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PLANTING THE SEED

A Guide to Establishing Prairie and Meadow Communities in Southern Ontario

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About This Guide

There is a growing interest in restoring and recreating natural areas. Together with this increasing enthusiasm is the recognition that healthy communities include people, plants and wildlife in balance. These trends are reflected in the growing number of restoration and naturalization projects underway in the highly disturbed Southern Ontario landscape. Restoration projects range from those in backyard gardens to agricultural field buffer strips and large plantings for wildlife habitat.

Restoration and naturalization are still new and developing fields, and there is much to learn. Sharing information derived from practical experience is the best way to develop better projects. This introductory guide is designed to assist people interested in planting prairie and meadow, two of Ontario's non-forested plant communities. The guide looks at the often confusing array of options and offers recommendations drawn from the experience of many practitioners working in Southern Ontario.

Prairie and meadow are complex communities and even the best attempts to recreate them will be simplified versions that do not fully replace the ones that have been lost. For this reason, protecting existing natural habitat should always be a top priority. If habitat-creation projects are well executed, however, they can provide a significant contribution to the conservation of wildlife diversity in the province and help improve the health and connectivity of natural landscapes. Projects that involve naturalization often also offer the benefit of reduced landscape maintenance costs.

A well-developed Southern Ontario meadow. *Larry Lamb*

Prairie and meadow are two distinct ecological communities; however, many of the techniques for planning and undertaking a planting project apply to both. This guide describes prairie and meadow separately and then provides information common to both. While shrubs and trees may be found in prairie and meadow, the focus here is on herbaceous plants, which make up the bulk of the vegetation in these communities.

With few exceptions, common names mentioned in this guide are consistent with the *Ontario Plant List* (Newmaster et al. 1998). The corresponding botanical names are listed in Appendix D. The term "prairie," as used throughout the guide, refers to the eastern tallgrass prairie. Words defined in the glossary are italicized on first use.

Meadow and Prairie: Which Is Which?

Similarities

- They are open communities of *grasses* and wildflowers, with few trees.
- Some plant and animal species, such as black-eyed Susans and goldfinches, are common to both.
- They support a rich variety of animal life.

Differences

- A prairie is maintained primarily by fire, whereas a meadow is often maintained by processes other than fire, such as flooding and drought, or arises from abandoned agricultural lands.
- Some plant and animal species are found or are more likely to be found only in one or the other – for example, Indian grass and wild indigo duskywing butterfly in prairies, and common evening-primrose and common sootywing butterfly in meadows.

Prairie

Prairie scene at Ojibway Nature Reserve near Windsor. *P. Allen Woodliffe*

What Is a Prairie?

A prairie is an *ecological community* made up of native grasses and wildflowers. Mature trees (predominantly oaks) are a minor component on some sites, providing less than 10 percent canopy cover. Grasses such as big bluestem, Indian grass and prairie cord grass can grow higher than 2 metres, their tops swaying overhead as they move with the breeze. Tall sunflower, Virginia Culver's-root and dense blazing star are examples of the more than 200 prairie wildflowers, or *forbs*, found interspersed among the grasses in Ontario's prairies.

Stepping into the lush landscape of an Ontario prairie will make you feel as though you are stepping back in time. In some places, grasses and wildflowers stretch as far as the eye can see, with barely a tree in sight. From season to season, there is a continuous and ever-changing show of blooms, from the brilliant orange of butterfly milkweed and bright yellow of gray-headed coneflower to the showy purple and white of fall-blooming asters.

Garden spider *(Argiope aurantia)*, one of the many small wildlife species found in Ontario's grassland communities. *P. Allen Woodliffe*

Prairie is, however, not simply a mix of flowers and grasses. Stand in a prairie, close your eyes, listen, and you'll know why some people call it "symphony grass." A healthy prairie is full of the humming, buzzing and singing of the many animals who call it home. Most mammals are of the smaller variety, and include meadow vole, common shrew, long-tailed weasel, American badger, red fox, coyote and eastern cottontail rabbit. Birds such as bobolink, eastern meadowlark and savannah sparrow depend on these open grasslands for food and shelter. By far the most numerous prairie animal species are *invertebrates*, including butterflies, grasshoppers, dragonflies, ants, beetles and spiders.

Closely related to prairie is *savanna*, which is also fire-dependent but with more tree cover – in between open prairie and closed forests. Savanna usually has less grass cover, with a correspondingly greater density of wildflowers and ferns. Many of the *remnant* prairie-type communities of Ontario are more like savanna.

Ontario Prairie: Endangered Spaces, Endangered Species

Tallgrass prairie and related savanna communities are some of the most *endangered* ecosystems on the continent. Today, less than 1 percent of Canada's original tallgrass prairie remains. With the loss of prairie comes the loss of *wildlife* that depends on it. Many animal species require large expanses of prairie, and loss of *habitat* has contributed to their decline. Both Henslow's sparrow and northern bobwhite are currently considered endangered, and the greater prairie chicken has not been seen in Ontario for decades. More than 150 plant species occurring in Ontario prairie are considered provincially or nationally rare – for example, the prairie white-fringed orchid. The beautiful Karner blue butterfly, whose larvae depend on wild lupine for food, has not been seen in Ontario for almost a decade.

Henslow's sparrow *(Ammodramus henslowii)* is just one of the many endangered species found in Southern Ontario prairies. *Parks Canada*

Prairie *Ecology*

Prairie is largely the result of a climate that favoured grasslands, not forest. Different types of prairie developed across North America. The west receives less precipitation and has shortgrass prairie; the wetter east, including Southern Ontario, has tallgrass prairie. Between these two regions occurs mixed grass prairie, which is of intermediate height. Each type of prairie has a distinct mix of grasses and wildflowers that change gradually from one to the other.

The root systems of prairie plants are extensive, sometimes growing 3 to 4 metres deep. This deep root system helps the plants survive drought and prevents shallowly rooted non-prairie species from gaining a foothold. As these root systems break down, they add large quantities of organic matter to the soil. Many prairie plants are long-living *perennials* and are able to withstand poor growing conditions and periodic grazing.

Sixty-five percent of prairie plant *biomass* is actually found underground in the form of massive root systems. *Judie Shore*

From the time Europeans arrived in North America until fairly recently, they thought of fire only as a destructive force. Historically, fires were set both by lightning strikes and by Aboriginal peoples who recognized their benefits. The First Peoples intentionally started grassland fires as a technique to drive game while hunting or to clear land for various reasons – for example, to attract additional game to the tender grass shoots that appeared after a fire. It is now widely known that fire is a natural process necessary for maintaining tallgrass prairie. Fire maintains prairie by suppressing non-prairie plants, clearing dead plant material and adjusting the nutrient balance in the soil in favour of prairie vegetation. After a burn, the blackened soil absorbs sunlight, which warms the soil and favours the regrowth of heat-loving prairie plants. When fire is suppressed, non-prairie species gain a competitive edge. The lack of fire is one of the main reasons why many of Ontario's remaining prairies are overrun with non-prairie plants such as woody shrubs and trees, which will eventually shade and kill the prairie grassland beneath them.

Visit a lush Ontario prairie and you can imagine early explorers getting lost on horseback in the tall grass. *Lindsay Rodger*

It is recognized that in western prairie regions, grazing bison had an

important role in maintaining prairies. While bison herds did not occur in Southern Ontario, elk were historically found here. Today, a variety of browsers and grazers, from white-tailed deer to grasshoppers, are still found in Ontario prairies, but their importance in keeping prairies healthy is not well understood.

Unlike many non-native pasture grasses, the sturdy stems of prairie grasses remain standing throughout winter, despite heavy snowfall accumulation. These stems provide cover in early spring, when waterfowl and ground nesting birds need it most.

Do you know how this Southern Ontario town got its name? *Paul Pratt*

Historical and Current Range

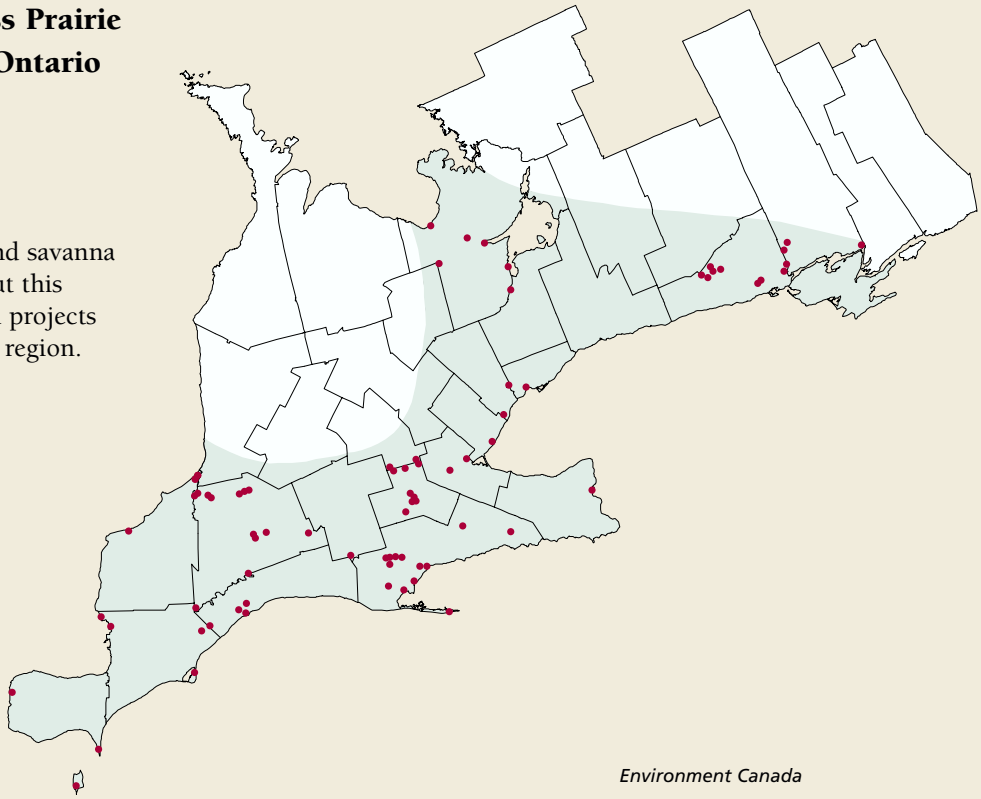
When Europeans first arrived, there were an estimated 1 million square kilometres of tallgrass prairie in North America. The prairie reached such heights that early explorers reportedly got lost on horseback in the tall grass. The rich soils under the prairie grasses were quickly converted to agriculture and became some of the most productive agricultural areas on the continent. It is estimated that Ontario may have had more than a thousand square kilometres of tallgrass prairie and related communities; today, however, only a few scattered but important remnants remain (see Figure 1 below).

Why Plant a Prairie?

Tallgrass prairie is one of the most endangered ecological communities in North America and is an important part of Ontario's natural heritage. A vast number of wildlife species depend on prairies for food and shelter, and when the prairies disappear, so does the wildlife. Many prairie-related plants and animals are at risk. You can be part of the solution. Help protect and expand remnant prairies in your community. Plant a demonstration prairie at a local school, community centre or park. Spread the word and lead by example. Replacing petunias in your garden with showy prairie wildflowers can spark interest among friends and neighbours.

Figure 1: Range of Tallgrass Prairie and Savanna in Southern Ontario

- Existing remnants
- Historically, tallgrass prairie and savanna occurred in patches throughout this shaded region. Prairie creation projects may be considered within this region.



Source: Modified from Bakowsky 1993

Environment Canada

Meadow

Butterflies such as this great spangled fritillary *(Speyeria cybele)* are attracted to the nectar-producing plants in meadows. *Ross Brown*

What Is a Meadow?

A meadow is a warm, sunny spot, brimming with a variety of life. Wildflowers such as spotted Joe-pye-weed, boneset, blue vervain and swamp milkweed, as well as a number of wetland *sedges* and grasses, can be found in wetter areas. Black-eyed Susan, wild strawberry and gray goldenrod may occupy drier spots. As most meadow wildflowers are nectar sources, they attract a variety of butterflies such as swallowtails, admirals, checkerspots and skippers. Meadows provide feeding and nesting areas for songbirds such as bobolinks and meadowlarks. They may also provide shelter for frogs and small mammals, which in turn attract hawks, owls and snakes.

A typical meadow, dominated by aster and goldenrod species, which has been left intact after the construction of a new subdivision in Dundas. *Sheila O'Neal and Joanne Rzadki*

Meadow Ecology

A variety of meadow types can be found in Southern Ontario. Wet meadow occurs in floodplain areas along rivers and streams, and in areas of medium moisture between wetlands and higher, drier land. This meadow is maintained by fluctuating water levels as well as by intermittent floods and ice scours, which make it difficult for trees and shrubs to become established. Dry meadow grows in parched areas such as on ridges and slopes. Here, the dry conditions prevent many trees from becoming established, which would shade out the meadow species. Each meadow type has characteristic species, which are adapted to the varying moisture conditions and soils.

The most familiar type of meadow is the old field meadow, which is common on abandoned agricultural land, in overgrown pastures and in roadside ditches in rural areas. This type of meadow is considered a more or less temporary ecological community – a transition stage between bare ground and forest. If adjacent to a wooded area, old field meadow eventually reverts to woodland as shrubs become established and are then followed by trees. This process of open land becoming forest is called *succession*. Succession from meadow to a forest is often slowed when rodents *girdle* and deer browse on young woody plants. In addition, dominant meadow species such as goldenrod can suppress the growth of other species by releasing growth-inhibiting chemical compounds from their roots.

Wild bergamot *(Monarda fistulosa)* and black-eyed Susan *(Rudbeckia hirta)* are easy to grow under a variety of site conditions and complement meadow and prairie plantings. *Mary Gartshore*

Nowadays, much of the forest cover in Southern Ontario has been cleared, removing seed-producing trees and slowing the transition from old field meadow to forest. It is usually this kind of meadow that people try to establish when they plant a "wildflower meadow." Most old field meadows in Southern Ontario, however, contain many non-native plants that have been introduced to Ontario's landscape. Only native plant species should be used in the planting of a meadow. See Native Plants in the next section, How to Get Started, for an explanation of native and non-native plants.

