A Landowner's Guide to Prairie Management in Minnesota

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Upland plover

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This booklet was developed by specialists of one sort or another but our intent was to provide an information base to help “make it work” for those on the land, those landowners who hold title to over 75% of Minnesota’s remaining prairie. It costs money for people to own prairie; so they must realize income of some kind or hold prairie values so dear that they willing to annually support land that will stay as prairie, or perhaps both. Interestingly, if left completely alone, much of Minnesota’s prairie lands would not remain as prairie but would eventually become overgrown with trees and be degraded by weedy species. Management of some sort is needed, be it burning, grazing, mowing, or haying. The photo collage above emphasizes that when these management actions are purposefully applied, they become “tools.” Even reestablishing prairie can be considered a tool. When these tools are applied to a prairie, they result in “products.” These can include satisfied landowners like Dean and Elaine Elmer who have a sustainable grazing rotation on their prairie hills near Ashby, or weaning calves ready for market, or aesthetic delights like wildlife and wildflowers.

Introduction

Native Vegetation of Minnesota

More than 18 million acres of prairie covered Minnesota prior to European settlement. Our prairie lands were part of the largest ecosystem in North America, stretching from Canada to Mexico and from the Rocky Mountains to Indiana. A wealth of diverse species, habitats, and cultures, thrived here. Today, less than 1% of our original prairie remains.

Prairie is the word we use in North America for the large expanse of grassland which once covered the middle of the continent. French trappers, traders, and missionaries were the first Europeans to see it and named the place as best they could. *Prerie* was their word for it. Back in France it meant grassland, a grassy orchard. About a quarter of the land on earth is grassland and it can be found on every continent except Antarctica. Because of their fertile soils, grasslands have become the "bread-baskets" of the world and as a result, are among the most altered natural ecosystems.

Prairies were maintained in their natural state by climate, grazing, and fire. They occur in regions commonly too dry to be a forest, and too wet to be a desert. Rainfall varies from year to year and there is usually a long, dry period during the summer months. Very few trees grow on the prairies and are usually widely scattered. Historically, fire would spread across the prairie very 1 to 5 years. These fires moved rapidly across the land, killing most saplings and removing the thatch of dead grasses, allowing early flowering spring species to grow. Before settlers moved west, prairies were covered with herds of grazing animals, such as buffalo, elk, and deer. These animals increased the growth in prairies by recycling nitrogen to the soil through urine and feces, and creating open areas for plants that like to have bare soil. These 3 ecological factors; climate, grazing, and fire, combined to create and maintain an expansive sea of grass resplendent with colorful wildflowers and abundant wildlife.

Bison grazing on native prairie in Blue Mounds State Park in southwest Minnesota near Luverne.

Minnesota lies near the northwestern corner of the tallgrass prairie formation. In presettlement times the tallgrass prairie essentially covered all the land east of the Great Plains (containing short and mixed grass prairie) and west of the eastern deciduous forest. It occupied a wide variety of landforms; beach ridges and swales, flat glacial lakebeds, morainic hills, steep bluffs, and rolling till plains. On different landform types from southeast to northwest Minnesota, important differences are seen in the composition of plants and animals that make up the prairie. However, the most striking feature of the prairie is its general uniformity across its large range. The prairie is dominated by a few major grasses and these are distributed according to moisture and topography. Major prairie types are:

Signs of the past–a bison rubbing rock and wallow in northwest Minnesota near Felton.

Dry Prairie—dominated by mid-height grasses—little bluestem, sideoats grama, and porcupine grass and flowers such as pasque flower, purple coneflower, prairie smoke, and dotted blazing star; found from the steep Mississippi River bluffs in southeastern Minnesota to the beach ridges of the northwest.

Dry prairie knoll with purple coneflower.

Prairie smoke and hoary puccoon, plants with dry prairie preferences.

Van Gooch

Somewhat of a misnomer, the magnificent wood lily is a mesic prairie plant.

Mesic Prairie—supports grasses up to 6 feet tall—big bluestem, Indian grass, switchgrass, and prairie dropseed prevail along with heart-leaved alexander, Maximilian sunflower, and wood lily; found throughout the prairie range of Minnesota.

Mesic prairie dominated by big bluestem and Indian grass.

Wet Prairie—prairie cordgrass, bluejoint reedgrass, big bluestem, tall blazing star, and mat muhly as well as several sedge species can be seen here; found throughout the prairie zone, but is especially common in the northwestern corner of the state bordering the Red River Valley.

Preserving this complex ecosystem—home to 40% of Minnesota's rare species—is critical to maintaining our state's natural heritage. Prairie vegetation also plays a key role in reducing soil erosion, supplies habitat for a wide variety of wildlife, and provides important pasture land. Whether you are a farmer, rancher, or prairie ecologist, the continued loss and deteriorating condition of our native prairie remnants is alarming. Without disturbances such as fire, haying, or grazing, Minnesota's prairies are becoming shrubby and overgrown with tree species such as red cedar, box elder, elm, oak, and aspen. Too much disturbance is also a problem.

Robert Dana

Wet prairie dominated by prairie cordgrass and tall blazing star.

Season-long overgrazing, for example, slowly converts a native prairie pasture to one dominated by exotic, cool-season grasses such as Kentucky bluegrass as well as, Canada thistle and leafy spurge, troublesome noxious weeds

Of the estimated 150,000 acres of prairie remaining in the state, 75% is privately owned. Hence, it is no exaggeration to say, *"The future of Minnesota's prairie depends on the good stewardship of farmers, ranchers, and other private landowners."* The goal of this booklet is to provide landowners, particularly those with livestock, an understanding of how to maintain or restore their prairie to a healthy, productive condition; one that is good for their prairie, as well as the landowner's bottom line.

The delicate, white lady slipper orchid of wet prairies.

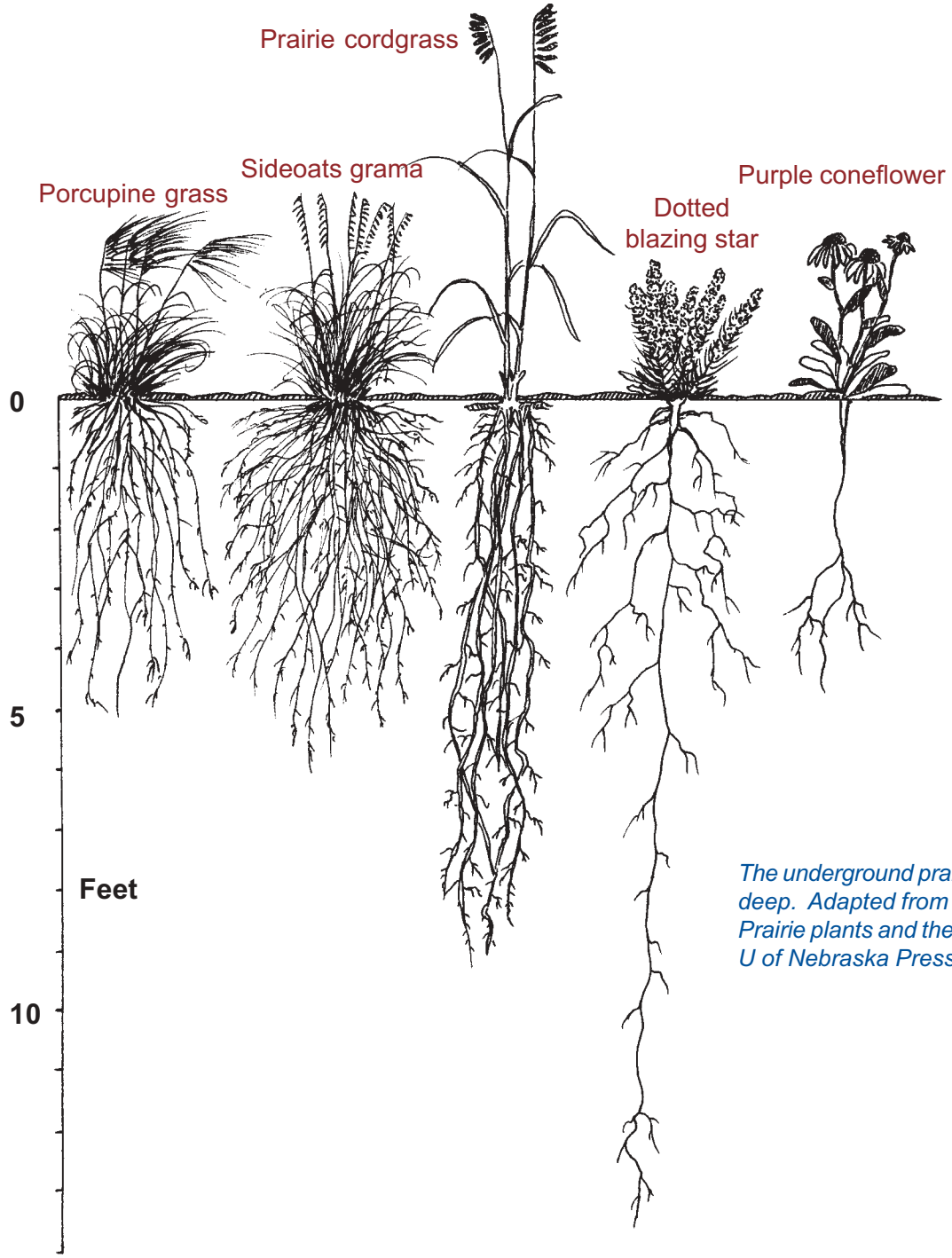
Fire Effects on Prairie

Fire is a natural and necessary disturbance in the tallgrass prairie. It interacts with climate to determine where grasslands will dominate over forests because both limited rainfall and fire, restrict tree growth. Fires were routine occurrences in the prairie prior to European settlement and were ignited both by lightning and Native Americans.

