PHOTO BY JON FARRAR, NEBRASKA GAME AND PARKS COMMISSION

Blue-winged teal are one of the waterfowl species that benefit from well managed wetlands.

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RAINWATER BASIN
JOINT VENTURE
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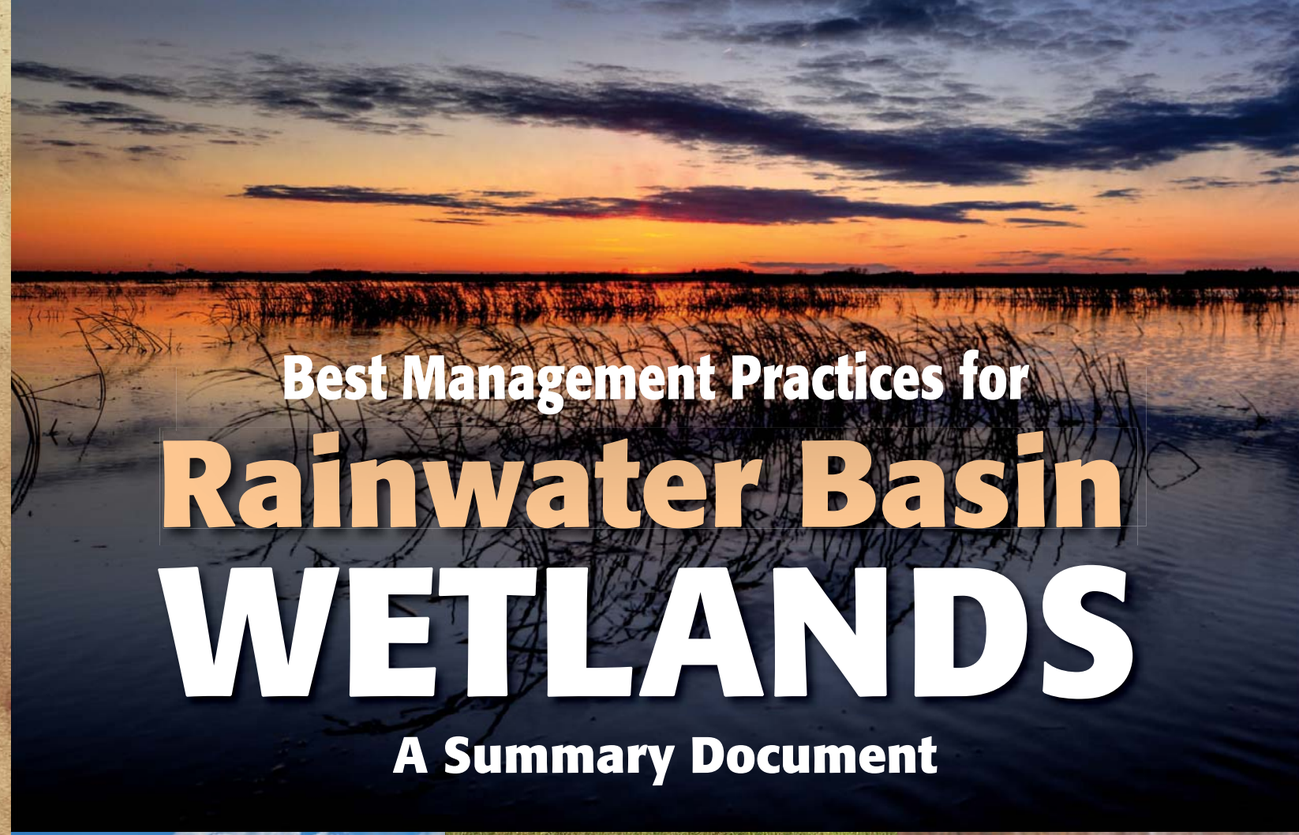
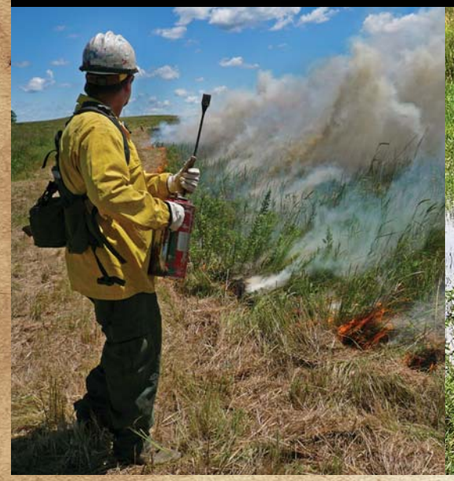
Cover Photos: Applying multiple management treatments such as fire and grazing benefits a wide variety of migrating wetland birds, including Northern Pintails, Mallards, and Green-winged Teal.