Why Plant a Meadow?

A meadow can provide wildlife habitat, is aesthetically appealing and is a welcome alternative to some of the intensely maintained, closely mowed spaces so frequently found around us. It can be used as an interim measure to repair damaged or disturbed sites where *restoration* to forest is the eventual goal. Meadow is also a good choice in areas where forest was probably the original land cover, but is not desired in the current land use. It would therefore be appropriate in areas such as roadsides and portions of parks or schoolyards where open areas are preferred. Meadows are being planted more frequently because of their beauty, utility and lower maintenance costs.

How to Get Started

Black-eyed Susan *(Rudbeckia hirta)*, wild bergamot *(Monarda fistulosa)* and butterfly milkweed *(Asclepias tuberosa)* provide colourful displays in these typical prairie scenes. *P. Allen Woodliffe*

This section provides some important background information needed for a planting project.

Identifying Goals

Set goals before beginning the project, and refer to them to help guide decisions while planning and planting. Answering the following questions will help to set goals: Does the project involve restoring the former natural plant community to the area? Are there remnant natural areas that can be reconnected or buffered? Is the main goal to create a beautiful wildflower display? Does the project involve providing a quality habitat for local wildlife?

My Goals Are …

Spend some time thinking about the goals of the project. Here are some suggestions:

- Restore a natural plant community that once existed on the planting site
- Connect a site to adjacent natural remnants
- Create a showy wildflower display
- Provide a quality habitat for local wildlife
- Create a low-maintenance landscape
- Use plants to stabilize a site (e.g., in an erosion-prone area)
- Provide an educational opportunity for schools or the surrounding community
- Conduct ecological research

Understanding Plant Communities

Plants exist in groupings, or communities, not in isolation from one another. Each community is made up of plants that share similar adaptations to particular soil type, climate, and moisture and light levels. For example, big bluestem and dense blazing star are plants that thrive in a fire-prone, full-sun environment; so they are found in prairies. They would never be found in a mature forest, where plants adapted to shady conditions thrive.

This prairie planting provides wildlife habitat as well as a buffer between an agricultural field and a watercourse on the McLean farm in Kent County. *Kim Delaney*

Species can often occur in more than one plant community. Some plants can thrive over a broad range of conditions, whereas others seem to survive in only a few

places with a very particular set of conditions. Planting a prairie or meadow, then, means first selecting a set of plants that are adapted to growing together and, second, establishing them on a site that provides the appropriate conditions for those plants to thrive.

"Native" versus "Naturalized": Similar Words, Dissimilar Plants

Plants such as Queen Anne's lace, ox-eye daisy, chicory and smooth brome grass are found growing wild along roadsides and in old fields in Southern Ontario. These plants are "naturalized," but are not native to Ontario. They were introduced to North America as European settlement took place. Due to their ability to colonize disturbed soils and their aggressive growing habits, these plants have become widespread and more evident in some areas than many native plants. Such naturalized plants should not be considered native, nor should they be used in restoration and naturalization projects.

Queen Anne's lace *(Daucus carota)* is a common weed in Southern Ontario meadows and prairies. *Judie Shore*

Choosing an Appropriate Plant Community

When you are undertaking a restoration or *naturalization* project, it is important to choose a type of plant community that will be suited to both the conditions of the planting site and the natural habitat in the region. Take note of the plant communities that occur naturally in the area and observe the way they fit together. If there are no natural areas nearby to provide models, try to find some historical information. Consult historical records or ask local ecologists, botanists or naturalists for help.

Native Plants

A plant is considered to be native to North America if it existed here prior to European settlement. Native plants are an integral part of their community. They have evolved over time with the insects, birds, mammals and other animals that rely on them for food and shelter. In turn, native plants depend on local wildlife to pollinate flowers and disperse seed. They are well adapted to the rigours of the regional climate, pests and diseases. Plants to be used in restoration and naturalization projects should be native to the project area (see Appendix A).

Be aware, however, that the term "native plant" is sometimes used very broadly. For example, the Douglas-fir is a tree species native to Canada but not native to the forests of Southern Ontario, and so is not an appropriate choice for a forest naturalization project here. Species that are native to the county or watershed are the most appropriate candidates. For more details, refer to Developing a Species List, page 13.

Meadow or Prairie?

Figure 1 illustrates the historical and existing range of prairie in Ontario. If the project is outside this range and the goal is to plant a *herbaceous* community, meadow would be the appropriate choice. If it is within this area, either prairie or meadow may be appropriate. Use additional information to determine which community would be the most suitable. Consider, for example, site conditions, whether the site can be burned, and current and historical information about natural habitat types in the local area. Look for nearby remnants and use them as a model for the project. If there are no remnants nearby, as is often the case in agricultural regions and large cities, consult experts (see Helpful Organizations under Sources of Information) to determine which community would be the best choice.

A Schoolyard Restoration at École Secondaire de Pain Court

When École secondaire de Pain Court acquired additional land for the schoolyard, students wanted to restore part of the area to a native plant community. At first they thought of planting trees, but when they realized that their school was within the historical prairie range, they decided to plant tallgrass prairie instead. The students went seed collecting with local prairie experts and successfully obtained more than 20 species for their 0.6-hectare demonstration area. The initial seeding was completed in 1994 and supplementary seeding and plug planting followed in 1995 and 1996. The planting is beginning to mature and is used by small birds, including bobolinks and savannah sparrows. This project became a great learning experience and now provides an outdoor classroom for young naturalists.

Students from École secondaire de Pain Court plant prairie plugs at their schoolyard naturalization project site near Chatham. *P. Allen Woodliffe*

Planning the Project

While many people think that planting is the first step in a project, actually many activities must take place before the first seed touches the soil. Careful planning is crucial to the success of a project. It is important to establish the timing of each activity and obtain the necessary equipment, supplies, plant material and labour. In most cases, completing the project over a minimum of two years is highly recommended. The first year is dedicated to planning and site preparation, and the actual planting is done in the second year. The tasks necessary for a well-planned project are outlined in the timeline below. In addition, talk to others who have completed similar projects, and learn from their experience.

A Sample Project Timeline

(Modified from Morgan, Collicutt and Thompson 1995)

Year 1

- Set project goals
- Select and analyze the site
- Talk to the community
- Consult with experts
- Inspect local natural communities
- Decide on the appropriate plant community
- Prepare site plan and work plan
- Select the species
- Ensure availability of equipment
- Organize volunteers
- Prepare the site
- Acquire plant material
  – if doing it yourself: harvest, process and store seed; or
  – if purchasing: order plant material from suppliers

Year 2

- Propagate plants (if growing your own plant *plugs*)
- Plant seed and plugs
- Conduct post-planting maintenance (e.g., watering)
- Control weeds
- Monitor to determine success
- Obtain seed or order plant material for year-3 supplementary planting

Years 3 to 6

- Engage in supplementary seeding or planting
- Control *weeds*
- Conduct *prescribed burning* (for prairie) or tree and shrub control (for meadow)
- Monitor to determine success

Years 7+

- Engage in long-term management and monitoring
- Continue prescribed burning or tree- and shrub-control regime

Selecting the Project Site

Sometimes you have a project in mind and go looking for a site. There are many interesting opportunities to restore historical natural communities. Some landowners are willing to restore portions of their property, and many other areas require revegetation – for example, roadsides, landfills, pits and quarries that are closing, utility corridors and parklands. Consider these potential project sites when you are looking for opportunities to plant prairie or meadow. Not all this work can be considered true restoration, but it provides opportunities to establish native vegetation where turf grasses would normally be used.

Often you will already have a site to work with, and you will have to decide what to do with it. Before deciding whether a site is appropriate for establishing a prairie or meadow, ask the following questions.

- Is the existing vegetation native and healthy? Should it be left alone or managed appropriately?
- What are the owner's long-term plans for the site? Do not invest significant time, money or plant material on a project that will be altered or destroyed within a few years.
- Does the site receive a minimum of eight hours of direct sunlight daily (preferably more)?
- Is the site wet? Meadows and prairies occur on seasonally wet sites; however, permanently wet locations are usually better suited for the establishment of wetland plant communities (see *Planting the Seed: A Guide to Establishing Aquatic Plants*, Hagen 1996).
- Is the site accessible to the necessary equipment and is it near a water supply?
- If the intention is to plant a prairie, is prescribed burning possible?
- Is the site located in a priority area for restoration? For example, is it adjacent to other natural areas? Will it expand existing habitat? Will it provide a buffer between sensitive land and adjacent land use?

Project Size

Deciding on the size of the planting project will depend on many factors, including your resources for obtaining plant material, available equipment (mechanized or non-mechanized) and the number of people available to help. While "small" and "large" projects are referred to in this guide, they are relative terms. A 0.2-hectare project will seem very large to an individual who is hand-planting plants and weeding by hand. But that same project may seem small and much more manageable to a group using mechanized equipment to

prepare, plant and maintain the site. Use your judgment and make a decision based on your capacity to complete the work involved.

A Roadside Prairie Planting

Thomas Chatterton

The members of the Sydenham Field Naturalists' Club decided that they would like to see native prairie wildflowers – instead of the traditional turf grass mixtures – growing on the roadsides of their community. They asked the Ontario Ministry of Transportation and received permission to plant 0.4 hectares of tallgrass prairie along Highway 40, just north of Wallaceburg. Club members raised funds to purchase plug plants, which they planted in the spring of 1998 and 1999 (see photo). The planting was slow to establish due to severe drought, but the club members watered and weeded, and the plants eventually became established. Today, flowers and grasses enhance the roadside and treat passersby to a glimpse of Ontario's beautiful prairie heritage.

Involving Others

In some communities, naturalization and restoration are well-understood and accepted activities; in other areas, they may be quite strange and new ideas. Depending on ownership of the project site, there may not be a legal requirement to inform other members of the community or get their approval, but it is in the project's best interest to do so. In fact, acceptance of and interest in the project should be viewed as an important indicator of success. For more detailed discussion of this important issue, see *Restoring Nature's Place* (Daigle and Havinga 1996). If this is your first project, ask local experts for their assistance when you are explaining the project details and answering questions. Take time to listen and respond to any community concerns.

Much help is needed throughout a restoration project, from site inventory and design through to after-planting maintenance. Restoration projects can be even more enjoyable and fulfilling when everyone pitches in. While some jobs (e.g., the use of heavy equipment, *herbicide* application and prescribed burning) must be done by specially trained persons, many jobs do not require such specialized skills.

Issues to Consider

- A lot of time and effort is required to train, coordinate and guide workers successfully.
- All safety issues must be faced and dealt with.
- Certain tasks should not be attempted without specialized training (e.g., prescribed burns, herbicide application, use of certain equipment).
- Volunteers can suffer from burnout.
- Volunteers should be shown appreciation (e.g., offered refreshments or a meal; sent a letter of thanks; given a slide show).

Selling Points of the Project

- Conserves natural heritage
- Provides wildlife habitat
- Pleases aesthetically
- Offers educational opportunities
- Offers recreational opportunities
- Provides an enjoyable community project
- Reduces traditional landscape maintenance (frequent mowing, long-term herbicide use)

Ways to Spread the Word

- Write short articles (providing background information on the type of project and examples of similar projects) in local newspapers and community newsletters
- Inform local television
- Have personal contact with neighbours
- Hand out information flyers to nearby residents
- Advise at community meetings
- Arrange speakers and/or displays at local service club meetings (horticulturists, naturalists, anglers, hunters)
- Post explanatory signs

Analyzing the Site

Once the site has been chosen and the local community is on board, you will need to learn more about the site's features. Gather the required information from as many

Gathering data prior to restoring 8 hectares of tallgrass prairie on Stag Island. *Kim Delaney*

sources as possible. Consult historical survey records, soil and topographic maps and aerial photos. Visit the site, talk to current and past owners and users of the land; seek assistance from local experts and others doing planting projects in the area. All this research will require time and effort, but will greatly increase the chance of the project's success – for example, by helping you to make correct decisions, such as which plant mix is most suitable and what kind of management activities are likely to be necessary on a continual basis.

Consider the information in the following chart when analyzing the project site. Not all of this information will apply to every project but it would be wise to be aware of each item.

Site Feature	Importance and Considerations
Size	Knowing the size of the project site will help determine the amount of plant material necessary, type of equipment and labour required, and time and cost involved.
Past and current uses of the site	Uses include any activities that may pose a safety risk or interfere with the success of the planting project – for example, use of herbicides or salt whose residue may prevent growth of native plants, waste disposal such as sewage sludge or construction waste and recreational use such as all terrain vehicle (ATV) or bike trails that may not be compatible with the new project.
Existing vegetation	Is the site bare soil or lawn or corn field? Is there any existing native vegetation that would fit into the planned project? Answers to these questions will be important in planning site preparation. Note the presence of any aggressive plant species that may cause management problems – for example, quack grass and Canada thistle.
***Topography,* drainage patterns, other natural features**	Locate areas of high and low, wet and dry land; drainage patterns; and watercourses. These features will have implications for equipment use and species selection. Is there steep terrain that might be erosion prone? Southern slopes tend to be hot and dry and to favour certain species. Watercourse areas may act as natural *firebreaks* for prescribed burns.
Soil type and moisture	Is the soil heavy *clay* or coarse *sand*? Is it rocky? Determine the soil *pH,* level of fertility and organic-matter content by sending a soil sample to a lab for analysis (see Soil Analysis Services under Sources of Materials, Specialized Equipment and Services). Soil characteristics play a part in species selection and site-preparation options.
Built structures and facilities	Note the presence of buildings, power-line poles and fences, as well as access to water and roads. Consider their location in terms of the need for prescribed burns (some are hazards; others are potential firebreaks).
Safety and accessibility	Can the necessary equipment gain access to the site? If the intention is to use the site for environmental education or other specific reasons, is the site easily accessible and is it free of hazards? Note any natural or built features that may pose safety issues.
Animal life	Note the animal life currently using the site, and features such as burrows and nests. Consider these in site planning. If possible, make linkages to neighbouring natural areas to expand available habitat.
Adjacent land types and uses	How will neighbouring land use affect the project, and how will the project activities affect neighbours? Invite the neighbours to participate in the project from the planning process through to planting. People are much more likely to accept something they understand. Note possible weed sources, previous herbicide use that may affect the planting, as well as flammable objects or vegetation types that will have to be protected from prescribed burning.
Prevailing winds	Wind direction may affect the success and safety of prescribed burn activity for prairie plantings. Design the site accordingly, including relative placement of vegetation, buildings and viewing platforms.

