance of existing management strategies. One of the keys to their success is sharing knowledge and building consensus with regard to proper management of public lands.

The **Acquisition Workgroup** contains representatives of organizations that have current and possible future involvement in acquisition of conservation easement and fee-title properties. Each organization has slightly different goals and objectives. By working together, partners can coordinate acquisitions so that the organization that ultimately owns or manages a property is the one that is best able to maximize the property's potential.

It is common for one organization to have the resources to purchase a property, but request that another organization be responsible for its long-term management. Coordination within this workgroup also prevents conservation organizations from competing for the same piece of property.

The **Private Lands Workgroup** is composed of representatives of agencies and organizations that provide conservation assistance to private landowners, generally in the form of technical and financial assistance. This workgroup is at the forefront in building trust and positive relations within communities. The workgroup becomes the forum to develop protocol for conservation practices and to build consensus among agencies.

The **Communications Workgroup** is a small group of individuals from agencies who work together to disseminate information about the RWBJV and the conservation work being done in the region. An example of their work includes the annual informational seminar which brings farmers and conservation groups together to share information and address land management issues.

The **Conservation Planning Workgroup** has biologists and researchers working together to expand knowledge about different habitats and needs of wildlife. Individuals serve as contact persons for universities and government agencies conducting research. The group is responsible for identifying and prioritizing the region's research needs. Their collective approach helps ensure that limited research funds are most effectively used.

Geographic Information Systems Office

The GIS Office includes one full-time GIS analyst and additional short-term employees or interns. Currently the office supports the biological planning and conservation design needs of the RWBJV and various conservation organizations, including:

- Natural Resources Conservation Service
- USFWS Ecological Services
- USFWS Partners for Fish and Wildlife program
- Nebraska Game and Parks Commission
- Ducks Unlimited
- Central Platte Natural Resources District
- Little Blue Natural Resources District
- Tri-Basin Natural Resources District

Much of the work done for individual organizations also helps fulfill the planning and conservation responsibilities of the RWBJV.

Funded Staff Positions

In addition to the Coordinator, the RWBJV has two other full time staff, paid for with the USFWS allocation to the RWBJV. These positions are GIS Analyst and Office Manager. The GIS Analyst oversees daily operations and project development in the GIS Office. The Office Manager coordinates with conservation delivery staff to pay for implementation of projects and subsequently tracks expenditures for grant reporting.

Capacity is often the limiting factor in the conservation enterprise. The RWBJV leverages a significant proportion of its USFWS funding to address capacity limitations. Five positions currently exist which are funded directly by more than one partner. Joint funding often results when two or more agencies or entities have a common need for a specific technical skill. It is a true example of how partnerships can often accomplish more than individual organizations working independently. These positions are diverse and are designed to address specific needs. Positions are both permanent and nonpermanent in duration. To date, the five jointly funded positions are: Science Coordinator, Habitat Specialist, WRP Specialist, SDM Coordinator, and Projects Coordinator. As needs change, the types of positions and associated responsibilities will change, but this leveraged approach has allowed numerous partners to benefit.

The **Science Coordinator** oversees and coordinates the biological work being accomplished by the RWBJV. This includes biological planning, conservation design, and monitoring/inventory/research. Scientific information that is gained is distributed by the Coordinator.

The position is funded by the RWBJV, but the position is held by the University of Nebraska at Lincoln. Office space and equipment are being contributed by Nebraska Cooperative Fish and Wildlife Research Unit, Nebraska Game and Parks Commission, and University of Nebraska–Lincoln.

The **Habitat Specialist** supports management of invasive and aggressive species, on both public and private lands. This position also develops wetland restoration and enhancement agreements with private landowners. The position is funded by the RWBJV, USFWS Partners for Fish and Wildlife, and Nebraska Game and Parks Commission.

The **WRP Specialist** is a full-time Natural Resources Conservation Service (NRCS) employee who focuses entirely on promoting and delivering WRP within the Rainwater Basin. A portion of the salary cost is funded by the RWBJV.

The **Structured Decision Making Coordinator** is a Nature Conservancy position. This person leads the Structured Decision Making (SDM) project. SDM involves developing a decision matrix which predicts vegetative response to management treatments. For example, the matrix identifies the level of success to expect if a specific plant community is burned, followed by two years of intense grazing. The matrix incorporates management costs associated with each strategy. The purpose is to develop the most effective and feasible management strategies to achieve desired habitat conditions.

The **Projects Coordinator** is responsible for providing oversight and consistency of delivery of numerous conservation programs offered by the RWBJV. By doing so, there is assurance that restoration projects are cost effective and meeting established goals.

Partners and Partnerships

In the most inclusive sense, "partnership" in the RWBJV includes all organizations, governmental bodies, institutions, and individuals who partner together to further the RWBJV's mission. The partners have played diverse roles. They range from being key contributors of administrative and project funding, to providing staff, to holding and managing conservation easements. As varied as the projects accomplished over the past 20 years have been, so varied are the contributions of the partners.

Most of the partners are involved in other areas of Nebraska outside the RWB. Therefore as the RWBJV expands its involvement into other regions, many of these partners will continue to be involved. New partners will most likely be local organizations whose interest or mission is limited to a small geographic area. Two existing organizations with which the RWBJV has had association in the past are the Niobrara Council and the Sandhills Task Force.

The Niobrara Council was formed by legislation and focuses on activities associated with the management of the Niobrara National Scenic River corridor. The Sandhills Task Force is a landowner-initiated organization whose involvement extends across the Sandhills. Other potential partners include local Natural Resources Districts.

Neighboring Joint Ventures

Four joint ventures border the RWBJV Administrative Area (Figure 5). Like the RWBJV, their original purpose and focus were on waterfowl habitats and waterfowl populations. They too have expanded their administrative and geographic boundaries to encompass all or portions of BCRs in proximity to their original administrative areas. Their responsibilities now include all birds as well. The four adjacent joint ventures are:

- Prairie Pothole Joint Venture
- Playa Lakes Joint Venture
- Northern Great Plains Joint Venture
- Upper Mississippi River/Great Lakes Joint Venture

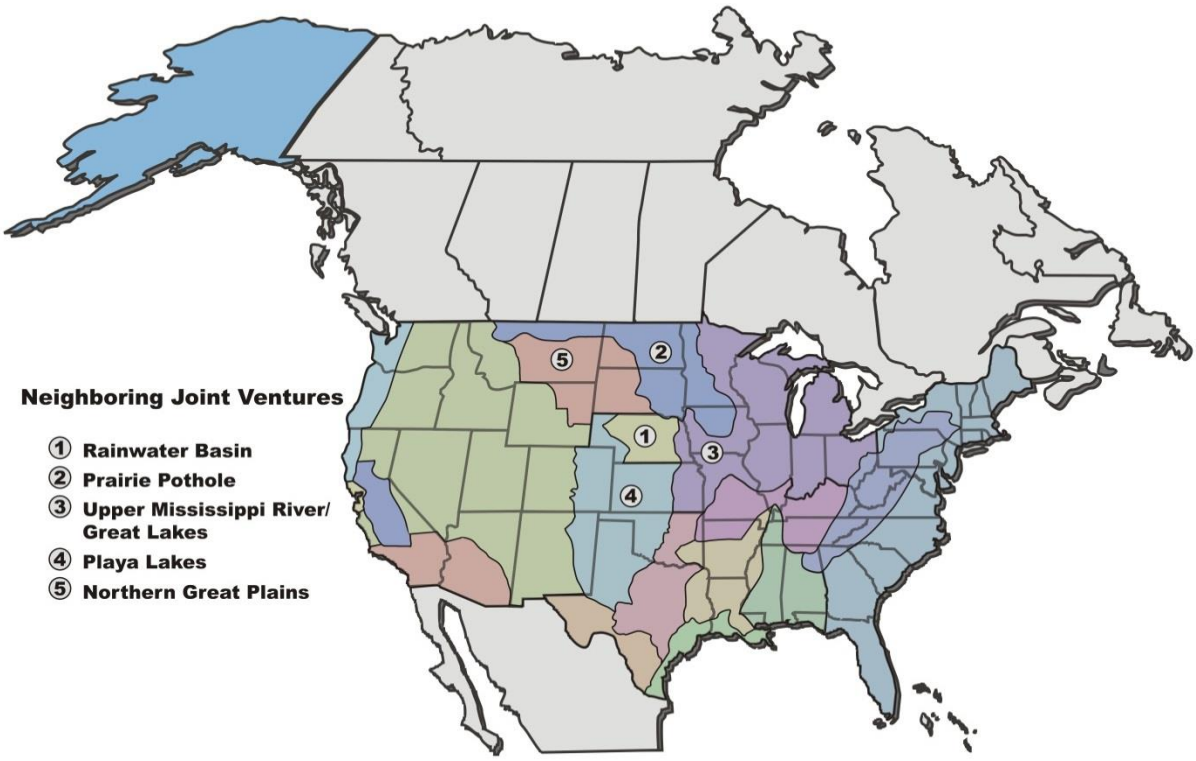


Figure 5. Joint venture boundaries within the continental United States.