Tallgrass prairies are dominated by warm-season perennial grasses such as, big bluestem, Indian grass, and switchgrass on moist sites, and by little bluestem and sideoats grama on drier sites. These species are classified as warm-season grasses because they begin actively growing in late spring or early summer when soil and air temperatures are warm and

Fire in the tall grass.

continue to grow throughout hot, dry periods in the summer. In contrast, cool-season grasses, such as non-native smooth brome and bluegrasses, begin growing right away in the spring, and usually become dormant during the hot, dry months of summer. Also present in the prairie are several species of cool-season native grasses, such as junegrass, needlegrass, Canada wild rye, and prairie dropseed, as well as a large variety of perennial wildflowers (known as forbs) that bloom in succession from spring through fall. Native prairie plants have roots that reach deep into the soil and some species store large food reserves in these roots or in rhizomes.



The underground prairie where roots go deep. Adapted from Weaver, J.E. 1968. Prairie plants and their environment. U of Nebraska Press, Lincoln.

The warm-season physiology of dominant prairie grasses makes it possible to use fire to selectively control invading non-native grasses. Fires set in the spring, when most prairie plants are still dormant and cool-season grasses are actively growing, can damage undesirable Kentucky bluegrass and smooth brome, while leaving many prairie species untouched. Fire also removes accumulated dead plant material, so sunlight can warm the blackened soil surface after a fire. Scarification by fire and increased light stimulates germination of forb seeds. Within a few days after fire, native plants begin to sprout from growing points below the soil surface.

In addition, fire limits woody vegetation that often invades unmanaged prairies by damaging growing points of trees and shrubs and their protective layers of bark. Native shrubs like; smooth sumac, prairie crabapple, and western snowberry, are usually top-killed by fire but resprout from their roots. Tree seedlings are usually killed by fire. Older trees may only be weakened, or resprout from their roots, making several applications of fire necessary for adequate control of some species.

Fire also stimulates germination of sweet clover seeds; a non-native biennial species which is not welcome in high-quality prairies. Because it blooms and produces seeds in its second year of growth, seed production can be reduced by mowing once or twice during the second summer after a burn.

Burning a prairie after leaf-out of woody vegetation.

Effects of timing of burns

Early spring burns have been shown to enhance the productivity (both growth and tillering) and flowering of warm-season native grasses, stimulate flowering of many forbs, and enhance seed germination of some native plant species. However, this isn't always the case due to variations in annual precipitation or length of time since the last burn. While spring burns decrease the vigor and cover of exotic cool-season grasses, they also can adversely affect flowering of some spring-blooming native forbs.

Fall fires produce many of the same positive effects as spring fire because cool-season grasses begin a second period of active growth at the end of the summer. Native species are generally dormant when fall burning conditions are present after frost.

Effects of summer fire are not well studied, but natural fires would have occurred at that time during drought periods.

Summer fire tends to reduce flowering of warm-season grasses and stimulate growth of annual plants. They can also stimulate growth and flowering of Kentucky bluegrass in the summer of the following year because it's dormant during a summer fire, but actively grows later in the fall.

Purple prairie clover

How often to burn?

Fire frequency is an important consideration in prairie management. Annual burning promotes the dominance of warm-season grasses and reduces native cool-season grasses and forbs. Ideally, managers should mimic historic fires, but unfortunately, we don't know what the original frequency and seasonal occurrence was. Most studies suggest a fire frequency of 3 to 5 years is best, with a mix of burns during spring and late summer for maintenance of a healthy and diverse prairie community.

It is unwise to burn an entire prairie in a single year. Besides the plants they support, prairies are home to a wide diversity of vertebrate and invertebrate animals. Burning only part of a prairie each year (perhaps a third or fourth) leaves an important refuge for these animals. This is especially important for some butterflies which may be present in the spring, not as adults, but as eggs or pupae that cannot escape from fires. These vulnerable species can escape the fire in unburned areas and later recolonize burned areas where growth will be vigorous. It is also important to plan burns so that not all of a habitat type, such as a dry knoll, is burned at once. Fire breaks should divide these in case a plant or animal species is restricted to those specific habitats.

Mowing and Haying

More labor-intensive methods of prairie management would include mowing (or clipping) and haying. Generally, mowing is used as a type of weed control or to stimulate the regrowth of more palatable forage for grazing. Haying has been extensively used in Minnesota prairies as a means of forage harvest for on-farm livestock. Until the late 1960's there was a market for prairie hay as horse forage and many tons were shipped by rail to Kentucky and Tennessee. A notable difference between mowing and haying is that the herbage is removed by haying as opposed to being dropped in place. Haying exports nutrients and presumably lowers productivity over time. In spite of this, many high quality Minnesota prairies have a long history of haying, which was particularly effective in brush control.

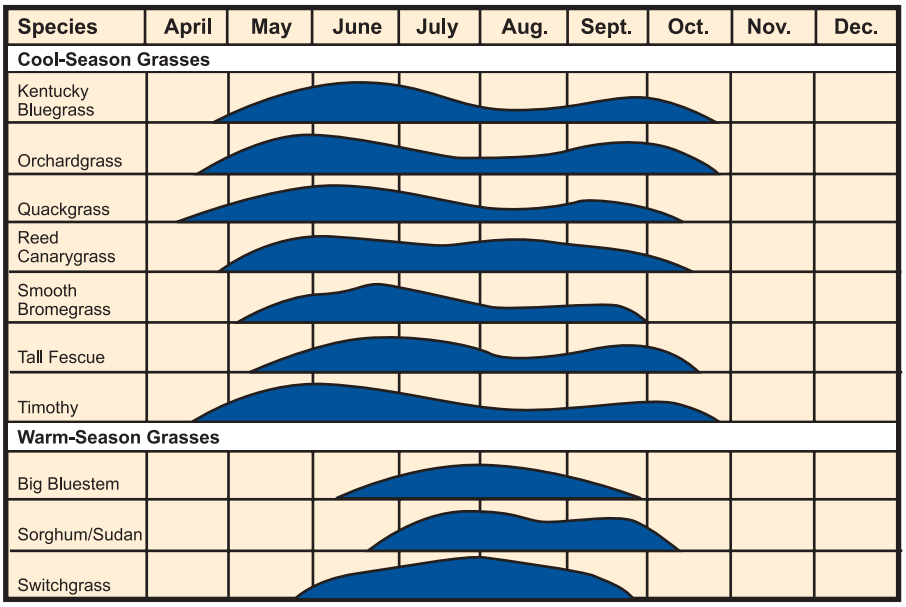
Mowing and haying are non-selective.

Like fire, mowing/haying are non-selective in defoliation action; that is, they remove top portions of all plants that can be cut off. Obviously it would be limited by the accessibility of equipment so wet ground, steep topography, rocky areas, and uneven terrain would prevent cutting. Often, burning was used in concert with haying to improve the quality of the forage by recycling nutrients tied up in litter and top-killing younger woody vegetation to produce more nutritious regrowth.

Haying of Minnesota prairies typically occurred in fall (generally after September 15, the average date of fall frost) after the majority of prairie plants had set seed, stopped growing, and replenished underground reserves. Hence, other than exporting nutrients in harvested hay, haying as a "management" technique did not seem to seriously damage most prairie species except perhaps late maturing species like gentians and ladies' tresses orchids. It should be noted however, that this is not the date to harvest prairie hay with a maximum protein content; that date would be when most warm-season grasses are actively growing in mid-summer. In tallgrass prairies of central Missouri, late June to mid-July is the best compromise date for forage quantity and quality. Depending on the year, this time period might be a useful reference date for Minnesota. Haying earlier allows prairie plants to replenish energy reserves before fall and provide more residual wildlife cover the following spring. However, mid-summer cutting could be detrimental to late ground-nesting birds and broods. Thus, there are 2 acceptable times for prairie harvest in Minnesota; mid-summer and after fall frost. Haying is also used as a prairie management technique in instances where fire is not feasible due to smoke management concerns as in residential or other sensitive areas.

Grazing and Prairie Vegetation

Like fire, grazing was an important factor in the maintenance of tallgrass prairies and the evolution of warm-season grasses. A native prairie dominated by warm-season grasses can provide desirable summer grazing when cool-season grasses are less productive. If a native prairie is not available, livestock producers often establish warm-season pastures to rotate with conventional, cool-season pastures. Warm-season grasses start actively growing about 4 to 6 weeks later than cool-season grasses and complete 60 to 90% of their annual growth during June, July, and August.



Seasonal growth patterns of cool-season and warm-season grasses used for forage. From Undersander, et al. 1994. Pastures for profit – a guide to rotational grazing. University of Wisconsin and University of Minnesota Extension.

Sideoats grama thriving on a well-drained site.

Warm-season grass pastures grow best on well-drained, fertile soils but are mostly established on soils with growth limitations because they perform better than cool-season grasses on those sites. Compared to cool-season grasses, warm-season grasses are more efficient in using nitrogen and water, and need less phosphorus. Of warm-season grasses, switchgrass tolerates poorly drained soils, flooding, and salinity best, and big bluestem, little bluestem, and sideoats grama are better adapted to well-drained or droughty soils.

Effects of grazing native warm-season grasslands

Well-managed grazing can restrict woody vegetation encroachment into grasslands, prevent excessive litter accumulation, improve forage production, and accelerate decomposition and nutrient cycling. Grazing can thus improve the use and quality of warm-season grasslands. Removing litter makes high quality forage more accessible to grazers and more light reaching the base of plants stimulates increased tillering. Rhizomatous species (those with underground stems), such as big bluestem, switchgrass, and Indian grass, all develop more tillers when the old vegetation is removed.