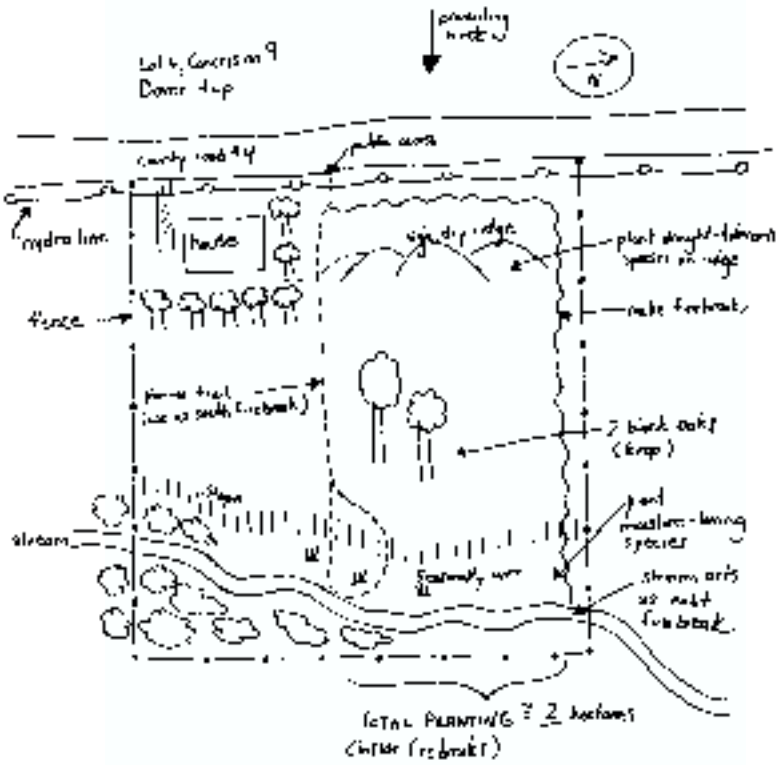
Making a Site Plan

The best designed prairie restorations look like they were not designed at all. They simply look like a natural part of the landscape. They fit the contours of the land, enhance other natural features and human made structures and hide their faults. (Morgan, Collicutt and Thompson 1995)

Just as a blueprint is drawn before a house is built, a site plan should be produced before a planting project is undertaken. A site plan is a detailed picture of the finished project; it can also be used to help plan the work schedule and sell the project to others.

Producing a good site plan involves various ecological, practical and aesthetic considerations. The types of features to include and the level of detail in the site plan depend on several things, including the size, location and intended use of the site. For example, if the project is a small, decorative natural garden, one might design the location of individual plants to produce the desired effect of colour, height and texture (for references on *natural gardening*, see Restoration, Naturalization and Management as well as Plant Propagation and Cultivation under Sources of Information). For a large-scale restoration, you may not be concerned about individual plant placement, but will be much more interested in planning for equipment access and firebreaks.

Start the site plan by making a scale drawing of the site (for large sites, refer to existing survey maps or aerial photos). Add the detailed information collected during the site analysis. For example, sketch in low wet spots, high dry areas, buildings, utility lines and prevailing wind direction. Next, sketch the planting area and add management features such as firebreaks, trails and access lanes if required. Now is the time to look at the developing project to make sure the project goals will be met. Will the project provide wildlife habitat and/or environmental education opportunities, and does it make sense? Use the following checklist to keep on track.



Sketching a site plan will help you plan and carry out the planting project. *Lindsay Rodger*

Planning for Managed Features

Firebreaks: Since regular managed fires are the optimum means of maintaining prairie plantings, firebreaks must be planned for and designed – for example, allocate space around the perimeter to mow or plough strips, or design trails that double as firebreaks. Designing also involves ensuring that anything flammable on the site, from power-line poles and fence posts to buildings and boardwalks, is outside the fire zone or can be protected from the flames. For details, refer to the Maintenance and Monitoring section.

Trails: If the site is to be used for human enjoyment and nature viewing, the type and placement of appropriate facilities, including trails, viewing stations and interpretive signs, need to be determined. Keep in mind the need for a balance between human use and wildlife needs. Trails should be kept to a minimum and should be placed along the edge of the site to leave areas relatively free of disturbance for wildlife use.

Considerations for a Site Plan

- How much of the area is to be planted? Where?
- Is there any native vegetation on site that should be retained?
- Will plants having different requirements for soil type and moisture level be planted in suitable locations on the planting site?
- Is aesthetics important – for example, should placement of plants produce complementary colour, height and texture combinations?
- Will the planting be designed around existing natural and built features in a safe and effective manner?
- If firebreaks are necessary, where will they be located? Consider combining them with other features, such as trails.
- If public facilities such as buildings and trails are planned, where will they be built?
- How much site maintenance will be required?
- Have the needs of wildlife, such as food and shelter, been considered?

- Is the project compatible with local human land uses?
- Is the plan reasonable, given the budget, labour and other resources available?

Scheduling the Work

Once the project is planned on paper, it is time to schedule the work to ensure that each step runs smoothly. See the sample project timeline provided earlier in this section.

Obtaining Seed or Plants

A decision will have to be made whether to plant seed or plants, or a combination of both. Seed is usually less expensive and tends to do better when planted on heavy soils; however, seeds take longer to develop into plants, usually requiring an additional season to reach flowering stage. For this reason, plants are often chosen for small, highly visible sites so that a showy display develops earlier. Volunteers often find it more enjoyable to plant plants. A combination of seed and plants may be considered to best suit the needs of the project.

Decisions regarding which species to plant must be made well in advance to ensure availability. When seed and plant material are to be obtained from a local supplier of native plants, they may need to be ordered at least a few months in advance, especially if large amounts are required. It is better to contact appropriate suppliers at least one year in advance to make sure that they can provide seed and/or grow the plants that are required. If you intend to collect the seed yourself, remember that this must be accomplished in the growing season before planting (see Acquiring Seed and Plants for more information).

Ensuring Availability of Equipment and Assistance

Once the size and scope of the project is known and the site has been analyzed, the type of equipment that will be required and the necessary help can be determined. Allow enough time to find appropriate equipment and sufficient "people power" to prepare the site, plant and undertake ongoing maintenance.

Taking Time to Prepare the Site

Putting the appropriate time and effort into site preparation is critically important – it can mean the difference between a successful project and a failure. The time and amount of work involved in preparing the site before planting vary, but may entail several activities over a whole year, so it is important to plan ahead. Use the results of the site analysis and information from Preparing the Site to help determine the necessary timeline for site preparation. Remember, the effort expended at this stage will more than pay off in terms of time spent dealing with weeds in the future.

Planning for Ongoing Management

You cannot just walk away from a naturalization and restoration project and expect it to succeed. Just like any other planting, continual maintenance is required, so be prepared to put in a fair amount of effort in the first few years. As the plants are trying to establish, they may require water, supplementary planting and some help in overcoming weeds. Once the plants are established, some ongoing maintenance activities will still be necessary (see Maintenance and Monitoring) – for example, regular prescribed burns for prairie plantings, weed removal (especially for meadows) and control of damaging human activities. Make sure to plan for regular help as well as the necessary equipment and supplies for ongoing management. Public acceptance of the project will increase if litter is removed and edges are kept tidy. Keeping a mowed edge, installing a rail fence or putting up an interpretive sign, for example, indicate that someone is maintaining the planting.

Developing a Species List

There is no such thing as an all-purpose species list for a meadow or prairie planting. A dry sandy site in the Peterborough area will be home to a very different group of plants than those found on a wet clay-*loam* site near Chatham. Use the following checklist to help determine which species are best for the project.

✔ **Determine the plant community**
Is the intention to plant a meadow or a prairie?

✔ **Choose native species that occur locally**
Consult Appendix A, regional plant lists (called *floras*) and local naturalists. Ask resource managers to assist in determining appropriate species (see Regional Plant Lists under Sources of Information). In addition, visit nearby natural areas to become familiar with the local native plants.

✔ **Tailor species to project site and goals**
Match information about plant preference, particularly moisture and soil preferences, to the conditions of the project site (see Appendix A). Make sure the choice of species matches the project goals. For instance, some species provide excellent erosion control, and cover and food for wildlife, whereas others provide a colourful show for aesthetic purposes.

✔ **Focus on core species**
Core species form the backbone of naturally occurring prairies and meadows. Core species that are common in nature should likewise be common in the planting. Rare species (such as those so noted in Appendix A) should only be added to the list with guidance from experts. Appendix A lists core species recommended for most planting projects in Southern Ontario.

A giant swallowtail butterfly *(Papilio cresphontes)* on dense blazing star *(Liatris spicata),* a prairie species that flowers from midsummer to late summer. *P. Allen Woodliffe*

✔ **Determine ratio of grasses to wildflowers**
In naturally occurring prairies, the ratio of grasses to wildflowers varies. A prairie planting of half grasses and half wildflowers (a 50:50 ratio) is recommended for Ontario prairies. Meadows are highly variable in their composition, but a good general guideline is to include no less than 30 percent grasses and sedges.

✔ **Consider availability of species**
When you develop the species list, consult seed suppliers to determine which local-source seed or plants are currently available. Planning a year in advance will increase the likelihood of obtaining seed of the desired species.

Milkweed species such as this butterfly milkweed *(Asclepias tuberosa)* are the main sources of food for monarch butterfly *(Danaus plexippus)* caterpillars. Partially eaten leaves in July and August are a sign of their presence. *Ross Brown*

Milkweed and the Noxious Weed List

Milkweed species are an important component of healthy prairies and meadows. They provide nectar for butterflies and hummingbirds, and their foliage is the main food source for monarch butterfly caterpillars. Milkweeds are currently classed as "noxious" under Ontario's Weed Control Act because one species, the common milkweed, can be aggressive in agricultural fields. Other milkweed species are suitable for prairie and meadow plantings and are not aggressive; they should be included in the planting.

Preparing the Site

Selecting the best site-preparation technique for the project can involve many different options and considerations. For example, if some prairie or meadow plants are already present, the site-preparation choices are different from those that would be suitable if the site had no native vegetation. The choice of planting method – use of seeds or plants, mechanized or hand-planted – will also affect the type of site preparation.

Controlling Weeds

Whether you are planting meadow species in a garden or restoring the "back forty" to tallgrass prairie, pay special attention to site preparation. Clearing away undesirable vegetation will remove competition and give seeds and plants the best possible start. The weeds growing on the planting site aren't the only ones to contend with. Weed seeds accumulate in the soil, sometimes for decades, waiting for an opportunity to germinate. This is called a seed bank. When the soil is cleared of surface vegetation, the seed bank has an opportunity to germinate. What looked like bare soil will be covered with weed seedlings that need to be removed. Weed removal may need to be done several times, over one or more growing seasons, to deplete the seed bank and adequately control the weeds. In a small garden, a hoe may be the tool of choice, but for a 2-hectare field, mechanized equipment and/or the application of a glyphosate-based herbicide may be required.

This 8-hectare site is free from weed competition and ready for planting. *Kim Delaney*

There is a lot of debate about whether a herbicide should be used to prepare a site. After all, one of the goals of many restoration projects is to reduce the use of herbicides, insecticides and fertilizers. Many herbicides have associated negative environmental impacts, but not all herbicides are equally harmful – for instance, glyphosate-based herbicide, in particular, can be used without causing harm to upland environments.

Weed-Free Is Key!

Spending the time and effort on weed control before planting and in the early stages of the project will save countless hours of work in the future. If weeds are not properly handled, they can quickly overtake a new planting. Removing an infestation of weeds from between new seedlings is extremely difficult and much more time-consuming than minimizing the problem in the first place. Resist the urge to skip site preparation and move on to planting. Take the time to do it right – at the outset.

Non-chemical site-preparation methods have environmental costs as well. For example, repeated use of heavy equipment on a site with heavy soils can harm or even destroy soil structure, which takes many years to form. Frequent ploughing can deplete vital organic material, disrupt intricate soil life and leave the site prone to erosion problems. Before making a final decision about site preparation, think carefully about the environmental costs, and choose the method that will achieve the desired results with minimum harm. Each site is different, so it is naive to make a blanket statement that one technique is more environmentally sound than another before investigating each one thoroughly. Use Table 1 to assist in comparing the potential environmental impacts of the various site-preparation techniques. Then choose a method on the basis of both relative practicality and environmental risk factors.

Goldenrod: Not the Allergy Culprit

Several species of goldenrod are found in prairies and meadows and should be included in planting projects. Goldenrod is often blamed for the onset of runny noses and itchy eyes during the late summer allergy season. The real culprits, however, are species called common ragweed and giant ragweed. They often grow with goldenrod and they flower at the same time but are not nearly as visible. Ragweed's light airborne pollen is easily inhaled, causing the irritation. Goldenrod is rarely the cause of respiratory allergies because its heavy, sticky pollen is carried by insects, not wind.

