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Wetland Management Guidelines for Nebraska's Wildlife Management Areas

Ted LaGrange
Nebraska Game and Parks Commission, ted.lagrange@nebraska.gov

Randy Stutheit
Nebraska Game and Parks Commission, randy.stutheit@nebraska.gov

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By Ted LaGrange and Randy Stutheit
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CHAPTER 1 – INTRODUCTION

Prior to Euro-American settlement, wetlands covered about 6% of the Nebraska landscape. Since settlement, the state's wetlands have suffered serious decline. For example, approximately 90% of Rainwater Basin playa wetlands and 90% of the eastern saline wetlands have been destroyed or are highly degraded. Remaining wetlands are threatened by conversion to other uses (e.g. agriculture), invasive and aggressive vegetation, siltation, and lack of proper management. Only through sound management can the wetlands on our Wildlife Management Areas (WMA) be preserved for the citizens of Nebraska, as well as the native plants and wildlife dependent on them.

This section is directed towards management that maintains and enhances the ecological character and biodiversity of wetlands on WMAs. Though directed toward management of the vegetation community, the objectives and strategies promoted within this section will provide direct benefits for wildlife.

The specific objectives of this section are as follows:

1) Build upon the philosophy of wetland management for WMA managers.
2) Provide background information on the need for, and benefits of, sound wetland management.
3) Provide information that will assist managers to identify wetland types, their ecological quality, and their management and restoration needs.
4) Provide information on sound wetland management techniques.
5) Provide minimum management strategies and options for use on WMAs.

Though this information has been developed specifically for managers of WMAs, other conservation land managers and private landowners may find it useful as well.

Wetland Definition

The State of Nebraska has adopted the federal definition that wetlands are "*Those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas*" (USACE 1987).

Wetland delineation in Nebraska is currently based on the 1987 Corps of Engineers Wetlands Delineation Manual (USACE 1987), and the Midwest and Great Plains Supplements. The manual uses three diagnostic environmental characteristics to delineate wetlands. These are:

1) **Vegetation** - Defined by a prevalence of hydric plants adapted to growing in inundated or saturated conditions.
2) **Hydric soils** - The presence of soils that developed under inundated or saturated conditions that limit oxygen (anaerobic conditions).
3) **Hydrology** - Defined by inundation or saturation by water at some time during the growing season.

Types of Wetlands

Nebraska's wetland resources are as diverse and dynamic as those of any state in the nation. They include marshes, lakes, reservoirs and ponds, river and stream backwaters, oxbows, wet meadows, playas, basins, fens, forested wetlands, and seep areas. These wetlands vary greatly in nature and appearance due to physical features such as geographic location, water source and permanence, and chemical properties. Some wetlands hold water for only a few weeks or less during the spring while others never go completely dry. Many wetlands receive their water from groundwater aquifers while others are totally dependent on precipitation and runoff. And finally, the water chemistry of wetlands ranges from fresh to saline and from acidic to basic. These descriptions identify the extremes of wetland characteristics. Nebraska's wetland resources possess these extremes and virtually every combination in between (LaGrange 2005).

Wetland Classification

Numerous classification systems have been developed for wetlands. The one most commonly used today is the Cowardin system (Cowardin et al. 1979). This is a hierarchical system that classifies wetlands according to system, plant community and substrate, water regime, water chemistry, and numerous special modifiers such as the presence of dikes, drainage, and excavations. In many cases, portions of the same wetland can be classified differently using the Cowardin system.

Systems - The three Cowardin wetland systems that occur in Nebraska are *palustrine*, *lacustrine*, and *riverine*. Palustrine systems are usually marshes and are dominated by vegetation. Lacustrine systems are lakes, reservoirs, and ponds usually deeper than 6.6 feet. Riverine systems are rivers and streams that flow in a defined channel.

Water Regime - Water regime describes the duration and timing of inundation or saturation in a wetland. In Nebraska, most palustrine wetlands are of the temporarily, seasonally, or semi-permanently flooded water regime. Temporarily flooded wetlands contain water for only brief periods, often just a few weeks during the growing season. Seasonally flooded wetlands have water present for extended periods during the growing season, but they tend to dry up by the end of the season in most years. Semi-permanently flooded wetlands have water in them in most years and only dry up occasionally.

Natural Community Types – The natural community types for Nebraska's wetlands have been described by Rolfsmeier and Steinauer (2010). For wetlands, this classification has been further "cross-walked" to correspond with a list of wetland hydro-geomorphic sub-classes and soil mapping units.

Grassland/Wetland Similarities

It is important to recognize the similarity of herbaceous grasslands and wetlands, especially in regards to management needs and the techniques used. Wetlands and grasslands are both influenced by similar disturbances such as fire and grazing. Grasslands, as discussed in the companion management guide, occupy the "dry" portion of the landscape and have a plant community that requires less moisture while wetlands occupy the "wet" areas and contain vegetation adapted to grow in saturated or shallowly flooded soils. It is often difficult to distinguish the transition from a wetland plant community to an upland community as you move from the wettest area on the landscape to the driest. Grasses and lowland forbs increasingly dominate these edge communities as you move up in elevation. Further, this transition zone can "migrate up and down" the gradient from year to year depending on how wet each particular year is. The delineation of wetland/upland boundaries can become especially difficult in areas such as the Platte River valley or in Sandhill meadows where minute changes in elevation dictate whether an upland or wetland plant community dominates. Where these situations occur, managers often need to concurrently apply the same management techniques, such as grazing, to both communities.

It should be noted at this time that in some regions of the state, mostly along rivers and streams in eastern Nebraska, certain wetlands are naturally wooded and/or they transition into woodlands. In these instances, many of the techniques applied to woodland management become relevant.

In situations where grasslands, woodlands, and wetlands are distinctly separated from one another, management techniques unique to each habitat type and need can be applied.

Wetland Function

Because wetlands occupy a continuum between wet and dry conditions, they undergo a variety of unique changes both seasonally, and from year-to-year. Wetlands under natural conditions go dry and then flood, are burned by prairie fires, and are subjected to other disturbances such as grazing. These are natural processes that don't harm the wetland. In fact, it is the interaction of all of these dynamic processes that make wetlands so productive. If some of these processes are altered, for example, by maintaining a constant water level or the exclusion of a vegetative disturbance such as fire, the wetland habitat will actually begin to deteriorate.