Livestock producers will do something if it is simple, profitable, and they feel good about it.

Harvey Peterson
Extension Agent, NDSU
Beach, North Dakota

Warm-season grasses are generally lower in forage quality than cool-season grasses, yet animals consuming these grasses often perform better than might be expected. In many warm-season grasses, stems become unpalatable later in the season due to low digestibility and protein content. Removing shoot tips by grazing during stem elongation delays stem development while stimulating leaf and tiller growth. Stems elongate and mature at different times among the warm-season grasses and this affects grazing management decisions. For example, switchgrass develops stems 2 to 3 weeks earlier than many warm-season grasses with Indian grass being one of the latest. Improper timing of switchgrass grazing results in poor animal performance and may be detrimental to stand health. Grazing that removes young stems in early summer will delay switchgrass stem heading and provide higher quality regrowth forage later in the grazing season. Generally, in mixed native grasslands, it is important to graze switchgrass when it is ready, despite other warm-season grasses not being ready. A typical scenario involving switchgrass and other warm-season native grasses is to give livestock access to a 14 - 18 inch grassland and graze it down to a 6-inch stubble in a 2 - 3 week period. Livestock should return to grazing cool-season pastures for a 6-week period, and then return to graze the regrowth, but ensuring an 8-inch stubble is maintained for the fall.

Grazing Systems

Season-long grazing

The main grazing method on all pastures in Minnesota is season-long, or continuous grazing, where livestock are turned into a pasture in the early part of the grazing season and removed late. Livestock have access to any plant in the pasture for the entire grazing season. Early in the season, livestock will select plants they most prefer and will continue to graze these plants before they have had a chance to replenish root reserves depleted during regrowth from previous grazing. The overall effect is that the plant becomes less vigorous, and may even die as a result. As more preferred plants become scarce, less desirable plants are grazed. In nearly all continuously grazed pastures, all but the most undesirable plants (thistles, for example) will be grazed to a point of being unhealthy and lack vigor. This opens the canopy of grass and allows invasion by undesirable plants such as, Kentucky bluegrass, and smooth brome.

Season-long grazing has converted this prairie to mostly Kentucky bluegrass, fringed sage, and western snowberry.

Beside the negative effect on native prairie plants and animals, continuous grazing leads to compaction of the soil surface. As the quantity of available forage shrinks through the grazing season, livestock must travel farther to find their daily forage. When confined, this means walking over the same area several times in a week and areas simply can't recover from this overutilization.

Rotational grazing

Rotational grazing is the controlled movement, or rotating, of livestock through a pasture system. Plants are grazed for a relatively short period of time then allowed to recover for a longer period of time. Typical grazing periods on native rangelands are from 5 days to 2 weeks depending on herd size, size of the grazing unit, and the use of "key" plant species. Grazing on a particular paddock should be discontinued when the desired stubble heights of key species is reached. These residual stubble heights range from 6-8 inches for warm-season tallgrasses (big bluestem, Indian grass, switchgrass),

"Over the years as a cattle producer I have learned that growing a good crop of grass is my top priority. My herd's success depends upon the quality of my pastures."

--Mark Fredrickson

Greater prairie chickens need 8-10 inches of residual cover for nesting.

to 4 inches for mid grasses (sideoats grama, little bluestem), to 2 inches for short grasses (buffalograss, blue grama). Gains per animal and per acre are often significantly greater in a rotation versus a continuous grazing system. Improved gains are due to less waste from trampling, more actively-growing plants, and more leaves compared to stems; all of which result in higher forage quality and quantity at the time of grazing

Stand decline and increased invasion of cool-season grasses and summer annual grasses are common symptoms of native warm-season pastures not given adequate rest between grazing cycles. The recovery, or "rest," period is essential because then plants can grow and replenish stored food reserves before being grazed again. Root and rhizome growth is enhanced during this time and plant health, vigor, and survival are increased. Maintaining vigor of preferred plants will prevent dominance by undesirable plants. In addition to the benefits to plants, soil compaction is reduced, water infiltration is improved, and wildlife cover is maintained.

A goal for a livestock producer is: Every day, graze the best grass.

Rapid rotation or Savory cell

This system involves a pasture being subdivided into several paddocks arranged like sections of a spoked wheel with a centrally-positioned water supply. The livestock manager rotates animals from one paddock to another every 3 or 4 days by simply opening and closing 2 gates at the water source. Livestock stocking densities may be high but the duration is short and, depending on the number of paddocks, each paddock has a rest period of 30 days or more. Drawbacks to this system are that central watering areas become severely overused and vegetation away from the water source is underutilized. One suggestion is to place mineral/salt blocks at the distant ends of paddocks to encourage better distribution of use.

Savory cell grazing system with a centrally-positioned water supply serving 12 paddocks.

Effects of livestock type

Each type of livestock has its own grazing habits and forage preference. To optimize grazing management of a prairie, one must consider these variables.

Cattle. Cattle tend to eat forages that are in front of them. As they consume preferred species, they move to find and eat more of these. They move as they eat. Because cattle do not have upper teeth, it is believed they can't eat close to the soil surface. However, when there is little to eat, they will crop pastures very close to the ground.

Bison. Bison have a diet similar to cattle, but tend to eat as they walk. As a result, they usually graze a pasture more uniformly in height. They also tend to travel farther to forage than cattle, rather than graze one end of a pasture while leaving the other end untouched. Studies in the shortgrass prairie showed bison preferentially consumed grasses and ate very few forbs, whereas cattle consumed a much higher proportion of forbs. Another characteristic of bison is their desire to roll in the mud or dust. Thus, bison pastures are typically pock-marked with wallows. Sandy soils are very susceptible to wind erosion from this activity. Vertical banks of bare soil, as found along streambanks, are also susceptible to rubbing and disturbance by bison.

"We've been real pleased with the Savory cell system on our prairie hills. The grazing cooperator has been successful, the prairie grasses and wildflowers seem healthy, and we see lots of wildlife."
--Dean Elmer

Horses. Horses can be destructive to pastures if grazing is not controlled because their hooves efficiently "tear" the soil surface. Also, they have upper and lower teeth that are capable of grazing very close to the soil surface, have a tendency to pull up forages as they graze, and often "spot graze." The typical grazing pattern for horses is to graze a small part of a pasture very short and keep coming back to that same area. They tend to deposit their manure in another part of the pasture, but will not eat the forages there. The remainder of the pasture is grazed very little; even forage that appears to be ideal for grazing by other types of livestock.

Overgrazing

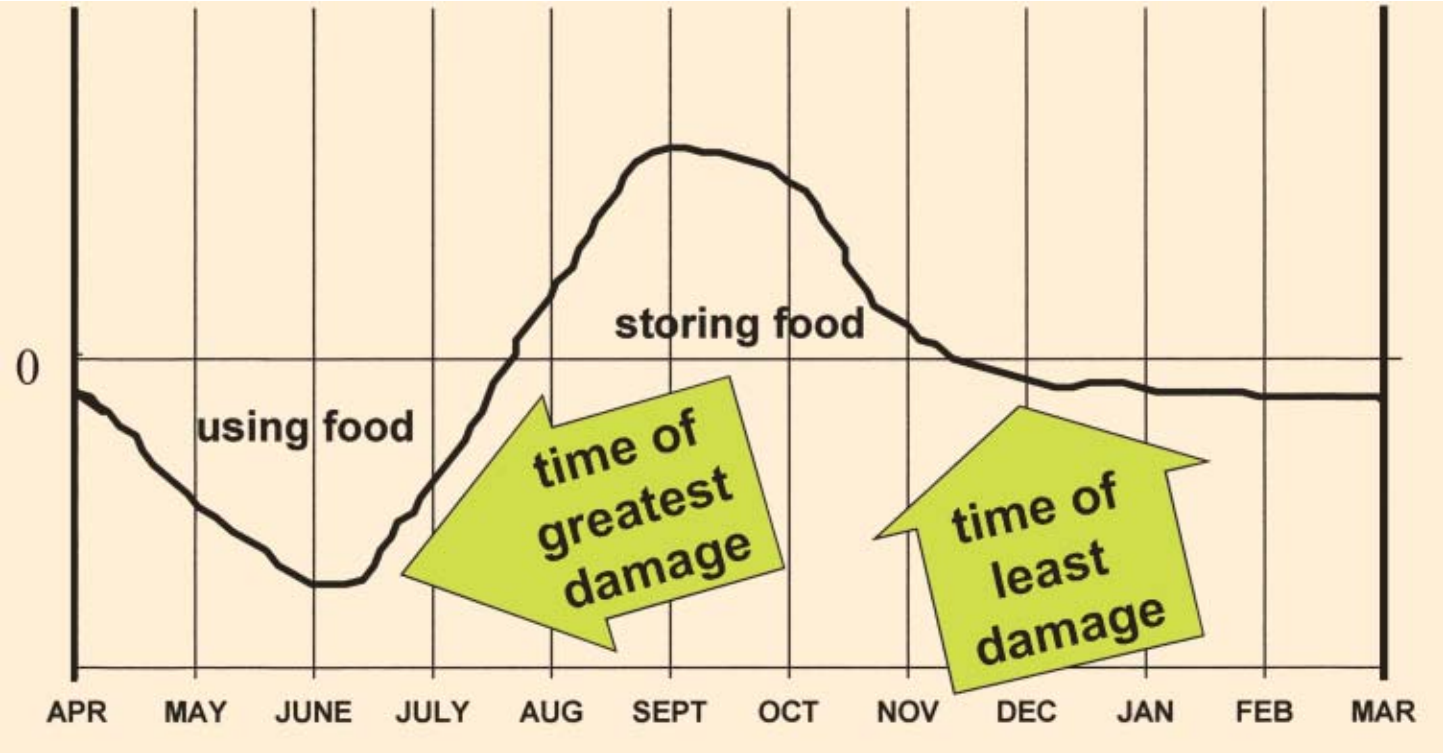
Overgrazing of native prairie is caused by stocking with too many livestock for too long. This results in reduced forage yield, soil erosion from livestock "trails" and excessive runoff, a change of plants to those less desirable, and invasion of exotic plants.