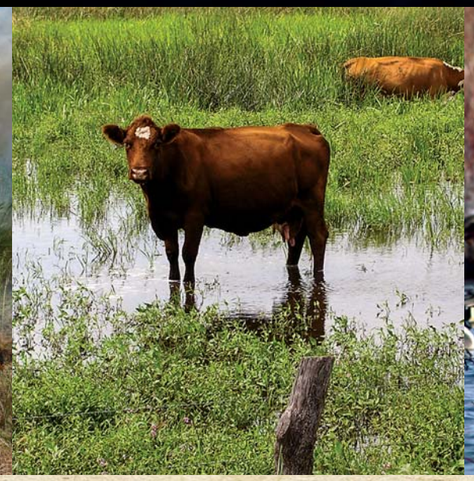
COVER PHOTO CREDITS:
TOP WETLAND BY RYAN ASKREN.
FIRE BY CHRIS HELZER.
GRAZING BY TED LAGRANGE.
DUCKS BY JON FARRAR



Best Management Practices for Rainwater Basin WETLANDS

A Summary Document





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Introduction

This document provides a summary of the more detailed publication *Best Management Practices for Rainwater Basin Wetlands* that was drafted by the Rainwater Basin Joint Venture Public Lands Workgroup. Please consult that document for additional information on this complex topic. The citation for the more detailed publication is:

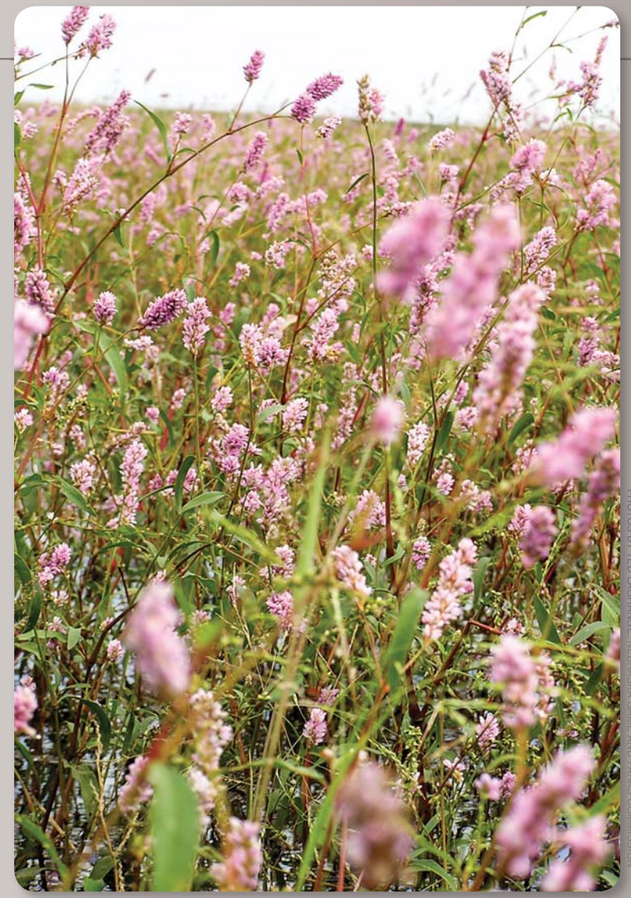
Rainwater Basin Joint Venture Public Lands Workgroup. 2016. Best Management Practices for Rainwater Basin Wetlands. Rainwater Basin Joint Venture Report, Grand Island, NE, U.S.A.

The *Best Management Practices for Rainwater Basin Wetlands* is a detailed publication that used monitoring data collected on public lands from 2009-2013 as part of a Structured Decision Making Project (hereafter referred to as the SDM Project) to investigate the effects of several management treatments on playa wetland plant communities in the Rainwater Basin Wetland Complex (RWB). This document, along with the more detailed publication, is not intended to be prescriptive, but rather to be a source of information for public land managers, private lands biologists, and private landowners interested in achieving the best possible wetland habitat conditions for the millions of wetland-dependent birds that rely on this region annually.