Charting the Future

Stepping Down National and International Bird Plans

Nationally and internationally, the goal of bird habitat joint ventures like the RWBJV is to provide sufficient habitat to support bird populations at levels described in the national bird plans. Four overarching, yet guild-specific, bird plans have been drafted to guide bird conservation at national and/or international scales: the North American Landbird Conservation Plan, the North American Waterbird Conservation Plan, the North American Waterfowl Management Plan, and the United States Shorebird Conservation Plan. The plans provide a framework for species prioritization, define geographic focus areas, and provide general habitat benchmarks by geographic area for the different phases of the annual life cycle. From a planning perspective, the most important elements of the plans are the species-specific population objectives.

The geography and focus vary for each bird habitat joint venture. The administrative areas of some bird habitat joint ventures span large geographies and contain habitats that support numerous priority species during their entire life cycle, while others provide important habitat for a single phase of the annual life cycle. Bird habitat joint ventures use the population objectives outlined in the national bird plans as a starting point, and develop different frameworks to "step down" national objectives to meaningful population objectives for the respective joint ventures'

local geographies. Like the other bird habitat joint ventures, the RWBJV has developed different guild-specific planning frameworks to step down the national bird plan objectives. These stepped-down objectives allowed the RWBJV to develop meaningful conservation targets for the RWBJV Administrative Area. The current habitat objectives are 20-year benchmarks that, if implemented, are predicted to result in landscapes capable of supporting the appropriate proportion of national bird populations that are expected to use the RWBJV Administrative Area when national objectives have been achieved.

During the initial years of the RWBJV, the partnership's approach to conservation was "conservation delivery"—getting projects on the ground wherever the opportunity arose within the RWB. With time, landowner participation increased and funding became more limited, compelling the RWBJV to move toward developing decision-making protocols. Factors taken into consideration were habitat goals, conservation priorities, and priority species. The process contained many of the core elements outlined in the SHC framework (National Ecological Assessment Team, 2006). SHC provides a transparent and flexible framework to guide conservation planning, project delivery, and ultimately evaluation and monitoring of outcomes.

As previously described, the SHC framework is a spatially explicit application of the Department of Interior's Adaptive Management approach to managing trust species and lands. The SHC framework consists of four elements: 1) Biological Planning, 2) Conservation Design, 3) Conservation Delivery, and 4) Research/Inventory/Monitoring. In the biological planning phase of SHC, priority species are identified and population goals are established. The conservation design phase is focused on identifying regions within the specific landscapes where the greatest biological return can be achieved for the priority species.

The conservation delivery element of the SHC framework is focused on strategic on-the-ground conservation. In landscapes dominated by private ownership, like the RWBJV Administrative Area, there are numerous methods and different conservation programs, but achievement of desired conservation outcomes depends on the willingness and cooperation of the various partners and most importantly on the relationships with private landowners. The SHC framework and Adaptive Management framework are structured to "learn by doing," using research/inventory/monitoring to refine conservation actions. In addition to monitoring conservation activities, the SHC framework emphasizes the integration of GIS technology to spatially target or prioritize best management actions to locations on the landscape where the greatest biological return can be achieved. Both SHC and Adaptive Management are iterative processes that are continually refined as new information becomes available.

The RWBJV used the SHC framework to establish specific population objectives, identify limiting habitats, establish habitat objectives, and outline priority research/inventory/monitoring information that will need to be collected to better inform the partners about key uncertainties outlined in this version of the RWBJV Implementation Plan. The following section describes how the elements of the SHC framework were applied and integrated into the RWBJV Implementation Plan.

Strategic Habitat Conservation within the RWBJV Administrative Area

Biological Planning

The SHC framework is an iterative process, but Biological Planning is often described as the initial element that outlines the foundation and ultimately guides the subsequent elements. In the Biological Planning phase, species population objectives are established and empirical or conceptual models are used to quantify species-habitat relationships. The RWBJV developed several models and planning frameworks to establish RWBJV-specific population objectives. The results are presented in the following sections.

Landbirds

The RWBJV developed a set of priority species based on the NALCP. The NALCP evaluated six vulnerability factors to identify regional priority species. The RWBJV refined the NALCP list of 31 landbird species of regional concern and the 13 stewardship species to create a list of 19 priority species. Approximately 85% of these species are grassland obligates, 10% are edge species, and 5% are associated with woodland habitats (RWBJV 2013*a*).

To establish landbird population targets, the RWBJV populated the Hierarchical All Bird Strategy (HABS) database. The HABS database generates species-specific landscape carrying capacities by incorporating species-specific density estimates (derived from directed research projects) and acreage estimates of the habitat types (derived from GIS landcover data). Trend data from the Breeding Bird Survey (BBS) were integrated into the database to establish population objectives for the RWBJV Administrative Area. The database was set up to calculate the species-specific populations (landscape carrying capacity) predicted to be observed if populations were returned to 1966 levels, or when the BBS was first initiated. These population levels correspond to the population objectives outlined in the NALCP.

Population goals are outlined in the RWBJV Landbird Plan (RWBJV 2013*a*). The goals were established at their respective 1966 population levels for species that have experienced moderate declines. For priority landbird species demonstrating drastic declines over the last 60 years, a goal was set to double the current landscape carrying capacity for each species by 2030. For species that have not experienced declines in the RWBJV Administrative Area, goals were set to maintain current population levels. The HABS database estimated that at population goals, the RWBJV Administrative Area will support about 16.6 million landbirds, 94% of which rely on grassland habitat (RWBJV 2013*a*).

A majority of the landbird species identified by the RWBJV rely on grassland habitats. Six GFAs within the RWBJV Administrative Area have significant grassland acres in the appropriate landscape juxtaposition needed to support sustainable landbird populations. Scenarios were developed for these six areas to help develop carrying capacity objectives.

Two strategies were designed to achieve landscape carrying capacity goals for these priority species. The first strategy reduces grassland habitat fragmentation by removing 220,000 acres of invasive eastern red cedar throughout the RWBJV Administrative Area. The intensity of eastern red cedar removal varies by GFA, depending on distribution and abundance. For example, regions like the Central Loess Hills have a conservation goal of removing 75% of the eastern red cedar, whereas areas with less established populations of red cedar (i.e., the Northeast

Prairies/Elkhorn River GFA) have a goal of 50% removal. The second conservation strategy focuses on increasing grassland habitat throughout four GFAs in the RWBJV Administrative Area. For planning purposes, the RWBJV assumed there would continue to be 450,000 acres in the CRP in the RWBJV Administrative Area. Therefore an additional 42,000 acres of CRP could still be enrolled before meeting this acreage level (RWBJV 2013*a*). Although only two strategies are currently outlined, additional strategies will be developed to improve habitat conditions on existing grasslands in the RWBJV Administrative Area.

Shorebirds

Recent estimates suggest the RWBJV Administrative Area supports 411,000 breeding shorebirds and 1.7 million shorebirds during the non-breeding phase of the annual life cycle (RWBJV 2013*b*). The "non-breeding phase," described in the RWBJV Shorebird Plan, refers to migration, as no shorebirds winter in this region. At population goal levels described in the USSCP (Brown et al. 2001), it is estimated that habitats within the RWBJV Administrative Area will need to support 3.4 million shorebirds.

To guide conservation planning, the RWBJV developed a bioenergetics model that describes the foraging resources necessary to support the number of shorebirds expected to use the RWBJV Administrative Area, by foraging guild, when national population goals are achieved. The four foraging guilds outlined in the RWBJV Shorebird Plan (RWBJV 2013*b*) are: Agri-probers and Upland Associates, Small-bodied Probers/Gleaners, Large-bodied Probers, and Swimmers. The bioenergetics model suggests that wetland habitats within the RWBJV Administrative Area will need be able to provide 2.1 billion kilocalories (kcals) of foraging resources for shorebirds (RWBJV 2013*b*). It is estimated that approximately 202,815 total wetland acres will be required to meet these foraging requirements.

Habitat inventories suggest that the RWBJV Administrative Area contains an adequate number of acres of wetland and upland habitat to support shorebirds using this large geographic landscape; however sufficient habitat may not be available in the geographic regions that experience high shorebird use, particularly the RWB. At USSCP goal levels, it is estimated that the RWB will need to provide 207 million kcals or 20,260 acres of suitable foraging habitat. Recent habitat inventories suggest the region contains adequate "total" wetland acres; however, during the non-breeding phase of the shorebirds' annual life cycle, the number of acres of ponded-water, or available, habitat is not sufficient.