Overgrazing is not how much biomass is harvested but how much rest the plants get before being harvested again.

John Gunderson
Range Manager
U.S. FWS
Detroit Lakes, Minnesota

Low productivity

Production in overgrazed pastures is reduced for several reasons; loss of plant leaves essential for photosynthesis, corresponding loss of roots, and soil compaction which leads to reduced water infiltration and less air exchange between the atmosphere and the soil. In well-managed grazing systems there are adequate leaves remaining after grazing to allow plants to replenish stored food reserves. If plants are nearly completely defoliated, as in an overgrazed situation, regrowth comes from dormant buds near the ground surface. Since energy for regrowth comes from stored energy in the roots, this causes significant reduction of the root mass. Reduced roots means the plant is less able to take up nutrients and water from the soil and forage growth is less, especially in the dry part of the grazing season. Overall plant health and vigor is drastically impaired.



General relationship between the timing of defoliation by grazing and the root and rhizome carbohydrate reserves of perennial prairie plants.

Erosion

Reduced infiltration results in increased runoff which can lead to serious erosion problems. In a continually grazed system, livestock often walk long distances to water sources and form trails which can divert runoff and concentrate flows. In rotation grazing systems, water is provided to livestock in each paddock and trail formation is reduced. Another important aspect of rotational grazing systems is the rest period when livestock are moved to a different part of the pasture. Soil has a chance to recover from effects of livestock traffic received during the grazing period.

Change of plant community

Plants that are preferred by livestock, and therefore first to be eaten, are called "*decreasers*" because grazing weakens them and their numbers decrease. Plants less preferred by livestock are referred to as "*increasers*" because they aren't grazed as heavily and maintain their vigor more easily. When preferred plants or decreasers can no longer provide competition, increasers expand their dominance. Native prairie decreasers include big bluestem, Indian grass, sideoats grama, and little bluestem. Desirable forbs that are considered to be decreasers include leadplant, coneflowers, and purple prairie clover. Increasers among grasses include red threeawn, foxtail barley, and needle-and-thread. With overgrazing, short grasses, such as blue grama, may increase simply because their growing point is low to the ground and they do not require as much soil water for survival. Forbs that are increasers include *Artemesia* species (absinthe wormwood, fringed sage, common sagewort, etc.), American licorice, and western snowberry.

Solar-powered well pump providing water to rotationally grazed paddocks in Manitoba tallgrass prairie.

Big bluestem, a highly palatable decreaser.

Blue grama grass, growing with dotted blazing star, is an increaser due to low growing points or buds.

Plumeless thistle, an invader, is becoming very common in continuously grazed prairies.

Under intensive, continuous grazing systems, both decreaser and increaser plants may be greatly reduced or eliminated and this makes it possible for *"invader"* plants to move in. Invaders are generally non-native plants with limited palatability such as thistles (Canada, plumeless, musk, and bull). The relative amounts of decreaser, increaser, and invader plants present in a prairie are an indication of "range condition." Things are in good shape if decreasers are the dominant plants; bad shape if most are invaders.

Cattle avoiding milkweed in a burned prairie.

Maximilian sunflower

Interactions Between Fire and Grazing

We often think of managing prairie vegetation either by fire or by grazing, but not always do we think of using both. However, research suggests that a *combination* of these tools may be ideal for maintaining healthy and diverse prairie plant communities since it most closely mimics natural conditions. Fire and grazing remove plant matter differently; fire is unselective and typically burns everything in its path, whereas cattle and other grazing animals remove vegetation selectively. The greater selectivity of grazers often leads to a more diverse plant community (especially of forbs) than does burning.

When given a choice, cattle, bison, and other grazers prefer areas that have been burned more than unburned grasslands. Fire removes standing dead vegetation and encourages rapid regrowth of plants, thus attracting grazers to burned areas. In addition, fire can increase pasture utilization efficiency by encouraging grazers to use the entire pasture. In unburned prairies, cattle return again and again to previously grazed areas, leaving previously ungrazed areas alone. In burned prairies, grazing is more evenly distributed throughout the pasture; assuming the entire area has been burned. Fire will not carry through a pasture that has been heavily grazed. Therefore, to treat a grazed prairie with fire, cattle have to be removed early enough the previous fall to allow regrowth of sufficient vegetation to support a fire.

Preferential grazing use of burned prairie on right half of photo. Unburned prairie on left, grazed very little.

Spring fire combined with grazing may help control shrub dominance in prairies. Spring fires only top-kill woody shrubs like willow, western snowberry, leadplant, sumac, and sand cherry. They vigorously resprout after a fire and their tender new shoots are much more palatable to grazers than the woody stems present before the fire.

Depending upon management goals, the practice of burning to increase forage utilization can be used to excess. In the Flint Hills region of Kansas and Oklahoma, ranchers spring burn extensive prairie areas and subsequently graze them at heavy stocking rates. Although this does increase livestock gains, it occurs during the nesting and brooding season of the greater prairie chicken whose populations have experienced recent declines in those areas.

Thomas Bragg

Bison responding to patch burning at Wichita Mountains National Wildlife Refuge in Oklahoma.

A variation of this practice called "patch burning" holds promise as a management tool on conservation lands and is being applied in Missouri and Oklahoma. In this technique, only a portion, perhaps 25%, of a prairie unit is burned and cattle or bison preferentially graze these burned areas, leaving unburned areas available for wildlife cover. In subsequent years, different sections of the unit are burned which achieves a kind of rotational grazing without the use of fences. On a small scale, this technique probably closely resembles original fire/grazing patterns.

Grazing and Wildlife

Since warm-season pastures aren t grazed until late June/July, they would be generally better to provide early season nesting cover than cool-season pastures.

The original setting

Sometimes people believe grazing is detrimental to wildlife, and it certainly can be. Like most things it depends on the situation. Intensive, season-long grazing which reduces plant cover to a "lawn" is bad for most prairie species except, killdeer, horned larks, and Richardson's ground squirrels or "flickertails." Bison and elk were original large herbivores of Minnesota prairies and their grazing was an integral part of the natural prairie processes, along with fire, drought, and floods. These herbivores occurred in huge herds capable of denuding vegetation but were not confined by fences and moved across the landscape in response to the presence of better forage elsewhere – such as would occur after prairie fires. There were probably many interactions between grazers and fire on the original tallgrass prairie. If grazers stayed in an area long enough to reduce the grass, those areas would not carry a fire. Areas where enough grass was present to carry a fire, and where a fire got started by Indians or lightening, would become attractive grazing areas and grazing herds moved to them. More subtle relationships existed. When a prairie that contains bison chips or manure piles burns, these may smolder for hours causing the soil to get hot enough to kill perennial plants and create bare ground or "holes in the grass." Annual forbs can then colonize these spots and become attractive micro-habitat for insects which are then available to young prairie birds.

Adding to the diversity

Diversity, or variety, in prairie plants and animals is considered a desirable quality in overall prairie health and function. Grazing, whether by native grazers or domestic livestock, contributes to this diversity. Large grazers may open up rank tallgrass vegetation and improve access at ground level for young broods of prairie chickens and sharp-tailed grouse. Scattered, closely-grazed areas may provide open areas for wildlife to sun themselves after rains, and dusting areas to control parasites. These areas may also be habitat for early-growing plants that provide greens for wildlife food. Prairie chickens will use these short cover areas for spring courtship display.

Llewellyn Manske

Prairie chickens need undisturbed cover for nest placement, but once chicks hatch they need lightly disturbed areas which allow them to move freely and hunt insects.

Grazing may also open up vegetation of prairie wetland edges to wildlife, such as shorebirds and waterfowl, that prefer short cover to feed on invertebrates or to rest while being able to detect the approach of predators. Grazers like wetland edges during the summer where they coat their lower legs with mud to deter insects. So long as it isn't excessive, manure deposits probably stimulate invertebrate populations that are eaten by shorebirds and ducklings.

Bruce Flaig

Some privately owned prairies host prairie chickens – splendid little athletes who gather on short cover areas in spring to compete for territories on display grounds.

Grazing as a wildlife management tool

Increasingly, conservation agencies are using cooperative grazing as a tool to achieve certain prairie management goals like litter reduction, brush control, and overall cover rejuvenation. Often, due to weather and manpower limitations, agencies are not able to complete prescription burns (generally the preferred management technique) on a 4-5 year rotation and supplement their management program with grazing. Under these arrangements, the private cooperator generally provides fencing (usually electric) and is responsible for moving livestock on schedule.

Battery-powered electric fencing is a convenient way to restrict livestock from nesting cover (left) and contain them in an area where brush control is desired (right). Mentor Prairie Wildlife Management Area. August 19, 1998.

Timing of this management grazing could be late spring/early summer, if the goal is to reduce cool-season bluegrass and smooth brome, or midsummer if brush control is a priority. Grazing at any time will reduce the litter buildup. Grazing under wet conditions can damage the sod and is generally avoided. Further creative opportunities are available for grazing cooperators and agencies to meet their respective needs while accomplishing better prairie management for wildlife.

