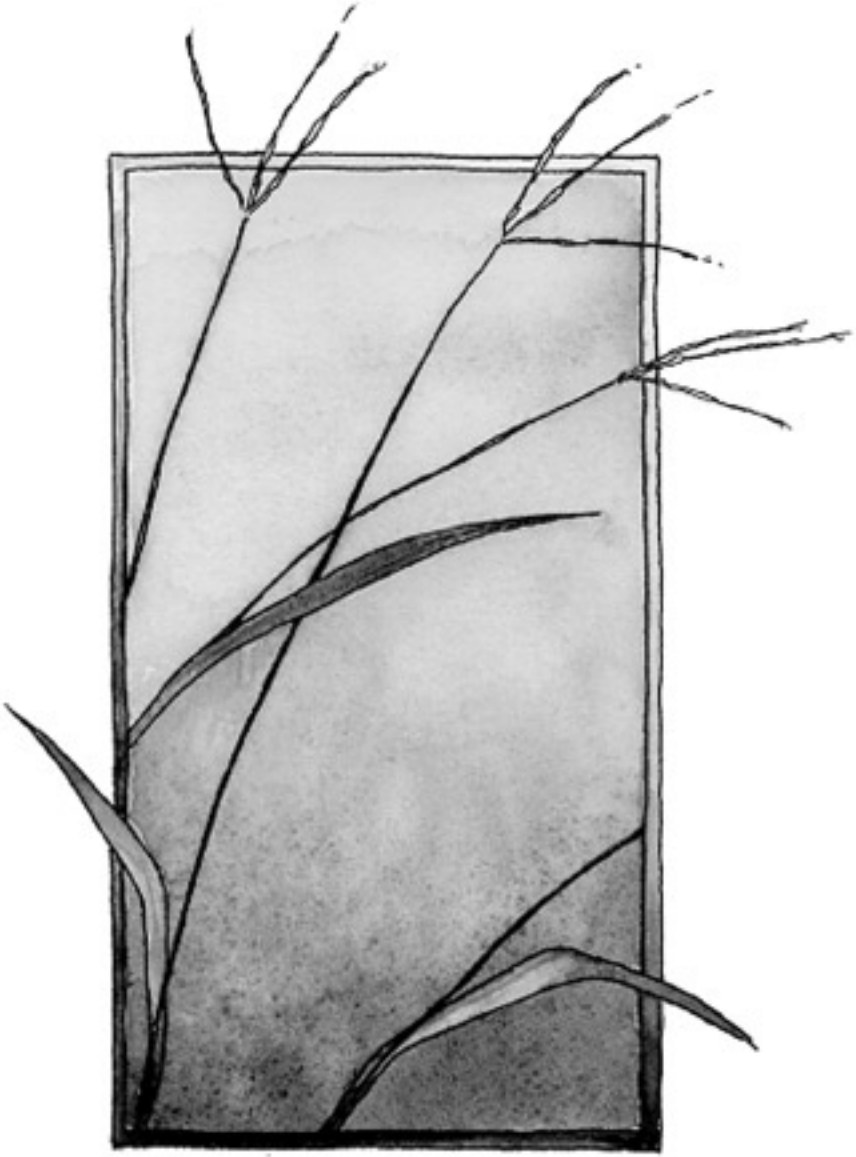

Going Native

A prairie restoration handbook for Minnesota landowners

Minnesota Department of Natural Resources
Section of Ecological Services
Scientific and Natural Areas Program

Going Native

A prairie restoration handbook for Minnesota landowners

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about this publication

This booklet is intended as a guide for Minnesota landowners interested in doing their own small (up to 20 acres) planting of a native prairie community where none remains. Once you have made the decision to establish a prairie plant community, it is important to develop a plan of action. This publication provides the specific steps you will need to consider and follow.

There is an important distinction between the meaning of "restoration" and "reconstruction," although you may hear the words used interchangeably. Prairie reconstruction or planting refers to reestablishing native plants such as prairie grasses and flowers on a site that probably grew there before being eliminated by lawns, crops, or other development.

A prairie restoration, on the other hand, refers to an existing native prairie remnant, a small piece of prairie that has never been completely eradicated, that is being managed to improve the native prairie plant community. Removing problem species, reintroducing fire, and possibly adding seed or seedlings are the management tools used to supplement existing species diversity.

Before you start digging, do take the time to do a plant survey. It could be that you already have native plants on your site which are uniquely adapted to your particular soil and microclimate. Often, a damaged remnant can be returned to a condition close to its original state by nurturing surviving plants and animals. We are promoting the use of native prairie plants and prairie reconstruction, but we want to point out that the best way to preserve native prairie (and other native communities) is to protect and enhance the remaining pieces of native habitat.

If you have a degraded prairie remnant, it may be a better choice to create an environment in which those plants will thrive, rather than to start all over with new seeds and species. This requires a different application of techniques than the ones outlined in this publication, and other resources should be consulted.

table of

Black Energy

Life is seething in this soil
which has been millions of years
in the making.
It has been forever
in the making.

A mingling of everything
which ever whistled here, leaped
or waved in the wind.
Plants and animals,
grasses of this prairie.
Buffalo and antelope grazing down
into roots and back again
into the sun.
Birds and insects, their wings still hum
in this soil.

And this swarm drinks
sunlight and rain,
and rises again and again
into corn and beans
and flesh and bone.

The quick bodies of animals and men
risen
from this black energy.

Joe Paddock
from Earth Tongues

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introd

Held up against the past, the native grassland preserves on the Coteau des Prairies are so small as to be nonexistent, inconsequential as veins of northern Minnesota gold. But we do not live in the past. … So we begin the only way we are able. We begin not with what was, but with what is. And like the wind in the grasses, sometimes the next pass we make is one that mends.

Laurie Allmann, from
Far From Tame

introduction

Less than one percent now remains of the 200 million acres of grassland that blanketed the North American continent from Illinois to Manitoba to Texas. Though we can't recreate that prairie, we can restore a sense of its grandeur by fostering plants and animals native to the region.

On a large scale, fragments of native prairie are being protected from degradation and destruction by established programs and organizations like the Minnesota Department of Natural Resources' (DNR) Scientific and Natural Areas Program and The Nature Conservancy (TNC). You can support these organizations and other local or national efforts to sustain and enhance the prairie by volunteering or contributing financially.

A new approach to sustaining existing prairie links smaller isolated parcels with continuous prairie grass corridors (see figure 1). This can greatly increase the long-term sustainability and diversity of scattered remnants and plantings by providing avenues that allow plants and animals to move between sites.

On a smaller scale, landowners like you can create a prairie on a field, building site, or backyard. This is much more than a beautiful, dynamic, and low-maintenance landscaping option. This is also an opportunity to gain insights into the complex relationship between native plants and animals and the larger environment.

By planting a prairie, you are protecting the environment. An established prairie absorbs more rainfall than many other vegetative covers, and can reduce erosion and runoff, improving water quality. A mature prairie doesn't need herbicides or pesticides, and thrives without the use of fertilizers.

You are creating a place in our modern landscape for the native plants that early settlement pushed out to make way for

figure 1: A grass corridor linking two prairie remnants or plantings can help to increase plant, insect, and other animal diversity in those areas if the corridor is large enough to harbor plant species and encourage insect and other animal movement between the sites.

roads, towns, and farms. You may even be creating a small haven for some native animals and insects, especially if your prairie is near other prairie remnants, other native plantings, or grassy areas.

You are promoting ecological diversity. A study from the University of Minnesota has shown that areas with diverse plant communities supporting dozens of species are more stable during the extreme variations in weather so common in the Midwest. A lawn or farm field contains around five species, making them more susceptible to drought, pests, and disease.

Planting a prairie is an exciting and dynamic process, but it can be slow and will require a commitment of time and resources. Some native plants take three to five years to establish. When growing a prairie, patience really is a virtue.

When your prairie plants do begin to take root and blossom, you will have the pleasure and satisfaction of watching their subtle and beautiful changes through the seasons and over the years.

chapter

Examine each question in terms of what is ethically and esthetically right, as well as what is economically expedient. A thing is right when it tends to preserve the integrity, stability, and beauty of the biotic community. It is wrong when it tends otherwise.