The very light wind-blown pollen of common ragweed *(Ambrosia artemisiifolia)* is the main cause of hay fever during August and September. *Judie Shore*

Table 1: Weed-Control Techniques

Technique	Method	Comments
Cultivation	1. Turn under the existing vegetation with a shovel, rototiller or tractor-pulled plough. 2. Allow weeds to grow to a height of 10 to 15 centimetres. 3. Remove weeds manually (hoe, cultivator) or by using a tractor-pulled disc. If perennial weeds are present, use a tractor-pulled harrow to drag roots to the surface, where they will wither. 4. Allow weeds to grow again and repeat step 3 until you are satisfied with weed control.* Each pass of the disc should be increasingly shallow until only the surface is cultivated on the final pass.	• Very effective at eliminating *annual* weeds. • Loosens the soil to allow machine planting of plug plants. • If perennial weeds are present in large numbers, the process can take one to three years, and some of the weeds may still persist. • Not effective when tough perennial weeds such a Canada thistle and quack grass are present. When the roots of these plants are cultivated, many small pieces remain in the soil and each piece is capable of producing a new plant. Cultivation alone may increase these weeds. • Cannot be used on waterlogged soils and may delay spring planting. • Repeated use of heavy equipment can harm soil structure and beneficial soil life that has taken many years to develop. • May leave soil prone to erosion by wind and water. • Prolonged cultivation delays planting activity and results in loss of wildlife habitat for one to three seasons. • Equipment suffers wear and tear. • Cultivation machines consume fossil fuels and release emissions.
Glyphosate-based herbicide	1. Glyphosate-based herbicide (e.g., Roundup®, Expedite Grass & Weed®) is applied to vegetation as per label instructions. Vegetation will be stressed or killed within two weeks. 2. Allow seed bank to germinate and grow up to 5 to 7 centimetres, then have the herbicide applied again. Repeat this process until you are satisfied with weed control.* 3. For shrub and tree removal, cut stems near ground level and treat stump with glyphosate-based herbicide (e.g., Roundup®, Vision®) as per label instructions to prevent resprouting.	• The Ontario Ministry of the Environment requires a glyphosate-based herbicide to be applied by a licensed commercial applicator who holds a valid Operator Licence and an appropriate Exterminator's Licence. Homeowners can apply a glyphosate-based herbicide labelled as "domestic" on their own property without a licence. But remember, it must be applied according to the instructions. Read and understand the label before using the product. • Suitable for small or large sites. • Absorbed into the entire plant, including the roots, therefore effective at eliminating persistent perennial weeds. • Does not disturb the seed bank; therefore, only the seed in the top layer of the seed bank germinates, reducing potential weed problems. • Does not disrupt soil structure or soil life. • Binds tightly to soil particles on contact so it will not leach into the water table. • Does not persist in the soil. • Kills or stresses all vegetation (even desirable species) that the chemical comes into contact with. In some cases it can be applied when desirable vegetation is dormant. • Cannot be sprayed over water or on any wet area. • Must be applied in dry weather and cannot be applied on windy days.

*Measures required for effective weed control can vary. It is most important to gain control of perennial and *biennial* weeds.

Table 1: Weed-Control Techniques (continued)

Technique	Method	Comments
Topsoil removal	Remove topsoil with shovels or heavy equipment, thereby removing weeds and the seed bank.	• Useful where topsoil has already been removed during construction activities. • Prairie plants have a competitive edge on the poor soils that remain after the topsoil has been removed, although planting in very poor soil will result in less lush growth. • Since the topsoil contains the seed bank and roots of weeds, removing it reduces the weed problem. • If too much topsoil is removed, the subsoil below may be too acidic or too alkaline to support plant growth (do a soil test; pH should be in the range of 6 to 7.5; see Soil Analysis Services under Sources of Materials, Specialized Equipment and Services). • Very expensive unless soil is removed as part of a construction process. • Beneficial soil invertebrates are removed with the topsoil and can take years to become re-established. • The specific fungi or bacteria that some plants require to survive are removed with the topsoil. Consider adding bacterial inoculant, see Beneficial Soil Organisms, below.
Soil impoverishment/ reverse fertilization	Turn into the soil organic materials that are high in carbon, such as sawdust and oat hulls.	• Depletes nitrogen in the soil, which weakens weeds and reduces their competition with prairie plants. • If too much organic matter is used, prairie plants become stunted and die.
Solarization	Spread black plastic over the site and pin or weigh it down for a season or more. The soil below heats up to the point where seeds and vegetation are killed.	• Practical only for very small projects. • Plastic is difficult to pin or weigh down for extended periods (prairie and meadow are usually established on exposed sites). • Most soil life is killed along with the plants and seeds. Life will eventually return to the soil but the long-term results are unknown. • Persistent perennial weeds may not die.

Large project sites can be prepared with standard farm equipment such as this combination of plough, disc and harrow. *Kim Delaney*

Choosing Appropriate Site-Preparation Techniques

Deciding which site-preparation techniques are the most appropriate can be confusing. The Site-Preparation Key in Appendix C will assist you in making the right decisions. Also consult local farmers or the extension staff of the Ontario Ministry of Agriculture, Food and Rural Affairs for information on which techniques work locally.

Soil Amendment

Nutrients

Do not add nitrogen to soil when planting prairie and meadow species because these plants can compete better with weeds when the soil is low in nitrogen; and do not bring in topsoil, compost or manure since this material often contains weed seeds as well as nutrients. If the soil is very poor (e.g., subsoil remaining after construction activities), a fertilizer high in phosphorus (P) and potassium (K) may be added to assist root growth.

Beneficial Soil Organisms

Some specific types of bacteria are associated with plant species such as showy tick-trefoil, round-headed bush-clover, shrubby false-indigo and wild lupine. Such plant species are called *legumes*. Bacteria assist legume growth by taking nitrogen from the air and "fixing" it in nodules on the plant's roots. These nodules will eventually decay, and nitrogen will be released into the soil where other plants can access it. This bacteria can be introduced to the plants by shaking seed in bacterial inoculant prior to planting (for source of inoculum see Sources of Materials, Specialized Equipment and Services). Plants may show satisfactory growth without the inoculant, but with it, nodule formation will increase.

Black-eyed Susan *(Rudbeckia hirta)* blooming on very poor soil (less than 2 percent organic content), which was dredged from the bottom of the St. Clair River. *Kim Delaney*

Acquiring Seed and Plants

Native plants grown from local seed

- are adapted to local growing conditions;
- have evolved with local wildlife and provide needed food and shelter; and
- are a part of local ecosystems and thus unlikely to upset the ecological balance.

Acquiring seed and plants can be one of the most enjoyable aspects of a project. Most prairie and meadow plants are perennial, returning every spring from the same root system. For these plants, seed production is a secondary means of reproduction. Seed is produced mainly for dispersal to other locations or as a backup in case the parent plant dies. You can assist seed dispersal by collecting some of this seed and planting it in appropriate areas.

Collecting seed can provide an opportunity to learn more about local plants and ecosystems, but it can also threaten the health and vigour of the few remaining wild stands. As the need for seed grows, wild stands may not be able to continue to satisfy the demand. Furthermore, removing seed from wild plants removes food that would otherwise be available for insects, birds and small mammals. Consider purchasing most of the seed for the project from a reputable native-plant nursery. These companies use small quantities of wild seed to grow plants in a nursery setting; the plants in turn produce large quantities of seed. This approach relieves the collection pressure on plants in the wild.

Use Local Seed

Seed for naturalization projects should be of local origin. Defining "local," however, is easier said than done. In the absence of research on the issue, even the experts are unable to agree on a definition. Recommendations for seed collection range widely: from no more than a few kilometres to more than 300 kilometres from the project site. Keep in mind that the growing conditions a hundred or more kilometres north or south of a project site will probably be quite different from the conditions the same distance east or west.

Collecting seed offers the chance to get to know more about the native plants that grow in your local area. *P. Allen Woodliffe*

If you are purchasing seed, ask about its source. Reputable suppliers will tell you where they obtain their seed. Also consider hiring a person to collect seed; but make sure that the person contracted to do this is qualified and uses ethical seed-collection techniques (see below for further details). The Ontario Chapter of the Society for Ecological Restoration (SER) publishes a directory that lists growers and collectors located in Southern Ontario (see Helpful Organizations under Sources of Information).

Seed collecting can be done by hand or with various machines designed for this purpose. *Larry Lamb (top and lower right) and P. Allen Woodliffe*

Plants, too, should come from a local seed source. Grow them from seed collected as close to the project site as possible or purchase them from a native-plant nursery that grows plants from local seed. It is surprising how many plants sold as native wildflowers have been grown from seed imported from as far away as Europe.

Avoid Planting Cultivars

Many nurseries sell horticultural varieties or cultivars of native plants. These varieties have been developed by the horticultural trade for traits such as showier blooms, more attractive leaf colour or larger flowers. They are often exact copies of the parent plant and therefore have extremely low *genetic diversity*. Cultivars of the following native species are widely available, but are unsuitable for restoration or naturalization projects: asters, goldenrods, wild strawberry, wild bergamot, sneezeweed, black-eyed Susan and blazing star.

Ethical Seed Collection

Reputable seed collectors follow guidelines for ethical seed collection. Spread the word and help new seed collectors understand the issues.

- Always obtain permission from the landowner before collecting. Remember that seed-collecting is normally prohibited in national and provincial parks, national wildlife areas, nature reserves and nature sanctuaries.
- Do not collect all the seed from one stand of plants. Guidelines on the amount to collect recommend a maximum of 50 percent of the seed from perennial plants and 10 percent of the seed from annual plants. The problem with this approach is that you may not know whether a plant is an annual or a perennial, and you have no idea how much seed has already been collected before you begin, or if others will harvest after you. Use your judgment and leave a lot more than you take.
- Do not collect seed from *vulnerable*, *threatened* or endangered species without the guidance of a qualified ecologist or biologist. Under Ontario's *Endangered Species Act*, it is illegal to pick the seeds of various endangered plant species.
- Store and handle this valuable, perishable resource wisely.
- Share seed and information with other local seed collectors and propagators.

Ethical Plant Salvage

- Do not dig plants from natural areas unless the donor site is to be cleared for development.
- Ask permission from the landowner to enter the site, and strictly follow the landowner's directions with respect to access.
- If salvaged prairie and meadow plants are properly potted and watered, they can be stored outdoors in a sunny location for at least a year, until a suitable recipient site is found.
- Keep in mind that it is always a priority to help protect natural areas, and salvaging a few plants from a development site does not save the complete habitat.

Ensure Genetic Diversity

Weather in Southern Ontario is extremely variable and plants need to be able to adapt to these changes. Genetic diversity allows plants the ability to do so. Increase the genetic diversity of a planting by observing the following guidelines.

- Collect seed from a large population. Take small quantities of seed from many individual plants rather than large quantities from a few specimens. Avoid

choosing only the most handsome plants. Valuable genetic traits for long-term survival may be missed if you are too selective.

- Collect seed of each species from several different locations with varying soil and moisture conditions.
- The seed of some species ripens over a period of time. In these cases, collect early-, mid- and late-ripening seed.
- Collect in different years and add to your planting site.

These dry, black-eyed Susans *(Rudbeckia hirta)* have ripe seed ready to be harvested. *Lindsay Rodger*

Seed-Collecting Tips

- Seed for most prairie and meadow species begins to ripen by mid-summer (except for some early-blooming species such as prairie buttercup, hoary puccoon and narrow-leaved blue-eyed-grass).
- Most seed is ready for collection six to eight weeks from time of blooming.
- Let seed ripen thoroughly on the plant because not all seed will continue to mature once picked.
- Seed is ripe when
  - it is dry and falls away readily when seed head is handled;
  - individual seeds are brown, tan or grey, and hard (pinch with fingernails to test for hardness); or
  - seed pods are brown or tan and beginning to split open, and seed is easily dislodged or readily falls from pod when it is shaken.
- Plants in seed often bear little resemblance to the same plants in full bloom. Identify species and record locations when plants are in bloom in order to help find them and ensure accurate identification later in the season. Tying colour-coded yarn on typical specimens of species works well.
- Use a hand lens and pen knife to check the quality of seed in the field before spending time collecting it. Look for full seeds with no insect damage.
- Use paper or burlap bags to hold seed, and store in a cool, dark place. Do not use plastic because it heats up and retains moisture, which will damage the seed.
- Immediately after collecting, label each bag with the species name, the date when and the location where the seed was collected.

Seed Drying and Cleaning

Seed should be thoroughly dry before it is stored; for most seed, this will take four or five days in good conditions. Place it in shallow pans or on screens in an area free of rodents, or place it in a paper bag and hang it from a rafter of an unheated garage or barn. Do not use a conventional oven, microwave oven or food-drying machine. Make sure each container is labelled with the species name, collection date and location. Low humidity and warm temperatures will speed the drying process, but higher temperatures will reduce seed *viability*.

This pink form of the typically purple New England aster *(Aster novae-angliae)* has begun to produce ripe seed. *Joanne Rzadki*

Before seed can be cleaned, pods and hulls need to be shattered, and seed heads broken up. Always wear a mask when processing dried seed because there can be a lot of dust, and, in some cases, the potential for contracting disease associated with mouse feces. Separate the dried seed from the waste plant material (chaff) using one of the following techniques:

- Sift seed through a variety of sieves and/or screens.
- Separate seed from its pappus (fluff) by rubbing it gently through a screen. Use a hand lens to check periodically for seed damage.
- Pour the seed from one container into another outside in a light breeze or indoors in front of a fan. The heavier seed will land in the container or in front of the fan, and the lighter chaff will blow away.
- On a smaller scale, a hair dryer can be useful for blowing chaff from a pan of seed.

Seed Storage

To remain viable for as long as possible, dry seed should be stored at low temperatures (4 degrees Celsius) and low humidity (no more than 10 percent). Store dry seed in airtight containers (jars or plastic pails with tight-fitting lids) in a refrigerator or in an unheated building over the winter, and in a space that can be kept as cool as possible during summer months. Seed stored above 28 degrees Celsius will lose viability quickly.

Insect eggs that are present at the time of collection can hatch, and the larvae can damage seed. Just because insects are not visible, do not assume there are no eggs. Eggs are often present inside the seed. Check stored seed periodically for the presence of insects. At the first sign of insect activity, place seed along with small pieces of *No-Pest® strips* in sealed bags or containers. Alternatively, sprinkle *diatomaceous earth* (obtained at garden centres or farm supply stores) throughout the seed. This will kill any insect larvae that emerge while the seed is in storage. Only a very small amount of diatomaceous earth is needed. Be sure to wear a dust mask while handling seed treated with diatomaceous earth. Squirrels and mice can also damage the seed; however, cats can be a good deterrent for mice in indoor storage areas.

Seed Treatment

The majority of prairie and meadow plants native to Ontario produce seeds that require a period of chilling, or *stratification*, before *germination*. This cold period approximates conditions that the seed would experience during the fall and winter months. Many species require additional treatments to induce germination. Appendix A lists germination codes on a species-by-species basis, and Appendix B explains germination requirements and corresponding codes.

Growing Plants

If a heated space with a lot of sunlight is available, you can consider growing some of the plants for the project.