Threats and Stresses to Wetlands

At the time of statehood in 1867, Nebraska contained an estimated 2,910,000 acres of wetlands covering about 6% of the state (Dahl 1990). Through much of the state's history, wetlands were viewed as impediments to transportation, agriculture, and other development. Early on, the federal government actively encouraged the conversion of wetland areas to other uses through direct financial and technical assistance, crop subsidies, and tax incentives. Wetlands have been impacted directly by filling, ditching, tiling, water concentration pits, channelization, and declining water tables. They've been impacted indirectly by changes in the surrounding uplands and catchment areas that caused increased sedimentation or the diversion of surface runoff away from wetlands. Wetlands and water areas were also created in some regions due to the construction of farm and livestock ponds, and locally rising water tables due to irrigation canal and reservoir seepage. However, the net result of all of these activities statewide was a reduction in wetlands by an estimated 35%, to 1,905,000 acres covering only 3.9% of the state (Dahl 1990). The destruction of wetlands was much higher in some regions of the state, but the statewide figure is buffered by the large wetland resource still remaining in the Sandhills. Temporarily and seasonally flooded wetlands were lost at the highest rate throughout the state and much of this acreage was not compensated for by the construction of lakes and ponds. Most states surrounding Nebraska have lost a greater percentage of their wetlands (Dahl 1990).

The wetlands that remain are highly productive and are an essential component of Nebraska's landscape. They serve a wide array of functions from improving water quality to providing critical wildlife habitat. Wetlands provide important habitat for 50% of Nebraska's bird species, 36% of mammal species, 35% of reptile species, 100% of amphibian species, and 50% of plant species. Wetlands are also an essential component of quality aquatic habitat for fish where they occur in conjunction with deepwater habitat. Wetlands also support a wide variety of outdoor recreation and educational opportunities.

The primary existing threats and stresses to Nebraska's wetlands are listed below:

1) **Conversion to Other Uses** - This threat exists especially for temporary and seasonal wetlands that are easier to convert. Agricultural conversion and development for building sites, roads, feedlots, etc. are the primary alteration threats wetlands face.
2) **Alterations in the Watershed** - Often not as obvious as direct impacts within the wetland itself, alterations within the watershed, or catchment area can be equally as damaging by disrupting the natural hydrology of the area. Concentration pits, terraces, diversions, stream channelization, ditches, etc. that either divert water away or stop water from reaching the wetland can have severe negative consequences for the area.
3) **Siltation** – For wetlands located in watersheds dominated by row crops or urban development, culturally-accelerated sedimentation is a serious problem. Sediment alters the natural depths and hydro-periods of the wetlands and can also encourage the dominance of invasive plant species and reduce wildlife use.
4) **Woody Invasion** - Tree invasion can be a serious problem in wetlands, especially in the eastern two thirds of Nebraska. Species such as cottonwood, green ash, silver maple, and willow can colonize wetlands very quickly. When left untreated for a long period of time, managers will be forced to resort to more expensive tree removal methods to restore the wetland to an herbaceous community.
5) **Invasive/Exotic Species** – In addition to the woody species already mentioned, there are a number of other plant species that can be invasive in wetlands. These include reed canary grass, hybrid cattail, common reed, river bulrush, purple loosestrife, and salt cedar. These species can form dense monotypic stands that reduce habitat and wildlife diversity.
6) **Extended Rest** - Long-term rest from disturbance leads to loss of native plant diversity along with increased abundance and invasion by non-native and aggressive wetland plant species. River bulrush, cattail, and reed

canary grass are especially adept at out-competing other vegetation and establishing a monoculture in wetlands lacking management.

7) **Fragmentation** - Fragmentation of wetlands by crop fields, roads, fences, berms, or other factors increases edge effect. This usually leads to increased and more rapid invasion by non-native and aggressive species (especially trees), loss of genetic diversity, and degradation of wildlife habitat.
8) **Repetitive Management** - Conducting the same management action every year at the same time can lead to a reduction of plant diversity and invasion of non-natives. Using a variety of techniques and applying them at different times of the year will generally increase diversity.
9) **Overgrazing** - Heavy grazing occurs when repeated severe defoliation of plants occurs without adequate recovery periods between defoliations. Ultimately, this reduces root development of the plants. Continued heavy grazing can shift the plant community to less desirable species by killing native vegetation and reducing the number of young replacement plants. However, periodic, intensive heavy grazing can produce positive results for wetlands depending on the goals and objectives. Some wetland complexes in the state, such as the Rainwater Basin and the southwest playas provide critical migratory habitat for many species of water birds. The migratory species that use these wetlands benefit from a strategy of heavy grazing since it provides open water, bare shorelines, and early succession vegetation. Periodic intensive heavy grazing should be followed by periods of rest to enable plant re-growth, if that is the desired objective.

The purpose of the chapters that follow is to provide guidance on techniques to use in managing wetlands on lands owned or leased by the Nebraska Game and Parks Commission. These same techniques are applicable to other public lands and to private lands as well. Examples of prescribed management techniques discussed include grazing, prescribed burning, haying/shredding/mowing, herbicide application, mechanical (e.g., disking), water-level manipulation, and tree removal. There is usually not one “magic bullet” treatment that can be applied once to accomplish desired objectives. Multiple management activities often need to be prescribed to obtain the desired effect. <u>Management should be prescribed based upon site conditions and biological justification</u>.

CHAPTER 2 – DISTURBANCE AND DIVERSITY

Nebraska’s pre-settlement wetlands were highly adapted to disturbance. They were frequently burned by prairie fires, grazed by both large and small herbivores, and endured droughts and flooding. Periodic disturbance is essential to maintain and enhance wetland quality, plant and animal communities, and ecosystem processes. Natural disturbances operate at a variety of scales, intensities, and duration. Climate operates at a large scale, fire and grazing at intermediate scales, and insect herbivory and numerous other factors at small scales. Interaction of disturbances, for example, flooding and grazing, increase the range of patch types within wetlands resulting in more complex systems of species composition and structure.

In pre-settlement Nebraska, the disturbance regimes occurred within a large landscape. Now, most wetlands are managed within a fragmented landscape with a limited disturbance regime applied on regular intervals. This has resulted in simpler systems then historically existed.

A primary goal of management on WMAs should be to mimic the natural disturbance regimes to the greatest extent possible. Circumstances in today's world often make this difficult. For example, a wetland may be located near a housing subdivision making prescribed burning a challenge, or a wetland may not have the infrastructure, such as fencing or livestock water facilities, needed for grazing. In addition, specific management challenges may require alteration of the natural disturbance regime. For example, control of the invasive reed canary grass in a wetland may require several consecutive years of early spring fire followed by intense spring grazing to reduce the reed canary grass. Or, a dense stand of reed canary grass in a wetland may need several passes with a disk followed by an herbicide application.