Aldo Leopold, from
A Sand County Almanac

one

site evaluation & project plan

groundwork

Before you pick up a shovel or buy a seed, you'll want to give some attention to your goals and budget. There may also be legal restrictions such as city codes and local ordinances at your location. Once you know what you want and what your budget allows, but before you begin planting, you will need to know the particulars of your site. Your site may have physical limitations due to past use and soil characteristics. Doing the groundwork will help to avoid frustrating and time-consuming problems later.

clarify your goals

Why are you planting a prairie? Is prairie, rather than forest, savanna, or wetland, the most appropriate community for your land? What do you want it to look like in five, 20 or 50 years? Each location is different, from a 1,000-square-foot backyard prairie, to a community landscaping project, to a 20-acre planting on an old field. It's much easier to make decisions along the way if you know where you're headed to begin with. Here are some things to consider.

aesthetics

Will you want trails, benches, prairie flower borders? Plan trails to meander through the restoration, but don't include so many that the prairie is cut up into tiny pieces. A mowed trail can also act as a firebreak, while other trail materials, like woodchips, will burn and can encourage weeds.

including wildlife

You shouldn't expect a huge migration of native birds and butterflies to a small prairie planting, but there are things that you can do to attract wildlife to your site. Specifics can be found on pages 8 and 9.

neighbors

There are a few things you can do to help your neighbors enjoy your prairie as much as you do. Although landscaping with prairie plants is widely accepted, most communities do have ordinances that regulate how tall a lawn can grow. If you live in a more urban area, or have a very visible site, consider mowing the edges of your prairie or plant a prairie flower border. This will give a visual cue that your planting is a landscaping choice, not a neglected lawn.

You may want to post signs indicating that you have planted a prairie. Some native plant nurseries sell signs, or you can make your own. Plant a border with clearly separated plants. Label the plants, and encourage people to look for them in the larger planting. Provide a bench or place to stop and enjoy the prairie.

Share your enthusiasm. You might want to offer to give a presentation at your school, church, or club. Not only will people appreciate your prairie more, they might decide to plant their own.

estimate your budget

What money and other resources do you have available to you? This will determine the size and scope of your project. Compared to a lawn, a prairie takes less money and time to maintain in the long run, but there is a substantial initial investment of time and money. One way to do a prairie planting is to hire a contractor and plant a wide diversity of species right away, but that's not the only way to do it. Here are a few ideas to tailor your project to fit your budget.

start small

Start on a small section, as little as 1,000 square feet, and

expand it as you can afford to. You could use seed from this first section to plant other areas later. Keep in mind that a bigger prairie will harbor more diversity and be less susceptible to weed invasions, but don't let that keep you from planting a smaller one.

start with fewer species

Plant a few of the common or more easily grown grasses over the entire site at first, and add more species as time and money allow.

do some or all of your own work

If you have the time and tools, this is a great way to save money and it can also be a lot of fun.

check local ordinances

Are there any legal restrictions for plant or lawn height that would prevent a prairie planting at your site? You can get this information by calling your county or city clerk. Changes to existing restrictions or introducing new ordinances to allow native plantings may be needed in your community.

As we will discuss later in the chapter on maintenance, fire is an important tool for sustaining a prairie. Find out from your local fire department if you will be able to periodically burn your prairie, and what restrictions or permit requirements there may be.

investigate the history of your site

recent history

If you are planting into a formerly cultivated field, there may be residues of herbicides that will kill prairie wildflowers or grasses. Lawns may have been recently treated with chemicals that could harm prairie plants. If your site has been treated with chemicals, you may need to delay planting until they break down or leave the soil. Your University Extension Service can provide more specific guidelines on the effects of selected herbicides.

Identify any areas that may need special attention, such as an old road that might be very compacted, or areas with tree stumps, old fences, or large rocks that could damage farm equipment.

biological history

If your site is vegetated, determine if it is an old field or pasture, previously cultivated or never plowed. Find out what was growing in your area before European settlement.

There are many kinds of native prairie, differing according to topography, soil and region of the state. Lists of plants commonly found in particular types of prairie have been compiled. Some of these sources are listed in appendix a. Appendix b in this publication is a province map, which shows the basic ecological zones in Minnesota.

Visit a prairie preserve to see what a native prairie looks like. *A Guide to Minnesota's Scientific and Natural Areas* is available from the Minnesota DNR. The Nature Conservancy also prints a guide to their preserves. Contact your local DNR office to find out which state parks or wildlife management areas contain native prairies. Appendix a lists these and other organizations that can identify protected native prairies in your area.

get to know your soil

Dry, mesic (having moderate moisture levels), and wet prairies each sustain different plant communities. By getting to know your soil's type, drainage, and pH you will be able to make better seed selection and planting decisions. The slope and aspect of the land will also be significant.

It's a good idea to test your soil for composition and nutrients. Keep in mind that you may have different types of soil on one site. Your University Extension Service offers inexpensive soil testing kits along with good advice about how to use them. Local labs and farm cooperatives can also process soil samples.

soil types

There are many different soil types, but they can be generalized into three basic categories: sand, silt, and clay. You will

generally find a combination of these categories, with about five percent organic matter from decomposing plants and, if you have healthy soil, lots of living organisms mixed in.

Sandy soil feels gritty and doesn't stick to your hands when it's wet. Silt feels like flour. Wet silty soil tends to stick to your hands. Clay has a smooth texture, and sticks to itself and your hands when it's wet. Loam refers to a mixture of these categories.

Note the presence or absence of rock or gravel in your soil. Certain native plants are adapted to those conditions.

drainage

Sandy soils tend to be drier, because they don't hold water. Clay doesn't drain well and tends to be wetter. Silt soils have more balanced drainage. Drainage also depends on depth of the water table and composition of the subsoil.

Poor drainage can also be the result of compaction, such as an old field road. If this is the case, plow or dig up the area to loosen the soil.

You can get a good idea of how well your soil drains by walking around after a long soaking rain. Watch for areas of standing water, which would indicate an area that doesn't drain quickly. Also look for areas that dry out very quickly, such as hilltops.

Starting with dry soil conditions, you can also check drainage by digging a small hole (or many uniformly sized holes around your site), filling it with water and timing how long it takes the water to drain. Water drainage should be one-quarter inch per hour or faster for dry or mesic prairie plants to do well. Plant wet prairie species if your soil drains slower than that. If you have areas that are consistently wet, plan to plant wetland species in that area.

pH

It is very difficult to predict pH by simply looking at your site. A soil test can be done if you want to know your soil's pH. (Again, you can get help with this from your University

Extension Service.) This will tell you if you have acidic or alkaline (limey) soil. The pH is measured on a scale from 1 to 14, with 1 being acid and 14 alkaline. Most plants do best with soil that has a neutral pH, between 6 and 7.5, because that is when the nutrients are most readily available to the plant.

Typically, it's not necessary to change the pH of your soil. If your soil doesn't have a neutral pH, that may be its normal condition. You can select plants that are adapted to acidic soils or soils high in lime.

If you want or need to amend your soil to change the pH, ask your University Extension Service about the long-term effects on the soil, plant establishment and survival, time commitment, and costs.

slope and sun

Prairies need six to 10 hours of sun a day. If you have shady areas, plan to plant them with native savanna or woodland species to complement your prairie.

Slope and aspect will affect both available sunlight and drainage. Hilltops and steep slopes will tend to be drier than depressions and valleys, no matter what soil type. South and west facing slopes will be hotter and drier, east facing slopes will generally have more moderate conditions, and slopes facing north will be cooler and wetter.

the plan

Once you have figured out why you want a prairie, what your goals are, and your site's particular characteristics, you can plan the layout, appropriate methods of site preparation, seed selection, and long-term maintenance. Here are some tips as you develop your plan.

write it down

While you might remember when you should call the contractor, when you were supposed to cultivate your site, which seeds you ordered, where and when you planted them, which section of prairie you burned last year, and where that pesky patch of sweet clover showed up, chances are you won't.

Planting a prairie, even a small one, is an involved undertaking. Developing a written plan, and then keeping a written record of your or your contractor's activities can become a very useful tool. It can be as simple as writing notes on your calendar or in a small notebook.

Write out a schedule to make sure that everything is in place as you need it. For an example, refer to appendices d and e.

While writing down important dates, activities, and seeding rates is important, many people find that keeping a prairie journal is a fun and interesting way to keep track of changes as the site matures. You can include photographs, notes about wildlife, dates that plants bloom, even pressed flowers.

map your site

Draw a map of your proposed site, like the one in appendix c. For larger sites, topographical maps and aerial photographs of your site would work well—ask your University Extension Service if they are available for your area.

If your map is to scale you will have a much easier time estimating how much seed to order. Include what's on the site, such as trees, roads, streams or ponds, hills, utility poles, fences, etc. Also map what borders your site, such as woods that might shade a section of the land, agricultural fields that might send herbicides drifting on prevailing winds, or buildings that may complicate a prescribed burn.

Note soil type, slope, and any other special considerations that will affect your plan.

Copies of the map will come in handy as you select seeds and plan for site preparation, planting, and maintenance. You may also want to note changes you observe as your prairie matures over the years.

think about site preparation, planting, and maintenance

Read the related chapters in this book and decide which methods you'll use for site preparation, where you will get your

seed and how much you'll need, and what method of maintenance—burning or mowing—you will use. The following paragraphs discuss some additional issues you will need to resolve to complete your plan.

hiring a contractor

If you plan to plant a tract larger than five to 10 acres, it is advisable to consult professional contractors with experience planting native prairies. Their access to large and specialized equipment make them better able to manage a large site. Even on smaller sites, contractors are a good choice if you don't have the time, equipment, or inclination to do the work yourself.