To collect the information for the SDM Project, the RWBJV Public Lands Workgroup collaborated with both academics and land managers to develop the SDM Project. The SDM Project was designed to provide habitat managers with a set of tools to evaluate the influence that management treatments have on plant communities and therefore how to maximize waterfowl food resources within the limits of financial constraints. The foundation of this framework was a set of response tables that were developed from five years of tracking management and vegetation at sampling points located on public lands. These tables outline the shifts in vegetative state that occurred in response to one or more management actions. These tables also depict the cost-benefit trade-offs to aid in decision making. Information regarding duration of benefit of treatments is presented in a series of graphs. Transition probabilities for the most common management techniques are also reported.

In the RWB, moist-soil dominated wetland plant communities are desirable because of the large amount of seeds produced, which are a high-quality waterfowl food. Some of the plants comprising this community include: smartweed, barnyard grass, spikerush, plains coreopsis, and beggarticks. Bare soil, which may include mudflats and shallow open water areas, is also desirable as it is an early successional state that typically develops into a productive moist-soil plant community. Late successional plant communities, such as stands dominated by invasive cattail, river bulrush, or reed canarygrass, provide fewer seeds that waterfowl feed on, and encroach on open water areas that are needed for roosting and loafing.

Monitoring data were collected on public lands from 2009-2013 as part of a Structured Decision Making project to investigate the effects of several management treatments on playa wetland plant communities in the Rainwater Basin Wetland Complex.



PHOTOS BY TED LABAUME, NEBRASKA GAME AND PARKS COMMISSION

This summary document discusses how to manage Rainwater Basin wetlands, including the best ways to address invasive plants such as reed canarygrass (right) and how to promote valuable moist-soil plants such as smartweed (above right) to provide food for waterfowl and habitat for other wildlife.

RWB Wetland Plant Communities

There are more than 240 species of plants that grow in and adjacent to RWB wetlands. These plants form communities that can be varied and dynamic. The communities are influenced by the interactions of a number of factors, including soil type, water depth, duration of ponding, weather and climate (deluge and drought), fire, grazing, human alterations to the wetland and the watershed, and many other factors. In addition, there are several species of plants in the RWB that are considered to be invasive and can greatly alter the plant communities. The most prevalent and harmful invasive species include reed canarygrass, hybrid cattail, and river bulrush.

PHOTOS BY TED LAGRANGE, NEBRASKA GAME AND PARKS COMMISSION

There are several species of plants in the RWB that are considered to be invasive and can greatly alter the plant communities. The most prevalent and harmful invasive species include reed canarygrass, hybrid cattail, and dense stands of river bulrush being monitored (left).

There are more than 240 species of plants that grow in and adjacent to RWB wetlands. These plants form communities that can be varied and dynamic.

Management Objectives

A first step in deciding management treatment options for a RWB wetland is to define objectives, and secondly to assess the current condition of the wetland plant community and compare with defined objectives. If the wetland is not meeting the stated objective, then some type of management action is likely warranted. When evaluating the wetland condition, it is also important to determine if there are stressors (e.g., culturally-accelerated sedimentation and/or fill, irrigation reuse pits, drainage ditches, roads) negatively impacting the function of the wetland or watershed. Although beyond the scope of this publication, addressing stressors through various restoration efforts will be critical for overall success. Numerous programs are available to help with wetland restoration and management. For information about the options available, please contact the Rainwater Basin Joint Venture (Andy_Bishop@fws.gov) or one of the RWBJV partner agencies or organizations (e.g., Natural Resources Conservation Service, U.S. Fish and Wildlife Service, Nebraska Game and Parks Commission, Natural Resource District, Ducks Unlimited, Pheasants Forever).

One of the overarching objectives as written in the RWBJV Implementation Plan is "By 2030, publicly owned wetlands will provide 55 percent of the total natural forage needed by waterfowl within the Rainwater Basin." To help achieve this objective, wetlands are needed that contain vegetation communities dominated by moist-soil plants that produce an abundance of nutritious seeds that are sought out by waterfowl. In recognition of this objective, and to address problems caused by invasive plants, the SDM Project examined three primary plant communities: moist-soil (including bare, unvegetated areas), reed canarygrass, and river bulrush/cattail. For the SDM Project, the two invasive communities were further broken into three sub-categories based on the predominance of the invasive species.