Large-scale plug production requires greenhouse space to ensure adequate light levels. *Kim Delaney*

For example, teachers may have their students produce a few trays of plants in a south-facing window, under grow lights or in a cold frame. Many high schools have empty greenhouse space that could be put to use. Consider the size of the project when deciding whether or not to grow your own plants. Growing plants can be an enjoyable experience if small quantities are required and there are appropriate facilities and enough time. Keep in mind that at a recommended planting rate of 25,000 plants per hectare, it is usually best to have a grower produce most or all of the plants.

Basic Growing Techniques

Many good books are available on growing plants from seed, and these can be consulted to learn more about basic growing techniques (see Plant Propagation and Cultivation under Sources of Information). Here is a brief summary of the process:

- Sterilize all containers by dipping them in a 2 to 3 percent bleach solution to prevent diseases.
- Fill containers with a growing medium of either a no-soil seedling mix or a sterilized potting soil, which will prevent fungal diseases such as *damping off*. Potting soil can be sterilized by heating one large zipper bag of soil in a microwave and then allowing it to cool. The moist growing medium should be settled by tamping down firmly; add more soil if necessary.
- Place four or five seeds on top of the soil in each container. If the seed requires light to germinate (see Appendices A and B), simply press the seed lightly into the soil. Otherwise, cover the seed with soil to a depth of approximately two times the diameter of the seed. A flour sifter is useful for this.
- Mist soil lightly after seeding. Plastic covers can be used to keep moisture in until germination occurs. Don't overwater new seedlings since waterlogged soil prevents the oxygen exchange necessary for proper root growth.
- Thin seedlings to one per container.
- Once plants are growing strongly, water them generously and allow the soil surface to become slightly dry before watering again. Water the edges of the growing area thoroughly – they dry out quickly. If fungus gnat larvae infest plant roots, or if other insects become a problem,

Plants grown from seed in containers that are divided into compartments are called plant plugs or plugs. *Kim Delaney*

lightly work the soil surface and hang yellow sticky plastic cards above the plants to capture adults. Insects are attracted to the yellow colour of the card and will be trapped by the sticky surface. These cards are readily available at most garden centres. Predatory mites are another non-chemical means of insect control (see Greenhouse Supplies under Sources of Materials, Specialized Equipment and Services).

- About four to six weeks after germination, fertilize lightly with a diluted solution of a balanced fertilizer such as 7-7-7. Organic growers can use fish emulsion or liquid seaweed.
- *Harden off* plants by gradually exposing them to outdoor conditions before they are planted permanently outside; initially, allow them only indirect sunlight since even 10 minutes in full sun can burn the leaves.

Planting the Project Site

All the hard work so far has been geared towards getting seeds and plants ready to put into the ground. Planting is one of the most rewarding aspects of naturalization and offers a perfect opportunity to involve interested community members in some hands-on work. Children, in particular, love planting, and many will watch the progress of their plants with great interest.

Planting Seed or Plants: Timing and Techniques

Choose appropriate timing as well as a suitable planting technique to give the planting the best possible chance of success. Use the information in Tables 2, 3 and 4 to help make decisions regarding the timing and techniques of putting the seed or plants into the ground.

Make sure that the seeds and plants are cared for on planting day. Seed left in a container in the hot sun will be damaged, maybe even killed; so keep seed containers in a cool, shaded spot. Plants will need protection from the sun and wind prior to planting, and they may also need watering. Keep an eye on them because they can dry out very quickly on a windy day.

Proud teacher and students of Howard-Harwich-Moravian Public School in Ridgetown have used their schoolyard prairie planting as a venue for outdoor theatre. *Lauren Harris*

Table 2: Appropriate Seeding and Planting Times

Seeding	Planting Plants
• Best done as early as possible in the spring and before the end of May in Southern Ontario, to take advantage of seasonal rainfall. • Early-winter seeding is an option for wildflowers but does not work well for grasses. Broadcast the wildflower seed over frozen soil, where it will remain cool and moist until spring. This technique is called frost seeding.	• In Southern Ontario, best done in May (before the end of June at the latest), to take advantage of rainfall and the long growing season ahead. • Plants can be planted throughout the season if watering is a practical option. • Fall planting is possible only in well-drained soils because frost will heave fall-planted plants out of the ground in wet, heavy soils.

This volunteer is hand seeding the weed-free bed. *Mary Gartshore*

While small projects can be seeded by hand, large-scale projects require machines such as this seed drill. *Kim Delaney*

Table 3: Seeding Techniques

Seeding Technique	Method	Comments
Hand broadcasting	• The simplest method is to scatter seed by hand over the bare soil. Mixing seed with sand before broadcasting allows for more even seed distribution. • Various hand-cranked seed broadcasters are available for surface broadcasting of seed. • Two passes over the site works best, at right angles to each other. • Rake seed in lightly. • Firmly pack soil after seeding to ensure good seed-soil contact. On a small site, stamp it in – or let children have fun jumping on plywood boards that are moved around the site. Larger sites can be rolled or cultipacked.	• Suitable for small projects and gardens. • Unskilled labour can be used. • Equipment is inexpensive. • Can be done on wet sites or slopes that equipment cannot reach. • Seeding rates are twice those recommended for drilling (see Drilling, below). • Cannot be done on windy days.
Machine broadcasting	• A tractor-pulled wildflower seeder or an ATV-mounted seeder broadcasts seed. Equipment brand names include Bevco™ and Truax™. • Incorporate seed lightly into the soil by raking or dragging chains behind the ATV. • Use a lawn roller or tractor-pulled cultipacker after broadcasting seed to make the soil firm and ensure good seed-soil contact.	• Suitable for large projects. • Equipment is less expensive than a drill. • Equipment availability and price can be a problem. • Skilled labour is necessary. • Seeding rates are twice those recommended for drilling (see Drilling, below). • Calibrating the seed rate can be difficult. • Cannot be done on windy days. • Fluffy seed will not always flow through seeder, but cracked grain can be added to help prevent equipment from plugging.
Drilling	• A tractor-pulled native-seed drill places the seed at a predetermined depth and spacing, and then packs soil firmly. Equipment brand names include Truax™, Nesbit™, Great Plains™, Brillion™ and Tye™. • One pass over the site is adequate.	• Suitable for large projects. • *No-till* option available. • Designed to handle fluffy seed, but seed must be free of chaff and stems. • Most efficient use of limited seed. • Can be done on windy days. • Ensures good soil contact without use of additional equipment. • Equipment availability and price can be a problem. • Skilled labour is necessary. • Equipment can get plugged up if seed is not clean enough; add cracked grain to seed to help it flow through the equipment.

Table 4: Planting Techniques

Seeding Technique	Method	Comments
Hand planting	• Place potted plants and plugs in a hole slightly larger than the root mass. Firm the soil around roots leaving a slight depression to catch water, and water plants thoroughly. Ensure that roots are not left exposed after watering. • Bury tubers and rhizomes below the surface, firm the soil around them and water thoroughly.	• Suitable for small projects and gardens. • Good opportunity to involve the community. • Equipment (trowels, shovels, *dibbles*) is readily available and inexpensive. • Can be done on wet sites or slopes that equipment cannot reach. • Time-consuming. • Hauling sufficient water can be difficult.
Machine planting	A tractor-pulled plug planter cuts a trench, places plugs at a predetermined depth and spacing, waters each plant and then closes the trench.	• Suitable for large projects. • Very efficient use of time – for example, a two-row planter can plant up to 40,000 plugs a day. • Water is used efficiently because it is delivered to the roots as plants are planted. • Rows are evenly spaced, which allows for machine cultivation of site for weed control. • Equipment availability and price can be a problem. • Needs a level or gently sloping site with good site preparation.

Seeding and Planting Rates

The following guidelines will assist you in determining the appropriate amounts of plants or seed to use. Before planting, take note of any major differences in conditions such as soil moisture within the site, and match species to conditions. For seeding, this may mean preparing two seed mixes – for example, one mix with species suited to moist conditions and the other with species preferring dry conditions.

Seed

In the tallgrass prairie region of Southern Ontario, the recommended seeding rate for drilling seed is 13 kilograms per hectare (see Table 3 for information on hand and machine broadcasting). Of this, 9 kilograms is grass seed and 4 kilograms is wildflower seed. This guideline aims at achieving a 50:50 grass-to-wildflower ratio. Double the amount of seed per hectare when broadcast seeding. Certain projects may require different seeding rates. For example, wildlife managers planting for northern bobwhite prefer a more open planting to facilitate the movement of birds. This would requiring a drill-seeding rate of approximately 9 kilograms per hectare.

Prairie grass seed destined for a restoration project in Southern Ontario. *P. Allen Woodliffe*

Meadows can be seeded at a similar rate, but to accommodate the higher percentage of wildflowers, divide the 13 kilograms into 7 kilograms of grass seed and 6 kilograms of wildflower seed. This is a general guideline; quantities can be adjusted to suit the project goals, such as providing food plants for a butterfly meadow, seed-producing species for birds or a high percentage of showy blooms.

If you use equipment such as a seed drill that can be calibrated, the seed should be spread at a rate of 320 to 540 seeds per square metre. If you are hand broadcasting the seed, mix it with dampened sand and divide into two batches. Take the first batch and starting at one end of the site, spread it as evenly as possible over the entire area. Then take the second batch and starting at right angles to the first pass, spread it as evenly as possible. This technique will ensure that there is enough seed to cover the entire area.

Hand planting plugs is an enjoyable activity for all ages. *Lindsay Rodger*

Plug Plants

Plant plugs at a rate of 25,000 per hectare. This works out to 2.5 plants per square metre, or 25 plants per 10 square metres. For some projects, and where funding permits, plugs can be planted closer. Spacing the plugs 25 to 40 centimetres apart (that is, between 9 and 5 plants per square metre respectively) will result in a thicker and showier planting. Mix species during planting so that grasses and wildflowers are evenly distributed throughout the project area.

While hand planting is fine for small projects, mechanized equipment such as this modified tomato planter is more appropriate for plug planting large areas. *Lauren Harris (top) and Thomas Chatterton*

Successional Planting

Prairies and meadows change over time. When you are establishing either a prairie or a meadow from seed, certain species will be more successful in the early stages and create conditions that allow other species to establish more readily later on as the community matures. You may wish to plant a prairie or meadow by seed and patiently wait up to five years or more for the later-successional species to appear. Or you may prefer to initially plant only the seed of early-successional species and add plugs of the later-successional species in subsequent years.

Gray-headed coneflower *(Ratibida pinnata)* blooms from early summer to midsummer. *Ross Brown*

- Some early-successional species are black-eyed Susan, gray-headed coneflower, wild bergamot and showy tick-trefoil.
- Some later-successional species are dense blazing star, closed gentian, fringed gentian and round-headed bush-clover.

See Appendix A for more listings of early- and later-successional species.

Cover Crops

Cover crops are sometimes planted for aesthetic reasons or to prevent erosion on steep slopes. They also provide quick cover that helps to suppress the growth of weeds while prairie or meadow plants become established. The non-native annual oats is a good cover crop because it suppresses weeds before disappearing from the planting. Annual oats is broadcast on the surface of the soil at the same time as planting or seeding, or up to two months before the first fall frost. Canada wild rye, a *cool season*, early-successional grass species that is native to tallgrass prairie, is gaining popularity as a cover crop. It establishes quickly, overwhelms many weeds and becomes less prevalent as the other prairie species become established. Do not use rye grain, rye grass or winter wheat because these species grow aggressively and are often persistent. They are also thought to release toxins that interfere with the growth of other plants.

There is debate about the effectiveness of cover crops. On the one hand, cover crops

- protect tender young plants from sun scald and wind burn;
- shelter the soil, thereby helping it retain moisture and reducing compaction from driving rains;
- provide quick cover, which protects the soil from erosion due to wind and rain;
- compete with annual weeds;
- provide fuel for a prescribed burn the following spring; and
- can be harvested as hay or grain crop, which may provide income.

On the other hand, they

- compete for sunlight, moisture and nutrients with the young plants they are intended to protect;
- often require mowing when in bloom to prevent seed from maturing; and
- may persist in the planting for several years longer than desired.

Cover crops such as annual oats are most effective when used with plug plants because the plugs have a head start on the seeded cover crop. When a cover crop is used in a seeding project, the results are more unpredictable. Experience suggests that annual oats may

work better on sand than on clay. If a cover crop is used, broadcast it at a rate of 30 kilograms per hectare, and mow it to a height of 20 centimetres in midsummer.

Mulch

Mulch can be considered for the planting. Mulch will

- protect the soil from erosion;
- shelter the soil and keep it moist;
- help prevent weed seeds in the soil from germinating (although seed may blow in and root in the mulch itself); and
- use nitrogen while decomposing, which depletes soil reserves of the nutrient. This nitrogen depletion, known as reverse fertilization, favours the growth of prairie and meadow species over weedy species.

Mulch is best used on small plantings since it is far too labour intensive for large projects. Use weed-free, biodegradable material such as aged sawdust or shredded or chopped straw (not hay, which contains weed seeds), and spread it between plants – deeper around more established plants (sawdust 3 to 5 centimetres, straw 5 to 10 centimetres). Do not allow the mulch to touch the individual plants because it can trap moisture against the plant tissue and cause rot. Mulch can also be used on seeded sites, but must be spread very lightly over the seed bed.

Ripe seed heads of Canada wild rye *(Elymus canadensis),* a tall, attractive grass that can be used as a cover crop. *Kim Delaney*

Maintenance and Monitoring

Many Hands Make Light Work

Some aspects of maintenance and monitoring are periodic and somewhat labour intensive. The involvement of community members who have a passionate desire to help out and see the project progress can make a valuable contribution to the long-term success of the project. Local youth groups, such as Scouts or Girl Guides, can gain insight into a natural ecosystem while working towards an environment or a community badge. Students from a local high school, college or university may be interested in undertaking monitoring work as a school project. The more involvement from the local community, the greater the understanding of and interest in the project goals. The most successful kind of project is one that all members of the community understand, participate in and enjoy.