The bioenergetics model outputs and habitat inventories indicate a habitat deficiency for species in the Small-bodied Probers/Gleaners and Large-bodied Probers foraging guilds. In the RWB, conservation delivery strategies for shorebirds mirror the strategies described in the RWBJV Waterfowl Plan (RWBJV 2013*d*). These strategies focus on wetland conservation to increase wetland acres, watershed restoration to improve hydrologic function (the number of acres that pond water), and management to promote desired habitat conditions during shorebird migration

For breeding shorebirds, conservation delivery will be undertaken along the major riverine systems and in the Sandhills. Habitat conservation along the major riverine systems will aim to provide nesting habitat for Piping Plovers. In the Sandhills, conservation actions still need to be developed. Ultimately these strategies will provide economically viable conservation programs that increase habitat for breeding and non-breeding shorebirds, while complementing cattle operations that exist in the Sandhills (RWBJV 2013*b*).

Waterbirds

Waterbirds are arguably the least understood suite of birds that rely on the RWBJV Administrative Area in significant numbers. Sandhill Cranes and Whooping Cranes are the primary waterbirds that use the RWBJV Administrative Area during the non-breeding phase of their annual life cycle. Nearly the entire mid-continent population of Sandhill Cranes (560,000 individuals) stage in the Central and North Platte River valleys. Whooping Cranes often use the Central Platte River and Loup rivers, as well as playa wetlands found in the Central Loess Hills and RWB GFAs.

It is hypothesized that the Sandhills provide significant breeding habitat for a variety of waterbirds. Nine species of colonial waterbirds and three solitary breeders are referenced as common or locally common (RWBJV 2013*c*). Unfortunately, no surveys or monitoring data are available to quantify the species or the number of individuals that use this GFA. The Interior Least Tern is the primary breeding species outside of the Sandhills. This species nests on unvegetated sandbars associated with the region's major river systems. When riverine habitat is unavailable, Interior Least Terns also nest on large, bare sand piles created by gravel mining operations. However, human disturbance and predation can cause low nest and chick survival at sandpit sites. The Interior Least Tern Recovery Plan (USFWS 1990) identified a population target of 1,550 individuals within the RWBJV Administrative Area (RWBJV 2013*c*).

The RWBJV Waterbird Plan (RWBJV 2013*c*) addresses the energetic needs of waterbirds that use the RWBJV Administrative Area, and the requisite conservation strategies. The plan describes the integration of the Sandhill Crane population estimates into a bioenergetics model. This model incorporated subspecies-specific use estimates, residency time, basal metabolic rates, and forage selection to estimate the foraging resources needed by Sandhill Cranes during spring migration.

The bioenergetics model estimated that the 560,000 Sandhill Cranes staging along the Platte and North Platte rivers during spring migration will require 10.3 billion kcals in total energy. Based on forage selection, 517 million kcals of the total energy requirements would need to come from wet-meadow habitats (RWBJV 2013*c*). Native habitats, like wet meadows and associated upland grasslands, provide an important source of invertebrates and native seeds, which contain essential amino acids and inorganic elements that waste grains lack. To provide these foraging resources, it is estimated that approximately 12,425 acres of wet-meadow habitat and just over 80,700 acres of corn fields, with at least 35.6 kg/acre (88.8 kg/ha) of waste grain, are needed (RWBJV 2013*c*).

For breeding waterbirds using the RWBJV Administrative Area, the partnership's primary focus is on the Sandhills. It is believed that the Sandhills currently provide adequate habitat to support breeding waterbirds. The goal of the RWBJV is to maintain the current distribution of wetlands and grasslands found in the Sandhills (RWBJV 2013*c*).

Waterfowl

Results from a combination of directed research projects and survey data suggest 8.6 million waterfowl use the RWB and associated Central Platte River during the non-breeding phase of their annual life cycle, specifically spring migration. Survey data from Vrtiska and Powell (2011) suggested that 235,000 breeding waterfowl are found in the Sandhills.

The RWBJV developed a bioenergetics model based on use estimates for non-breeding waterfowl. This model incorporates species-specific use estimates, residency time, basal metabolic rates, and forage selection to estimate the foraging resources needed by waterfowl during this period. The bioenergetics model estimated that the 8.6 million waterfowl that use the RWB during spring migration would require 16.0 billion kcals in total energy. Based on forage selection, 4.4 billion kcals of the total energy requirements would need to come from wetland-derived seed resources (RWBJV 2013*d*). Native seeds provide essential amino acids and inorganic elements that waste grains lack. To provide these foraging resources, an estimated 62,500 acres of functioning wetland habitat would need to be available in the RWB (RWBJV 2013*d*).

For breeding waterfowl using the RWBJV Administrative Area, the partnership's primary focus is on habitat conditions in Nebraska's Sandhills. It is believed that the Sandhills are currently providing sufficient habitat to support breeding waterfowl. Therefore, the goal of the RWBJV is to maintain the current distribution of wetlands and grasslands found in the Sandhills (RWBJV 2013*d*).

Surrogate Species

As described previously, the RWBJV has used a variety of planning tools to develop population objectives and benchmarks for the habitat necessary to support the diversity of avian species that use the RWBJV Administrative Area. At times research and monitoring cannot be conducted to evaluate the success of conservation actions or the landscape's capacity to support all species. To help facilitate effective conservation, a subset of species is often used to evaluate conservation success and monitor landscape health. Bird species that are endangered, threatened, or considered a candidate for listing are commonly considered as surrogate species, because their return to greater numbers indicates a recovering ecosystem.

At times, however, these species do not regularly occur, or are not abundant enough to be effectively monitored. In these situations, more common species are selected for evaluation. For example, Northern Pintail numbers in the RWB during spring migration closely reflect the status of shallow wetland habitat conditions. As wetland conditions improve, Northern Pintail numbers increase. By setting a population goal for Northern Pintails, strategies can be evaluated and refined, based on the response of this species. This provides a mechanism to effectively evaluate actions and ultimately improve wetland conditions for a majority of the waterfowl that rely on this region.

The RWBJV used a variety of conservation planning strategies to develop criteria for identifying surrogate species. To facilitate the process, the RWBJV identified key habitats in each of the GFAs. Surrogate species were identified for each of these habitat types (Table 2) with the expectation that future management actions for selected species would also meet the needs of a majority of the species that use similar habitats. Criteria used by the RWBJV to identify surrogate species include:

- The species has established population targets
- The species has the habitat needs of other species
- The species can be monitored to evaluate response to habitat delivery or conditions
- The species can be modeled to predict distribution to help guide conservation delivery
- The species represents a specific habitat that is essential during a critical portion of the annual life cycle (breeding or migration)
- The habitat is limited for a priority species identified in the RWBJV Administrative Area and the habitat can be measured to evaluate success

Table 2. Habitats, Geographic Focus Areas and Priority Species Identified by the RWBJV.

Habitat	Geographic Focus Area	Surrogate Species
Contiguous Grasslands	Central Loess Hills, Northeast Prairies/Elkhorn River, Republican River/Blue River Drainages and Loess Canyons, Sandhills, Verdigris-Bazile Creek Drainages	Greater Prairie-Chicken, Sharp-tailed Grouse, Long-billed Curlew
Playa Wetlands	Rainwater Basin, Central Loess Hills (Central Table Playas)	Mallard, Northern Pintail, Semipalmated Sandpiper, Baird's Sandpiper, Lesser Yellowlegs, Willet, Whooping Crane
Prairie Rivers and Riverine Wetlands	Central and North Platte River, Central Loess Hills (Loup Rivers), Missouri River, Northeast Prairies/Elkhorn River	Piping Plover, Interior Least Tern, Sandhill Crane, Whooping Crane
Platte River Wet Meadows	Central and North Platte River	Sandhill Crane, Whooping Crane
Sandhills Wet Meadows	Sandhills	Long-billed Curlew
Sandhill Lakes	Sandhills	Wilson's Phalarope, Trumpeter Swan

Conservation Design

As described in the biological planning section, the RWBJV used a variety of planning tools to describe species-habitat relationships and estimate the amount of habitat needed to support avian species at target population levels. The tools included bioenergetics models to evaluate habitat needs of shorebirds (RWBJV 2013*b*), waterbirds (RWBJV 2013*c*), and waterfowl (RWBJV 2013*d*). The HABS database was used to describe population objectives and habitat objectives for landbirds (RWBJV 2013*a*).

The conservation design phase focuses on identifying regions within the landscape where conservation delivery is likely to provide the greatest biological return. This is important, since relative conservation efficiency (e.g., biological benefits per acre) varies across landscapes. Thus, the actual amount of habitat required to meet our population objectives depends on where conservation programs are delivered (NEAT 2006).

The RWBJV used a scaled approach to implement conservation design. At the coarsest geographic scale, habitat objectives were established for each of the GFAs. By developing habitat objectives for each GFA, the RWBJV was able to customize conservation targets and strategies to address the species that could be most impacted within these regions. Eco-regional planning also allows the conservation targets and strategies to be tailored to address limiting factors and habitats specific to the geographic area of interest. Within each GFA, the RWBJV used GIS technology to create spatially explicit species-habitat models, identify priority areas, and create decision support tools (DSTs) that help focus conservation delivery.