CHAPTER 3 - GUIDING PRINCIPLES AND MANAGEMENT GOALS FOR WETLANDS

Addressing the Need for Wetland Restoration or Enhancement

The need for wetland restoration should be assessed both within the wetland and for the entire watershed. Although we may only control a part of the wetland, we need to remember that the wetland is being impacted by alterations in the entire watershed. Addressing the watershed alterations may require different tools (e.g., private lands programs), but should be considered in the restoration planning. Wetland "projects" are usually placed into 1 of 3 categories. They are: 1) Restoration, 2) Enhancement, and 3) Management. As you move from restoration to enhancement to management, project needs, costs, and time involvement generally decrease. Following is a brief description of each category:

1) **Restoration** - Generally defined as restoring hydrology by undoing modifications in the wetland (e.g. - pits, drainage ditches, dikes, tile lines, land leveling, severe sedimentation), and within the watershed (e.g. filling upland pits, re-establishing water delivery). Hydrology modifications have a cause and effect on wetland vegetation and, over long period of time, soils. Restoration usually requires engineered solutions and input from other specialists.
2) **Enhancement -** Actions that accentuate existing wetland functions by changing the plant community and/or water management capabilities in the wetland (e.g. - new well, water control structure, boundary fence). Nothing is *seriously* wrong with the wetland's hydrology, but the plant community may be in poor condition due to long period of management inactivity (e.g. - the presence of trees, reed canary grass, dense cattails, river bulrush, etc.).
3) **Management** - The application of vegetation management actions that keep the plant communities in target condition. Nothing is *seriously* wrong with hydrology or the vegetative community. Management tools such as

prescribed fire, grazing, light disking, or herbicide spot treatments are used to maintain the vegetation in its desired condition.

Wetlands on all WMAs should be carefully evaluated to determine if a restoration or enhancement project is needed to reduce the time and effort required for proper management of the area. If you determine that restoration or enhancement is needed, contact the district supervisor and the Wetland Program Manager to begin initiation of a restoration or enhancement project. Wetland restoration and some enhancement projects can be complex and usually require expertise in biology, engineering, permitting, hydrology, and soils to complete properly. Because of this, an interdisciplinary team possessing the necessary expertise should help you design these types of wetland projects.

Management Philosophy

Management philosophy can be just as critical to sound wetland management as choosing the proper technique(s). The management philosophy on WMAs should include the following considerations:

1) **Management is a Long-Term Process** - Wetland management is usually a long-term process. However, some management objectives, such as modifying vegetation structure, can be accomplished in the short term. Managers should choose strategies that will accomplish both short-term and long-term objectives. Management regimes should be designed to mimic the natural processes that originally formed and maintained the wetlands. Particular emphasis should be placed on integration of burning and grazing to achieve long-term objectives.
2) **Set Management Objectives** - Management progress and effectiveness can only be measured if objectives have been set. These objectives should be quantifiable and timed-based, such as reduce reed canary grass by 50% in five years, or raise the wetland to Grade B quality in 10 years.
3) **Use Adaptive Management** - Adaptive management is simply the process of setting objectives, taking action through experimentation, measuring progress, and then adjusting strategies. Once management plans are implemented, they need to be evaluated yearly to see if management objectives are being met.
4) **Be Flexible and Use Diverse Management** - Flexibility is the key to sound management. Managers should be willing to use a diversity of techniques and change management methods, timing, and intensity on any given wetland to mimic natural disturbance regimes and help meet objectives. Also, management techniques don't have to be applied over the entire wetland, but can be targeted to the portions of the wetlands in need. The primary tools to be used are water level management, invasive species control, fire, and grazing. Diverse management promotes both species and structural diversity. Simplified management, for example, use of only prescribed fire in the spring, can simplify diversity. External factors may also require managers to be flexible. Wetlands are resilient systems so it is often better to take action and learn from it as opposed to taking no management action at all.

5) **Be Familiar With Native Plants** - Knowledge of wetland plants is vital to sound management. Native plants, as well as exotic and invasive species, are indicators of condition and management needs. Changes in condition, both good and bad, will be reflected in the plant species composition. Many wetland plant species are good for wildlife and the ability to identify these species is valuable to wildlife managers. At-risk plant species may also be a management priority and managers should be able to identify these in the field.
6) **Make High Quality Wetlands a Management Priority** - Many high quality wetlands occur on WMAs. These wetlands are uncommon and need proper management to preserve them into the future. However, management resources and staff are limited and because of this, it is possible that not all wetland habitats on WMAs will receive proper management. It is essential that the high quality sites be given priority.
7) **Management can be complex and challenging to implement and evaluate** – Due to the complexities of natural systems, it can be difficult to know how to best manage a given site and to evaluate your results. When unsure what the best course of action is, seek counsel from other managers and people with wetland expertise and the most up-to-date information. Such a team approach may be very helpful in deciding on a course of action.

Guiding Principles

Guiding principles are general rules to direct management of wetlands on WMAs. Individual guiding principles may not apply to all situations. For example, it may not be feasible to provide structural diversity, or do large-scale management on a small wetland. Managers are encouraged to follow these guidelines where applicable:

1) Manage for native species diversity.
2) Mimic natural disturbance regimes.
3) Strive for structural diversity.
4) Decrease fragmentation.
5) Restore natural communities.
6) Emphasize large-scale management.
7) Control invasive species.
8) Manage for at-risk species where present.

Wetland Condition Grades

To assess the current condition of your wetland, start by completing the ranking sheets (Appendix A) and assigning a score to each of the 7 parameters for every wetland on the WMA. This process will help determine the wetland(s) condition grade. A compilation of the scores for each wetland will derive the final WMA wetland condition grade.

Levels of Improvement

In many situations, it is possible to improve a wetland's condition grade through management or restoration. High priority should be given to restoring wetlands to the extent possible. In most cases it is unlikely a wetland can be improved more than one condition grade if components of its plant diversity have been lost or if restoration cannot be done. For example, it may be possible to convert a Grade C wetland to a Grade B wetland, but not to a Grade A wetland. As another example, some Grade D wetlands are so degraded and dominated by invasive species and lack of native plants that it may not be possible to improve their condition. Management objectives should include improving the condition grade at least one grade with the exception being Grade A wetlands. Here an objective should be to maintain the Grade A condition.

CHAPTER 4 – MANAGEMENT

Need for Management

As noted earlier, Nebraska's wetlands evolved with, and are dependent on natural disturbances such as fire and grazing. Lack of periodic disturbance (management) has severe consequences for wetlands. In previous decades, land managers sometimes assumed that little or no management was good for wildlife. Research has shown that in nearly all cases this assumption is false. In wetlands, a major consequence of little or no management is a dense and often monotypic stand of vegetation.