Maintaining the New Planting

Watering

Seedlings and small plugs are particularly vulnerable to drought as they are becoming established in their new environment. If rainfall is not regular and sufficient, the plants will benefit from watering. Watering is rarely necessary if seed is used, since most seed will not germinate until there is adequate moisture. The exception to this rule occurs when there is a prolonged dry period after the seedlings have started growing. Plug plants, however, may require periodic watering during their first season in the ground. Portable sprinkler systems are an advantage if a large water supply is readily available. Any water is better than none, however, for watering will improve almost any project's results, especially in the first year.

Once the seedlings are established, they should need no further watering; even in dry years they will survive much better than most surrounding vegetation. Prairie plants, in particular, spend most of the first season developing a good root system, an adaptation critical to survival in a drought-prone environment.

A Community Restoration on the Rice Lake Plain

Tony and Heather Kenny own land along the Otonabee River in Peterborough County. Working with the local *Stewardship* Council, the Kennys restored 5 hectares of their agricultural land on the Rice Lake Plain to tallgrass prairie. More than 50 volunteers came out to help plant the prairie, and many continue to assist with ongoing maintenance.

A demonstration garden was established at the entrance to the project so visitors can identify some of the 20 species of plants used in the restoration. Two years after the first plant went into the ground, the number of songbirds and butterflies was already rising.

Weeding

One of the biggest challenges in the early stages after planting is the suppression of weeds. Even with the most rigorous site preparation, weeds will appear, although this is less of a problem in sandy soils than in clay or organic (nutrient-rich) soil.

It is important to identify the weeds growing in your planting and to determine which are annual, which are biennial and which are perennial (see Restoration, Naturalization and Management under Sources of Information). It is quite possible that there may be some of each.

Persistent perennial weeds such as Canada thistle *(Cirsium arvense)* can be effectively controlled with a spot-spray of glyphosate-based herbicide. *Steven Aboud*

In the case of annual weeds such as common barnyard grass, it is not necessary to remove the whole plant, since it only lives to produce seed once and then dies. Annuals can be controlled effectively by preventing them from producing seed; this is best done by mowing them in the growing season to remove the flowers. Mowing might have to be done several times in one season to keep seed from forming. A tractor-mounted mower may be necessary for the first mowing. Setting the mower at about 20 centimetres high should allow for the cutting of the flower parts of the weeds, which, in the first year of planting, will likely shoot up above most of the planted species. Even if you mow the tops off the perennial prairie or meadow species, this will not harm them, but will prevent them from flowering. Follow-up weed control can be done with a gas-powered "weed eater" to control problem patches while minimizing the impact on growing prairie or meadow.

Biennial weeds, such as white sweet-clover, won't flower until the second season of growth, so it isn't necessary to mow them during the first season of growth. In the second year, they should be mowed to prevent them from flowering and setting seed. If there are only a few biennial weeds in a planting, individual flowering stems can be cut off by hand, at the base just above the root.

For hard-to-control species, including biennials and most perennials such as red clover, Queen Anne's lace and Canada thistle, spot spraying with a glyphosate-based herbicide is recommended. Remember that glyphosate will kill all actively growing plants it comes into contact with, including the planted species, so it must be applied in a way that only undesirable plants are sprayed. Mowing perennial weeds is not an effective technique. While mowing can keep them from setting seed, it will not remove them from the planting and will provide, at best, only limited control.

Hand pulling is an option for weed control, but not the preferred method in most cases. Pulling up roots disturbs the soil, which brings dormant weed seeds to the surface where they are likely to germinate and thus exacerbate the weed problem. It is hard, time-consuming work, and it is often difficult to interest volunteers in this activity. If you wish to hand-pull, it is important to remove the entire root, especially when pulling perennials, because even the smallest piece of root may be capable of producing a new plant. If not done properly, pulling can compound the problem. On sandy sites, weeds can be pulled anytime. On clay sites, it is easiest to get the entire root when the soil is damp – for example, the day after a good rain. Removing the material from the site is recommended, especially if the plants are mature enough to have begun to set seed. If it rains before the weeds die, they may have a chance to reroot and all the hard work will go to waste!

Unwanted Guests: Weeds That Won't Go Away

In some plantings, specific unwanted plants may cause problems, even with the best weeding and mowing efforts. For example, plants such as Canada thistle, black locust trees and dog-strangling vine (pale swallowwort) can be very invasive, and special efforts may be required to completely remove them. Take time to identify, to the species level, any problem plants in the planting. Then use the various resources on *exotic* and *invasive plants* listed in Restoration, Naturalization and Management under Sources of Information to figure out the best way to get rid of these unwanted guests.

Long-Term Maintenance

After the planting has become established and has covered all exposed ground, maintenance requirements will be substantially reduced. The deep roots of prairie plants, in particular, help minimize the establishment and growth of weedy species. Long-term maintenance involves simulating natural disturbance to keep woody species from moving in and turning the prairie or meadow into a woodland. This can best be done with prescribed burning for prairie plantings and with tree and shrub control for meadows.

The deep roots of native prairie grasses can block the spread of persistent perennial weeds with lateral root systems (such as Canada thistle), whereas non-native, more shallowly rooted grasses do not control these weeds. *Judie Shore*

Maintaining Meadow Plantings

Natural meadows along rivers, on floodplains and on very dry sites often rely on the natural processes of flooding or drought to maintain them. This periodic disturbance keeps woody species from becoming established and prevents succession to a treed landscape. In a meadow planting, these disturbance processes are likely to be absent, thereby allowing woody species to become established. The key to long-term meadow maintenance, then, is to keep a balance between herbaceous and woody species. When trees and shrubs become too numerous, selective removal is necessary. Some can be controlled by mowing with a heavy-duty mower or hand-held brush saw. Mowing, however, may actually encourage the spread of other species such as dogwoods and willows. Removing these species requires a different approach: cut the woody stems near ground level and have a commercial herbicide applicator (see Sources of Materials, Specialized Equipment and Services) follow immediately behind to treat the stumps with a glyphosate-based herbicide (e.g., Roundup®, Vision®) as per label instructions to prevent resprouting.

Prescribed Burns for Prairie Plantings

CAUTION: This guide does not provide detailed instruction for successfully carrying out a prescribed burn. It merely highlights some of the concerns to be considered and provides contacts where proper assistance can be obtained. If you have no experience with prescribed burning, seek help and training from someone who does. For assistance in planning and preparation, read reference material such as *How to Manage Small Prairie Fires* (Pauly 1988). Contact the local Ontario Ministry of Natural Resources (OMNR) district office for guidance, and the local fire department for permission to conduct the burn.

CAUTION: It is necessary to obtain permission before conducting a prescribed burn. In some areas, municipal bylaws prohibit the setting of fires. In other places, permits may be necessary. Check local regulations by contacting the municipal office, and discuss the plans with the local fire department. A written burn plan helps to satisfy local requirements.

Fire is a key maintenance tool for prairie remnants and plantings. When performed correctly, a prescribed burn will serve to both discourage weeds and stimulate growth of the fire-adapted prairie plants.

Unlike a forest wildfire, a prairie prescribed burn is a low-intensity fire that moves quickly over the landscape. Extensive experience with prescribed burns in Southern Ontario has demonstrated that they can be carried out safely on prairie remnants and plantings, even in cities (see Fire in the City, on page 28). However, a prescribed burn must be carefully planned and conducted, with experienced people advising and assisting.

Fire is a natural and important part of prairie ecology. *P. Allen Woodliffe*

Fire in the City

Toronto's High Park is home to a remnant oak savanna that has become degraded, in part due to decades of fire suppression. When the restoration initiative for this site started in 1993, volunteers were faced with an invasion of non-native trees and herbaceous plants. Various restoration techniques, including prescribed burning, are being used to help bring the oak savanna back to its former glory. The OMNR worked with the volunteer group and the city's Parks and Recreation Division to develop a prescribed burn plan, and trained OMNR employees conducted the burns. Initially, some Toronto residents expressed concern about the burning, but members of the High Park project took steps to explain the vital role that fire plays. They made presentations at community meetings, installed informative signs in the park and wrote articles in local newspapers. Thanks to their efforts, community support for this restoration project has grown. As of 1999, two small burns had been safely conducted right in the heart of Canada's largest city. Following this success, the city is planning to proceed with operational-scale burns of 10 to 15 hectares per year, for the next eight years. The annual burns are to be implemented by experts, with the help of city staff and volunteers. Restoration work in this city park has become a concerted effort with the addition of a seasonal field crew dedicated to this purpose.

Ontario Ministry of Natural Resources fire crew members conduct a prescribed burn to restore oak savanna habitat in High Park, Toronto. *Karen Yukich*

The remnant population of wild lupine *(Lupinus perennis)* in High Park has flourished since the reintroduction of fire. *Gera Dillon*

A Prescribed Burn Plan

Preparing a prescribed burn plan is an essential first step that will help you think through all the necessary preparations and precautions. Keep in mind that simple small-scale prescribed burns have fewer planning requirements than larger burns, and that the OMNR can provide advice on preparing a plan that is appropriate for the complexity of the burn. Once this plan is in place, it can be revised annually, and, depending on the complexity of fire issues, can possibly be carried out with minimal OMNR involvement. If additional assistance is needed in subsequent years, the local OMNR fire-management office will be able to provide information on consultants and contractors who are involved with prescribed burning in the area (see Sources of Materials, Specialized Equipment and Services).

A prescribed burn plan should cover the following:

- A list of the objectives and how they will be accomplished
- Amount of land to be burned
- Timing and frequency of burns
- Site preparation (e.g., setting up firebreaks)
- Appropriate weather conditions for conducting the burn (e.g., wind direction and humidity)
- Equipment and people required
- Water sources available
- A step-by-step outline of how the burn will be conducted
- The necessary fire permits
- A communications plan (notifying appropriate local authorities and local residents)
- Safety and emergency procedures

Use the following information to develop a prescribed burn plan:

- Burn frequency

  For new plantings, fire should be used when there is enough build-up of dry grass to carry the fire, usually by the second or third year after planting. Burning every year initially and every two years on average after the planted vegetation is well established can be the most effective tool in controlling weedy and/or non-native competition as well as in stimulating the prairie vegetation. As the prairie matures (once non-native plants are largely removed and the prairie plants have covered the bare ground), conduct burns less frequently (every three to five years).

- Time of year
  In the past, prairie fires would be sparked by lightning strikes and they likely occurred at different times of the year. Most prescribed burns are done in early spring (mid-March to late April in southwestern Ontario, late April to mid-May in more northerly areas) for both ecological and practical reasons. Fires set at other times may favour certain weed species that do not cope as well with early spring burns. Consult an expert if you would like help in fine-tuning the timing of the burn to manage the planting for specific prairie species within the mix of forbs and grasses.
- Animal refuges
  Many animals will be able to escape the flames, but some wildlife, such as insect eggs and larvae, will be lost. If practical, leave some areas unburned to allow refuges for wildlife. Consider burning half of the site each time on a rotating basis.
- Safety
  Ensure that adequate firebreaks are created by ploughing a 2-metre strip of vegetation or mowing a strip and laying out a soaker hose or treating it with fire-retardant foam. Take advantage of existing firebreaks such as rivers or roads. Fire should be managed so that smoke does not become a nuisance or hazard to residents or motorists.

Prairie Fires

Fire is one of the most important factors leading to the development of prairie and is vital for keeping a prairie healthy and thriving. Prairie fire

- Consumes dead plant material and recycles nutrients quickly.
- Directly kills or at least suppresses non-prairie species.
- Releases nitrogen into the atmosphere, making it less available for plant growth. Prairie species are adapted to low nitrogen levels and thus have an advantage over weedy species.
- Leaves a layer of black ash on the soil surface, which absorbs warmth from sunlight and stimulates the growth of prairie plants.

Alternatives to Burning Prairie

Burning will not be an option at every location. If this is the case at your site, mowing can be a partial substitute for fire. Mow in late fall, according to the same cycle that would be used for burning. By then, birds have finished nesting, and prairie and meadow plants have set seed. Consider mowing only half the site on a rotating basis to retain adequate winter cover for wildlife.

Firebreaks such as this ploughed strip are used to contain the prescribed burn within selected areas. *John Bayes*

Remove the cut stems because the thatch (dead grass) layer will provide an additional nitrogen source for weed growth. Once the thatch is removed, sunlight will warm the ground and encourage the growth of prairie plants.

Monitoring and Reporting

There is nothing like hard evidence to demonstrate the successes (and pitfalls) of any project. Written notes, photos and numerical data provide a record of what has been done for your own satisfaction. But this information can also be useful to

- demonstrate success to project funders;
- nullify potential opposition to secondary phases of a project;
- advertise and promote for future fund-raising;
- add to the knowledge base in your local area and encourage others; and
- learn which approaches and techniques worked and which did not; this is valuable information for modifying management methods and for future projects.

Monitoring a project requires patience and realistic expectations – a ploughed field does not become a dense, weed-free flowering prairie or meadow in one season. Use the information in Table 5 to assess progress or troubleshoot.

Photo Monitoring

One of the easiest monitoring methods is using photos to record the process from the beginning, the species that are present and the people involved. Photos taken from fixed reference points can be useful to demonstrate both obvious and subtle changes over time. This should be done seasonally and annually.

Table 5: Assessing the Success of the Planting Project

Items to Monitor	Signs of Success	Troubleshooting
Number of species growing versus number planted	High percentage of species survival; if seeded, increasing number of species appear in future years.	Poor results may suggest • poor species choice for site conditions; • extreme early growing conditions (too wet or dry); • site contamination by herbicides; • inadequate maintenance (e.g., water needed to establish); or • heavy grazing by insects or other animals (e.g., rabbits, geese). Assess problem/conditions and augment planting with appropriate species.
Estimate of percentage of plant survival for each species (if using plugs)	At least 75 percent in first year. Gaps will be filled in through clumping or self-seeding in subsequent years.	Troubleshooting comments above are applicable here as well.
General plant health and vigour	Hardy, green (or red-brown in late season), growing plants, with no sign of damage or disease.	If an excessive amount of mulch has severely depleted available soil nitrogen, plants will appear yellow. Consider fertilizing with small amounts of nitrogen.
Flowering and seed set	If planted early enough, flowering and seed set of plugs could occur in first year. Most plants, whether starting from seed or plugs, should flower and produce seed by second year.	Extreme growing conditions may cause delay in growth and development. Excess weed problem could hamper growth. Patience is needed. If the plants are still alive, with proper maintenance (weed control, prescribed burns) all should flower and produce seed.
Plant cover	By second or third year, there could be a relatively even, dense plant cover over the entire project area.	Assess very large bare patches for specific problems (e.g., too wet/dry, herbicide drift from adjacent areas) and augment by planting with appropriate species. Bare patches in moderation are important for wildlife such as insects, birds and snakes.
Weed types and abundance	No invasive weeds; reduction of *weed diversity* and abundance over time, with planted species becoming dominant.	Excess weeds suggest that site preparation was inadequate. Remove weeds using most appropriate means (see Weeding, above).