In addition to informing conservation delivery, species-habitat models can be analyzed to conduct scenario planning exercises. These exercises allow the partnership to evaluate the different prioritization schemas and delivery strategies. The process not only provides guidance for delivery staff, but also gives the RWBJV the ability to convey the magnitude of the conservation efforts needed from partners and stakeholders to support bird populations at goal levels.

The habitat objectives presented in this Implementation Plan are not absolute, but represent a scenario allowing the RWBJV to help meet habitat objectives for the avian species that rely on the RWBJV Administrative Area. All habitat objectives are based on the assumption that, on average, species respond as predicted to the habitat modifications prescribed. Changes in policies, programs, public support, and funding can and will determine which conservation opportunities will arise. As one target is exceeded, other target numbers will be adjusted. Timely adjustments to habitat objectives will be made in response to new scientific information, recent management accomplishments, and other influences on habitat resulting from policy changes and socioeconomic factors.

Targets and Strategies

The relatively small geography of the RWBJV Administrative Area allowed the RWBJV to establish habitat objectives for each of the GFAs. Within each of the seven GFAs there are similar land uses, threats to the habitats, priority species, and conservation opportunities.

Central Loess Hills Conservation Targets and Strategies

There are three primary focuses in the Central Loess Hills. The first focus is to provide high-quality playa wetland habitat in the Central Table Playa Wetland Complex. Functional playa wetlands in this landscape provide important stopover habitat for Whooping Cranes (RWBJV 2013*c*), foraging habitat for migrating waterfowl (RWBJV 2013*d*), and stopover habitat for shorebirds (RWBJV 2013*b*). The second focus is on the Loup rivers that flow through this area. The Middle and North Loup rivers provide nesting habitat for Interior Least Terns and Piping Plovers. The grasslands found in this region provide breeding habitat for an estimated 875,000 landbirds (RWBJV 2013*a*).

Four conservation targets are identified. They will result in approximately 4,000 acres of functional playa wetland habitat, provide information to better understand distribution and abundance of nesting habitat for Piping Plovers and Interior Least Terns using the Loup rivers, remove nearly 124,000 acres of invasive eastern red cedar, and strategically restore 10,500 acres of grasslands to benefit grassland nesting birds.

The habitat objectives used in each target and its associated strategies are not absolute, but represent one scenario that would allow the RWBJV to develop habitat conditions needed to support priority avian species. Changes in policies, programs, public support, and funding can and will help determine what conservation opportunities will arise. As one target is exceeded, other target numbers will be adjusted. Explanations of how specific numbers and percentages were derived are described in the RWBJV Landbird Plan (RWBJV 2013*a*), RWBJV Shorebird Plan (RWBJV 2013*b*), RWBJV Waterbird Plan (RWBJV 2013*c*), and RWBJV Waterfowl Plan (RWBJV 2013*d*).

Target 1. By 2030, enroll 4,000 acres of playa wetlands in existing or newly developed conservation programs that fully restore wetland and watershed function. At goal, these wetlands should, under average climate conditions, provide 2,000 acres of reliable wetland habitat during spring and fall migration to support the shorebirds, waterfowl, and Whooping Cranes that use this region.

Strategy A: Strategically market wetland conservation programs, such as the Natural Rresources Conservation Service's Wetlands Reserve Pprogram, and Farm Service Agency's (FSA) Conservation Reserve Program, which provide financial and technical assistance to restore wetland functions.

- Annually enroll 200 acres of playa wetlands in the Wetlands Reserve Program or similar programs in the Central Table Playas.
- Develop a CRP Conservation Practice, like CP 23A, that provides a ten-year contract to restore playa wetlands and adjacent upland buffer enrolled in the program. The RWBJV will pursue opportunities to compensate enrolled acres at county irrigated rental rates, since a majority of the Central Table Playa wetlands are embedded in center pivot-irrigated crop fields. The program should be structured to require full hydrologic restoration to the extent possible and also require mid-contract management.
- Enroll 75 acres annually (50 acres of wetland and 25 acres of adjacent upland buffer) in CRP.
- Integrate geospatial habitat prioritization tools to promote conservation programs to high-priority landowners and producers.

Strategy B: Develop a watershed restoration program to fill irrigation reuse pits that are negatively impacting Central Table Playa wetlands.

- Analyze existing geospatial datasets to determine the number of watershed modifications (irrigation reuse pits) and the potential impacts (storage volume) of these features on wetland function.

- Analyze existing irrigation practices to identify those irrigation reuse pits that have been abandoned and are no longer actively used due to a transition to pivot irrigation systems.
- Develop a prioritization tool to identify those abandoned irrigation pits that have the greatest impact on existing playa wetlands in the Central Table Playas.
- Develop and implement conservation initiatives to remove 75% of these modifications by 2030.

Strategy C: Develop infrastructure to integrate Central Table Playa wetlands into producers' operations for either forage production or cattle production. Such activities (grazing, fire, and haying) emulate the ecosystem processes under which these wetlands evolved and will promote desired vegetation communities and habitat conditions for priority species.

- Develop and implement programs that will provide cost-share for agriculture producers to install cross fence, perimeter fence, and livestock water systems to integrate these wetlands into agriculture operations.

Target 2. Work with partners to maintain stream flows necessary for maintenance of in-channel habitat conditions through scouring and other ecological processes, to provide nesting habitat for Piping Plovers and Interior Least Terns, as well as reliable habitat for shorebirds during the non-breeding phase of their annual life cycle.

Strategy A: Provide technical resources necessary to complete geospatial analysis to quantify and map the habitat conditions found on the Loup River systems.

Strategy B: Provide technical resources necessary to describe available in-channel nesting habitat for Least Terns and Piping Plovers to better target conservation activities.

Target 3. By 2030, work with partners to remove 75% of eastern red cedar from grasslands, reducing woody encroachment on 124,000 acres.

Strategy A: Work with willing landowners to remove eastern red cedar from grasslands on their property.

Strategy B: Coordinate with local partners to conduct controlled burns to control and manage encroachment of eastern red cedar and other invasive species.

Strategy C: Create a decision support tool to prioritize management of cedar-infested areas and conduct targeted mailings to landowners, to generate interest in cedar removal projects.

Target 4. By 2030, work with partners to enroll 10,500 additional acres in CRP in this GFA.

Strategy A: Work with willing landowners to re-establish grassland habitat in crop fields through the CRP program.

Strategy B: Create habitat suitability indices or species distribution models to identify areas of the landscape where CRP contracts are most likely to benefit the targeted species. Work with partners on directed mailings to generate landowner interest in CRP sign-up.

Strategy C: Work with willing landowners to enhance habitat on existing grassland acres through development of rotational grazing systems.

Central and North Platte River Conservation Targets and Strategies

There are two primary focuses within the Central Platte and North Platte River GFA. The first is to provide high-quality wet meadows and associated grasslands. These habitats are important foraging areas for Sandhill Cranes (RWBJV 2013*c*) and provide breeding habitat for an estimated 140,000 landbirds (RWBJV 2013*a*). The second focus is on the active channel. Woody encroachment and altered hydrology have reduced stream flows and available roosting habitat for Sandhill Cranes and Whooping Cranes, as well as nesting habitat for Least Terns and Piping Plovers. The active channel and associated wet meadows are also important roosting and foraging areas for the millions of waterfowl that use this region, particularly during spring migration. This is especially true during periods of drought and when early spring storms freeze the shallow RWB wetlands, thus limiting habitat in this adjacent GFA.

The six conservation targets outlined below will provide information needed to understand available foraging, nesting, and roosting habitat for priority species, while the conservation delivery actions will result in desired habitat conditions. Removal of woody vegetation and restoration of grasslands will provide additional nesting habitat for grassland obligates and foraging habitat for waterfowl, Sandhill Cranes, and Whooping Cranes. Management and monitoring will also be conducted within the active channel to better understand roosting habitat for Sandhill Cranes and Whooping Cranes, as well as nesting habitat for Piping Plovers and Interior Least Terns.

The habitat objectives used in each target and its associated strategies are not absolute, but represent one scenario that would allow the RWBJV to meet its goals. Changes in policies, programs, public support, and funding can and will help determine what conservation opportunities will arise. As one target is exceeded, other target numbers will be adjusted. The processes through which specific numbers and percentages were derived are described in the RWBJV Landbird Plan (RWBJV 2013*a*), RWBJV Shorebird Plan (RWBJV 2013*b*), RWBJV Waterbird Plan (RWBJV 2013*c*), and RWBJV Waterfowl Plan (RWBJV 2013*d*).

Target 1. By 2030, work with partners to remove 10% of invasive woody vegetation from grasslands, reducing woody encroachment on 6,000 acres.

Strategy A: Work with willing landowners to remove undesirable woody vegetation from grasslands on their property.