Another consequence of no management is uniform vegetative structure that is not conducive to use by a diverse suite of wildlife. Lack of management in wetlands can also lead to woody species encroachment resulting in habitat fragmentation and loss. Wetlands lacking proper management will move toward a state of dense, perennial vegetation such as cattails or reed canary grass. Active management not only maintains and enhances habitat quality, but also is necessary to sustain healthy populations of wildlife.

The lack of management can lead to long-term damage to wetlands and can result in the need for a more expensive and time consuming restoration or enhancement project to be completed before proper management can begin.

Management Options

1) Grazing

Bison and elk were the primary pre-settlement large ungulate grazer of Nebraska's landscape. Today, under several management scenarios cattle can be used as a substitute for native grazers to attain management goals. Species other than cattle (e.g., goats, horses, hogs) may also be able to be used for management, but we currently have little experience with these species. When properly applied, cattle grazing can be used to alter wetland species composition, diversify vegetative structure, increase the amount of bare ground, reduce invasive species, increase the productivity of selected species, and increase the nutritive quality of the forage. Grazing is a tool that allows managers' flexibility with regard to timing, frequency, and intensity of plant defoliation and trampling.

There are two basic methods of using grazing as a management tool in wetlands. One is to use cattle infrequently and for a limited period of time to address a particular management issue. The other scenario is to use cattle as part of a permanent grazing system such as rotational grazing. Which grazing system is best for a specific wetland depends on the land management objectives, existing plant composition, wetland size and condition, existing grazing infrastructure, and other factors.

The most critical issue when planning livestock grazing for wildlife management is determining the goals and objectives of the property you manage. How wetlands are managed varies across the state, according to the wildlife species desired, stocking rates, season of use, availability of livestock, and soil conditions. For example, the Rainwater Basin wetland complex is critical for spring and fall migration of waterfowl and shorebirds, thus early succession habitat conditions, and some exposed shoreline, in the spring and fall would be desirable. This could be accomplished by periodic heavy grazing in the spring and early summer. In the Sandhills, wetlands are part of the normal ranching operation and interspersed in upland rangeland, fenced in large pastures, and grazed in planned grazing systems. The waterfowl focus of the region is generally for waterfowl production rather than migratory habitat.

Season of grazing is critical to consider. Depending on management objectives, determining the desired plant(s) growing dates will dictate when grazing will be most effective. Invasive plant species will often require season-long grazing to hinder plant development. In wetlands with severe invasive plant problems, grazing should begin as soon as the plants start to develop as this is the time when the plants are most palatable. In wetlands that have a combination of native species and invasive species, such as reed canary grass, it may be necessary to graze two times, resting the site during annual plant growth, and then resuming grazing during the second growing phase. In wetlands where the goal is to provide more open water/bare ground and annual plants, spring and early summer grazing may be sufficient. In these cases, cessation of grazing by mid-summer will allow for annual plant seed production that is an important source of wildlife food. Wetlands can be grazed annually in the Sandhills under conservative stocking rates, but the season of use should vary when planned grazing rotations are applied.

The stocking rate (animal unit months per acre) influences the overall intensity of herbivory and the physical impacts to wetlands. Light stocking rates allow cattle to select favored grazing species or areas. Heavy stocking rates force cattle to consume more plant species, including undesirable plants, and the hoof action can help to compact wetland soils, shred stems and tubers, and promote more bare ground. In the Rainwater Basin, you may desire a moderate to heavy stocking rate for a short duration while in the Sandhills, you may strive for conservative stocking rates to meet rangeland objectives and sustain good or excellent range condition. Wetlands in the Sandhills may be choked with cattails or bulrush whereby some temporary fencing with high stocking rates may be desirable to create open water habitat.

Conservation land managers sometimes avoid using high stocking rates in fear of damaging native wetland plant communities and wildlife habitat.

Nebraska's wetlands are adapted to severe periodic disturbances such as heavy grazing, fire, and drought. Wetlands will recover quickly from high-intensity, short-duration grazing. In some circumstances it may be necessary to conduct intense short-duration grazing for consecutive years. There are several grazing methods and systems that can be used on WMAs to benefit wetlands, biodiversity, and wildlife and that are acceptable to tenants. Some traditional grazing systems designed for livestock production, such as deferred rotational grazing and high intensity/short duration grazing, generally promote uniform disturbance through even distribution of grazing animals within a year. However, uniform disturbance generally does not promote the plant community heterogeneity desired by ecologists and wildlife biologist. In addition, deferred rotational grazing and high intensity/short duration grazing systems often require extensive grazing infrastructure and management and are not recommended for use on WMAs. On the other hand, if a WMA is adjacent to a private grazing operation, fitting the WMA grazing need into the private operation would be desirable with little infrastructure needed to meet wetland management objectives. Some grazing systems, such as fire-driven rotational grazing or patch-burn grazing, offer an alternative, heterogeneity-based approach to traditional grazing systems. The heterogeneity associated with patch-burn grazing and some other grazing systems may be critical for conservation of many wetland species.

There are even reasons to promote grazing systems that use intensive season-long grazing (up to 2-3 times the traditional stocking rate) in wetlands while other areas are rested for an extended period (1 to 2 years in some cases). Such systems promote heterogeneity of vegetation structure with both short and tall vegetation and open water/bare ground, within wetlands, which is important to wildlife. Native plant species may also be more adapted to such disturbance regimes than exotic species. In addition, many wetland species when rested for one or two years, then burned, are highly nutritious and palatable for large ungulates and other wildlife. For tenants, the increase in forage quality and quantity should make up for any perceived loss in forage due to the extended rest period.

2) <u>Prescribed Burning</u>

Lightning and Native American set fires were a primary disturbance in pre-settlement Nebraska prairies and wetlands. The pre-settlement fire return interval was estimated to be 3 to 5 years for tallgrass prairie (including the wetlands contained within the larger prairie landscape), 5 to 10 years for moist mixed-grass prairie, and 25 years for dry mixed-grass prairie (Samson and Knopf 1996). Native American set fires occurred primarily in two periods: March through May with a peak in April, and July through early November with a peak in October. Fires caused by lightning occurred generally during summer and early fall with most in July and August (Higgins 1986).

Managers need not exactly mimic pre-settlement fire return intervals as more frequent or infrequent fire return intervals may be needed to manage native habitats in today's altered ecosystems. Also, present day season-of-fire need not follow historic season-of-fire as invasive species, limited resources, and burn windows require that prescribed fire be used during all seasons of the year when management objectives can be achieved. Burning can be justified for any season of the year as long as management objectives are met. For example, late spring fires can be used to control exotic cool-season grasses such as reed canary grass, late-summer fires can be used to reduce bulrush and cattail stands in wetlands, and winter or early spring fires can be used to open up wetlands for the spring migration.