If you decide to use contractors for some or all of the work on your project, you will need to understand and monitor their work. Planting prairies and landscaping with native plants are increasingly popular, and new companies appear every year. As with any project, your best assurance of selecting a good contractor is educating yourself. If you are familiar with the steps needed to create a successful prairie planting, you can better judge how well your contractor is doing.

Always ask for references. Visit sites that have been established by the contractor. Require that they visit your site before you accept any bid, and get your bids in writing. Inspect the work the contractor is doing, inquire about guarantees, and don't be afraid to ask questions.

encouraging wildlife

The more diverse your prairie, the more attractive it will be to a variety of animal species. The relationships between native plants and animals are complex, and we are still learning a lot about how to attract animals to a prairie planting.

Many kinds of animals—mammals, insects, reptiles, and birds—contribute to a healthy prairie. Animals pollinate plants, aerate soil, recycle nutrients, and maintain a balanced population so that one species, such as grasshoppers or mice, doesn't become a pest. Animals also provide hours of interesting viewing.

Here are a few tips to encourage wildlife on your prairie:

- Plant and maintain high quality food plants. Attempt to plant so that some species are blooming throughout the growing season to provide nectar, pollen, and seeds.
- Provide a small pond or low, shallow bird bath for birds, mammals, and amphibians. Birdbaths should be cleaned every three days to minimize the spread of disease. Butterflies can't drink from open water, and need a moist, sandy spot to drink from.
- Don't burn the entire planting in a single year. Mow or burn your prairie in sections, and vary the timing from early to late, spring to fall. This promotes diversity, leaves winter cover, provides refuge for wildlife, and allows seed development for food and plant propagation.
- If you have a choice, locate your prairie near other prairie sites and/or adjacent to grassy areas. Your planting will entice birds or butterflies living nearby with additional food and nesting areas.
- Minimize or eliminate herbicide and pesticide use on the rest of your property, because they can enter the food chain and harm wild animals and insects.

chapter

We are here because there are things that need our help. Like the planet. Like each other. Like animals. The world is like a garden, and we are its protectors.

B.B. King

two

getting seeds & plants

Once you have done your site evaluation and you know what kind of conditions you have, your job is to select plants that will thrive in those conditions. Prairie plants have developed adaptations over thousands of years and won't change to fit your site. Plants placed in conditions that don't suit them won't grow well, or simply won't grow at all.

Plan to plant as wide a range of species as you can. Original native prairie sites had as many as three or four *hundred* different species. The oldest reconstructed prairie, originally planted 65 years ago at the University of Wisconsin in Madison, maintains about 200 species. (Compare that with the average lawn that has two to five species, and the average pasture that has around 30.) The greater the diversity, the greater the long-term success of your prairie.

buying seed

buy locally

Prairie plants have developed adaptations to particular conditions over the millennia. Plants of the same species have adapted to differing local conditions as well. For that reason, you should know what grew in your area historically and make every effort to reproduce that as closely as possible. Many prairie plantings done by the DNR require that seed originate within 25 miles of the site. Try to obtain seed that originates no more than 100 miles from your site.

buyer beware!

A good seed supplier will sell seed that has been cleaned, and

that is measured by weight or percentage of Pure Live Seed (PLS). Pure Live Seed has been laboratory tested to determine what percent of the seed can be expected to germinate.

Look for content and viability ratings. This ensures that you pay for prairie seed, not weed seed, straw and other organic matter, and also determines how much seed you need to buy. The Minnesota Crop Improvement Association (MCIA) has developed a certification system for some prairie seed, and many growers are adopting it. Good seed suppliers will also guarantee their seed.

Beware of mixes that don't include the Latin or scientific name. Common names can vary from one location to another, or can be similar for different species. For example, the white petalled ox-eye daisy (*Chrisanthemum leucanthenum*) is a troublesome exotic agricultural pest and on the noxious weed lists of several states while the common ox-eye (*Heliopsis helianthoides*) is a native, yellow daisy that is a lovely component of native prairies in the Midwest. Some cultivars of native species that have been genetically selected for particular characteristics or traits can also be aggressive

Many commercial "wildflower" mixes contain non-native species. Some of these plants can be very aggressive and displace native plants. A few are listed as noxious weeds in Minnesota and are prohibited for sale, transport or growing here. All of them will compete for water and nutrients with native plants, and shouldn't be included in your seed mix. Watch out for mixes that contain the following species. They probably contain other non-native seeds.

table a: non-native flowers often found in commercial "wildflower" mixes.

common name	**scientific name**
bachelor's button	*Centaurea cyanus*
California or Oriental poppy	*Papaver orientale*
*daisy, ox-eye (non-native)	*Chrysanthemum leucanthmum*

daisy, shasta	*Chrysanthemum superbum*
*purple loosestrife	*Lythrum salicaria*
*Queen Anne's lace	*Daucus carota*
sweet William	*Dianthus barbatus*
tall purple coneflower	*Echinacea purpurea*

** on the Minnesota noxious weed list*

protect wild native communities

It's best to buy seeds from a native plant nursery that grows its own seed stock. As the demand for prairie seeds increases, so does the danger of destroying existing wild sites by unethical seed collection practices. Make a point of asking where your suppliers get their seeds and plants.

Prairie plants, even those not officially endangered, are greatly reduced from their original populations. Collecting too

FOR MN DNR BY COLDSNAP PHOTOGRAPHY

Spiderwort, *Tradescantia occidentalis,* blooms in June and July, and thrives in a variety of moisture conditions.

much seed will make it difficult for a plant community to sustain itself. Seeds are also important food sources for native birds, mammals, and insects.

Digging up wild plants removes them from locations to which they are uniquely adapted, reduces the population and its ability to propagate, and deprives others of enjoying them in their native setting. Many prairie plants don't even survive transplanting. Collecting plants from private or public lands without permission is illegal.

Wildflower seedlings, grown from seed at a native plant nursery, are easy to plant and more likely to survive than transplants from the wild. The cost, from an economic as well as an ecological point of view, is reasonable.

seed mixes

The optimal prairie will include enough different grasses and flowering plants (forbs) for good bloom throughout the growing season, with thick enough growth to discourage competing weeds. Variations in grass/forb mixes will depend on how you want your prairie to look. If you want more flowers, increase the percentage of forb seeds. Native seed nurseries sell pre-mixed seed selected for specific conditions.

A standard prairie mix is 40 to 50 percent grasses and 50 to 60 percent forbs by weight. A mix with less than 40 percent forbs will result in a prairie

FOR MN DNR BY COLDSNAP PHOTOGRAPHY

Pasque flower, *Pulsatilla nuttalliana,* blooms in April and May, and likes limey soils.

dominated by grasses in a short time. It is recommended that forbs don't make up more than 70 percent in any mixture.

Grasses provide a vertical aspect to a prairie planting that is aesthetically pleasing and provides structural support. If you plan to burn your prairie, grasses supply the principal fuel to carry a fire. An excessively high percentage of forbs may make it difficult to burn.

Some plants are prolific seed producers or are aggressive and can crowd out more conservative plants, especially on small sites. The following is a list of a few of the more common plants that should be seeded at low rates on small sites.

table b: native plants recommended for low seeding rates, especially on small sites

common name	**scientific name**
grasses	
big bluestem	*Andropogon gerardii*
Indian grass	*Sorghastrum nutaus*
flowering plants	
black-eyed Susan	*Rudbeckia hirta*
common ox-eye	*Helopsis helianthoides*
coneflower, gray headed	*Ratibida pinnata*
coreopsis	*Coreopsis palmata*
goldenrod, stiff & showy	*Solidago rigida & S. speciosa*
sawtooth sunflower	*Helianthus grosseserratus*
wild bergamot	*Monarda fistulosa*
whorled milkweed	*Asclepias verticillata*

Some desirable species don't germinate or survive well in initial plantings. To integrate these plants into your prairie, use seedlings or interseed after a burn year. These include prairie dropseed *(Sporobolus heterolepis)*, Culver's root *(Veronicastrum virginicum)*, alum root *(Heuchera richardsonii)*,

gentians *(Gentiania sp., Gentianella sp., Gentianopsis sp.)*, wood lily *(Lilium philadelphicum),* and Michigan lily *(Lilium michiganense)*.

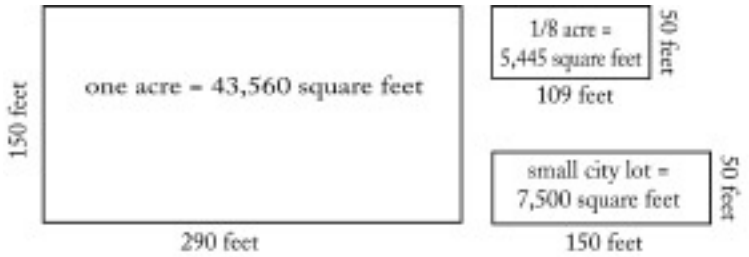
seeding rates

Figure out how many square feet or acres you will be planting. In the case of a mosaic planting, calculate how many square feet or acres you will be planting in each different environment. This is where your carefully drawn map will come in handy.