Strategy B: Coordinate with local agencies to conduct controlled burns to manage and control encroachment of invasive species in problem areas.

Strategy C: Create a decision support tool to prioritize areas and conduct targeted mailings to landowners, to generate interest in projects to remove undesired vegetation. .

Target 2. By 2030, work with partners to increase wet meadow and associated upland grassland habitat by 5,000 acres. These actions will often be achieved through conservation easements and fee title acquisition by the numerous conservation partners and entities working in this GFA.

Strategy A: Work with willing landowners to re-establish grassland habitat in crop fields through conservation programs.

Strategy B: Create habitat suitability indices or species distribution models for a planning species or group of species to identify areas of the landscape where conservation programs are most likely to benefit grassland nesting species. Work with partners on directed mailings to generate landowner interest in grassland restoration programs.

Strategy C: Work with willing landowners and conservation organizations to enhance, manage, and maximize benefits for grassland nesting species on existing grasslands.

Target 3. Develop landscape inventories that RWBJV partners can use to guide river management to increase the frequency of in-stream target flows that maintain in-channel habitat conditions through scouring and other ecological processes, maintain functioning wet meadows, and provide nesting and roosting habitat for priority species.

Strategy A: Provide technical resources for geospatial analysis to quantify and map roosting habitat under different flow regimes.

Strategy B: Provide technical resources necessary to quantify the impacts of different flow regimes on available in-channel nesting habitat.

Target 4. When necessary, implement active management (disking, herbicide treatments, tree removal, roto-tilling) to promote desired habitat conditions within the active channel, plus a wetland matrix that provides roosting and nesting habitat for priority species.

Target 5. Work with partners to assess the capacity of the Central and North Platte River GFA to provide suitable nesting habitat for Least Terns, Piping Plovers, and other priority shorebirds.

Strategy A: Provide technical resources for geospatial analysis to quantify and map current nesting habitat. .

Strategy B: Provide technical resources necessary to develop decision support tools to assist conservation partners and land managers in prioritizing restoration and management projects to provide the greatest biological return for priority nesting species.

Target 6. Work with partners to provide foraging habitat for Sandhill Cranes and Whooping Cranes.

Strategy A: Ensure that there is sufficient wet-meadow habitat in the right landscape juxtaposition and spatial configuration to provide 11,125 acres of high-quality wet-meadow foraging habitat for Sandhill Cranes and Whooping Cranes in the Central Platte River and 1,300 acres in the North Platte River Valley.

Strategy B: Continue to monitor waste grain availability to ensure that 72,200 acres of harvested corn fields along the Central Platte River and 8,500 acres in the North Platte River valley contain at least 35.6 kg/acre of waste grain. .

Strategy C: Provide technical resources necessary to develop decision support tools to assist conservation partners and land managers in prioritizing restoration and management projects to provide the greatest biological return from habitat projects for Sandhill Cranes and Whooping Cranes.

Missouri River Conservation Targets and Strategies

The unchannelized portion of the Missouri River provides important breeding habitat for both Piping Plovers and Interior Least Terns. These two species rely on bare sandbars for nesting habitat. The primary focus in this GFA is on the active channel. Woody encroachment and dams on the main stem have significantly altered hydrology and stream flows that were once sufficient to maintain suitable nesting habitat conditions.

The primary focus of the RWBJV partnership in this GFA will be to inventory current habitat conditions and monitor habitat changes over time. Specific inventory and monitoring activities are outlined in the RWBJV Waterbird Plan (RWBJV 2013*c*) and RWBJV Waterfowl Plan (RWBJV 2013*d*).

Target 1. Work with partners to increase the frequency of stream flows that maintain in-channel habitat conditions through scouring and other ecological processes and provide nesting habitat for Least Terns and Piping Plovers, as well as reliable foraging and nesting habitat for other priority shorebirds during their annual life cycle.

Strategy A: Provide technical resources for geospatial analysis to quantify and map the habitat conditions under different flow regimes.

Strategy B: Provide technical resources necessary to quantify the impacts of different flow regimes on available in-channel habitat for nesting Least Terns, Piping Plovers, and other priority shorebirds (e.g., Spotted Sandpipers).

Northeast Prairies/Elkhorn River Conservation Targets and Strategies

The primary focus in this GFA is on grassland nesting species. This region supports an estimated 1.3 million priority grassland-nesting birds. At goal levels, 4,700 acres of grassland will be enhanced by removing eastern red cedars and strategically enrolling 4,200 acres of environmentally sensitive cropland in CRP.

Target 1. By 2030, work with partners to remove 50% of eastern red cedar from grasslands, reducing woody encroachment on 460 acres.

Strategy A: Work with willing landowners to remove eastern red cedar and other invasive species from grasslands on their property.

Strategy B: Coordinate with local partners to conduct controlled burns to manage and control eastern red cedar encroachment in problem areas.

Strategy C: Create a decision support tool to prioritize management of cedar-infested areas and conduct targeted mailings to landowners, to generate interest in projects to remove eastern red cedar.

Target 2. By 2030, work with partners to increase CRP enrollment by an additional 4,200 acres.

Strategy A: Work with willing landowners to re-establish grassland habitat in crop fields through the CRP program.

Strategy B: Create habitat suitability indices or species distribution models for a planning species or group of species to identify areas of the landscape where CRP contracts are most likely to benefit the targeted species. Work with partners on directed mailings to generate landowner interest in CRP sign-up.

Strategy C: Work with willing landowners on existing CRP acres and other grassland acres to manage and maximize benefits for planning/targeted species.

Rainwater Basin Conservation Targets and Strategies

The primary focus within the RWB is on providing reliable stopover habitat for Whooping Cranes (RWBJV 2013*c*) as well as sufficient foraging habitat to support the estimated 8.6 million waterfowl (RWBJV 2013*d*), and 600,000 shorebirds (RWBJV 2013*b*) that rely on this region during spring migration. The five targets listed below will result in approximately 62,500 acres of functional wetland habitat – the amount that is estimated to be necessary to provide the foraging resources needed by waterfowl. If sufficient habitat is protected, restored, and managed for waterfowl, habitat assessments suggest there will also be sufficient habitat to support the shorebirds and waterbirds that rely on this region (RWBJV 2013*b,c,d).*

The habitat objectives used in each target and its associated strategies are not absolute, but represent one scenario that would allow the RWBJV to meet its goals. Changes in policies, programs, public support, and funding can and will help determine what conservation opportunities will arise. As one target is exceeded, other target numbers will be adjusted. The processes by which specific numbers and percentages were determined are described in the RWBJV Waterfowl Plan (RWBJV 2013*d*).

Target 1. By 2030, publicly owned wetlands will provide 55% of the total natural forage needed by waterfowl within the Rainwater Basin.

Strategy A: Increase public wetland acres from 18,814 to 26,800. Most of the newly acquired wetland acres will be "roundouts" to existing public wetlands. The roundouts also may increase the forage production on existing public wetlands.

Strategy B: Through management, maintain 80% of public wetland acres in early successional plant communities, to optimize moist-soil seed production.

Strategy C: Increase ponding frequency under average moisture conditions from 17.7% to a more natural 45%.

- Restore the natural hydrologic characteristics of each wetland to the greatest feasible degree.
- Increase the function of associated watersheds by reclaiming irrigation reuse pits and implementing other conservation practices.
- Provide additional supplemental water delivery by increasing the use of high-volume wells.
- Develop a long-term funding mechanism to operate high-volume wells.

Strategy D: Increase the number of upland buffer acres from 13,268 to 17,793 through fee-title land acquisition.

Target 2. By 2030, "long-term conservation wetlands" will provide 25% of the total natural forage needed by waterfowl in the Rainwater Basin.

Strategy A: Increase the number of wetland acres from 3,448 to 12,687 through conservation easements or other long-term conservation programs.

Strategy B: Through management, maintain 75% of these wetland acres in early-succession plant communities.

Strategy C: Increase ponding frequency under average weather conditions to 45%.

- Restore the natural hydrologic characteristics of each wetland to the greatest feasible degree.
- Increase the function of associated watersheds by reclaiming irrigation reuse pits and implementing other conservation practices.
- Provide additional supplemental water delivery by increasing the use of high-volume wells.
- Develop a long-term funding mechanism to operate high-volume wells.

Strategy D: Increase the number of upland buffer acres from 2,899 to 7,245 through conservation easements or other long-term conservation programs.

Target 3. By 2030, wetlands placed in conservation agreements of less than 30 years will provide 10% of the natural forage needed by waterfowl in the Rainwater Basin.

Strategy A: Increase the number of wetland acres enrolled in short-term conservation programs from 2,481 to 7,346 acres.

Strategy B: Restore and maintain wetland plant communities at 60% early-succession, 30% cropland (farmed), and 10% late-succession in wetlands enrolled in short-term conservation programs.

Strategy C: Restore wetland and watershed function so that ponding frequency reaches 33% under average weather conditions.