Monitoring your project closely helps you notice and troubleshoot any problems and keep track of ongoing changes and successes.
Kim Delaney

Statistical Monitoring

Although a statistical evaluation of a project is more involved than photo monitoring, it can be useful. Over time, the data recorded will demonstrate even subtle changes and provide information that can be used to make appropriate management decisions. This works best for plantings greater than 0.5 hectares. Methods for collecting data will differ from project to project. *The Tallgrass Restoration Handbook for Prairies, Savannas and Woodlands* (Packard and Mutel 1997) has a chapter devoted to vegetation monitoring (see Restoration, Naturalization and Management under Sources of Information). Check an academic library for other introductory field biology books that cover vegetation-sampling techniques. Ask an ecologist for some assistance with appropriate data collection and statistical-analysis techniques for the project, and check with a nearby college or university to see if students might like to assist as part of a course project.

A Final Thought

Natural landscapes need not be confined to parks, conservation areas and nature reserves. Restoring ecological communities to settled landscapes can provide vital connections among remnant natural areas. Opportunities for prairie and meadow restoration exist everywhere, including in local community parks, along highway shoulders, on marginal rural land and even in backyards.

Prairie and meadow are low-maintenance, high-*biodiversity* habitats that add beauty and value to settled landscapes. Well-planned prairie and meadow naturalization projects will help to restore the health of our settled landscapes and bring back some of the rich diversity of Ontario's natural heritage.

Cultivating these changes in community landscapes can involve everyone, offering both fun and an educational experience. This guide provides the basic tools to help you dig in and restore Southern Ontario's grassland communities.

P. Allen Woodliffe

Appendix A: Recommended Species for Prairie and Meadow Plantings in Southern Ontario

This table can be used as a guide to help you develop a species list for your project. Use the information to choose species that are appropriate to the location and conditions of your project site.

Key to the Species Table

Prairie: The species is associated with prairie and may be suitable for a prairie planting within the range indicated in the Range column.

Meadow: The species is associated with meadow and may be suitable for a meadow planting within the range indicated in the Range column.

Range: The area in Southern Ontario where the species currently occurs and/or historically occurred. The Range indicators are shown as two-letter codes that refer to a county or municipality. For the purposes of this guide, we recommend that a species be planted only within the general range of its historical occurrence in Southern Ontario – that is, only within the counties or municipalities specified. Range information is taken from a variety of sources, primarily regional distribution lists, with the terms used as follows:

- **Throughout:** The species is found throughout the 26 counties/municipalities within the historical range of prairie; however, those species identified as meadow only are not necessarily limited to the historical range of prairie and do, in fact, occur beyond that range.
- **Widespread:** The species is generally found across the entire range of the 26 counties/municipalities, but with several exceptions (noted in parentheses).
- **Restricted:** The species is not widespread, and the nine or more counties/municipalities where the species has been recorded are listed.
- **Very restricted:** The species is not widespread, and the less than nine counties/municipalities where the species has been recorded are listed.

The two-letter range codes are as follows:

BN Brant County
CK Municipality of Chatham-Kent (formerly Kent County)
DF Dufferin County
DR Durham County
EL Elgin County
ES Essex County
HL Regional Municipality of Halton
HN Regional Municipality of Haldimand-Norfolk
HS Hastings County
HU Huron County
HW Regional Municipality of Hamilton-Wentworth
LA Lambton County
MI Middlesex County
NI Regional Municipality of Niagara
NO Northumberland County
OX Oxford County
PE Prince Edward County
PL Regional Municipality of Peel
PR Perth County
PT Peterborough County
SI Simcoe County
TO Toronto
VI Victoria County
WA Regional Municipality of Waterloo
WE Wellington County
YO Regional Municipality of York

Core Species: Core species are the species forming the backbone of naturally occurring prairies and meadows. Core species that occur in the project area (consult Range column) should form the common component of the planting. Other species on the following list not marked as core species can be used for planting projects within the appropriate range, but should not be as prevalent as core species.

Moisture Preference: Moisture preference describes the site moisture conditions in which the species is generally found. Conditions range from Wet (W) to Wet *Mesic* (WM), Mesic (M), Dry Mesic (DM) and Dry (D).

Soil Preference: Soil preference describes the soil type(s) on which the species is generally found. Basic soil types include sand (S), loam (L) and clay (C).

Germination Code: Germination requirements and corresponding codes are explained in Appendix B: Seed-Treatment Techniques. (N/A [not available] in the table below indicates that the requirements are not yet known.)

Successional Stage: Successional stage refers to the period in which the species becomes best established when seeded; that is, species identified as **early** should become well established in the first five years, and **later** successional species after five years. Of course, local conditions will vary, and some species may become established earlier or take longer, depending on soil conditions, the seed mix, etc. (N/A [not available] in the table below indicates that the successional stage has not yet been determined.)

Height and Other Comments: Height classes are as follows: **short** species are less than 1 metre high; **medium** species are 1 to 1.7 metres high; **tall** species are higher than 1.7 metres.

Species	Prairie	Meadow	Range	Core Species	Moisture Preference	Soil Preference	Germination Code	Successional Stage	Height and Other Comments
Grasses and Sedges									
Andropogon gerardii Big bluestem	•	•	Widespread (***not*** in DF); dominates many prairies	•	WM–DM	S, L, C	CD or CM	Early	Tall, to 3.0 m or more
Bromus kalmii Kalm's brome	•		Widespread (***not*** in DF, DR, GR, OX, PL, PR, WE); never dominant		WM–DM	S, L	CD	N/A	Medium, to 1.6 m
Calamagrostis canadensis Canada bluejoint	•	•	Throughout; common on wet sites and can be quite dominant		W–M	S, L, C	CD	N/A	Medium, to 1.6 m
Carex bebbii Bebb's sedge		•	Throughout	•	WM	S, L, C	CM	Early	Short
Carex comosa Bristly sedge		•	Throughout		WM	S, L, C	CM	Later	Short
Carex crinita Fringed sedge		•	Throughout		WM	S, L, C	CM	Early	Short
Carex retrorsa Retrorse sedge		•	Throughout		WM	S, L, C	CM	Early	Short
Carex stipata Awl-fruited sedge		•	Throughout	•	WM	S, L, C	CM	Early	Short
Carex stricta Tussock sedge		•	Throughout		WM	S, L, C	CM	Early	Short
Carex vulpinoidea Fox sedge		•	Throughout	•	WM	S, L, C	CM	Early	Short
Cyperus esculentus Yellow nut-grass		•	Throughout		WM	S, L, C	CM	Early	Short
Eleocharis obtusa Blunt spike-rush		•	Throughout		WM	S, L, C	CM	Early	Short
Elymus canadensis Canada wild rye	•	•	Widespread (***not*** in DF, PR, VI)	•	WM–D	S, L, C	CD	Early	Medium, to 1.3 m
Elymus hystrix Bottle-brush grass		•	Throughout		M–DM	S, L	CD or CM	N/A	Medium, to 1.3 m
Glyceria striata Fowl manna grass		•	Throughout		WM	S, L, C	CM	Later	Tall
Hierochloe odorata Sweetgrass	•	•	Widespread (***not*** in HL, HW, NI, OX, PE, PL); locally abundant		W–WM	S, L	CD	N/A	Short, to 0.6 m
Juncus articulatus Jointed rush		•	Throughout	•	WM	S, L, C	CM	Early	Short
Juncus balticus Baltic rush		•	Throughout		WM	S, L, C	CM	Early	Short
Juncus effusus Soft rush		•	Throughout	•	WM	S, L, C	CM	Early	Short
Juncus tenuis Path rush		•	Throughout	•	WM	S, L, C	CM	Early	Short

Species	Prairie	Meadow	Range	Core Species	Moisture Preference	Soil Preference	Germination Code	Successional Stage	Height and Other Comments
Juncus torreyi Torrey's rush		•	Throughout		WM	S, L, C	CM	Early	Short
Leerisia oryzoides Rice cut grass		•	Throughout		WM	S, L, C	CM	Early	Short
Panicum virgatum Switch grass	•	•	Widespread (***not*** in DF, HL, HS, PT, VI, WA); sometimes dominant on drier sites	•	M–D	S, L	CD or CM	Early	Medium, to 1.6 m
Schizachyrium scoparium Little bluestem	•		Widespread (***not*** in DF, DR, NO, PR, PT); often dominant on drier sites	•	DM–D	S, L	CD	Later	Medium, to 1.3 m
Scirpus atrovirens Green bulrush		•	Throughout	•	WM	S, L, C	CM	Early	Medium
Scirpus cyperinus Wool-grass		•	Throughout	•	WM	S, L, C	CM	Early	Medium
Sorghastrum nutans Indian grass	•		Widespread (***not*** in DF, DR, HL, OX, PR, VI); often dominant	•	WM–DM	S, L, C	CD	Later	Tall, to 2.5 m
Spartina pectinata Prairie cord grass	•		Widespread (***not*** in DF, DR, HL, NO, OX, VI, WE); often dominant on wet sites	•	W–WM	S, L	CM Low viability	Later	Tall, to 2.3 m
Sporobolus asper Rough dropseed	•		Natural occurrences believed to be restricted to BN, CK, EL, ES, HN, MI, NI, SI, WA, YO, but often found as introduced or ***adventive*** in most other areas, often along roads		DM–D	S, L	CD	Early	Medium, to 1.2 m
Sporobolus cryptandrus Sand dropseed	•		Widespread (***not*** in BN, DR, OX, PL, PR)		DM–D	S, L	CM, S	N/A	Short
Forbs									
Achillea millefolium Yarrow	•	•	Throughout; some locations may have an introduced subspecies		W–DM	S, L	CD	Early	Short
Amphicarpaea bracteata Hog peanut	•	•	Widespread (***not*** in DF, PE)		WM–M	S, L	CD, S, I	N/A	Medium, usually entangled with other vegetation
Anemone canadensis Canada anemone	•	•	Throughout		WM–M	S, L	CM	N/A	Short, to 0.4 m
Anemone cylindrica Thimbleweed	•	•	Widespread (***not*** in HU, OX, PR)	•	M–DM	S, L	CM	N/A	Short, to 0.5 m
Apios americana Groundnut	•	•	Widespread (***not*** in PR, DF)		WM–M	S, L	N/A	N/A	Medium, usually entangled with other vegetation
Apocynum cannabinum Indian hemp	•	•	Throughout		W–M	S, L, C	CM	N/A	Medium, to 1.2 m

Species	Prairie	Meadow	Range	Core Species	Moisture Preference	Soil Preference	Germination Code	Successional Stage	Height and Other Comments
Asclepias incarnata Swamp milkweed	•	•	Throughout	•	W–WM	S, L, C	CM	N/A	Medium, to 1.5 m
Asclepias tuberosa Butterfly milkweed	•	•	Widespread (***not*** in DF, HU, OX, PR, PT, VI)	•	M–DM	S, L, C	CM	Later	Short, to 0.7 m; highly desirable, attracts insects, especially butterflies
Aster ericoides Heath aster	•	•	Throughout; one of the most common and widespread asters in Southern Ontario	•	WM–DM	S, L, C	CD	Early	Short
Aster laevis Smooth aster	•	•	Widespread (***not*** in DF, NO, OX, PE, PL, PR, VI)	•	WM–DM	S, L	CD	Later	Medium, to 1.2 m
Aster lateriflorus Calico aster		•	Throughout; common		WM–M	S, L, C	CD	Early	Medium, to 1.5 m
Aster novae-angliae New England aster	•	•	Throughout; one of the most common and widespread asters in Southern Ontario	•	WM–DM	S, L, C	CM	Early	Medium, to 1.2 m
Aster oolentangiensis Sky blue aster	•	•	Widespread (***not*** in DF, HU, PE, PR, OX, WE)		WM–D	S, L	CD	Later	Short, to 1 m
Aster pilosus Hairy aster	•	•	Throughout	•	WM–M	S, L	CD	Early	Medium
Aster puniceus Purple-stemmed aster		•	Throughout; common		WM–M	S, L, C	CM	Early	Tall, to 2.4 m
Aster umbellatus Flat-topped white aster	•	•	Widespread (***not*** in DF, PE)	•	W–WM	S, L	CM	Early	Tall, to 2 m
Aster urophyllus Arrow-leaved aster	•	•	Widespread (***not*** in HU, PR)		WM–M	S, L	CD	Later	Medium, to 1.2 m
Bidens frondosa Devil's beggar-ticks		•	Throughout		WM–M	S, L, C	CD	Early	Medium
Campanula aparinoides Marsh bellflower	•	•	Throughout		W–WM	S, L	CM, L	N/A	Short; usually sprawling in low vegetation
Cirsium discolor Field thistle	•		Widespread (***not*** in DF, HL, HU, HW, NO, PE, PL, PR, PT, WE)		WM–DM	S, L, C	CM	Early	Tall, to 2.2 m; can be aggressive, but is easily controlled
Chelone glabra Turtlehead		•	Throughout		WM	S, L, C	CM	Later	Medium
Desmodium canadense Showy tick-trefoil	•	•	Widespread (***not*** in DF, HU, PR)	•	W–M	S, L, C	CD, S, I	Early	Tall, to 1.8 m; showy