Common Management Tools

A wide array of management tools are available to manipulate RWB wetland vegetation communities, including grazing, prescribed fire, herbicide application, disking, rototilling, haying/shredding/mowing, and water level manipulation. Additional information about these tools is available in the more detailed publication. The tools that were applied in the RWB with enough regularity to evaluate as part of this SDM Project were grazing, fire, herbicide application, disking, and haying. In addition to evaluating these tools alone, the SDM Project also evaluated the use of multiple tools in the same year and over multiple years.

PHOTO BY JEFF PRAHOTA, USFWS

PHOTO BY TED LAGRANGE

PHOTO BY GENE MACK, USFWS

A wide array of management tools are available to manipulate RWB wetland vegetation communities, including: prescribed fire (below), grazing (left) herbicide application (spraying), disking (above), roto-tilling, haying/shredding/mowing, and water level manipulation.

Results

Waterfowl and other wetland-dependent birds evolved to survive in an environment that was constantly in flux. Prior to European settlement, grazing by native ungulates such as bison and elk, drought and deluge weather events, annual hydrological cycles, and frequent fire resulted in optimal conditions for spring-migrating waterfowl and other waterbirds in the RWB. Modern development has altered many of these natural processes. Some vegetation management treatments attempt to mimic natural processes, such as the use of prescribed fire and cattle grazing. Management treatments can also be applied to address effects of human alterations, such as invasive species and increased nutrient and sediment inputs.

Wetland management can maintain or even increase desired plant communities. The SDM Project found that management treatments were more effective at promoting moist-soil plant communities when applied in multiple and consecutive years. Combinations of more than one treatment method in a single year were also more effective. Management treatments led to an increase in desirable plant communities if applied when invasive plant communities were at a lower density (i.e., 25 - 50 percent).

PHOTO BY RYAN ASKREN (MISSOURI COOPERATIVE FISH AND WILDLIFE RESEARCH UNIT)

Each year millions of waterfowl, migrating through the Central Flyway, stop and replenish their nutrient reserves before continuing to the breeding grounds. This is estimated to include 50% of mid-continent population of Mallards and 30% of the continental population of Northern Pintails.

Grazing

Grazing is used on a large proportion of public lands because it is effective at reducing plant stand height, creating structural and species diversity, and increasing ponding frequency. Previous research has also found that grazing can greatly reduce cover of some invasive plants. Grazing has the benefit of creating income, rather than costs, which can be incurred by other management treatments such as applying herbicide. Results of the SDM Project indicated that grazing was more effective at promoting a desirable plant community when compared to no management except in patches of bare soil. Grazing was more effective when applied in multiple, consecutive years, as results indicated that the treatment effects did not carry over into subsequent years of rest.

Compared to other management techniques, increases in moist-soil seed production following grazing alone were small. In reed canarygrass communities, one year of grazing consistently resulted in fewer sampling points dominated (i.e. greater than 75 percent) by reed canarygrass when compared to the results of no management. The percentage of sampling points containing moist-soil vegetation was always higher after resting than after grazing alone. Whereas grazing successfully reduced or prevented the spread of reed canarygrass, it did not appear to facilitate establishment of moist-soil plants. However, when applied to an existing moist-soil area, grazing always performed better than resting, and effects were magnified in consecutive years of grazing.

Grazing seemed to produce mixed results when applied to river bulrush/cattail communities. This may be due to large variations in cattle stocking rates among areas, as high intensity grazing is likely more effective than low intensity grazing. The duration of grazing also likely has an effect on the plant community. More research is needed to determine ideal stocking rates and grazing duration to promote or maintain moist-soil plant communities in the RWB.

PHOTO BY TED LAGRANGE, NEBRASKA GAME AND PARKS COMMISSION

Grazing is an important management tool because it is effective at reducing plant stand height, creating structural and species diversity, and increasing ponding frequency. Grazing can also greatly reduce cover of some invasive plants.

Prescribed Fire

Prescribed fire, when used alone, usually did not change an invasive plant community to a moist-soil community. Results were mixed when fire and grazing were used in the same year. Again, this may be due to differences in grazing intensity. Some of the results suggested that the full effects of prescribed fire may not be realized until a year or more following treatment. Burning seems to produce the best results when combined with grazing in the same year, followed up by additional grazing in one or more subsequent years, and applied to a preexisting moist-soil community. This management regime mimics historic patterns. Fire can also be a tool to help control woody invasion, but that is something that was not evaluated as part of the SDM Project.