Of the grazing systems discussed, continuous grazing is clearly the worst for prairie health as well as livestock production. Rotational grazing more closely represents original, moving-herd grazing action. A newer variation of this idea, rapid rotation or a Savory cell system, may have some applications. It has had limited use in Minnesota prairies but in a study near Ashby, Minnesota, the overall health of native prairie plants and breeding bird use was better in grazed paddocks compared to long-term ungrazed paddocks where litter accumulation and cool-season grass invasion was substantial. However, a more conventional rotation system might have yielded similar or even better results.

Actively growing clumps of big bluestem after early grazing to reduce cool-season Kentucky bluegrass and smooth brome. Mentor Prairie Wildlife Management Area. July 1, 1998.

Grazed paddock with healthy prairie on left, long-term ungrazed unit on right with flowering smooth brome and excessive litter buildup. Savory cell, rapid rotation grazing system near Ashby, MN.

Planting Prairie and Warm-Season Grasses

If a person has a piece of prairie on their land, great! If they don't, and wish to establish a prairie, it has never been easier because of the accumulated, "how-to" knowledge and the availability of equipment and seed sources. If the goal is to simply develop a planting of warm-season, native grasses for a mid-summer pasture rotation then the techniques are basically the same as planting a prairie. The reasons for establishing native prairie plants over exotic species are many but wildflower values are important and low maintenance after establishment is key as well. Agencies in Iowa are converting roadsides to prairies and justifying them on an economic basis alone when considering the cost of chemicals needed in weed control for conventional brome grass covers. The enhanced wildlife values and aesthetics are a further bonus.

A nice stand of planted prairie in western Minnesota.

As a point of clarification, planting a prairie in an area of cropland or where there were no preexisting prairie plants is referred to as *"prairie reconstruction."* Rejuvenating, by the use of prescribed burning, a prairie that has been degraded by overgrazing or non-management, would be an example of *"prairie restoration."*

Planting prairie is an exercise in proper planning and patience. Those used to seeing spectacular results immediately after planting, are usually disappointed with prairie projects because prairie plants grow down more than above ground when in the early establishment phase. This is why they are better competitors under drought conditions. When establishing a prairie, it generally takes 3 or more years to note results and much longer for full success.

Soil factors

Land in western Minnesota is where native prairie occurred in presettlement times and sites are generally well suited for prairie establishment. For that matter, much of the original deciduous forest along the forest-prairie transition is suitable for prairie so long as the soil pH is 7 or above. Different prairie species are adapted to a variety of moisture conditions so possibilities for plantings are wide indeed. On larger sites with varying topography, seed mixes should be adjusted to the moisture characteristics of the site; that is, plant dry prairie mixes on well-drained hilltops, moist prairie species on mid slopes, and wet prairie mixes in lowlands. Plants tend to sort themselves out over time, but with high–priced seed, it would be much more efficient and economical to adjust species mixes to ecological conditions as much as possible at planting time. Fertility is generally not limiting and in fact, low fertility is best because of reduced competition from exotic plants. Fertilizing is never recommended when establishing a prairie planting.

Sideoats grama

Site preparation

Site preparation is clearly the most important step in the process. If aggressive exotic plants such as reed canarygrass, quackgrass, or bird's foot trefoil are present, they can be very difficult to control later. Time spent in proper site preparation is time well spent, even if it means delaying planting a year while a "pre-crop" is grown such as, corn or soybeans. Roundup®-Ready soybeans are becoming a popular pre-crop because of lower weed seed carry-over. Conventional soybean fields often have had a variety of herbicides applied to control grass and carry-over may complicate prairie grass establishment. Corn can be a good crop to remove excessive nitrogen from the soil.

A Truax™ drill, specialized to plant feathery prairie grass seeds.

If the existing cover is a grassy sod, burn the fall before or spring, then apply Roundup® (glyphosate) when plants are actively regrowing. Later, burn the Roundup®-killed residue when dry enough then seed directly into the burn stubble with a specialized Truax™ or no-till drill. Seeding directly into a killed sod is especially desirable if erosion is a concern on slopes. Disturbing a sod could also expose more weed seeds. Sometimes prairie is seeded directly into a burned area and then Roundup® is applied when the unwanted vegetation is regrowing but before prairie seeds have germinated.

Seed source

The selection of prairie seeds is another very important step because of high cost. Seed must be chosen that is adapted to grow at a particular location and should usually be within 200 miles of its origin; better still if within 100 miles. Another important consideration is the germination qualities or the percent of "pure live seed." In Minnesota, the Minnesota Crop Improvement Association has recently developed a certification program for native plants that documents the source of origin and germination characteristics. This is the best guarantee of quality control. Smaller amounts of seeds can be hand collected from a remnant roadside prairie or perhaps collected under an agreement from a neighboring prairie. A list of prairie plant seed sources is contained in **Appendix 6**.

Seeding

The general approach is to first establish a good stand of prairie plants (heavy towards grasses) for weed control and then enhance with forb diversity later. Forbs may be drilled in or broadcast later after burning a reconstruction site. Seeding with a Nesbit™ or Truax™ drill can be done in late spring and early summer, or late fall in mid-September or early October ("dormant season seeding").

A specialized drill is needed to plant some of the prairie grasses such as bluestems and Indian grass which have feathery seeds that plug seed tubes without small augers. Seeding should be shallow (less than 1/3 inch deep) and into a firm seedbed so there is good contact between seeds and the soil. Seeding in 2 directions avoids the appearance of rows.

Broadcast seeding with a Vicon™ seeder or a fertilizer spreader can be used on a site that has been disked/harrowed and then followed by harrowing and packing after seeding. Alternative site preparations can be untilled soybean fields or burned grasslands.

A firm seedbed is required to receive the shallowly planted seeds.

In 1984, Larry Hanson and co-workers at the U.S. Fish and Wildlife Service Wetlands Office in Detroit Lakes pioneered a rather novel seeding technique which they call, "snow-seeding." This involves spreading seed (with a Vicon™ seeder) over snow. Seeds melt into the snow when warmed by the sun. As the snow melts it creates a "mayonnaise" consistency at the soil surface which helps incorporate seeds. Snow seeding is done when there is less than 12 inches of snow, usually in December, February, March, or April. Vicon™ seeders are mounted on a tracked vehicle and, with snow, seeded areas are visible. Hanson believes they get a better diversity of plants (more forbs, especially) using this method compared to a Truax™ drill and also, plants do not occur in rows. He believes it's better to seed forbs right away rather than try to establish them later. They prefer to seed following a crop of Roundup®-Ready soybeans. Their desirable seeding rate is 2 million "pure live seed" per acre, which converts to about 12 lbs. per acre. They do not clean seeds unless they are going to plant with a Truax™ drill. They later clip new seedings with a modified swather at a height that is just above the height of desirable plants (commonly 10-16 inches).

In some cases where livestock are available and the area to be planted is not large, high quality prairie hay can be spread and hoof action will effectively plant seeds. Care must be taken though that exotic plant seeds are not introduced in the hay or from livestock manure.

Equipment

Truax™ Company in Minneapolis makes a special, no-till drill but a conventional model works well in most no-till situations. The older model Truax™ or "Flex-Drill™" uses spring tension to press seeding disks down whereas the newer, "Flex-II™" uses hydraulic pressure. Vicon™ broadcast seeders are typically followed by harrowing and/or packing equipment to scratch seeds in except when used in "snow seeding" or when broadcasting over burned areas. Vicon™ seeders typically have an 18-foot swath width but need to be calibrated.

Maintenance/management

Maintenance should be planned for at least the first 3 years to ensure a good start for prairie plantings. After planting in **year 1**, clipping with a sickle bar, flail, or rotary mower at a height of 5-8 inches will usually be required 3-4 times, depending on the thoroughness of pre-planting weed control. Swathers may be useful due to their wider coverage and lighter weight. Hand weeding or spot spraying might be appropriate in small plots.

In **year 2,** clipping is usually required and varied depending on weed competition. "Roundup® over-spray" may also be carried out in the spring prior to the onset of native species' growth or after fall frost (late September/October). This typically doesn't harm warm-season species since they are not actively growing then. Generally, sites will have been mowed and target weed species (generally, cool-season, exotic grasses such as Kentucky bluegrass, reed canarygrass, quackgrass, smooth brome) are actively growing. A standard rate of Roundup® is 2.5 quarts per acre but occasionally good control can be achieved with only 1 quart per acre. A wick application of Roundup® can also be used for selective control. In some prairie plantings, early season grazing can be used to reduce competition from cool-season (native as well as exotic) grasses that might otherwise dominate a planting.

Year 3 should present a promising looking prairie with good stands of native grasses and wildflowers. Prescribed burning or mowing in late fall is generally a good clean-up procedure.

Yellow coneflower

Seed harvest

Where conditions permit the harvesting of native seed to be used in planting, some general principles apply:

1) Native prairie is generally seed-harvested in September but the drawback is that some earlier flowering species are missed;

2) If a planting site is relatively close to a harvest site, seed can be immediately spread, thus eliminating cleaning, drying, etc. The rule of thumb is "harvest an acre, plant an acre" but this is perhaps a heavier rate than needed;

3) Go to the best remnant prairie available to get good seed; and

4) Remnant prairies must not be damaged by seed harvesting equipment so care must be taken to not harvest in wet areas to avoid rutting.