Target 4. By 2030, wetlands in private ownership that are not in any conservation program will provide 9% of the total natural forage needed by waterfowl in the Rainwater Basin.

Strategy A: Through incentives and education, maintain wetland vegetation communities that are 30% early-succession, 50% cropland (farmed), and 20% late-succession.

Strategy B: Restore watershed function to these wetlands so that they reach a 25% ponding frequency under average weather conditions.

Strategy C: Encourage the development of short-term conservation programs that encourage the establishment of grassland buffers for these wetlands.

Republican River/Blue River Drainages and Loess Canyons Conservation Targets and Strategies

The primary focus in this region is on grassland nesting birds. This region supports an estimated 1.7 million priority landbirds (RWBJV 2013*a*). At goal levels, 70,000 acres of grassland will be enhanced by removing eastern red cedars and strategically enrolling 16,800 acres of environmentally sensitive cropland in CRP.

Target 1. By 2030, work with partners to remove 75% of eastern red cedar from grasslands, reducing woody encroachment on 53,200 acres.

Strategy A: Work with willing landowners to remove eastern red cedar from grasslands on their property.

Strategy B: Coordinate with local partners to conduct controlled burns to manage and control eastern red cedar encroachment in problem areas.

Strategy C: Create a decision support tool to prioritize management of cedar-infested areas and conduct targeted mailings to landowners, to generate interest in projects to remove eastern red cedar.

Target 2. By 2030, work with partners to enroll an additional 16,800 acres in CRP.

Strategy A: Work with willing landowners to re-establish grassland habitat in crop fields through the CRP program.

Strategy B: Create habitat suitability indices or species distribution models for a planning species or group of species to identify areas of the landscape where CRP contracts are most likely to benefit the targeted species. Work with partners on directed mailings to generate landowner interest in CRP sign-up.

Strategy C: Work with willing landowners on CRP acres and other grassland to enhance, manage, and maximize benefits for planning/targeted species.

Sandhills Conservation Targets and Strategies

There are two primary focuses in the Sandhills. The first is to provide high-quality wet meadows and associated grasslands. These habitats provide important nesting habitat for a large proportion of the landbirds (RWBJV 2013*a*) and nearly all of the shorebirds, waterbirds, and waterfowl that breed in the RWBJV Administrative Area (RWBJV 2013*b*, *c*, *d*). The second focus is on the myriad of palustrine and lacustrine wetlands that are scattered throughout the Sandhills. These groundwater-influenced wetlands attract an estimated 235,000 breeding waterfowl and provide breeding habitat for the entire High Plains flock of Trumpeter Swans.

The primary conservation actions will be removal of woody vegetation and enhancement of grassland structure and stature through rotational grazing and prescribed fire. These activities will contribute to suitable nesting conditions. The Sandhills are nearly all privately owned. The RWBJV will have to develop new partners and find ways to make the implementation of these conservation actions economically viable and complementary to cattle production, the primary land use in this area.

Currently, species-habitat relationships are not well understood in the Sandhills. Monitoring will be required to improve the understanding of species distribution and priority landscapes in this GFA. This will require developing partnerships with private landowners to gain access for surveys on private lands.

The habitat objectives used in each target and its associated strategies are not absolute, but represent one scenario that would allow the RWBJV to meet its goals. Changes in policies, programs, public support, and funding can and will help determine what conservation opportunities will arise. As one target is exceeded, other target numbers will be adjusted. The processes through which specific numbers and percentages were determined are described in the RWBJV Landbird Plan (RWBJV 2013*a*), RWBJV Shorebird Plan (RWBJV 2013*b*), RWBJV Waterbird Plan (RWBJV 2013*c*), and RWBJV Waterfowl Plan (RWBJV 2013*d*).

Target 1. By 2030, work with partners to remove 50% of eastern red cedar from grasslands, reducing woody encroachment on 8,410 acres.

Strategy A: Work with willing landowners to remove eastern red cedar and other invasive species from grasslands on their property.

Strategy B: Coordinate with local partners to conduct controlled burns to manage and control eastern red cedar encroachment in problem areas.

Strategy C: Create a decision support tool to prioritize management of cedar-infested areas and conduct targeted mailings to landowners, to generate interest in projects to remove eastern red cedar.

Target 2. Work with partners to identify conservation opportunities that can be developed to promote nesting habitat on private lands managed for beef production.

Strategy A: Provide technical resources necessary to complete landscape-level surveys that can be used to define species-habitat relationships and identify priority landscapes for shorebird, waterbird, and waterfowl conservation.

Strategy B: Develop conservation programs and strategies that will promote shorebird, waterbird, and waterfowl nesting habitat and complement cattle operations in the Sandhills.

Verdigris – Bazile Creek Drainages Conservation Targets and Strategies

The primary focus in this GFA is on grassland nesting birds. This region supports an estimated 820,000 priority grassland nesting birds. At goal levels 42,850 acres of grassland will be enhanced by removing eastern red cedars and strategically enrolling 10,500 acres of environmentally sensitive cropland in CRP.

The habitat objectives used in each target and its associated strategies are not absolute, but represent one scenario that would allow the RWBJV to meet its goals. Changes in policies, programs, public support, and funding can and will help determine what conservation opportunities will arise. As one target is exceeded, other target numbers will be adjusted. The processes through which specific numbers and percentages were determined are described in the RWBJV Landbird Plan (RWBJV 2013*a*).

Target 1. By 2030, work with partners to remove 75% of eastern red cedar from grasslands, reducing woody encroachment on 32,350 acres.

Strategy A: Work with willing landowners to remove eastern red cedar from grasslands on their property.

Strategy B: Coordinate with local partners to conduct controlled burns to manage and control eastern red cedar and other undesirable invasive species encroachment in problem areas.

Strategy C: Create a decision support tool to prioritize management of cedar-infested areas and conduct targeted mailings to landowners, to generate interest in projects to remove eastern red cedar.

Target 2. By 2030, work with partners to increase CRP acreage through enrollment of an additional 10,500 acres.

Strategy A: Work with willing landowners to re-establish grassland habitat in crop fields through the CRP program.

Strategy B: Create habitat suitability indices or species distribution models for a planning species or group of species to identify areas of the landscape where CRP contracts are most likely to benefit the targeted species. Work with partners on directed mailings to generate landowner interest in CRP sign-up.

Strategy C: Utilize habitat suitability indices and/or species distribution models and work with willing landowners on CRP acres and other grasslands to enhance, manage, and maximize benefits for planning/targeted species.

Decision Support Tools

In 2000, the RWBJV coordinated the development of a collaborative GIS office where geospatial analysts, biological planners, and remote sensing professionals could work together to develop landcover inventories, create species-habitat models, and generate spatially explicit decision support tools. To date, the staff in this office has coordinated with numerous stakeholders and produced habitat inventories, species habitat models, and decision support tools (DST) for every GFA in the RWBJV Administrative Area.

One of the first models was the Wetland Prioritization Model, which was developed to prioritize wetland conservation delivery in the RWB. Local and landscape-scale variables were analyzed in a GIS environment to identify those wetlands that were most important to migrating waterfowl in the RWB. Results from directed research projects conducted in the RWB indicated that landscapes with high wetland densities (>30) within a 5-kilometer radius, and containing a semi-permanent "core" wetland, had higher bird use than similar landscapes with a low wetland density. Local variables included in the model were wetland size, wetland density, proximity to human disturbance, and contribution to a wetland complex.

The output of this additive model was a relative score for each historic wetland footprint. By weighting different criteria within the model, three related DSTs were developed: 1) wetland roundouts that should be priorities for future acquisition efforts, 2) wetlands to prioritize for enrollment in WRP, and 3) wetlands with the highest value to Whooping Cranes.

For areas outside the RWB, the GIS Office has developed species-habitat models for a variety of grassland birds including Greater Prairie-Chicken, Field Sparrow, and Sharp-tailed Grouse. These models have been used to develop DSTs to guide grassland enhancement (tree removal, prescribed fire, rotational grazing) and grassland restoration measures through the CRP program in several of the RWBJV Administrative Area GFAs.

The RWBJV GIS Office has also completed detailed mapping and modeling projects to evaluate nesting habitat for Interior Least Terns and Piping Plovers along the Central Platte River under different flow regimes. The information generated by these assessments is currently being analyzed to evaluate roosting habitat for Whooping Cranes under different flow regimes as well.

The RWBJV is committed to working with partners to identify other key uncertainties and data needs that can be addressed by the GIS office. One of the next projects is the development of decision support systems for entire GFAs. These systems will allow the RWBJV to understand how programs can be prioritized and delivered in a way that maximizes habitat benefits for multiple priority species.

Conservation Delivery

There are numerous methods of delivering conservation on the land. Each depends on the willingness and cooperation of the various partners. Because each project is unique, partnership agreements among agencies and organizations are highly flexible, with each partner contributing different resources at varying levels, according to the particular project or program.