PHOTO BY CHRIS HELZER

Prescribed fire produces the best results when combined with grazing in the same year, followed up by additional grazing in one or more subsequent years, and applied to a preexisting moist-soil plant community. Fire can also be a tool to help control woody plant invasion.

Herbicide Application

More aggressive management, such as applying herbicide, can be indiscriminate and kill most of the vegetation. Herbicide application often produces bare ground, thus creating an opportunity for a more desirable community to replace an undesirable community. The SDM Project found that herbicide application alone usually resulted in greater moist-soil plant seed production when compared to other treatments also done individually. Positive effects of herbicide application were often magnified in subsequent years, and full effects were often not realized until the third year after two consecutive years of treatment. Herbicide application treatments work best when repeated in consecutive years because they initially do not have an effect on the seed bank of invasive species. The seed bank of invasive species can be reduced by applying herbicide to newly emerged plants each year before additional seeds are produced. One way to compensate for the cost of herbicide application is to also use grazing as a management tool. This also has the benefit of magnifying the individual effects of each treatment. Herbicide application and grazing often worked better in combination than individually. Prior research has indicated that herbicide application in multiple consecutive years may be needed in areas where an invasive plant seed bank is present and the results of the SDM Project supported those earlier results.

There are a wide variety of herbicides on the market, and new herbicides are constantly being developed, so it is not possible to list here all of the potential products that are available. Each situation is unique, so it is important to select the herbicide that will best meet your needs. Because herbicides are regulated, applicators must follow label directions and over-water use restrictions.

PHOTO BY DOREEN PFOST, RAINWATER BASIN JOINT VENTURE

Prescribed application of select herbicides (opposite) usually results in greater moist-soil plant seed production when compared to most other treatments also done individually. Care must be taken not to apply herbicide on desirable plant communities and applicators must follow label directions and over-water use restrictions.

Disking

Disking kills most of the vegetation and can produce bare ground, creating an opportunity for a more desirable community to replace an undesirable community. Disking was particularly effective at converting reed canarygrass and river bulrush/cattail communities at high densities (i.e., greater than 75 percent) to a more desirable state when combined with grazing and/or herbicide application. When combined with herbicide application, disking is effective because the herbicide kills plants not destroyed by disking and also kills the newly sprouting plants from the seedbank. In general, disking works well alone or in combination with other methods because it creates an early successional "blank slate" where moist-soil vegetation can be re-established without competition from invasive plants. However, if the invasive plant seed bank is not managed, the positive effects of disking may be temporary.

PHOTO BY TIM HORSTDUCKS UNLIMITED

Disking works well alone or in combination with other methods because it creates an early successional "blank slate" where moist-soil vegetation can be re-established without competition from invasive plants.

Other Treatments

The SDM Project was not able to fully evaluate all vegetation management treatments or combinations of treatments used in the RWB due to small sample sizes for some of the treatments. For example, rototilling, haying, and mowing could not be assessed, although they may be effective management techniques in some situations. Additionally, water level manipulation, a common moist-soil management activity in some regions, is rarely able to be used in the RWB. Changes in water levels due to precipitation or drought may have affected plant communities in the SDM Project, as transitions away from a late successional state in areas that received no management were frequently observed. It is unlikely that a plant community dominated by reed canarygrass, river bulrush, or cattail would shift back to a moist-soil state without some form of management disturbance or water-level changes such as inundation for extended periods or prolonged drought. Further research is needed to determine how these additional tools could be used to manage wetlands for the benefit of waterfowl and other waterbirds in the RWB.

PHOTO BY JON FARRAR, NEBRASKA GAME AND PARKS COMMISSION

Providing shallow water with some openings is important for migrating shorebirds and other waterbirds (below) and waterfowl such as Northern Pintails, Mallards, and Green-winged Teal (above).

PHOTO BY MIKE FORSBERG, NEBRASKA GAME AND PARKS COMMISSION

Other management treatments, including haying, may be valuable to apply, but this project was not able to fully evaluate them.