Integrated Uses and Management of Prairie

The uses of prairie are many depending on the type of prairie, its size, ownership, and proximity to people and other habitats. Obviously, the uses will determine management applied to a particular tract. A private landowner with land taxes to pay, tends to have a utilitarian view of prairie and sees it as pastureland or hayland or perhaps as acreage which could be converted to additional row crop land. Some landowners have a sentimental attachment to a prairie if it represents a connection to the original family heritage on the farm. Ancestors may have harvested hay on a prairie 70-80 years ago, or present owners may have picked prairie wildflowers with a grandparent. These are ties that bind.

Harvesting of native prairie seed is a recent use of prairie that some landowners employ. This capitalizes on the high value of prairie seed due to planting of native vegetation covers by agencies, the use of prairie plants in Conservation Reserve Program plantings, and the increased interest that people have in natural landscaping.

A newly-established landscape planting in Minnesota using native prairie species.

"This harvesting of seed from the prairie has worked out real well for us, overall. You don't have to plant it and if you get it burned, you'll get a good seed crop. That is, if it doesn't rain too much at harvest time. And we have lots of prairie chickens around too."

---Jim Glass

Even after prairie seed harvest the previous fall, there is still adequate residual nesting cover for many wildlife species. May 31, 1997.

Prairie turnip or breadroot. Common on dry prairies, breadroot has a tuberous enlargement about 4 inches deep that was a starchy food staple of Plains Indians. This was dried for winter use and sold to early Europeans, including Lewis and Clark.

Minnesota prairies host over 300 species of flowering plants and some of these are known to have medicinal values. Noteworthy among these is echinacea, or purple coneflower, which grows on gravelly, dry prairies. This is currently the most popular herbal plant in the U.S. and accounts for over $80 million in annual sales. Some individuals are growing this plant for their own use and to supplement their income. In the 1970's, there was a concerted effort to collect seeds of tall meadow rue to evaluate its cancer-arresting properties. Who knows what additional values and uses lie still undiscovered in prairie remnants? Thus, it behooves us to save all the pieces we can of the unique landscape covering.

David Hansen

Purple coneflower and blue grama in flower. This plant of dry prairies in Minnesota and Great Plains states was used for more medicinal purposes by Plains Indians than any other plant. Extracts of this plant and its relatives are popular herbal supplements.

Noteworthy too, in the uses of Minnesota prairie, are their significant values as wildlife habitat. The array of animals and plants bring people from afar to experience them. Each season has a new performance to offer. In fact, the show changes weekly from spring to fall as different plants flower and as prairie birds go through courtship, nesting, and brood-rearing cycles. Migratory bird passages of waterfowl and sandhill cranes are nothing short of spectacular, as is the fall monarch butterfly migration. The prairie is indeed a vibrant place, whether our view is economic or aesthetic. The authors hope this booklet has highlighted some of these uses and values and makes a contribution towards better stewardship of Minnesota prairies.

Monarch butterflies in the fall. Occasionally monarchs will concentrate by the hundreds in certain farmstead groves as they move south to wintering areas.

Bruce Flaig

Bobolink. To many, the true sign of spring is when bobolinks arrive on breeding grounds after wintering in the pampas grasslands of Brazil and Argentina. It has the longest migration of any North American songbird!

APPENDIX

Appendix 1
Glossary

Animal Unit (AU).* Considered to be 1 mature cow (1000 lb.) either dry or with a calf up to 6 months of age, based on an average daily forage consumption of 33 lbs. of dry matter. Livestock which consume more or less forage than the standard animal unit are rated on an animal unit equivalent (e.g. 1300 lb. cow = 1.3 AU).

Animal Unit Month (AUM).* The amount of forage required by an animal unit for 1 month.

Carrying Capacity.* Maximum stocking rate possible on a sustained yield basis without causing damage to grassland vegetation.

Cool-Season Grass. Grass which grows mainly in spring and fall during cool temperatures (59-77 ºF is optimum), and requires only partial sunlight for full photosynthesis.

Decreaser. A high-producing, palatable plant that is part of the original prairie that is highly preferred by grazers and *decreases* in occurrence in response to grazing pressure. e.g. Indian grass.

Defoliation. The removal or top-killing of above ground vegetation by fire, grazing, or mowing.

Dominant Species.* Plants or groups of plants which, in terms of their abundance, coverage, or size, have considerable influence or control upon other species.

Forage.* All browse (woody) and herbaceous foods that are available to grazing animals.

Forb.* Any herbaceous plant other than those in the grass, sedge, and rush families that generally have broad leaves.

Increaser. A plant that is not as palatable as a decreaser plant and is part of the original prairie community, but *increases* in response to grazing. e.g. Blue grama, red threeawn.

Invader. Plant that is of very low palatability, usually non-native or exotic, which *invades* prairies or rangelands as more desirable plants are eliminated or severely weakened by grazing. e.g. Plumeless thistle.

Paddock. A subdivision of a pasture, usually separated by fencing.

Prairie Reconstruction. The establishment of a prairie planting on a site which contains no prairie species at the time; often in cropland, pastureland, or a construction site.

Prairie Restoration. The rejuvenation of a prairie which has been degraded by overgrazing, haying, or non-management. Generally involves a combination of rest, prescribed burning, and perhaps exotic or woody species control.

Pure Live Seed (PLS). Purity and germination of seed expressed in percent; may be calculated by the formula: PLS = % purity X % germination + hard seed.

Appendix 1, continued

Range. Land that supports a cover of herbaceous or shrubby vegetation useful for grazing animals.

Range Condition.* The state of health of a specific range area. The current productivity of a range, relative to what that range is naturally capable of producing. Often determined by the relative amounts of decreasers, increasers, and invader plants which are present in a grassland.

Residual Vegetation. Refers to vegetation that is left over from the previous growing season. It may be of low forage value but very important for wildlife nesting cover.

Rhizome. Underground stems, often quite common in grasses.

Stocking Rate. Actual number of animals on a specific area at a specific time. The area of land allowed per animal unit for the entire grazeable period of the year. Expressed as animal units/unit area (AU/Acre) or Area/AUM (Acre/AUM).

Tillering. The production of addition stems from buds low on a plant, often stimulated by grazing or mowing.

Warm-Season Grass. Plants which grow mainly in June, July, and August when temperatures are high (86-95°F is optimum) and in full sunlight.

**Adapted from: A glossary of terms used in range management. 2nd Edition, 1974. Society for Range Management. Denver, Colorado.*

Eastern kingbird

Appendix 2

Common and scientific names of plants mentioned in the text

Common name	*Scientific name*
Absinthe wormwood	*Artemesia absinthium*
American elm	*Ulmus americana*
American licorice	*Glycyrhiza lepidota*
Big bluestem	*Andropogon gerardii*
Bird's foot trefoil	*Lotus corniculatus*
Blue grama	*Bouteloua gracilis*
Bluejoint reedgrass	*Calamagrostis canadensis*
Box elder	*Acer negundo*
Buffalo grass	*Buchloe dactyloides*
Bull thistle	*Circium vulgare*
Canada thistle	*Circium arvense*
Canada wild rye	*Elymus canadensis*
Common sagewort	*Artemesia campetris*
Dotted blazing star	*Liatris punctata*
Foxtail barley	*Hordeum jubatum*
Fringed sage	*Artemesia frigida*
Gentians	*Gentiana spp.*
Heart-leaved alexander	*Zizia aptera*
Hoary puccoon	*Lithospermum canescens*
Indian grass	*Sorghastrum nutans*
Junegrass	*Koeleria pyramidata*
Kentucky bluegrass	*Poa pratensis*
Ladies's tresses orchid	*Spiranthes cernua*
Leadplant	*Amorpha canescens*
Leafy spurge	*Euphorbia esula*
Mat muhly	*Muhlenbergia richardsonis*
Maximilian sunflower	*Helianthus maximiliani*
Musk thistle	*Carduus nutans*
Needle-and-thread	*Stipa comata*

Appendix 2, continued

Oak	*Quercus spp.*
Orchardgrass	*Dactylis glomerata*
Pasque flower	*Anemone patens*
Plumeless thistle	*Carduus acanthoides*
Porcupine grass	*Stipa spartea*
Prairie cordgrass	*Spartina pectinata*
Prairie crabapple	*Pyrus ioensis*
Prairie dropseed	*Sporobolus heterolepis*
Prairie smoke	*Geum triflorum*
Prairie turnip	*Psoralea esculenta*
Purple coneflower	*Echinacea angustifolia*
Purple prairie clover	*Dalea purpurea*
Quackgrass	*Agropyron repens*
Reed canarygrass	*Phalaris arundinacea*
Red cedar	*Juniperus virginiana*
Red threeawn	*Aristida purpurpea*
Sand cherry	*Prunus pumila*
Sedge species	*Carex spp.*
Sideoats grama	*Bouteloua curtipendula*
Smooth brome	*Bromus inermis*
Smooth sumac	*Rhus glabra*
Switchgrass	*Panicum virgatum*
Tall blazing star	*Liatris pcycnostachya*
Tall fescue	*Festuca arundinacea*
Tall meadow rue	*Thalictrum dasycarpum*
Trembling aspen	*Populus tremuloides*
Western snowberry	*Symphoricarpos occidentalis*
White lady's slipper	*Cypripedium candidum*
White sweet clover	*Melilotus alba*
Yellow sweet clover	*Melilotus officinalis*
Willow	*Salix spp.*
Wood lily	*Lilium philadephicum*