An acre is 43,560 square feet. If you know your site is an eighth of an acre, that site will be 5,445 square feet.

figure 2: some common land areas illustrating comparative square footage

In general, a seeding rate of 10 pounds of Pure Live Seed



(PLS) per acre or eight ounces per 1,000 square feet will provide enough prairie plants to dominate the site.

A lighter rate may result in plants so scattered that there is plenty of bare ground for weeds to take root. It can take a long time for the prairie plants to fill in the open areas and successfully push out the weeds.

A heavier rate can result in prairie seedlings crowding each other out, wasting precious seed.

The seeding rate used, whether it is based on pounds per acre or ounces per square foot, ultimately depends on the species compositions of the seed mix selected.

table c: recommended forb to grass seed ratios
based on an overall seeding rate of
10 lbs. Pure Live Seed (PLS) per acre or
8 oz. PLS per 1,000 square feet

Forbs (flowering plants)			Grasses		
%	lb. /acre	oz./1000 sq. ft.	%	lb. /acre	oz./1000 sq. ft.
20	2	1.6	80	8	6.4
40	4	3.2	60	6	4.8
50	5	4	50	5	4

birdsfoot violet
(Viola pedata)

chapter

It is the landscape of monoculture in which both nature and humanity are most at risk.

Wendell Berry, from
Home Economics

three
site preparation

This step is critical to the success of your prairie planting. Good site preparation will remove competing weeds, improving your prairie plants' success in establishing themselves over the first few years. Young prairie plants don't compete well with invasive perennial and annual weeds. Good site preparation also includes developing a smooth, firm seedbed, which will increase the germination rate of your seeds and the success of the prairie planting.

This is not the place to cut corners. Doing this step right will definitely pay off in the long run. Patience and perseverance during site preparation will spare you frustration and disappointment later on. Poor site preparation will waste seed and increase weed infestations in the future. In fact, skimping on this step may even result in the failure of your planting.

choosing a method for site preparation

Each planting is unique, and the way the site is prepared for planting will need to be tailored to it. What follows are some common situations and guidelines to prepare a typical site. A prairie consultant can help you decide what needs to be done.

Some common situations include cultivated fields, hay fields, and old fields. Cultivated fields are those currently in row crops. A hay field typically consists of alfalfa and mixed grasses. An old field is one not recently cultivated and since grown up with a heavy population of cool season plants that may include blue, quack or brome grasses, Canada goldenrod, and daisy fleabane.

If you are converting a field planted to row crops such as corn or soybeans, you are fortunate to be starting with a relatively clean seedbed. Even a cultivated field not planted to row crops for a year will be relatively free of persistent weeds.

Some herbicides, such as Atrazine, that are used on corn can inhibit the growth of prairie plants. Consider planting a former cornfield with Roundup–ready soybeans for one year to reduce the effect of Atrazine on prairie seed germination. In addition, prairie seed can be drilled directly into a harvested bean field, while corn stubble can interfere with planting.

Hay fields or old fields will require more aggressive measures to prepare them for a prairie planting. A combination of mechanical cultivation and herbicide treatment is recommended. It is the method most often used by professionals, and will generally have the best results.

combination method

The most effective method for many sites is a combination of herbicide treatment and mechanical cultivation. The combination method is standard procedure for large sites, because it is usually successful in the majority of situations.

Mow your site to get rid of last year's growth and encourage new plant growth. The timing of this step will depend on whether you are planting in spring or fall. After two to three weeks, when the weeds are 10 to 12 inches high, apply a two to four percent solution of glyphosate, depending on the species present (refer to manufacturer's directions for more detail about application rates). If vegetation is particularly heavy, burn off the dead, dry material after herbicide treatment. This will improve herbicide coverage if further applications are needed and facilitate disking or cultivating. If regrowth occurs, reapply herbicides when weeds are 10 to 12 inches high.

The recommended herbicide for site preparation, glyphosate, is marketed under the brand names Roundup, Kleenup, Silhouette, and others. Glyphosate is a broad-spectrum herbicide and will kill any green plant that it comes into contact

with. The leaves of the plant will turn brown within a few days. Glyphosate breaks down into substances like water, nitrogen, and carbon dioxide. Planting can take place as soon as seven days after an application. As with any chemical, follow the label instructions and wear protective clothing.

If you are hesitant about using herbicides, keep in mind that you'll use glyphosate for as little as one season and the resulting prairie will not require chemical pest control or fertilizers.

Other methods, such as mechanical cultivation alone and no-till, may not establish as quickly, but they are appropriate in other situations, such as on sites that are likely to erode or for planting around existing trees that you want to keep.

mechanical cultivation method without herbicides

Mechanical cultivation alone can be used to clear an area of weeds if you choose not to use an herbicide, but you must be very diligent. You must cultivate once every two to three weeks at a depth of four to five inches during the entire growing season to kill perennial weeds. Don't wait longer than two weeks during May, June, and July. Many rhizomatous weeds, such as quackgrass, will thrive if you wait longer than two weeks to cultivate again.

The following spring, till the soil one inch deep after the first good rain. This will kill germinating weeds before they emerge. Plant immediately.

Environmental costs of intensive mechanical cultivation include increased fuel use, breakdown of soil structure, and greater risk of erosion on exposed soils for one or possibly two seasons.

no-till method

The no-till method plants seeds directly into dead sod or areas with sparse plant growth, minimizing erosion and cost. This method also has the advantage of reducing weed

FOR MN DNR BY COLDSNAP PHOTOGRAPHY

Purple Prairie Clover,
Petalostemum purpureum,
blooms in July and August. It is an important prairie legume that adds nitrogen to the soil.

infestations since the soil is not disturbed, and so weed seed isn't exposed to growth-stimulating light. No-till is also a good choice for establishing prairie species around existing trees.

Apply glyphosate as in the combination method, but do not cultivate or disturb the seedbed.

No-till can also be used to sow a site that has been planted with a cover crop. Be sure to mow the cover crop before it goes to seed, and follow by raking or burning to prepare the seedbed.

A specialized no-till seed drill is required to plant this way. Check with local farm implement dealers or agricultural cooperatives about renting seed drills for planting native seed mixes.

seedbed preparation: the final step in site preparation

On sites of one acre or more, use a double-disk or field cultivator to break the soil into smaller chunks. Make two or three passes at right angles to each other. Harrow, or rake, the ground using diamond or spring-toothed harrows to even out irregularities in the soil. When you walk across the dry prepared soil, your footprints should not be more than one to two inches deep. If they are, pack the soil using a cultipacker or roller to make it firm. This will ensure that the seed will not be buried too deeply for proper germination. A firm and smooth seedbed is essential for good seed germination.

When you have completed this cycle there will still be weed seeds lying dormant in the soil, which will grow and compete aggressively with your prairie plants. These weeds are typically annuals that can be mowed off when your prairie starts to grow, but you can spray one more time before planting if you'd like. If you choose to do a final weed elimination step, wait about a month for weeds to grow and reapply glyphosate.

cover crop

If you have prepared your soil in the fall for a spring planting or are planting on a site that is likely to erode, you may want to plant a cover crop. A cover crop will smother some weeds and reduce erosion. Prairie plant seeds are planted into the stubble of the cover crop, and the root system of the dead cover crop will hold the soil while prairie plants become established during the next growing season.

If you plant a cover crop during the growing season (mid-July to early September), don't let it go to seed. Mow it when the cover crop has grown six to 10 inches. A cover crop planted in middle to late September will be killed by frost before it goes to seed. Wheat and oats planted at a rate of 96 to 128 pounds per acre or annual rye planted at 35 to 50 pounds per acre are commonly used as cover crops. Avoid perennial rye, which is alleopathic, which means it has naturally occurring chemicals that may suppress the growth of other plants.

Contact your local University Extension Service if you need more information about cover crops.

special considerations for small sites

On smaller sites, less than a quarter of an acre (about 10,000 square feet), using large farm equipment isn't feasible. A rototiller can be used instead of a cultivator in the combination method outlined above. Use the rototiller to break the soil into small chunks, making two passes at right angles. Rake and pack by hand using a small lawn roller to create a smooth, firm seedbed. Remember, it is important to pack the soil so the seed will not be planted too deeply to germinate.

A mulch can be used instead of cultivation and herbicides to smother sod and weeds. Cover the area with heavy black plastic, old carpet, or a thick layer of leaves and burlap. Make sure to secure the cover well, because it needs to stay in place for the entire growing season to kill the weeds and seeds near the soil surface. Don't cultivate or till deeper than one to two inches with this method, or you'll stir up weed seeds that will grow and compete with your prairie plants.