PHOTO BY ANDY BISHOP, RAINWATER BASIN JOINT VENTURE

Conclusions

Results of the SDM Project indicate that long-term planning and implementation can greatly improve the effectiveness of vegetation management, as within-year and across-year treatment interactions have clear effects on outcomes. The SDM Project found that generally, any management that is applied, regardless of type, resulted in a greater amount of moist-soil seed energy available compared to no management. Best results are usually achieved by applying management treatments over multiple years and using several different management treatments. Finally, preventing undesirable species from becoming dominant may be more efficient than attempting to convert an already established stand back to a more desirable plant community.

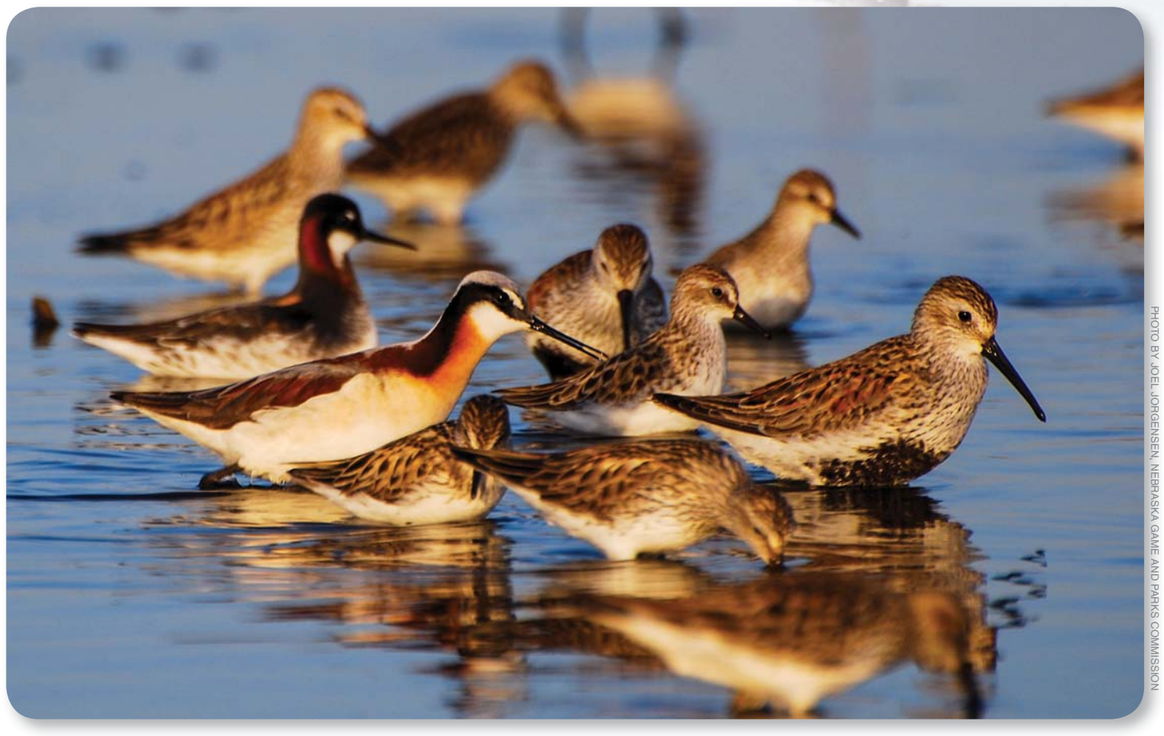


PHOTO BY JOEL JORGENSEN, NEBRASKA GAME AND PARKS COMMISSION

Well managed Rainwater Basin wetlands provide vital habitat for millions of migrating waterbirds, including Snow Geese, Cackling Geese, and Greater White-fronted geese (above right), and Red-necked Phalarope, Wilson's Phalarope, Dunlins, Semipalmated Sandpipers, and White-rumped Sandpipers (above).

PHOTO BY TED LAGRANGE, NEBRASKA GAME AND PARKS COMMISSION

Results of the SDM Project indicate that long-term planning and implementation can greatly improve the effectiveness of vegetation management.

PHOTO BY RYAN ASKREN (MISSOURI COOPERATIVE FISH AND WILDLIFE RESEARCH UNIT)

Recommended Steps

- Develop a long-term management plan and establish objectives for a desirable plant community composition and structure.

- Assess the wetland and the watershed to determine if there are any restoration needs. Programs are available to help with wetland and watershed restoration.