Appendix 3

A grazing plan for Mentor Prairie

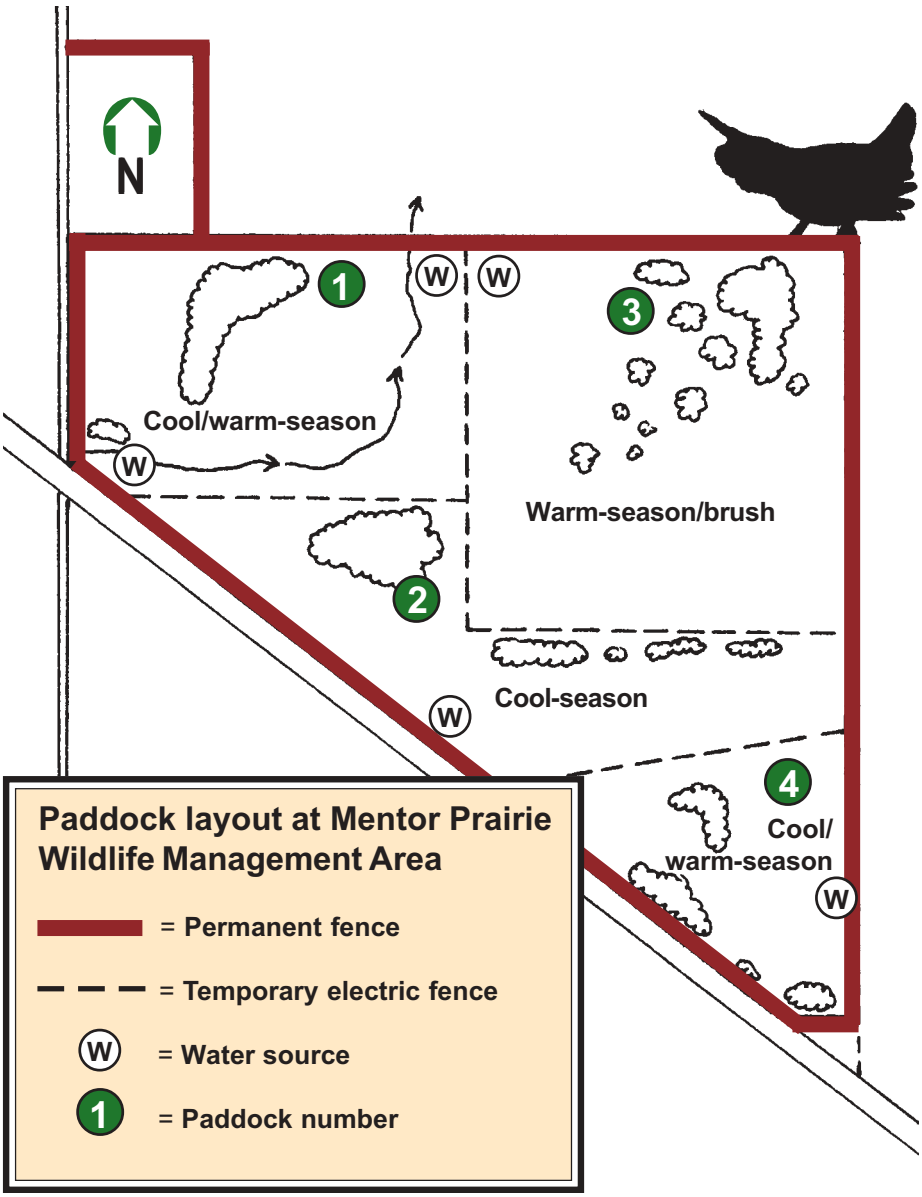
The Mentor Prairie Wildlife Management Area is located in northwestern Minnesota near Mentor. In 1998, grazing was initiated as a wildlife management tool but with the combined objective of providing livestock forage for a private cooperator as well. Using both grazing and burning as tools, the following objectives were established:

1. Shift plant composition from cool-season exotic species to warm-season natives, with the long-term goal of having prairies dominated mainly by warm-season plants.

2. Control brush, with long-term goal of having less than 25% "brush" (trees and shrubs) and all of that less than 6 feet tall.

3. Provide grazing opportunities that are practical to a cooperator and available for a given number of livestock from 15 May – 30 September.

The area was first divided into 4 paddocks containing similar amounts of forage within each. Productivity of each paddock was estimated by 30, $^1/_4$-m^2 plots collected in mid-August. For planning purposes, 25% of the total amount of plant productivity may be removed by livestock which makes allowance for vegetation which becomes unavailable due to trampling and soiling by excrement. Paddock 3, a low unit, was burned in the spring of 1998 to remove an accumulation of litter, top-kill woody vegetation, and stimulate root and stump suckering. The main vegetation recovery management was carried out in Paddock 1 where the intent was to graze early and stress cool-season exotic grasses (Kentucky bluegrass, smooth brome, and quackgrass) during their active growth while providing desirable forage for the cooperator. Cattle were removed from this paddock as native warm-season grasses began actively growing (see photo page 20). Livestock were grazed in each paddock for about 30 days and the cooperator reported satisfactory animal gains and vegetation management was accomplished as well.



Appendix 3, continued

Rotational grazing plan data for a portion of Mentor Prairie Wildlife Management Area						
Paddock	Desired grazing period	Acreage	Productivity, lbs/acre	Total avail. forage[2] lbs/acre	Cow days[3]	Allowable stocking rate[4]
1 Mesic prairie[1]	15 May-15 Jun	120	4,128	123,840	3,538	1/A (118)
2 Dry old field	15 Jun-15 Jul	100	5,338	133,450	3,813	1.3/A (127)
3 Wet brush prairie	15 Jul-15 Aug	150	3,767	141,262	4,036	0.8/A (126)
4 Mesic prairie	15 Aug-10 Sep	119	4,128	122,808	3,509	2/A (234)

[1] Predominant habitat type contained within paddock.
[2] Estimated as 0.25% of the total productivity x number of acres.
[3] Available forage¸ considering that the consumption rate of an adult Simmental cow is 35 lbs/day.
[4] Cows per acre (total cows per grazing period).

Wildlife and vegetation management is the primary goal, grazing is the tool to accomplish it.

Appendix 4

Land protection programs for landowners with native prairie

Many landowners want to help protect their native prairie lands – and be rewarded for their commitment. Fortunately, Minnesota has several effective programs and organizations that can help.

Conservation Easements

Minnesota Native Prairie Bank Program: This program is administered by the DNR Scientific and Natural Areas program. It protects native prairie through the purchase of conservation easements, while still allowing the land to remain in private ownership. Easements may allow selected agricultural uses, such as mowing for hay or grazing, to continue.

To apply, contact:

State Prairie Biologist
DNR Scientific and Natural Areas Program
1221 Fir Avenue
Fergus Falls, MN 56537
(218) 739-7576
E-Mail: prairie.biologist@dnr.state.mn.us

Website: **http://www.dnr.state.mn.us/ecological_services/sna/bankbrochure.html**

U.S. Fish and Wildlife Service Grassland and Prairie Easements: The U.S. FWS also purchases prairie and grassland easements from private landowners as part of its Northern Tallgrass Prairie Refuge.

To apply, contact:

Brett Wehrle, Manager
Northern Tallgrass Prairie National Wildlife Refuge
Rural Route 1, Box 25
Odessa, MN 56276
(320) 273-2191
E-mail: brett_wehrle@fws.gov

Website: **http://midwest.fws.gov/NorthernTallgrassPrairie/faq.htm**

Tax Incentives

Minnesota Native Prairie Tax Exemption Program: This program exempts native prairie lands from property taxes. Qualifying lands may be hayed but not grazed. Contact the local County Tax Assessor or DNR Area Wildlife Manager to apply.

For additional information contact:

State Prairie Biologist
DNR Scientific and Natural Areas Program
1221 Fir Avenue
Fergus Falls, MN 56537
(218) 739-7576
E-Mail: prairie.biologist@dnr.state.mn.us

Website: **http://www.dnr.state.mn.us/ecological_services/sna/exemptbrochure.html**

Registry Programs

Registry programs are a means by which conservation organizations honor and recognize owners of outstanding natural areas for their commitment to the preservation of their land. These are voluntary, non-binding agreements based on the Minnesota tradition of self-reliance and citizenship. The organizations administering these programs can provide the landowner information about the unique resources on their property, and tips on how to manage it.

Private organizations that administer registry programs in the state include:

The Nature Conservancy, MN Field Office
1313 5th Street SE, Suite 320
Minneapolis, MN 55414
(612) 331-0750
E-mail: jmuehlberg@tnc.org

Website: **http://www.tnc.org/minnesota**

Friends of the Minnesota Valley
3815 East 80th Street
Bloomington, MN 55425
(612) 854 5900
E-mail: mnvalley_friends@mail.fws.gov

Website: **http://midwest.fws.gov/MinnesotaValley/friends.html**

Friends of the Mississippi River
46 East 4th Street, Suite 606
Saint Paul, MN 55101-1112
651/222-2193
Email: info@fmr.org

Website: **http://www.fmr.org/**

Other Protection Tools

Landowners may also be interested in other land protection tools such as deed restrictions, mutual covenants, leases, donating land and more. *Land Protection Options — A Handbook for Minnesota Landowners* is a good publication describing a wide variety of ways landowners can preserve their land for future generations to enjoy. It was written and designed by Laurie Allman for publication by The Nature Conservancy, the Minnesota Department of Natural Resources, The Trust for Public Land, and the Minnesota Land Trust. Sprinkled liberally with landowner profiles describing successful protection efforts throughout Minnesota, this booklet is an invaluable information source for how open spaces can be preserved. Charts, tables, photographs, and illustrations combined with chapters on tax matters, stewardship considerations, and partners create an attractive, user-friendly publication.