If you are replacing established lawn with a prairie, you can use a spade or shovel, or you can rent a sod cutter to remove the sod. A sod cutter cuts strips of sod, and then the strips are removed, including roots and a layer of soil. Sod cutters can be adjusted to make a shallow cut that will take up no more than an inch of soil. This should leave a relatively weed-free

seedbed. Keep in mind that this area will be somewhat lower than the surrounding lawn. If you bring in extra topsoil, a sandy loam is best. Avoid peat, clay, or heavy loam-based soil, and make sure it isn't contaminated with weed seeds.

chapter

There might be as many as thirty million species of insects…rapidly disappearing. The current extinction rate is four hundred times that of the recent geologic past and climbing. It is an odd irony that the places we call empty should retain some memory of the diversity of life, while the places we have filled up grow emptier and emptier.

Paul Gruchow from
The Necessity of Empty Places

four

planting your prairie

planting considerations

timing

Decide whether you will plant in the spring or the fall. There are advantages and disadvantages to both. The best time to plant prairie seed in Minnesota is late May to mid-July. If you plant too early in the spring, especially in northern Minnesota, you risk freezing newly germinated seed. Planting in late spring or early summer increases the chance of sufficient rainfall and reduces competition with fast-growing cool-season weeds. (You will have cultivated, applied herbicide, or mowed them down, depending on your site preparation method.) Prairie seeds, which germinate best in warmer temperatures, will do well planted later. Unless there is a feasible way to water your site, don't plant after July 15 or you risk not getting enough rainfall for good germination.

Fall planting mimics the natural cycles of nature. Remember that your seed must be stratified (exposed to cold) before it will germinate. This method takes care of that, although commercially purchased seeds are already stratified. Plant from mid-September to freeze up, but make sure the weather is consistently cold in your area before planting. Many prairie plants can germinate with as little as 10 days of warm weather and will be killed by a frost.

You can "frost seed" from November to March. "Frost seeding" eliminates compaction on a previously planted prairie, and allows access on frozen ground to a wet prairie. It is also a

good choice for interseeding forbs into a grass stand and augmenting a prairie remnant. Seed broadcast on frozen ground, or any broadcast seed that is exposed on the soil surface, is more susceptible to being eaten by birds and rodents.

mosaic planting

If your site has varied conditions, such as a sunny hill and a wet bottomland, you should consider a mosaic planting. With this method, you plant each area with species that fit those specific conditions. While it takes a little more time and planning to customize your seed mix this way, your plants will do better and you'll have a more diverse prairie.

planting methods

There are two methods for planting: drill and broadcast. Both have advantages and disadvantages. Equipment for both methods must be carefully calibrated to achieve the desired planting rates. Check regularly while planting to make sure that seeding rates are appropriate.

The two most important factors in successful seed germination are seed to soil contact and sufficient water. Good seed to soil contact is achieved by starting with a smooth, firm seedbed (described on page 23), and by packing the soil after seeding, which is discussed below. We'll talk about water later in this chapter.

native-seed drill

Many brands of native-seed drill are available, including Truax, Nesbit, Tye, and Great Plains. The native-seed drill is adapted to accommodate different shapes and sizes of seeds that have different seeding requirements. It has a series of small plows or disks that open a furrow for the seed and meter out specific amounts of seed. The seed is then covered by soil and packed down by rubber rollers, ensuring good soil to seed contact. Several different sizes are available for pulling behind tractors and ATVs.

The native-seed drill is a good choice for no-till seeding,

spring planting, and planting on a windy day. The drill is also the best choice for large plantings when you have a limited amount of seed and require very even coverage.

Drills can be rented or borrowed, but you may have problems scheduling for optimum planting, since everyone else wants the equipment at the same time.

Native-seed drills require very clean seed. Even small amounts of straw will clog the machine, and you will have to stop frequently to clean it out.

The drill plants in parallel rows, and the visual effect can remain apparent for some time. This is an aesthetic consideration, not a functional one.

how to drill

The drill requires a firm seedbed. Seeding should be done immediately following roller packing or cultipacking. A special no-till drill is used to plant into dead sod or stubble, and doesn't require seedbed preparation.

Seed should be planted no deeper than one-half inch in clay, silt, or loam soils, and three-quarters of an inch in sandy soils. Calibrate the drill so that the desired planting rate is achieved. Tractor speed should be no more than three miles per hour. If possible, make two passes at right angles to each other. Plants will grow together more quickly, and the rows won't be so apparent.

Native-seed drills work best when the seedbox is kept as full as possible. Their efficiency drops off if the seedbox is less than one-quarter full. Monitor the seed tube windows, and if they become jammed, stop and clean them out immediately. If you mix the seed with a carrier medium, use vermiculite or perlite instead of sand. Sand will damage the drill.

Many drills have separate boxes for large and small seeds. Forb seeds are generally smaller, and don't need to be drilled. Pulling the tube out of the small seedbox bypasses the drill and allows forb seeds to be distributed evenly on the soil surface. Very small seeds should be hand broadcast after planting to be sure they are planted shallow enough to germinate.

broadcasting

Broadcasting, as the name suggests, is simply spreading the seed by hand or mechanically on the soil surface. This is followed by lightly incorporating the seed and packing the seedbed to achieve good contact between seed and soil. Be careful of the two most common mistakes while broadcasting: spreading seed too thickly and not making good soil to seed contact.

Broadcasting has the advantages of requiring no special equipment and creating a less structured look than seeds planted in rows by a drill. Truck and tractor-pulled agricultural broadcasters are commonly available. Small ATV-mounted broadcast seeders are also on the market. Some native-seed broadcasters, such as the Vicon, are adapted to spread mixes of different sized seeds more evenly and work well with bulk or mixed prairie seed.

Another advantage of broadcasting is that the seed doesn't need to be clean. In fact, uncleaned bulk seed or seed mixed with some sand or other organic inert carrier is preferable because it minimizes clogging in the equipment and spreads seed more evenly.

Broadcasting can also be used for seeding into mowed or burned cover crops.

Hand broadcasting is the best choice for small sites, but big sites can readily be hand broadcast with a few volunteers. It takes 10 people about three hours to hand broadcast 40 acres. One person can seed an acre in about 45 minutes. Hand broadcasting or small ATV-mounted broadcasters are good choices for more complicated mosaic plantings or plantings in areas that are too wet to support heavy machinery. You can also use hand-held cyclone seeders and small fertilizer spreaders, which are inexpensive and can be found at most hardware stores. Depending on the type of seed you're using, they may clog up. They work best with heavier, smoother seeds.

how to broadcast

Broadcast seed on a prepared, firm, smooth seedbed. Don't broadcast seed on a windy day.

Cleaned seed may need to be mixed with one to four parts of an inert carrier. Very small seeds such as gentians should be handled separately, because they'll settle to the bottom of your bucket or seeder and result in uneven coverage.

Make two passes at right angles to each other to get a more even covering of seed. It's better to spread the seed too lightly and have to make an extra pass than to sow too heavily and run out of seed. Practice hand broadcasting by spreading about a cup of uncleaned seed or seed/carrier mix over a 10-by-10-foot area. A good rule of thumb for broadcasting is 40 seeds per square foot.

If you're doing a mosaic planting, the edges of mosaic pieces should overlap.

Incorporate the seed using a long-handled garden cultivator or a rake on small areas, or lightly harrowing for larger areas. The rule of thumb is to cover the seed with soil twice as deep as the thickness of the seed. Seed shouldn't be buried deeper than one-half inch.

After you've incorporated the seed, firm the planted seedbed to ensure good seed to soil contact. Use a hand-pushed water-filled roller over a small planting. Tires or any other heavy, rollable object will also work, or you can simply walk over the entire area. Firm larger areas with a roller or cultipacker.

nurse crops

A nurse crop is an annual species that germinates quickly, planted with prairie seed to suppress annual weeds and reduce soil erosion from wind and water. A nurse crop can also reduce prairie seed loss, especially in fall plantings. Nurse crops are generally drilled, even over broadcast prairie seed. Oats, wheat, and annual rye make good nurse crops.

For fall seeding in mid to late September, plant 96 to 128 pounds per acre of oats or wheat, 15 to 20 pounds per acre for

annual rye. Spring seeding rates, in mid to late July, are 20 to 64 pounds per acre for oats or wheat. Annual rye spring seeding rate is five pounds per acre, flax should be planted at 10 pounds per acre.

planting seedlings

Although planting seedlings is a quick way to see results, it is expensive and time consuming, so it's not usually used as a method for establishing prairie. You may want to plant nursery-grown seedlings in a border garden or as specimen plants in small plantings. Regardless of your prairie's size, after a few years when your planting is more established you may want to plant seedlings to increase the amount of flowering plants or to incorporate some species that are rare or hard to germinate from seed.

don't use fertilizers

Prairie plants don't need additional nitrogen and weeds love it, so don't fertilize your prairie planting. Talk to your prairie seed supplier about innoculants (microorganisms) that can be added to improve plant growth.