3) <u>Grazing and Fire Interaction</u>

The fire-grazing model (patch-burn grazing system) is based on information that on Great Plains prairies, fire and grazing interacted through a series of positive and negative feedbacks to cause a shifting mosaic of vegetation patterns across the landscape (Fuhlendorf and Engle 2004). This same interaction likely also occurred in wetlands. The interruption of landscape scale processes, such as the fire-grazing interaction, may be the primary mechanism for loss of biodiversity in the Great Plains. Recently burned areas are typically preferred grazing sites for large ungulates and the combination of burning and grazing impacts vegetation composition and diversity to a greater extent than each action operating alone (Collins and Steinauer 1996).

4) <u>Haying, Shredding, or Mowing</u>

Haying, shredding, or mowing of wetlands is often less effective than grazing or burning for managing wildlife habitat. Like burning, these methods are nonselective management practices that cut and/or remove all vegetation. From a vegetative standpoint, haying, shredding, or mowing stress actively growing desirable and undesirable plants species equally. Though, if properly timed, these methods can place more stress on the undesirable species you are targeting. For example, summer haying can be effective in controlling some woody species and late spring haying or mowing can stress reed canary grass.

Timing of haying is often dictated by the forage quality of the hay. Producers prefer to hay when forage quality is high. Many Nebraska producers prefer to hay in July to compromise between forage quality and quantity. Many nesting birds don't complete hatching until late June, and others nest until mid-July. Early- to mid-summer haying can destroy nests or kill nestlings. In addition, annual, mid-summer haying stresses native warm-season plants and promotes exotic cool-season species, such as reed canary grass. Another option is to mow reed canary grass in late spring before it goes to seed. Allowing the mowed reed canary grass to dry, and then burning the mowed area can produce a hotter fire that may damage the roots and the unwanted seed bank. Most plants are low in below-ground energy (i.e. carbohydrate) reserves just prior to and during flowering, so mowing them at that time is the best way to stress them and over time possibly reduce their abundance.

Resting portions of wetlands, and then haying, shredding, or mowing on alternative years is a management option. Rest periods will allow native plants to restore root reserves and complete reproductive cycles. Rest from haying, shredding, or mowing should also increase forage production. Rested wetlands can also be spring burned to remove thatch and allow for easier hay removal later in the year.

In addition to the grazing-fire interaction that was discussed earlier, there can also be a grazing-mowing interaction. An early spring mowing can result in a rapid re-growth of vegetation that grazing animals will find very palatable.

5) <u>Herbicide Application</u>

Herbicide application is not always a preferred management technique, but unfortunately, due to the difficulties that can be encountered in wetland management, it has become a necessary method of controlling some of the more aggressive species such as river bulrush, common reed, cattails, or reed canary grass. There are several strategies for using herbicide application:

1) **Broadcast Application Using a Floater** - Because temporary and seasonal wetlands dry more frequently during the year, it is often possible to utilize a float applicator to apply the herbicide.
2) **Broadcast Application Using a Spray Plane -** On larger and/or semi-permanent or permanent wetlands (e.g. reservoir or pond edge), it is often necessary and more economical to hire a spray plane for aerial application of the herbicide.
3) **Spot Treatment Using a Pickup, Boat, or ATV** - Wetlands that have scattered populations of the vegetation you are wanting to control do not need to be broadcast sprayed but should instead be spot treated with application of the herbicide directly to the target plants.

New herbicides are put on the market and labels are subject to change, so it is best to keep current with the latest developments and not to rely solely on recommendations in this guide. There are several commercially available herbicides such as Rodeo® and other glyphosates labeled for use over water. Two other herbicides that are reportedly grass specific are Vantage® and Poast®. However, Vantage® and other herbicides not labeled for over water use (e.g. Roundup) must be applied only when the wetland site is dry. Spraying bulrush, cattail, or reed canary grass in late August and early September with glyphosate controls these plants and has less effect on your other desirable wetland plants.

6) <u>Mechanical (Disking, Roto-tilling)</u>

Using a heavy construction disk or roto-tiller to mechanically disturb the soil can be effective in reducing the population of unwanted vegetation on a site. Experience has shown that for disking alone to be effective, especially on species such as reed canary grass, a minimum of 3-4 passes with a heavy disk must be made. Roto-tilling is more effective because the tiller blades bring the roots, rhizomes, and tubers to the soil surface where they die more quickly by drying in the heat of summer, or freezing during the winter. However, most roto-tillers are narrow and require the tractor operator to go very slow which greatly limits the number of acres that can be effectively treated in a day. Roto-tilling is a good technique to use for smaller stands of undesirable vegetation or to create small openings.

A more effective means of vegetation control utilizing a disk is the spray-disk-spray combination of treatments, especially for reed canary grass. Applying an herbicide in the summer when the reed canary grass is flowering and root reserves are at their lowest will usually kill most of the mature plants. Disking 10-14 days later will further destroy the vegetation and open the seedbed for new plants to sprout from the seed bank. Once the seedlings have reached a sufficient size, treating with the herbicide again will kill the new vegetation.

It should be remembered that mechanical methods can destroy desirable vegetation along with the invasive species, so care should be applied when using this technique. The positive aspect of mechanical control is that it opens the wetland up for annual vegetation to quickly grow and establish.

7) <u>Water Level Manipulation</u>

Water level manipulation has limited application on most of our Wildlife Management Areas. Many areas lack water control structures or groundwater wells to supplement and manipulate hydrology. Plus, many of our wetlands are shallow and it is difficult to flood the undesirable vegetation deep enough for a long enough period of time to eliminate it. An exception to this is managing the wetland fringe on ponds and reservoirs where this technique can actually be very successful. If this is a management technique available to you, preparing the site for flooding beforehand can increase success. Cut or burn the site prior to flooding. Next, flood the vegetation with a minimum of 6-18 inches of water over the top of the vegetation for at least 3 months during the growing season. After 3 months drain the site, if possible, or allow it to dry up naturally. Then, cut or burn the re-growth again in late fall, winter, or early spring and submerge once more during the next growing season. It is important that no stems or leaves be allowed to emerge from the water during the growing season as they will supply the plant they are originating from with oxygen thus preventing it from drowning. This requires close monitoring of the wetland and the water level during the 3-month period to ensure the vegetation remains submerged.

Water level manipulation can also be used to encourage desirable plant species. For detail on this, please refer to Chapter 5.