Funding for wetland restoration and protection comes from a variety of sources. The Nebraska Environmental Trust and the North American Wetlands Conservation Act are prominent financial contributors. Ducks Unlimited (Nebraska) works closely with the RWBJV to find outside funding.

The Fish and Wildlife Service's Partners for Fish and Wildlife program, Nebraska Game and Parks Commission, Natural Resources Conservation Service, Farm Service Agency, Pheasants Forever, and Ducks Unlimited have on-the-ground conservation programs. With the exception of WRP and DU's revolving lands initiative, most programs are short-term cooperative agreements with private landowners to effect wetland conservation.

The RWBJV categorizes conservation programs into two groups: short-term and long-term. Short-term programs are typically carried out under a ten-year agreement. They are designed to complement existing environmental and socio-economic conditions. They often provide financial incentives to encourage specific conservation practices, such as wetland restoration, removal of concentration pits, rotational grazing, prescribed fire, and vegetation management. Some of these agreements augment Farm Bill programs. Individual agreements can be tailored to the specific wishes of the landowner.

Long-term programs (30 years or more) usually involve the purchase of a conservation easement. Easement acquisitions are undertaken by various RWBJV partners. While the acquiring partner takes the lead in such a project, the RWBJV may help the purchaser to identify potential properties, assist with funding, and plan future management needs. All acquisitions are strictly on a voluntary-seller basis.

In the process of pursuing long-term wetland protection, conflicts commonly arise between the requirements of a conservation program and the economic imperatives of agriculture. One such conflict arises in making the transition from flood-prone cropland to pastureland. Working with its partners, the RWBJV developed the Working Landscapes Initiative, which helps landowners make this transition. The initiative restores the wetland, reseeds native grasses, and provides the fencing and livestock watering source that are necessary for grazing. The easement placed on the property allows grazing but precludes future farming, development, or wetland drainage. In some areas, the program results in a reduction in total irrigation acres, thus helping the local Natural Resources Districts come into, or remain in, compliance with interstate water compacts.

Two other examples of bringing agriculture and wetland conservation together involve modifications of the Wetlands Reserve Program—modifications that both originated in the Rainwater Basin. The Reserved Grazing Rights option (Natural Resources Conservation Service 2012a) allows the seller of an easement to retain grazing rights. The landowner retains all income from livestock production. Grazing has proven to be an important management practice for migratory bird habitat. The second example is a new pilot program which allows landowners to retain the right to traverse irrigation pivots across wetlands enrolled in the WRP (NRCS 2012b). Previously, many wetlands located within irrigated cropland would not have qualified for a conservation easement.

Monitoring, Inventory, and Research

Critical to the SHC framework are the testing of key uncertainties and the measuring of responses to management actions. The most common monitoring is the casual observation that is done subjectively. Although there is some value to this method, the RWBJV will continue to

increase its efforts in conducting structured research, inventory, and monitoring activities to scientifically address key uncertainties and evaluate the assumptions identified in the planning process.

The RWBJV works closely with the U.S. Geological Survey, Landscape Conservation Cooperatives, and universities from various states to conduct directed research projects to investigate key uncertainties. Projects often focus on specific questions that can be addressed as part of a three- to five-year research project, often measuring cause-effect relationships as they pertain to wetland and grassland habitats or species response to habitat conditions. Habitat inventory projects have often been conducted by the RWBJV GIS office and focus on comparing historic and contemporary habitat conditions. Long-term monitoring projects have been collaborative efforts that often leverage RWBJV partner resources. Previous long-term monitoring projects have been designed to understand the temporal variation of available wetland habitat or to quantify the duration of impacts resulting from different wetland management practices.

Each of the RWBJV bird plans contains a chapter outlining key uncertainties and assumptions that should be tested to improve the biological foundation of the plan. As in the past, the RWBJV will prioritize funding that supports research, inventory, and monitoring to directly test assumptions on which the plans are based, or assumptions used in directing management decisions.

Landbirds

The RWBJV Landbird Plan focuses on providing sufficient habitat for priority landbirds during the breeding phase of their annual life cycle. The HABS database was the primary planning tool used to estimate current landscape carrying capacity and to establish habitat objectives. There are two key uncertainties associated with the RWBJV Landbird Plan (RWBJV 2013*a*). The first centers on the density estimates used to populate the HABS database, while the second involves how to integrate a spatially explicit component into the HABS database. By addressing these questions, uncertainty in the Landbird Plan will be significantly reduced.

Landbird Density Estimates by Habitat Association and Condition - The HABS database is a deterministic model that estimates current carrying capacity based habitat acres and density estimates reported in peer reviewed literature. For some species, the available information is insufficient to accurately describe landscape carrying capacity. The RWBJV has made it a priority to work with the PLJV and local partners to integrate uncertainty into the population estimates generated by the HABS database. Survey protocols will be developed which can more accurately produce the density by habitat for species with highly variable estimates.

Integration of Spatially Explicit Species Distribution Models – The deterministic nature of the HABS database has the potential to overestimate potential landscape carrying capacity. This is a result of applying the same density estimate to every acre of the same habitat type. Integration of Species Distribution models will allow the species-specific HABS landscape carrying capacity estimates to incorporate the potential for an acre of habitat to be occupied by an individual species. The RWBJV and PLJV partnerships will actively work to develop a spatially explicit HABS framework.

Shorebirds

Several assumptions built into the bioenergetics model for non-breeding shorebirds will need to be tested. The estimation of natural food production (2.1 billion kcals) relies on key assumptions and uncertainties. The assumptions need to be tested and the uncertainties need to be removed and/or reduced. The four most prominent uncertainties are estimates of shorebird use, invertebrate availability, forage efficiency, and local and landscape factors influencing habitat selection.

The RWBJV Shorebird Plan focuses on providing sufficient habitat to support the 3.4 million non-breeding shorebirds and 411,000 breeding shorebirds that are expected to rely on the RWBJV Administrative area when USSCP population objectives are achieved.

Shorebird-use estimates – At the foundation of the RWBJV bioenergetics model are shorebird-use estimates derived from directed research projects as well as monitoring efforts. To better understand the variation in use by non-breeding shorebirds, the RWBJV will need to build upon previous monitoring efforts. Additional survey efforts will need to be temporally and spatially balanced to inform the partnership about the variation and distribution of shorebirds using the RWBJV Administrative Area. Data thus collected will help refine the planning estimates and provide insight into how different weather patterns and associated habitat conditions influence shorebird use.

Development of Spatially Explicit Species Distribution Models – Data collection to refine our understanding of shorebird use should be conducted in a spatially balanced framework. Data collected in this manner can be analyzed to understand the juxtaposition of habitat features that influence habitat selection. The models and information provided by this analysis will allow RWBJV stakeholders to understand the influence of local and landscape habitat features (e.g., wetland size, wetland density, wetland type, influence of disturbance features) on habitat selection. Such information will help the RWBJV develop tools to guide conservation delivery to those landscapes that have the greatest potential to positively influence priority shorebirds.

Invertebrate Foraging Resources - Research will be needed to better estimate shorebird foraging efficiency and invertebrate abundance in wetlands under different ownership and management regimes. This will require evaluation of invertebrate abundance and density by habitat type. Foraging efficiency, by shorebird species and foraging guild, needs to be refined. These results will help to refine the bioenergetics model and landscape carrying capacity estimates.

Distribution and abundance of breeding shorebirds across the RWBJV Administrative Area, especially in the Sandhills, have been documented; however, our understanding of local landscape features that influence habitat selection by shorebirds needs to be refined. This will require the RWBJV to initiate statistically valid, spatially balanced surveys.

In the Sandhills, gaining access to grasslands and wetlands will be challenging, due to the limited number of roads and over 97% private ownership. Multiple-year sampling will be required, to account for temporal variability. Research and monitoring should determine the trends of breeding shorebirds in the Sandhills. If negative trends are detected, then research should be implemented to determine the proximal cause of the declines. Research may also be needed to guide management actions that increase shorebird recruitment in the Sandhills.

Because livestock grazing is the primary land use in the Sandhills, a greater understanding of different grazing systems and their effects on shorebird recruitment and beef production is needed. By understanding how various grazing systems impact the profit margin of beef production, conservation programs can be developed to encourage grazing systems that benefit shorebirds as well as the ranching community.

Local and Landscape Factors Influencing Breeding Shorebird Habitat Selection – To understand the local and landscape-level factors that influence habitat selection by breeding shorebirds, the RWBJV will need to initiate surveys. If designed similar to the four-square-mile surveys conducted in the Prairie Pothole Region (Cowardin et al. 1995) local (wetland type) and landscape level (wetland density at different spatial scales) factors could be described. Access to wetlands will be difficult, due to the limited number of roads and the fact that over 99% of wetlands are in private ownership. Multiple-year sampling will be needed to account for temporal variability.