If your soil is particularly high in nitrogen (you should know this from your soil samples), you may want to consider incorporating organic matter, like straw, into the soil while you cultivate to reduce nitrogen available to weed seeds. Make sure the organic matter doesn't contain herbicides or grass and weed seeds. Contact your local University Extension Service for more information.

watering

While most prairie plants are drought resistant, prairie *seedlings* are susceptible to drought. An entire prairie planting could be lost due to insufficient moisture at critical times in the growth cycle. While it doesn't make sense to worry too much about the weather, it does make sense to research your area's average rainfall. Especially for large sites that can't be watered or irrigated, plant when you're most likely to get sufficient rain, generally before July 15 in most parts of Minnesota.

chapter

Being able to visualize a sustainable world is the first step toward building one.

Lester Brown, from Saving the Planet

five
maintenance

Although an established prairie is low-maintenance, that doesn't mean *no* maintenance. Especially in the first three to five years, as the prairie is becoming established, some careful attention is required.

practice patience

Like many people new to planting prairies you may think you have failed in the first two or three years if most of what you see are dandelions, mare's tails, and a lot of bare ground. Not quite the lush field of bluestem and Indian grass colored by flowers that you pictured at the beginning. Have patience! Remember that your prairie plants are putting most of their energy into root growth in the first few years. Just maintain a friendly environment for prairie plants by mowing, controlling weeds and woody plants, and eventually burning.

burn or mow?

Prescribed burning is the best method for maintaining a prairie, which is a fire-dependent ecosystem. Use this method unless it's impossible at your location.

burning your planting

before you burn

Be sure to contact your county or city clerk to find out what ordinances regulate burning at your site, and obtain any required permits from your local fire department. Notify neighbors that you will be burning, and respond to any concerns they have.

Carefully plan any prescribed burn. Mow a 10- to 15-foot-

wide border around the entire planting that will act as a firebreak. Consider natural firebreaks on your site, such as trails, roads, or streams. Figure out how you will handle problems such as combustible buildings and trees adjacent to your site.

While fire is a significant tool for maintaining a healthy prairie, never underestimate the danger of fire. Any prescribed burn can escape. Don't attempt to conduct a prescribed burn if you have no experience. You can get experience by volunteering to help with prescribed burns at other locations. Contact local nature centers or community-based prairie restoration groups for more information. We've listed a few of these groups in appendix a. If you prefer not to attempt a prescribed burn yourself, many prairie restoration companies offer maintenance services such as burning and mowing.

why burn?

Prairies are fire-dependent ecosystems, and so using a prescribed burn is an important maintenance tool. Fire has a dramatic effect on a prairie. Plants are more vigorous, grow taller, and produce more flowers and seed following a burn. The growing season is extended, because the blackened soil warms sooner in the spring. The warmer soil also favors prairie plants over cool-season invasive weeds. Fire controls trees and woody shrubs.

when to burn

How often a site should be burned will depend on the site. Once every three to four years is a good rule of thumb for most prairies. Dry prairies take as long as 10 years to accumulate enough plant litter to burn.

Rotationally burning sections of your prairie at different times each year will have different results. Burns conducted from mid-April to late May will set back cool season grasses and remove competing plants. A dry prairie should be burned earlier, because it blooms earlier and a late fire could damage native plants. A planting with a lot of weeds should be burned

later because that will do the most damage to the cool season invasive weeds.

Burning in the fall can be used to set back woody plants and in areas too wet to burn in the spring. Make sure adjacent fields have been harvested, because fires in crop fields are very difficult to put out.

Specialized burning regimes can be used to set back exotic problem weeds that are biennials, the most common being sweet clover. Sweet clover seed is activated by fire, so burn in early spring one year to stimulate seed germination and mow the next year before the clover blooms (late June in most areas in Minnesota).

To promote diversity, never burn more than one third to one half of your site. The unburned areas will provide winter cover, food, and a haven for insects and other wildlife.

mowing and raking your planting

If the location of your planting makes it impossible to burn, you can mow and then rake off the cut material to prevent development of a thick thatch. Mow and rake on the same schedule you would burn. If you'll be mowing regularly, use a mulching mower. Rake off thatch periodically as it builds up. If you rake often you will also be removing nutrients, and may need to consider fertilizing ocassionally.

This method is not as effective as burning for maintaining a good quality prairie. Some prairie plants may disappear from your planting over time, so it's a good idea to interseed periodically to maintain diversity. Mowing also doesn't work as well as fire to control non-native weeds, such as brome and quack grass. Pay special attention to removing shrubs and trees if you can't regularly burn your planting.

Even if you can't burn every year, an occasional burn would still be beneficial. By mowing before a burn, flame height can be lowered, making it safer.

weed control

Be vigilant about controlling invasive native or non-native weeds, trees, and brush. Become familiar with the following species and patrol your planting for them throughout the growing season. Failure to nip a weed infestation in the bud could result in a serious invasion.

table d: common invasive native and non-native plants

common name	scientific name
trees and brush	
box elder	*Acer negundo*
*buckthorn, common & columar	*Rhamnus cathartica & R. frangula*
*siberian elm	*Ulmus pumila*
sumac, smooth & staghorn	*Rhus glabra & R. typhina*
wild plum	*Prunus americana*
grasses	
*smooth brome	*Bromus inermis*
quack	*Agropyron repens*
*reed canary	*Phalaris arundinacea*
forbs (flowering plants)	
*bird's foot trefoil	*Lotus corniculatus*
*Canada thistle	*Cirsium arvense*
*crown vetch	*Coronilla varia*
*leafy spurge	*Euphorbia podperae*
*spotted knapweed	*Centaurea biebersteinii*
*sweet clover, yellow & white	*Melilotus officinalis & M. alba*
wild parsnip	*Pastinaca sativa*

** non-native plant*

A good wild plant guide (see appendix a), your University Extension Service, or the DNR can help you identify a plant if you don't know what it is.

a year by year maintenance outline

year one: what to expect

Your prairie won't look like much after the first growing season. Prairie plants will probably only have one or two small leaves above ground. Your site will look messy, and annual weeds may still be present.

year one: maintenance

During the planting year, you will want to control annual weeds by mowing. Prairie seedlings will be putting most of their energy into their roots in the first year, and won't get very tall. For the first mowing set your mower to cut higher than the seedlings, usually four to five inches. Don't let the weeds get higher than six to eight inches tall, which usually requires that you mow an additional two to three times in a season. Mow until late September.

Use a mulching or flail mower so that you're less likely to smother the small prairie plants with grass clippings. Alternatively, thick cuttings left after mowing should be removed or raked off.

Don't let the weeds go to seed. This can happen very quickly,

PHOTO COURTESY OF PRAIRIE RESTORATIONS, INC., PRINCETON, MINN.

year one of a prairie planting: mowing

especially when there's been a lot of rain. Monitor your site frequently. Don't pull weeds or invading tree seedlings in the first year. You are likely to pull up or damage native seedlings in the process.

year two: what to expect

Short-lived prairie perennials like Canada wild rye, gray-headed coneflower, wild bergamot, and showy tick-trefoil will become established, and might even bloom. Annual weeds should be nearly gone. Black-eyed Susan is reseeding itself profusely.

PHOTO COURTESY OF PRAIRIE RESTORATIONS, INC., PRINCETON, MINN.

year two: a lot of bloom from
black-eyed Susan and wild bergamot

year two: maintenance

Mow first thing in the spring to six to eight inches, as soon as weeds begin to grow. Avoid disturbing the soil, which will encourage weed seed germination. If the cuttings are heavy and thick, rake them off. Limit mowing in the second growing season to one or two times, no shorter than eight inches and only if needed to control weeds. Time your mowing before the weeds flower. Pull or mow sweet clover the second year before it flowers. Don't let it go to seed. Sweet clover seeds

are stimulated to germinate by fire, and can be a long-term problem.

If necessary, use spot applications of glyphosate, being careful not to kill nearby native seedlings, or manually pull weeds to control them. Especially watch for non-native grasses, leafy spurge, Canada thistle, spotted knapweed, mullein, curly dock, wild parsnip, and burdock, which can invade quickly.