8) <u>Mechanical Woody Vegetation Removal</u>

As used here, the term mechanical means cutting, sawing, clipping, mowing, and uprooting to remove woody vegetation. A variety of tools and equipment can be used to cut back or remove the vegetation, depending on the size of the wetland as well as the size and density of the woody vegetation to be removed. Tools used can range from limb loppers to chain saws to tractor driven shredders to dozers and backhoes. The amount of time required for different techniques is also an important consideration. If there are a significant number of trees, and/or they are of a large size, it may be necessary to hire a contractor to do the job for you.

In most cases, all woody debris generated by this type of work should be cleaned up and hauled to an upland site where it can be burned and the residue buried. It may be acceptable in some eastern Nebraska wooded wetlands and riverine sites to leave a few logs and tree limbs in the wetland as would naturally occur in these situations.

Many hardwood species such as willow, green ash, or cottonwood will re-sprout if simply cut off at ground level. Stumps of these species should be chemically treated within 5 minutes of cutting to prevent this from occurring.

Note that the mechanical removal of wood vegetation may trigger Swampbuster and 404 permit compliance issues and if you are in doubt the appropriate agency should be contacted. Also, woody vegetation removal, including the timing, needs to be done in compliance with the Migratory Bird Treaty Act.

CHAPTER 5 - WETLAND MANAGEMENT CONSIDERATIONS AND RECOMMENDATIONS FOR PONDS AND RESERVOIRS

Ponds and reservoirs are artificially created deepwater habitats with fringe wetlands found within the littoral zone. Most were constructed for the primary purposes of flood control and livestock watering. These water bodies can also provide important fish, wildlife, and water-based recreation opportunities on some Wildlife Management Areas. However, as the ponds and reservoirs have aged, these opportunities have been reduced due to a decline in the quality of the water and the fish and wildlife habitat. The purpose of this section is to provide recommendations for increasing the amount of emergent and aquatic vegetation in these ponds and reservoirs and maintaining the vegetation once established.

The Role of Wetland Vegetation in Ponds and Reservoirs

Fish and wildlife managers recognize that one of the most limiting habitat factors in ponds and reservoirs is the lack of emergent and aquatic vegetation. Many things have contributed to this lack of vegetation including timing of water level changes, turbidity, wave action, uprooting by fish, and herbivory. There are a variety of benefits that wetland plants provide in a pond or reservoir setting.

Benefits

Fish Habitat - Aquatic vegetation provides benefits for fisheries including production of invertebrates eaten by fish as well as cover for spawning and hiding from predators. One of the reasons ponds and reservoirs are so productive in the years following initial flooding is that substantial nutrients are cycled from submerged decaying terrestrial plants into the aquatic food web. In addition, nutrients and organisms washed in during filling also get cycled into the aquatic food web. This phenomenon is termed trophic upsurge. Trophic upsurge refers to the 5-10 years of highly successful sport fish production that follows initial filling. Unfortunately, internal nutrient loading declines substantially once the original terrestrial vegetation component is lost. A period of 3-4 years of low water levels, when re-growth of terrestrial and wetland vegetation takes place on exposed mudflats, followed by flooding of substantial areas of the new vegetation, can simulate trophic upsurge, increase productivity, and bring on strong year classes of certain fish species (Summerfelt 1999, Ploskey 1986).

Wildlife Habitat - Ponds and reservoirs with emergent and aquatic vegetation provide habitat for a greater number and diversity of wildlife than those without vegetation. The plants provide food directly, are a production site for invertebrate foods, and provide resting, hiding, and nesting cover. The number and types of wildlife using an area is dependent on the distribution and types of plants growing in the area. As a general rule of thumb, it is best to have sites that provide a diversity of habitat types (i.e., a good interspersion of plant communities, open water, and exposed mudflats) (Helmers 1992, van der Valk 1989, Weller 1987).

Shoreline Protection and Sediment Reduction - Stands of emergent plants along the shoreline help to absorb wave energy and reduce shoreline erosion (Jorgensen and Loffler 1990). This not only protects the shoreline, but also reduces water turbidity. In addition, plants growing within the inlet areas to the ponds and reservoirs help slow the flow of the water and cause silt to settle. This helps to keep silt from entering the main body of the pond or reservoir.

Improved Water Quality and Nutrient Transformation - It is well documented that wetland plants, along with their associated organic matter and microbial community, help to transform nutrients and contaminants that can impair the health of the pond or reservoir system (Jorgensen and Loffler 1990). They are especially effective at nitrate removal through denitrification (USEPA 1992, Neely and Baker 1989). Excessive nitrates are a common problem in ponds and reservoirs including those in Nebraska.

Although there are many well documented benefits to wetland vegetation, there are several issues related to the plants and their associated management that need to be addressed in a pond or reservoir setting.

Issues for Consideration

Real and Perceived Impacts to Recreation - There is a substantial amount of information concerning the negative effects of large beds of aquatic vegetation on fish and anglers (Cooke et al. 1993). However, most of these instances occur in lakes and ponds with high water clarity that allow very dense stands of vegetation to cover large portions of the lake. This usually is not the case with Nebraska ponds and reservoirs because water clarity is not good enough to produce this kind of plant growth. In areas where bands of emergent vegetation are continuous around the shoreline, they can impact water access by shoreline anglers. This problem can be addressed by reshaping the bottom of the pond or reservoir during renovation projects to provide deep-water areas near shore and/or the construction of jetties and docks to reach deeper water.

Recreationists often perceive vegetation and water level reductions to be a problem. However, most ponds and reservoirs have sufficient size and water depth to inhibit plant growth over a large percent of the surface area even when the water level is lowered. In addition, boat ramps can be designed for use in low water periods and vegetation can be controlled in beach areas.

Decomposition - Rapid re-flooding of vegetated areas after a draw-down can cause accelerated decomposition of organic material and a release of nutrients. If there is an abundance of plant matter and decomposition is rapid, there can be a serious reduction in dissolved oxygen. In addition, the temporary release of nutrients can create algal blooms. These problems can be alleviated by gradual re-flooding of vegetated areas.

Management

As with the management of any natural resource, the establishment of the proper distribution, density, and diversity of emergent and aquatic vegetation is complex and one need to consider both the ecology of the system you are managing and the needs of a diverse set of users.

Dynamics - Like all other wetlands, those associated with ponds and reservoirs are highly dynamic and productive systems. Because wetlands occupy a continuum between wet and dry conditions, they undergo a variety of unique changes both seasonally and from year-to-year.