- Evaluate the existing plant community to see if it is meeting the stated objective.

- If the wetland is currently meeting your objective, then apply management treatments as needed to maintain the community in its current condition.

- If the wetland is not meeting your objective, then apply management treatments to change the community to what you desire. Programs and technical assistance are available to help landowners with wetland management.

- Changing the plant community is more effective if the treatments are applied when invasive species are at low densities.

- Best results are usually achieved by applying management treatments over multiple years and also by using more than one management tool in a year.

- Evaluate your successes and failures and keep trying. Some management treatments may take a year or more to yield results. RWB wetland plant communities are dynamic and resilient, so don't be afraid to try different treatments.

PHOTO BY TED LAGRANGE, NEBRASKA GAME AND PARKS COMMISSION

Best wetland habitat results are usually achieved by applying management treatments over multiple years and using several different management treatments.

History of the Rainwater Basin Joint Venture

The Rainwater Basin Joint Venture (RWBJV) was formed in 1992. It is administered by a 15-member Management Board representing private landowners and conservation agencies and organizations. The initial focus of the RWBJV was the Rainwater Basin Wetland Complex (RWB). This region contains a high density of playa wetlands and is the focal point of spring migration for many wetland-dependent bird species. Each year millions of waterfowl, migrating through the Central Flyway, stop and replenish their nutrient reserves before continuing to the breeding grounds. This is estimated to include 50 percent of mid-continent mallards and 30 percent of the continental population of northern pintails. Thus, conservation actions during the partnership's initial years were focused on protecting, restoring, and enhancing wetlands to support migrating waterfowl.

In 1999, the RWBJV expanded the partnership's geographic and conservation focus, and accepted the responsibility of implementing the conservation objectives outlined in all four national bird plans: the North American Landbird Conservation Plan, the United States Shorebird Conservation Plan, the North American Waterbird Conservation Plan, and the North American Waterfowl Management Plan.

In 2013, the RWBJV partnership updated its Implementation Plan to reflect the findings of recent research and monitoring projects. Although landscape habitat objectives (total acres) did not substantially change, the revised Implementation Plan placed a significant emphasis on hydrologic function (i.e., restoration of wetland function) and the importance of management to maximize desired habitat conditions. One of the main strategies outlined in the Plan is to use vegetation management to increase the percentage of wetland acres in moist-soil plant communities.

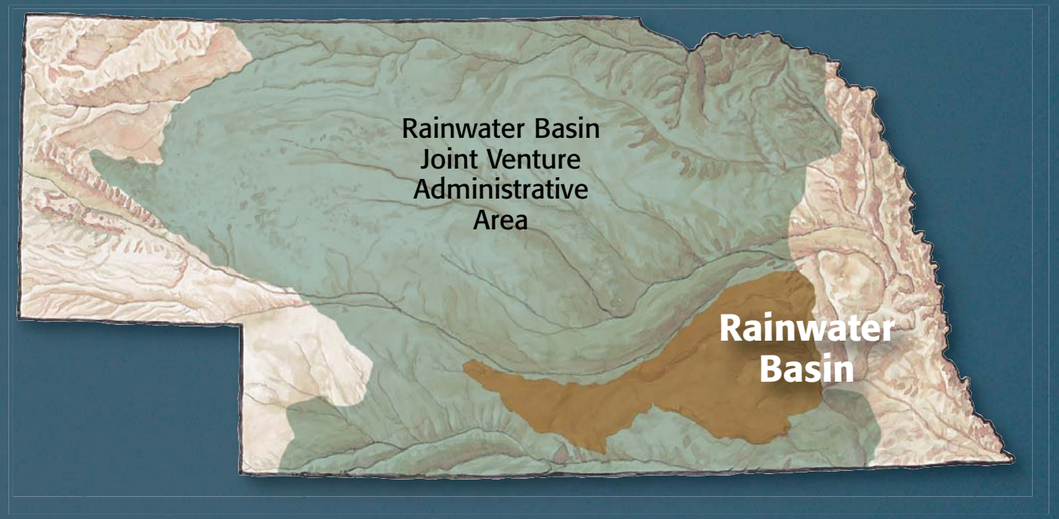


PHOTO OF NORTHERN PINTAIL DUCKS BY ERIC FOWLER. MAP ILLUSTRATION BY TIM REIGERT, NEBRASKA GAME AND PARKS COMMISSION