Black-eyed Susan can be pretty aggressive so if you have more than you want, pick the flowers before they go to seed.

year three: what to expect

Short-lived prairie perennials like Canada wild rye and black-eyed Susan, so prolific in the first few years, will be joined by other grasses and forbs. Long-lived native perennials like big bluestem, little bluestem, switchgrass, Indian grass, side-oats grama, and rattlesnake master will become established. Purple coneflower, compass plant, and white and purple prairie clover will begin to flower.

year three: maintenance

A prescribed burn is recommended starting the third year if there is enough plant litter to provide fuel for the fire. Remember, in urban areas or with neighbors close by, mowing a tall, dense prairie before a burn will lower flame height and be a safer, more subdued burn. Interseed areas that don't have a good growth of native plants after the burn.

year four and beyond: what to expect

More conservative species like prairie dropseed, prairie cinquefoil, New Jersey tea, wild indigo, and Culver's root will start to hold their own after about six years. Some prairie plants might take as long as 10 years or more to bloom.

year four and beyond: long-term maintenance

Continue to rotationally burn, or mow and rake each year. Fertilize only if you mow regularly, being careful not to favor

weeds. Interseed or plant seedlings to maintain or increase species diversity.

Continue to monitor for weeds, especially in areas that have been disturbed, and eliminate them before they become a widespread problem. You should not have to water your site.

Pack a picnic and take some time to enjoy your prairie!

PHOTO COURTESY OF PRAIRIE RESTORATIONS, INC., PRINCETON, MINN.

year three: a diverse and healthy prairie plant community

appendices

Never be afraid to
ask questions.

your first-grade teacher

FOR MN DNR BY COLDSNAP PHOTOGRAPHY

New england aster,
Aster novae-angliae,
blooms August to October. The dark purple masses of flowers are an important late-season nectar source for butterflies.

appendix a

useful literature and publications

Ecological Restoration published by the Society for Ecological Restoration. Members receive the journal, which is a nationally-recognized academic publication, but also a good read for those interested in restoration. For subscription and membership information, contact SER, University of Wisconsin-Madison Arboretum, 1207 Seminole Highway, Madison, WI 53711, (608) 262-9547, web site ser@macc.wisc.edu or www.ser.org

Grow Plants Native to Minnesota brochure, Minnesota Department of Natural Resources, St. Paul. This leaflet has an excellent bibliography, and is a highly recommended addition to your planting resources. Call the DNR Information Center (numbers follow) for a copy.

A Guide to Minnesota's Scientific and Natural Areas, Minnesota DNR, second edition, illustrated, 1999. Available from the DNR Gift Shop at (651) 228-9165 or the Minnesota Book Store at (651) 297-3000 or (800) 657-3757.

How to Manage Small Prairie Fires, by Wayne R. Pauly, Dane County Park Commission, Madison, WI, 1982. An invaluable guide for carrying out a prescribed burn. To order, call the Minnesota Department of Natural Resources Scientific and Natural Areas Program (numbers follow).

The Natural Areas Association Compendium on Exotic Species, NAA, 1992. Papers from the NAA journal with information on identification and control of exotic species. Available from the NAA, PO Box 1504, Bend, OR 97709.

The Prairie Reader, North America's only independent journal devoted to prairie issues, ecology, heritage, restoration, preservation, and gardening. PO Box 8227, St. Paul, MN 55108.

Prairie Restoration for Wisconsin Schools: A Guide to Restoration from Site Analyses to Management, Molly Fifield Murray, University of Wisconsin-Madison Arboretum, 1993. For ordering information write to the Arboretum at 1207 Seminole Highway, Madison, WI 53711.

Restoring the Tallgrass Prairie, by Shirley Shirley, University of Iowa Press, 1994. A good illustrated listing of prairie flowers and grasses, and more information about collecting, storing, and starting seeds.

Tallgrass Prairie, J. Madson, Falcon Press MT, 1993. An excellent, readable text and photo essay on prairie ecology.

The Tallgrass Restoration Handbook, edited by Stephen Packard and Cornelia F. Mutel, Island Press, 1997. If you want more in-depth scientific information, this is a readable and interesting collection of essays about a broad range of subjects related to restoration.

Valley of Grass: Tallgrass Prairie and Parkland of the Red River Region, by Kim Alan Chapman, Adelheid Fischer, and Mary Kinsella Ziegenhagen, North Star Press of St. Cloud, 1998. This Nature Conservancy publication, which won a Minnesota Book Award, documents the natural legacy of the Red River Valley with sound science accompanied by stories told by the people who live there. To order, call (612) 331-1759.

Wild and Beautiful: A Guide to the Native Wildflowers of Southeastern Minnesota, includes a map and information about finding wildflowers in their native habitat. Call the Institute for the Development of Educational Alternatives, (800) 828-1231.

Wisconsin Manual of Control Recommendations for Ecologically Invasive Plants, edited by Randy Hoffman and Kelly Kearns, Bureau of Endangered Resources, Wisconsin DNR, 1997, PO Box 7921, Madison, WI 53703. Steps to control many problem weeds.

helpful organizations

Great River Greening

A nonprofit, Twin Cities metro-based organization whose purpose is to help communities restore, manage and learn about their natural environment through volunteer involvement. For more information, call (651) 665-9500.

Laq Qui Parle Prairie Preservation Group

A grassroots organization educating landowners in western Minnesota to recognize and manage prairie, and explore ways to make prairie an economically vital component of farming. For more information, contact Lynn Lokken at (320) 269-2105.

Minnesota Department of Natural Resources

Information Center. Toll-free (888) 646-6367, or (651) 296-6157 in the metro area; TTY (800) 657-3929 or (651) 296-5484 in the metro area; website at www.dnr.state.mn.us

Minnesota County Biological Survey. Identifies high quality natural communities and rare plant occurrences. (651) 296-9782.

Natural Heritage and Non-game Wildlife Program. Maintains a database of known locations of rare species and natural communities of Minnesota. (651) 296-8324.

Neighborhood Wilds Program (NWP). NWP promotes stewardship among groups of private homeowners in order to protect and restore the ecological value of communities and nearby natural areas. Metro region only. (651)772-7574.

Oak Savanna Landscape Project, Minnesota DNR. Working to restore or preserve native ecosystems in nine southeastern Minnesota counties. Call to find out if you are in the targeted area. Cynthia Osmundson, (507) 444-2424 or cynthia.osmundson@dnr.state.mn.us

Roadsides for Wildlife Program. Works with private landowners, public parks and highway departments to promote the use of native plants along roads. (507) 359-6036 or 261 Hwy. 15 S, New Ulm, MN 56073-8915.

Scientific and Natural Areas Program (SNA). The SNA program preserves natural features and rare resources of exceptional scientific and educational value, and provides public access to these rare and endangered features in their natural communities. St. Paul: (651) 297-2357. SNA Prairie Biologist, Fergus Falls, MN: (218) 739-7497.

The Nature Conservancy of Minnesota

The Nature Conservancy in an international organization committed to preserving plants, animals, and natural communities that represent the diversity of life on earth by protecting the lands and waters they need to survive. Field trips are available to some preserves, preserve guide available. Minneapolis office: (612) 331-0750 or www.tnc.org.

Minnesota Native Plant Society

Guest speakers, monthly meetings, and quarterly newsletter. They've got a great web site. 220 Biological Sciences Center, 1445 Gortner Ave., St. Paul, MN 55108. www.stolaf.edu/depts/biology/mnps

Minnesota Native Wildflower/Grass Producers Association

Promotes diversity, quality, and availability of native plant species. Member listing and brochure available. Rt. 3, PO Box 163, Winona, MN 55987.

The Minnesota Landscape Arboretum

In Chanhassen, Minnesota, the arboretum includes a 20-acre prairie planting. Membership and educational opportunities. (612) 443-2460.

Northern Tallgrass Prairie National Wildlife Refuge, U.S. Fish and Wildlife Service

This ambitious project plans to permanently protect, enhance, and restore 77,000 acres of tallgrass prairie remnants in western Minnesota and northwest Iowa with participation from private landowners and other organizations. For more information, call the Big Stone National Wildlife Refuge at (320) 273-2191. For information about the Big Stone refuge, call (800) 344-WILD. You can also call your local U.S. Fish and Wildlife office.