A wide array of factors influences the development of a wetland plant community. First, a seed or propagule source needs to be present. This is generally not a problem in most aquatic areas because large numbers of seeds are usually present and many of these seeds remain viable for 20-100 years (van der Valk and Davis 1978). Studies in marshes have found up to 20,000 seeds per m^2 in the upper 5 cm of exposed sediments (van der Valk and Davis 1978). If it is suspected that seeds of desirable species are not present, the seed bank can be tested through a controlled germination experiment. Seeding and planting can be done if necessary but this usually is not needed.

The lack of properly timed water level changes has been the primary reason that wetland plant communities have not become well established in most Nebraska ponds and reservoirs. Many aquatic and emergent plants will not germinate underwater. The seeds will only germinate in very shallow (<1 inch) water conditions or on moist, exposed mudflats. These conditions ensure that the germinating plants have access to oxygen, sunlight, nutrients, and water - all key components in plant growth. The two primary factors that determine the density and composition of the wetland plant community are the time of year of the draw-down and the amount of moisture available. These two factors influence both seed germination and seedling growth and survival. If the draw-down is early (e.g. April) or late (e.g. July-August), then annual plants are favored. Annual plants are also favored if the site becomes drier. A draw-down during May-June that stays moist for most of the summer (either by water control or rainfall) will favor the establishment of persistent, perennial emergent plants such as cattail and bulrush.

Managers should be cognizant of the potential for creating ideal conditions for an outbreak of avian botulism. Most botulism outbreaks occur during summer and fall when ambient temperatures are high. Conditions that elevate wetland sediment temperatures and decrease dissolved oxygen, including the presence of decaying organic matter and shallow water, may increase the risk of botulism outbreaks.

Goals - In light of these complex dynamics and diverse user interests, it is critical to clearly establish goals for the pond or reservoir. There will often be multiple, and sometimes competing goals. The goals relating to wetland plant management need to define the desired plant community, describe how much of the area should become vegetated, and state how long the plant community should persist.

Adaptive Management - Dealing with complex resource issues requires the use of an Adaptive Resource Management approach (Johnson 1999). A "cookbook" manual simply can't be written to account for all of the variability of weather, soil types, water level changes, species composition, predation, and disease. It is necessary and important to draw up a management plan; however it is imperative that this plan be molded to meet the established goal(s) based on real conditions and responses.

Monitoring/Evaluation - An important component of Adaptive Resource Management is monitoring the response of the plant, fish, wildlife, and recreationists to the changes implemented. At a minimum, information should be collected on pond or reservoir water levels, weather patterns, and the distribution of dominant plant communities.

Management Plan

The following describes a few general management concepts based on experience with other wetland systems, familiarity with ponds and reservoirs, and the literature. A site-specific plan will need to be developed for each area based on goals, draw-down capabilities, basin topography, and plant community response.

Draw-down - As discussed in the section on dynamics, wetland vegetation is cyclic and the community occasionally needs reset by exposing the substrate to sunlight and oxygen. This is either accomplished through natural drought or by purposeful draw-down by letting water out of the pond or reservoir. If the pond or reservoir on your WMA does not have a manual draw-down capability, your first consideration is to replace or retrofit the existing structure so that it can be used to manipulate water levels. Engineering assistance will likely be needed to determine what the best water control structure is to install. Once you have draw-down capability, it is best to lower water levels slowly when applying management. This has two benefits: (1) it optimizes the water/land interface that is heavily used by foraging water birds (feeding on both seeds and invertebrates), and (2) it allows for the greatest germination of plant seeds (Fredrickson 1991). In areas where the goal is to establish persistent emergent vegetation (such as cattails and bulrush) it is best to have these areas exposed, but moist, during May and June. If the area becomes too dry, the growth of annual moist soil plants (such as smartweed, wild millet, pigweed and nutgrass) will be favored. The distribution and amount of area that will stay moist during the desired germination window can be determined by knowing the basin morphology in relation to the water control structure outlet. Therefore, if the goal is to establish a large area of perennial emergent vegetation, then the largest and flattest areas should be kept moist from mid-May until mid-June. During the germination and seedling stage, most wetland plants are sensitive to any prolonged flooding. They can survive being covered by water for several days, but a longer duration will cause mortality.

At times, a pond or reservoir drawn down occurs too rapidly to promote the growth of perennial emergent vegetation. When this happens, bringing the water level up to a desired elevation and maintaining the moist mudflat conditions during May and June can establish perennial emergent vegetation. If this is done, some of the existing plant litter may need to be removed (possibly by burning) to prevent this litter from inhibiting germination (van der Valk 1986).

Re-flooding - Although established, mature wetland plants are well adapted to survive in flooded conditions (usually water less than 18 inches deep); seedlings are extremely vulnerable to flooding. The general rule of thumb on re-flooding areas is to bring the water level up at the same rate the plants grow, always being careful not to overtop them. A failure to re-flood may cause the site to become too dry which will favor the survival of annuals. Bringing the water up too fast will flood over the plants and cause excessive mortality.

Grazing - Shoreline and shallow water vegetation in ponds and reservoirs can be impacted by grazing if livestock use is for extended periods and livestock are concentrated around the wetland. Livestock trampling of the shoreline can lead to bank erosion thus causing an increase in water turbidity and a "shallowing" of the water near shore. Livestock often prefer the moist, succulent wetland vegetation found along shorelines and in the shallow water zone and will graze this more heavily than the uplands. A permanent, 4-strand barbed wire fence should be installed along reservoir shorelines or completely around smaller ponds with a minimum setback from the high water line of 150 feet. This will maintain a filter strip of upland vegetation and prevent livestock from grazing the wetland plants. If livestock are used to manage the surrounding uplands and the pond or reservoir is the only water source, two options are available to provide livestock water. The most desirable option is to install a small pipe through the dam that then supplies water to a stock tank placed downstream below the structure. A second option is to allow livestock access to a small area of the pond or reservoir by bringing the fence down to, and a short distance out into the water. The fence can be configured in many different ways to allow this, but livestock should be given access to only the minimum area necessary for their watering needs. Pass-throughs and gates can be incorporated into fences to allow recreationists access to the pond or reservoir for hunting, fishing or bird watching, or for vehicular access for management purposes. The impacts from grazing may be more greatly realized in non-Sandhill wetlands. In the Sandhills, if ponds or wetlands are in large enough pastures, fencing ponds would generally not be necessary.

Depending on your goal, you may also want to graze the edge of a pond periodically, especially if your goal is to have some mudflats and annual plants. Please see the grazing section in Chapter 4 for more details on how to conduct prescribed grazing.

Prescribed Fire, Disking, and Herbicide - These tools can be utilized to manage both the upland filter strip and the wetland vegetation in a manner similar to their use in a large grassland setting or on a playa wetland. Again, see the appropriate sections in Chapter 4 for more details.