Waterbirds

The Whooping Crane and Sandhill Crane are the two primary non-breeding waterbird species addressed in the RWBJV Waterbird Plan. The RWBJV assumed that if the conservation targets and strategies outlined in the RWBJV Waterfowl Plan are met, there will also be sufficient habitat for Whooping Cranes. Continued monitoring will be necessary to test this assumption.

To guide conservation delivery for Sandhill Cranes, the RWBJV used a bioenergetics modeling approach. The bioenergetics models suggest the Central Platte River will need to provide 9.2 billion kcals of foraging resources derived from waste grain, while wet meadows will need to provide an estimated 463 million kcals. Along the North Platte River, an estimated 1.1 billion kcals will need to be available from waste grain, while 54 million kcals will need to be available in wet-meadow habitats. There are several assumptions built into the bioenergetics model that need to be tested. In addition, local and landscape-level habitat assessments are needed to help understand roost and forage site selection by Sandhill Cranes.

Invertebrate Foraging Resources - Research will be needed to better estimate Sandhill Crane foraging efficiency and invertebrate abundance in wet meadows under different ownership and management regimes. This will require evaluation of invertebrate abundance and density by habitat type. Foraging efficiency by Sandhill Cranes needs to be refined. These results will help to refine the bioenergetics model and landscape carrying capacity estimates.

Development of Spatially Explicit Species Distribution Models – Data collection to refine Sandhill Crane use should be conducted in a spatially balanced framework. Data collected in this manner can be analyzed to understand the juxtaposition of habitat features that influence habitat selection. The models and information provided by this analysis will allow RWBJV stakeholders to understand the influence of local and landscape habitat features (e.g. channel width, proximity to wet meadow, influence of disturbance features) on habitat selection. Such information will help the RWBJV develop tools to guide conservation delivery to those landscapes that have the greatest potential to provide high-quality roosting and foraging habitat for Sandhill Cranes.

Whooping Crane Use of Playa Wetland Systems – The RWBJV has made an assumption that if the playa wetland habitat objectives outlined in the RWBJV Waterfowl Plan are achieved, there will also be sufficient habitat in the right spatial juxtaposition to support migrating

Whooping Cranes. This assumption needs to be tested as part of a long-term effort to monitor Whooping Crane use of playa wetlands.

The distribution and abundance of breeding waterbirds across the RWBJV Administrative Area, especially in the Sandhills, have been documented; however, our understanding of local landscape features that influence habitat selection by these species needs to be refined. This will require the RWBJV to initiate statistically valid, spatially balanced surveys. In the Sandhills, gaining access to grasslands and wetlands will be challenging, due to the limited number of roads and over 97% private ownership. Multiple-year sampling will be required, to account for temporal variability.

Research and monitoring should determine the trends of breeding waterbirds in the Sandhills. If negative trends are detected, then research should be implemented to determine the proximal cause of the declines. Research may also be needed to guide management actions that increase waterbird recruitment in the Sandhills.

Because livestock grazing is the primary land use in the Sandhills, a greater understanding of different grazing systems and their effects on waterbird recruitment and beef production is needed. By understanding how various grazing systems impact the profit margin of beef production, conservation programs can be developed to encourage grazing systems that benefit waterbirds as well as the ranching community.

Local and Landscape Factors Influencing Breeding Waterbird Habitat Selection - To understand the local and landscape-level factors that influence habitat selection by breeding waterbirds, the RWBJV will need to initiate surveys. If designed similar to the four-square-mile surveys conducted in the Prairie Pothole Region (Cowardin et al. 1995) local (wetland type) and landscape level (wetland density at different spatial scales) factors could be described. Multiple-year sampling will be needed to account for temporal variability.

Waterfowl

Several assumptions built into the bioenergetics model for non-breeding waterfowl will need to be tested. The estimation of natural food production (4.4 billion kcals) relies on key assumptions and uncertainties. The assumptions need to be tested and the uncertainties need to be removed and/or reduced. The three most prominent issues are bird population estimates, wetland seed production, and the impact of vegetation management.

Migratory Bird Populations - The amount of natural forage required within the Rainwater Basin depends on the number of waterfowl and their length of stay during spring migration (bird-use days). The vast numbers of waterfowl, their mobility, and their distribution across the area make it nearly impossible to obtain an accurate estimate. The RWBJV has made it a priority to develop a survey protocol to acquire accurate and comprehensive data.

Seed Production in Different Vegetation Communities - Current estimates of wetland forage (energetic) production are based on preliminary research in the RWB and on research conducted in other regions. These numbers need to be tested and refined.

Impact of Vegetation Management Techniques - Each year management is conducted on wetlands, based on assumptions as to the effectiveness of the applied practice. It is not certain, however, if the effectiveness of a particular practice is due to current conditions, or if past years' treatments have set the stage for the current management to be successful. It is especially

important to better understand livestock grazing applications. Effective grazing depends greatly on timing, intensity, and duration. Each of these variables, in turn, needs to be adjusted with changes in climate and water conditions. An improved understanding of the effects of grazing intensity is a priority for future research and monitoring.

The use of a decision matrix will permit the evaluation of data showing vegetative response to various management practices. The matrix or model would provide guidance as to which treatment would be the most effective in achieving the desired plant community.

Distribution and abundance of breeding waterfowl across the RWBJV Administrative Area, especially in the Sandhills, are not well understood. The three highest-priority uncertainties regarding breeding waterfowl are: understanding habitat features that influence the settling patterns of dabbling ducks, economically viable grazing practices that complement duck and cattle production, and landscape carrying capacity for Trumpeter Swans.

Local and Landscape Factors Influencing Dabbling Duck Settling Patterns - To understand the local and landscape-level factors that influence habitat selection by breeding waterfowl, the RWBJV will need to initiate surveys. If designed similar to the four-square-mile surveys conducted in the Prairie Pothole Region (Cowardin et al. 1995) local (wetland type) and landscape level (wetland density at different spatial scales) factors could be described. Multiple-year sampling will be needed to account for temporal variability.

Economically Viable Waterfowl and Cattle Production Strategies - Research and monitoring are needed to gain insights into the habitat factors or management actions that improve duck nesting success and recruitment in the Sandhills. Although duck nesting densities are not as high in the Sandhills as in the Prairie Pothole Region, the amount of grassland currently present in the Sandhills would appear to be conducive to high nesting success (Stephens et al. 2005). However, nesting success appears to be low (Glup 1987, Walker et al. 2008); improved nesting success would likely increase duck recruitment from the Sandhills region.

Because livestock grazing is the primary land use in the Sandhills, an improved understanding is needed of how different grazing systems may affect duck recruitment as well as beef production. This knowledge could lead to conservation programs that encourage grazing systems that benefit both the waterfowl and the ranching community.

Landscape Carrying Capacity for Trumpeter Swans - The carrying capacity and/or possible limiting factors for Trumpeter Swans in the Sandhills are unknown. The initial population target of 500 individuals needs to be re-evaluated, since the population has exceeded that level and continues to increase at a rate of 4.2% each year (Comeau and Vrtiska 2010).

Appendix A

Common and Scientific Nomenclature for Species Described in the RWBJV Implementation Plan

Birds	
Common Name	**Scientific Name**
Baird's Sandpiper	*Calidris bairdii*
Blue-winged Teal	*Anas discors*
Field Sparrow	*Spizella pusilla*
Greater Prairie-Chicken	*Tympanuchus cupido*
Interior Least Tern	*Sternula antillarum athalassos*
Lesser Yellowlegs	*Tringa flavipes*
Long-billed Curlew	*Numenius americanus*
Mallard	*Anas platyrhynchos*
Northern Pintail	*Anas acuta*
Piping Plover	*Charadrius melodus*
Sandhill Crane	*Grus canadensis*
Semipalmated Sandpiper	*Calidris pusilla*
Sharp-tailed Grouse	*Tympanuchus phasianellus*
Spotted Sandpiper	*Actitis macularius*
Trumpeter Swan	*Cygnus buccinator*
Whooping Crane	*Grus americana*
Willet	*Tringa semipalmata*
Wilson's Phalarope	*Phalaropus tricolor*

Plants	
Common Name	**Scientific Name**
Alfalfa	*Medicago sativa*
Common reed grass/*Phragmites*	*Phragmites australis*
Corn	*Zea mays*
Eastern red cedar	*Juniperus virginiana*
Hybrid broadleaf cattail	*Typha latifolia*
Hybrid narrowleaf cattail	*Typha angustifolia*
Kentucky bluegrass	*Poa pratensis*
Leafy spurge	*Euphorbia esula*
Milo	*Sorghum bicolor*
Musk thistle	*Carduus nutans*
Purple loosestrife	*Lythrum salicaria*
Reed canary grass	*Phalaris arundinacea*
River bulrush	*Schoenoplectus fluviatilis*
Russian olive	*Elaeagnus angustifolia*
Smooth brome	*Bromus inermis*
Soybean	*Glycine max*
Wheat	*Triticum aestivum*

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