Prairie Enthusiasts of Central Wisconsin

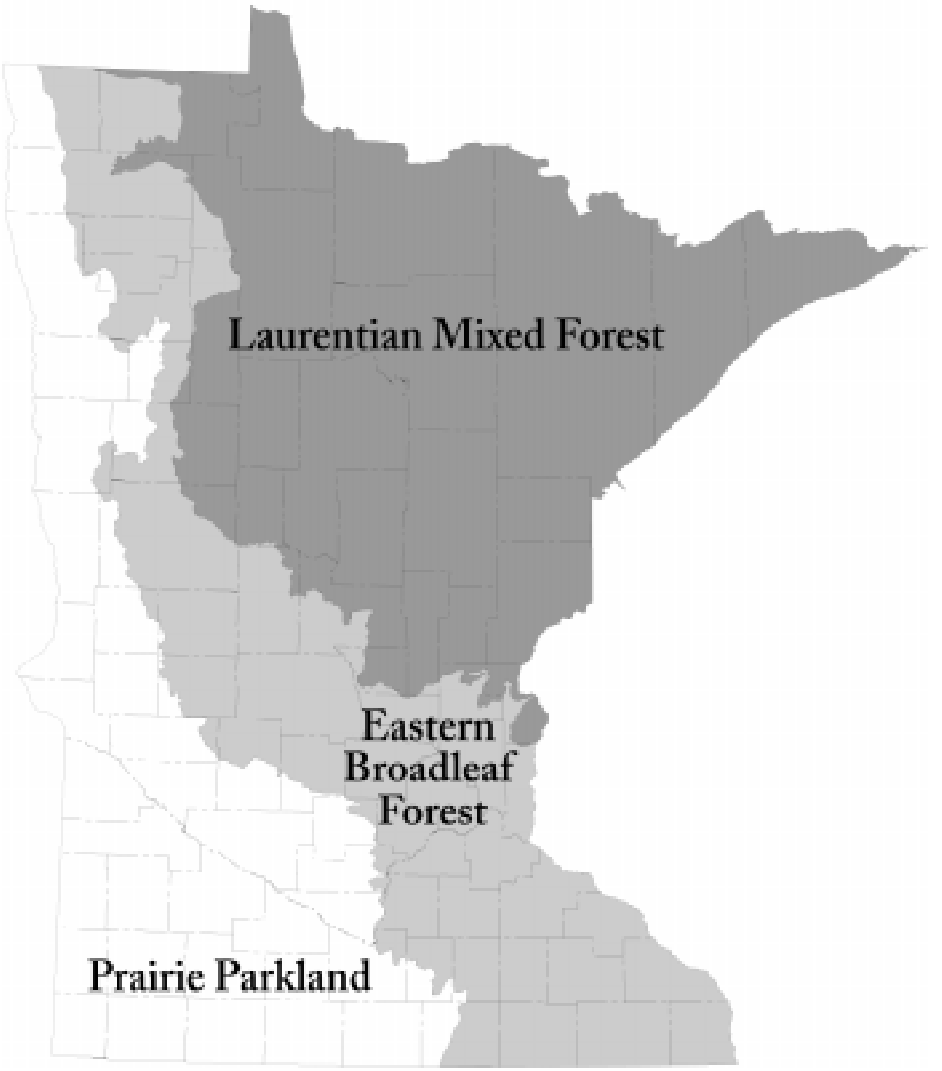
Offers burn workshops and other events. Active volunteer organization with chapters in Wisconsin, Minnesota, and Iowa. Contact Alice Mirk, 10052 CTH C, Woodman, WI 53827, or log on to www.prairie.pressenter.com.

Prairie Smoke

Volunteer organization that promotes prairie restoration and reconstruction on private lands. PO Box 392, Chatfield, MN 55923.

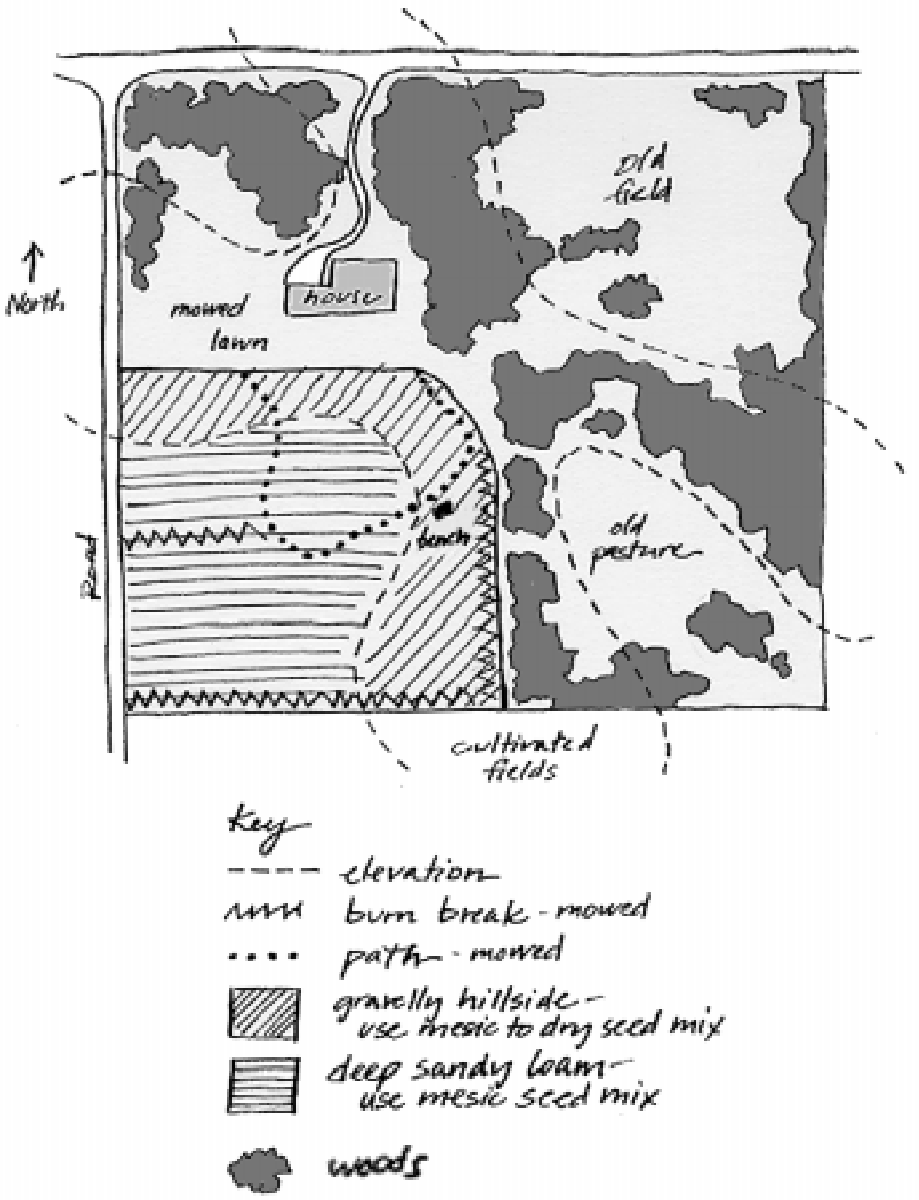
appendix b

province map of Minnesota's ecological classification system



appendix c

sample map of the "New Farm" prairie planting



appendix d

sample prairie planting plan for southwest 12 acres at "New Farm"

general overview and desired results

We'll plant the 12-acre field in native prairie vegetation, with a balance of grass and flowers. The field was last plowed 15 years ago and now has a solid cover of exotic grasses and weeds.

The flat bottom area will be planted with species that do well with moderate moisture levels (mesic). The hillsides will be planted with species that are better suited to drier conditions.

We'll buy our seed from Prairies-Are-Us in Big Bluestem, Minnesota. They will do herbicide spraying and planting.

Harold, the former owner of our land who still farms the fields adjacent to us, is willing to do some of the fieldwork to prepare for planting, and some of the follow-up maintenance mowing.

There are some small trees and stumps, and part of an old fence on the east end of the field to watch out for.

We want an expanse of prairie plants to look at off the back deck of the house, with nice trails and a bench. We hope we'll see a lot of butterflies. In about five years, we want to expand the restoration to the adjacent old pasture, cutting some of the trees but keeping all of the bur oaks.

yearly outline of tasks

Year One (1998)

A. Site Preparation

1.-Remove old fence posts, small trees, and stumps in fall 1997.

2.-Mow the field to six inches in June 1998.

3.-Allow vegetation to regrow to 10 to 12 inches, then treat with glyphosate according to directions.

4.-Implement a controlled burn, with the assistance of

Prairies-Are-Us, using appropriate procedures, equipment, and permits.

B.Seed and Seeding

1.-Buy local seed in August 1998.

Year Two (1999)

A. Site Preparation

1.-Re-spray with glyphosate where regrowth occurs when it reaches 10 to 12 inches.

2.-Allow the herbicide to work for at least seven days before disturbing the vegetation with other procedures.

3.-Disk or cultivate the soil to four inches.

4.-Harrow to create a smooth, firm seedbed. Pack if needed.

B. Seed and Seeding

1.-Plant in May (July 15 at the very latest).

C. Maintenance

1.-When first year growth gets 10 to 12 inches tall, mow to four or five inches.

2.-Keep the vegetation at six to eight inches by mowing one to three more times.

Year Three (2000)

1.-Flag location of path and bench area (see map).

2.-Mow the path and install bench.

3.-Mow second year growth 10 to 12 inches high, above the tops of the native seedlings.

4.-Mow again only if needed.

5.-Mow 10- to 15-foot-wide burn breaks (see map).

Year Four (2001)

1.-Burn the three northwest acres between late April and mid-May to set back the cool-season exotic grasses. Don't forget to move the bench! Burn the other sections over the next two years, then repeat the cycle.

appendix e

sample planning chart

FOR MN DNR BY COLDSNAP PHOTOGRAPHY

Prairie blazingstar,
Liatris pycnostachya,
blooms in August and September

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