Long-term Management - It is important to keep in mind that wetland plant management is not a one-time event. Most of our prairie wetlands go through a predictable cycle of dry marsh, regenerating marsh, degenerating marsh, and lake marsh (van der Valk and Davis 1978). This cycle takes 5- 20 years in most prairie marshes. However, this cycle may be accelerated to as little as 3-5 years in ponds and reservoirs due to turbidity, wave action, and uprooting by fish. As was discussed earlier, using the Adaptive Resource Management approach will help to determine when a water-level change is needed. The life of the established plants can be prolonged by small (1-2 feet), short-term (1-2 months), draw-downs that improve plant vigor and survival. When all of the vegetation has died off, then the system will need to be reset by a draw-down.

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APPENDIX A

Wetland Grades for WMA Management Plans

The condition grade for a wetland will be dependent on the type of wetland (HGM subclass/natural community type) and the wetland's natural water regime based on the Cowardin wetland classification system (i.e., temporarily flooded, saturated, seasonally flooded, semi-permanently flooded, intermittently exposed, and permanently flooded).

Wetlands, unlike grasslands or other habitat types found on Nebraska Wildlife Management Areas, can be highly impacted by conditions or alterations on neighboring land off the WMA. Hence, an evaluation of the entire watershed should be made to determine the grade of the wetland.

Fill out the ranking sheet for each area that is, or historically was, a wetland on the WMA. The total score shown at the end of the table will determine the overall condition grade for the wetland.

RANKING SHEET-Name of WMA: ______________________________

Wetland Hydrology

Condition	**Score**
The hydrology within the wetland has been fully restored.	30
The hydrology within the wetland has been fully restored to the extent possible. Some minor modifications still exist, but the wetland exhibits a high level of function.	20
The hydrology within the wetland has not been fully restored to the extent possible, but wetland still exhibits moderate functions.	10
The hydrology within the wetland has not been fully restored to the extent possible and the functions of the wetland are highly impaired.	5
Hydric soils are present, but the on-site hydrology is so altered that no wetland is present (if this is the case, the total wetland score should equal zero because there is no wetland present).	0

Siltation Threat

Condition	Score
The entire watershed is in perennial vegetation and managed using appropriate techniques per the prairie and woodland chapters.	30
The watershed, or a major portion of the watershed, is cropped but is under best management practices to control erosion, or with very little slope and there is a 300' wide continuous buffer from the outer edge of the hydric soil. The buffer is managed using appropriate techniques per the prairie and woodland chapters.	25
The watershed, or a major portion of the watershed, is cropped but is under best management practices or with very little slope and there is a 100' wide continuous buffer from the outer edge of the hydric soil. The buffer is managed using appropriate techniques per the prairie and woodland chapters.	20
The watershed, or a major portion of the watershed, is cropped and lacks best management practices and slopes are moderate to steep, and a 100' wide continuous buffer is present from the outer edge of the hydric soil. Or the watershed lacks best management practices and slopes are gentle. The buffer, if present, is managed using appropriate techniques per the prairie and woodland chapters.	15
Watershed lacks best management practices and slopes are moderate to steep, and no buffer is present.	10

Hydric Soil Ownership

Condition	Score
The entire hydric soil footprint of the wetland is on the WMA.	20
The entire hydric soil footprint of the wetland is not on the WMA, but the portion off WMA does not pose any serious management problems.	15
The entire hydric soil footprint of the wetland is not on the WMA and the portion off WMA poses some challenges to wetland management.	10
The entire hydric soil footprint of the wetland is not on the WMA and the portion off WMA poses serious management problems.	5

Watershed Impairment

Condition	Score
The watershed is fully intact, or at a minimum supports a fully functioning wetland. There is minimal alteration of the upland watershed source area through structural surface alterations or irrigation tail water addition; existing catchment is 85% - 110% of historic.	20
Surface alterations of the upland watershed source area that impact overland flow into the wetland have occurred, however, no irrigation additions and 75% - 84% of catchment area is intact.	15
Surface alteration of the upland watershed source area is changed to alter the dominant surface flow path of water to the wetland. However, the alteration(s) does not change the wetland water regime class and 25% - 74% of the catchment area is intact.	10
Surface alterations of the upland watershed source area have been changed to alter the dominant surface flow path of water to the wetland and the alteration(s) changes the wetland water regime class (e.g. a seasonal wetland has been changed to a semi-permanent).	5
Hydric soils are present, but the watershed is so altered that no wetland is present. If this is the case, the total wetland score should equal zero because there is no wetland present.	0

Plant Community (Invasive plant species are trees in non-forested wetlands, reed canary grass, hybrid cattail, river bulrush, Phragmites, purple loosestrife, salt cedar, and Russian olive).

Condition	Score
The wetland plant community is dominated by native, non-invasive species that are appropriate for the wetland type. Please refer to the document *Terrestrial Natural Communities of Nebraska* by Rolfsmeier and Steinauer for a description of the appropriate plant community.	20
The plant community is dominated by non-invasive species, but not necessarily all native species.	15
Invasive plants are present, but at manageable levels.	10
Invasive plants dominate the wetland vegetation.	5

Existing Management of the Wetland

Condition	Score
Management of the wetland consists of using activities that employ native disturbance dynamics (grazing, fire, water level fluctuations) or activities that mimic these native processes.	20
Management of the wetland is limited to using some activities that employ native disturbance dynamics (grazing, fire, water level fluctuations) or activities that mimic these native processes. The full suite of management tools is not being used on the wetland.	15
Management of the wetland consists of using few activities that employ native disturbance dynamics (grazing, fire, water level fluctuations) or activities that mimic these native processes.	10
Management of the wetland consists of using no activities that employ native disturbance dynamics (grazing, fire, water level fluctuations) or activities that mimic these native processes.	5

Presence of Utility Lines (power, gas, cable) or Roads Crossing the Wetland

Condition	Score
No utility lines or roads cross through the hydric soil footprint.	10
Utility lines or roads cross through the hydric soil footprint and pose minimal disturbance or management issues.	5
Utility lines or roads cross through the hydric soil footprint and pose significant disturbance issues.	0

Total Score (Range 0-150): ___________________

Grade A equals a total score of: 119-150
Grade B equals a total score of: 88-118
Grade C equals a total score of: 56-87
Grade D equals a total score of: 25-55
Grade F equals a total score of: 0

Important - If hydric soils are present, but the on-site hydrology or the watershed is so altered that no wetland is present, then the total wetland score must equal zero. These sites represent excellent restoration opportunities that would result in a high score gain.