Available in print from:

Minnesota DNR, Division of Ecological Services, Attention: Publications
500 Lafayette Road, Box 25
St. Paul, MN 55155
(651) 296-2835
E-mail: ecoservices@dnr.state.mn.us

Website: **http://www.dnr.state.mn.us/ecological_services/nhnrp/landprot.pdf**

It is also available online at the Great Plains Partnership website **http://www.greatplains.org/resource/1998/landprot/landprot.htm** in html and pdf formats

Appendix 5

Useful references

Blanchet, Kevin, Howard Moechnig and Jodi DeJong-Hughes. 2000. ***Grazing systems planning guide.*** University of Minnesota Extension Service, St. Paul, MN. Good general guide to grazing systems with emphasis on cool-season exotic grass and legume pastures.

Budd, B. 2000. ***Promoting biodiversity through grazing.*** Renewable Resources Journal 18: 10-14. A very readable article written by a Nature Conservancy land manager on the values of introducing grazing into grassland management.

Chapman, Kim A., A. Fischer, and M.K. Ziegenhagen. 1998. ***Valley of grass: tallgrass prairie and parkland of the Red River Region.*** North Star Press, St. Cloud, MN. Nice discussion of the interactions between environment, economy, and social factors in the Red River Valley with a focus on sustainability.

Clubine, Steve. ***Native warm-season grass newsletter*** (Issued quarterly). Missouri Department of Conservation, Clinton, MO. Contains lots of practical suggestions and case studies regarding warm-season grass management on private and public land.

Dickerson, John, Brent Wark, D. Burgdorf, T. Bush, C. Miller, R. Maher, and B. Poole. 1998. ***Vegetating with native grasses in northeastern North America.*** Ducks Unlimited, Canada/USDA-NRCS, Syracuse, NY. Thorough, practical guide to establishing native grasses over a wide area.

Hamilton, R. ***Native prairie management guide***. http://www.clinton.net/~hamfam/prairie/index.html. A brief but excellent summary guide to managing tallgrass prairie with a focus on Iowa.

Kilde, Rebecca and Ellen Fuge. 2000. ***Going native – a prairie restoration handbook for Minnesota landowners.*** Section of Ecological Services, MN Department of Natural Resources, St. Paul. Useful general guide to planting prairie.

Minnesota Department of Natural Resources. 1994. ***The benefits of prescribed burning on private land.*** Section of Wildlife, MN DNR, St. Paul, MN. Helpful pamphlet on the whys and how-tos of prescribed burning.

Missouri Department of Conservation. 2001. ***Rich grasslands for Missouri landowners.*** MO Department of Conservation, Jefferson City, MO. Excellent guide booklet for managing Missouri grasslands with a focus on native species.

Morgan, J.P., D.R. Collicutt, and J.D. Thompson. 1995. ***Restoring Canada's native prairies, a practical manual.*** Prairie Habitats, Argyle, MB, Canada. Useful how-to manual with focus on Canada but much is applicable to Minnesota.

Natural Resources Conservation Service. 1998. ***Pasture management guide for northern Missouri.*** NRCS, Columbia, MO. A 71-page guide to many aspects of pasture management containing a section on the biological characteristics of common cool-season and warm-season grasses used for forage.

Packard, Stephen and Cornelia F. Mutel. 1997. ***The tallgrass restoration handbook.*** Island Press, Covelo, CA. A thorough sourcebook on prairie, savanna, and oak woodland reconstruction.

Appendix 5, continued

Pauly, Wayne R. 1982. ***How to manage small prairie fires.*** Dane County Park Commission, Madison, WI. Helpful to those with little prescribed burning experience.

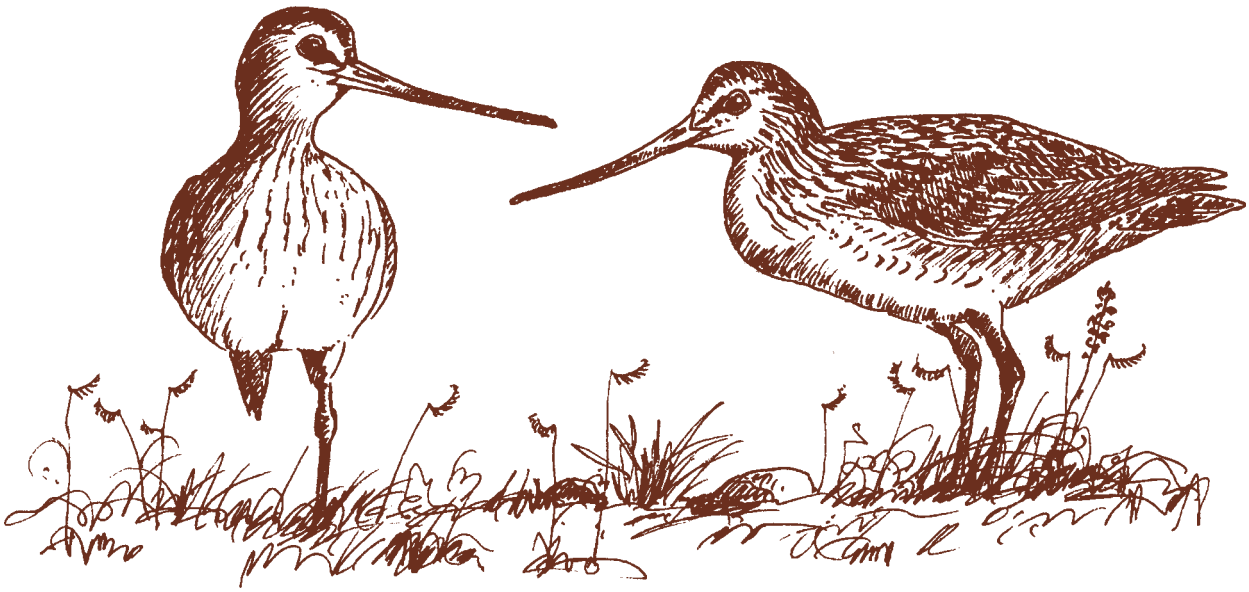
Shirley, Shirley. 1994. ***Restoring the tallgrass prairie.*** University of Iowa Press, Iowa City, IA. A book containing reconstruction techniques but also propagation information for over 100 species.

Tober, Dwight. 1998. ***Native grasses for prairie landscaping in the Northern Great Plains.*** USDA, Natural Resources Conservation Service, Plant Materials Center, Bismarck, ND. Pamphlet of species and ideas.

Trottier, G. C. 1992. ***A landowner's guide: conservation of Canadian prairie Grasslands.*** **http://www.mb.ec.gc.ca/nature/whp/prgrass/df03s00.en.html**
Excellent guide to managing prairies in Canada and several guidelines are applicable to Minnesota tallgrass prairies.

Undersander, D, B. Albert, P. Porter, A. Crossley, N. Martin. 1997. ***Pastures for profit: a guide to rotational grazing.*** Publication A3529 – RP-08-94-9M-225-S. University of Wisconsin and University of Minnesota Extension. Good guide to rotation grazing planning which includes some case histories of producers.

Wark, D.B., W.R. Poole, R.G. Arnott, L.R. Moats, and L. Wetter. (Undated). ***Revegetating with native grasses.*** Ducks Unlimited Canada, Stonewall, MB. A how-to notebook of guidelines.



Marbled godwit

Appendix 6

Sources of native prairie seed for the Northern Great Plains and the Midwest

Vendor	Address	Phone
Alberta Lea Seedhouse	Box 127, Albert Lea, MN 56007	507-373-3161
Agassiz Seeds	445 7th St. NW, West Fargo, ND 58078	701-282-8118
Carlson, Oscar	Box 157, Lake Bronson, MN 56734	218-754-4475
Den Besten Seeds	Box 896, Platte, SD 57369	1-800-894-3318
Feder's Prairie Seed Co.	12871 380th Avenue, Blue Earth, MN 56013	507-526-3049
Gullickson, Mark E.	RR 2 Box 150A, Fertile, MN 56540	218-945-6894
Kaste, Inc.	RR 2 Box 153, Fertile, MN 56540	218-945-6738
Mohn Frontier Seed	RR 1 Box 152, Cottonwood, MN 56229	507-423-6482
Morning Sky Greenery	RR 1 Box 137, Hancock, MN 56244	320-392-5282
North American Prairies	111754 Jarvis Avenue NW, Annandale, MN 55302	612-274-5316
Norfarm Seeds, Inc.	Box 725, Bemidji, MN 56619	218-751-8617
Peterson Seed Company	Box 346, Savage, MN 55378	612-445-2606
Prairie Habitats	Box 1, Argyle, Manitoba, Canada R0C 0B0	202-467-9371
Prairie Hill Wildflowers	RR 1 Box 191A, Ellendale, MN 56026	507-451-7791
Prairie Moon Nursery	RR 3 Box 163, Winona, MN 55987	507-452-1362
Prairie Restorations, Inc.	Box 327, Princeton, MN 55371	612-389-4342
Prairie Ridge Nursery	RR 2 9978 Overland Road, Mt. Horeb, WI 53572	608-437-5245
Shooting Star Native Seed	RR 2 Box 191, Spring Grove, MN 55974	507-498-3993
USDA, NRCS, Plant Materials Ctr.	3308 University Drive, Bismarck, ND 58504	701-223-8536
Vogt, Don	RR 3 Box 178, Owatonna, MN 55060	507-451-6771

Notes

Upland plover

Notes

Short-eared owl

"Some landowners have a sentimental attachment to a prairie if it represents a connection to the original family heritage on the farm. Ancestors may have harvested hay on a prairie 70-80 years ago, or present owners may have picked prairie wildflowers with a grandparent. These are ties that bind."

2002

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