Species	Prairie	Meadow	Range	Core Species	Moisture Preference	Soil Preference	Germination Code	Successional Stage	Height and Other Comments
Eupatorium maculatum Spotted Joe-pye-weed		•	Throughout		WM–M	S, L, C	CD	N/A	Tall, to 3.0 m; showy
Eupatorium perfoliatum Boneset		•	Throughout		WM–M	S, L, C	CD	N/A	Tall, to 1.8 m
Euphorbia corollata Flowering spurge	•	•	Restricted; found in BN, CK, ES, LA, MI, OX, PR, WA, YO	•	WM–D	S, L	CM	Later	Short
Euthamia graminifolia Grass-leaved goldenrod		•	Throughout		WM–M	S, L, C	CD	Early	Medium
Fragaria virginiana Wild strawberry	•	•	Throughout	•	WM–D	S, L, C	CD	N/A	Short
Gentiana andrewsii Bottle gentian	•	•	Widespread (***not*** in DF, HS, PL)		W–M	S, L, C	CM, L	Later	Short, to 0.6 m
Gentianopsis crinita Fringed gentian	•	•	Widespread (***not*** in DF, HS, HU, PR)		WM–M	S, L	L, FM	Later	Short, to 0.6 m
Helenium autumnale Sneezeweed	•		Widespread (***not*** in DF, DR, HW, NO, OX, PL, SI, TO, VI, YO)		WM–M	S, L, C	CM	Later	Short, to 0.8 m
Helianthus giganteus Tall sunflower	•	•	Restricted; found in BN, CK, EL, ES, HN, HU, HW, LA, MI, PL; may occur elsewhere, but is believed to be introduced	•	WM–DM	S, L, C	CD or CM	Later	Tall, to 3.0 m or more
Helianthus strumosus Pale-leaved sunflower	•		Widespread (***not*** in DF, HU, OX, PR, VI, WE)		WM–DM	S, L, C	CD or CM	N/A	Medium
Heliopsis helianthoides False sunflower	•	•	Restricted; found in BN, CK, DR, EL, ES, HN, HU, HW, LA, MI, SI, WA, VI, YO		W–M	S, L, C	CD or CM	Later	Medium, to 1.5 m
Hypoxis hirsuta Yellow star-grass	•		Restricted; found in BN, CK, ES, HN, HS, HW, LA, MI, NI, YO*		W–WM	S, L	CM	Later	Short, less than 0.2 m; early flowering
Impatiens capensis Spotted jewel-weed		•	Throughout		WM–M	S, L, C	CM	Early	Medium
Iris versicolor Multi-coloured blue-flag iris		•	Throughout		WM	S, L, C	CM	Later	Short
Iris virginica Southern blue-flag iris		•	Very restricted; found in CK, EL, ES, HN, HW, LA, MI, NI		WM	S, L, C	CM	Later	Short
Lathyrus palustris Marsh vetchling		•	Widespread in BN, CK, DR, ES, HN, HS, HW, LA, MI, NI, NO, PE, PL, PT, SI, TO, VI, YO		W–WM	S, L	CD, S, I	N/A	Short; climbing, vine-like
Lespedeza capitata Round-headed bush-clover	•	•	Widespread (***not*** in DF, OX, PE, PR, VI, WE)	•	WM–D	S, L, C	CD, S, I	Later	Medium, to 1.2 m

* Can be rare within these areas; consult the ecologist at your local OMNR office before including in the planting.

Species	Prairie	Meadow	Range	Core Species	Moisture Preference	Soil Preference	Germination Code	Successional Stage	Height and Other Comments
Lespedeza hirta Hairy bush-clover	•	•	Widespread (***not*** in DF, DR, HS, HU, NO, OX, PE, PR, SI, VI, WE)		M–D	S, L	CD, S, I	N/A	Short
Liatris cylindracea Cylindric blazing star	•		Very restricted; found in CK, HN, LA, NI, NO, TO, WA, YO*		M–D	S	CM	N/A	Short, to 0.6 m
Liatris spicata Dense blazing star	•		Very restricted; found in CK, EL, ES, LA, MI, NI, YO*	•	WM–M	S, L, C	CM	Later	Medium, to 1.5 m
Lilium michiganense Michigan lily	•	•	Widespread (***not*** in DF, HS, PE, PT, VI)		W–M	S, L	WM (90 days) /CM (20-60 days) or F	N/A	Tall, to 2.0 m
Lilium philadelphicum Wood lily	•		Widespread (***not*** in DF, HS, HU, OX, PE, PL, PR, TO)		WM–DM	S, L	WM (90 days) /CM (20-60 days) or F	N/A	Short
Lithospermum canescens Hoary puccoon	•		Very restricted; found in BN, ES, HN, LA, MI, PE, WA*		M–D	S, L	WM (60 days) /CM (120 days)	Later	Short, to 0.6 m
Lobelia siphilitica Great lobelia		•	Throughout	•	W–M	S, L, C	CD	Early	Short
Lobelia spicata Pale-spiked lobelia	•	•	Widespread (***not*** in DF, OX, PE, PL, PR, PT, TO, VI)	•	WM–DM	S, L, C	CM, L	Later	Medium, to 1.3 m
Lycopus americanus Cut-leaved water horehound		•	Throughout		WM	S, L, C	CM	Later	Short
Lysimachia ciliata Fringed loosestrife	•	•	Throughout		WM–M	S, L	CM	N/A	Short
Lysimachia quadriflora Prairie loosestrife	•		Restricted; found in BN, ES, HN, HU, HW, LA, MI, NI, SI		W–M	S, L	CM	N/A	Short, to 0.6 m
Lysimachia quadrifolia Whorled loosestrife	•		Restricted; found in BN, CK, DR, EL, ES, HL, HN, NI, NO, OX, PE, PL, PT, TO, WA, YO		M–D	S, L	CM	N/A	Short, to 0.6 m
Lythrum alatum Winged loosestrife	•	•	Restricted; found in CK, DR, ES, EL, HN, HW, LA, MI, PT, WA*		W–M	S, L	CM	Later	Medium, to 1.2 m; this species should not be confused with the closely related and invasive purple loosestrife (*Lythrum salicaria*) – the two species can sometimes hybridize
Mentha arvensis Wild mint		•	Throughout		WM	S, L, C	CM	Later	Short

* Can be rare within these areas; consult the ecologist at your local OMNR office before including in the planting.

Species	Prairie	Meadow	Range	Core Species	Moisture Preference	Soil Preference	Germination Code	Successional Stage	Height and Other Comments
Mimulus ringens Square-stemmed monkey-flower		•	Throughout		WM	S, L, C	CM	Early	Short
Monarda fistulosa Wild bergamot	•	•	Throughout	•	WM–D	S, L, C	CD	Early	Short; showy
Oenothera biennis Common evening-primrose		•	Throughout	•	WM–D	S, L, C	CD	Early	Tall; showy but can be weedy
Parnassia glauca Bluegreen grass-of-Parnassus	•	•	Widespread (***not*** in DF, HL, PE, PR, TO, VI, YO)		W–WM	S, L	CM	N/A	Short, usually less than 0.4 m
Penstemon digitalis Foxglove beard-tongue	•	•	Throughout	•	M–DM	S, L, C	CM (30 days)	Early	Medium, to 1.4 m
Penstemon hirsutus Hairy beard-tongue	•	•	Widespread (***not*** in HU, OX, PR)	•	M–DM	S, L, C	CD	Early	Short
Polygala sanguinea Field milkwort	•		Very restricted; found in CK, EL, ES, HN, LA, PL, WA		WM–M	S, L	N/A	N/A	Short, to 0.4 m
Polygala senega Seneca-snakeroot	•		Widespread (***not*** in DF, HU, OX, PR, VI)		WM–DM	S, L	CM	N/A	Short, to 0.4 m
Polygala verticillata Whorled milkwort	•		Restricted; found in CK, DR, EL, ES, HL, HN, HW, LA, MI, NI, PL, WA, YO		WM–M	S, L	N/A	N/A	Short, to 0.3 m
Potentilla arguta Prairie cinquefoil	•	•	Widespread (***not*** in DF, HL, HU, HW, MI, NI, OX, PL, PR, YO)	•	M–D	S, L	CM	Later	Medium, to 1.2 m
Prenanthes alba White lettuce	•		Widespread (***not*** in OX, PR, VI)		M–DM	S, L	CM	N/A	Medium, to 1.6 m
Prenanthes racemosa Glaucus white lettuce	•		Very restricted; found in CK, ES, HL, LA, SI		M–DM	S, L	CM	N/A	Medium, to 1.3 m
Pycnanthemum tenuifolium Slender-leaved mountain-mint	•	•	Restricted; found in CK, DR, EL, ES, HN, LA, MI, NI, TO, YO*		WM–DM	S, L	CD	N/A	Short
Pycnanthemum virginianum Virginia mountain-mint	•	•	Widespread (***not*** in DF, HL, HS, HU, HW, NO, OX, PE, PL, PR, VI, WE)	•	W–DM	S, L, C	CD	Later	Short
Ranunculus rhomboideus Prairie buttercup	•		Restricted; found in CK, DR, HN, HS, LA, MI, NO, PT, SI, YO		M–D	S, L	F	N/A	Short, to 0.2 m
Ratibida pinnata Gray-headed coneflower	•		Very restricted; found in CK, EL, ES, LA, MI*	•	M–DM	S, L, C	CD or CM	Early	Tall, to 1.8 m

* Can be rare within these areas; consult the ecologist at your local OMNR office before including in the planting.

Species	Prairie	Meadow	Range	Core Species	Moisture Preference	Soil Preference	Germination Code	Successional Stage	Height and Other Comments
Rudbeckia hirta Black-eyed Susan	•	•	Throughout; common	•	WM–DM	S, L, C	CD	Early	Short
Sisyrinchium montanum Montane blue-eyed-grass		•	Throughout	•	WM–M	S, L	CM	N/A	Short, to 0.45 m; will probably appear in plantings whether it is planted or not
Sisyrinchium mucronatum Narrow-leaved blue-eyed-grass	•	•	Widespread (***not*** in DF, EL, HL, HN, HS, HW, NO, OX, PE, PL, PT, TO, VI, YO)		WM–M	S, L	CM, germinates in cool soil	N/A	Short, to 0.2 m
Solidago altissima Tall goldenrod		•	Throughout	•	W–M	S, L, C	CM, S	Early	Tall, to 2.1 m; will probably appear in plantings whether it is planted or not
Solidago canadensis Canada goldenrod		•	Throughout	•	W–M	S, L, C	CM, S	Early	Medium, to 1.5 m; will probably appear in plantings whether it is planted or not
Solidago nemoralis Gray goldenrod	•	•	Throughout; common	•	M–D	S, L, C	CD	Later	Short, to 0.5 m
Solidago ohioensis Ohio goldenrod	•	•	Widespread (***not*** in DF, DR, HL, HS, HW, NO, OX, PE, PL, PR, PT, TO, VI, WE)		WM–M	S, L	CM (30 days)	N/A	Medium, to 1.4 m
Solidago patula Rough-leaved goldenrod		•	Throughout		W–M	S, L, C	CM, S	Early	Tall, to 2.1 m; will probably appear in plantings whether it is planted or not
Solidago riddellii Riddell's goldenrod	•		Very restricted; found in CK, EL, ES, LA, MI*		WM–M	S, L	CM	Later	Medium, to 1.2 m
Solidago rigida Stiff goldenrod	•		Restricted; found in BN, CK, EL, ES, HW, LA, MI, PR, YO*	•	WM–D	S, L, C	CM	Early	Medium, to 1.5 m; this species can be aggressive early in a planting if there is not enough competition from other planted species; plant sparingly
Solidago rugosa Rough-stemmed goldenrod		•	Throughout	•	WM–M	S, L, C	CM, S	Early	Tall, to 2.1 m; will probably appear in plantings whether it is planted or not

* Can be rare within these areas; consult the ecologist at your local OMNR office before including in the planting.

Species	Prairie	Meadow	Range	Core Species	Moisture Preference	Soil Preference	Germination Code	Successional Stage	Height and Other Comments
Teucrium canadense Germander	•	•	Widespread (***not*** in DF, OX, PR, VI)		WM–DM	S, L	CM	N/A	Medium, to 1.2 m
Thalictrum dasycarpum Purple meadow rue	•	•	Restricted; found in BN, CK, DR, EL, ES, LA, MI, PT, SI, WA		WM–M	S, L	CM	N/A	Tall, to 2 m
Verbena hastata Blue vervain	•	•	Throughout		W–M	S, L, C	CD or CM	N/A	Tall, to 2 m
Vernonia missurica Missouri ironweed	•	•	Very restricted; found in CK, ES, LA, MI*	•	W–M	S, L, C	CM	Later	Medium, to 1.5 m. *V. missurica*, traditionally misidentified as *V. gigantea*, has recently been determined to be the most common *Vernonia* in Southern Ontario; *V. gigantea* seems to be much less common, at least in the southwest. More easterly populations (in EL, HN and NI) have not been verified and may be either *V. missurica* or *V. gigantea*

* Can be rare within these areas; consult the ecologist at your local OMNR office before including in the planting.

Appendix B: Seed-Treatment Techniques

Technique	How It's Done	Germination Code
Cold **D**ry Stratification	• Place seed in a refrigerator or unheated building for 6 to 8 weeks, and protect from rodents.	**CD**
Cold **M**oist Stratification	• Mix 1 part seed with 2 to 3 parts damp (not wet), sterile potting medium or sand, and place in a plastic bag. Place in a refrigerator for up to 60 days unless otherwise indicated (see Appendix A), or • Plant seed in trays or pots, and cover with plastic to keep moisture in. Place in an unheated building or cold frame for up to 60 days unless otherwise indicated (see Appendix A), and protect from rodents.	**CM** (# days)
Warm **M**oist/ **C**old **M**oist Stratification	• Mix 1 part seed with 2 to 3 parts damp (not wet), sterile potting medium or sand, and place in a plastic bag. Store at room temperature, then place in a refrigerator – see Appendix A for required number of days for each stage, or • Sow outdoors and allow one full year for germination.	**WM/CM** (# days)
Scarification	• Rub the seed between two pieces of sandpaper or shake in a jar lined with sandpaper to abrade the seed coat and allow moisture and oxygen to enter.	**S**
Needs **L**ight to Germinate	• Do not cover seed after sowing. Do not let seed dry out; cover with clear plastic until germination occurs.	**L**
Sow **F**resh Seed	• Early flowering species often germinate best if seed is sown as soon as it ripens. It may germinate within a few weeks or it may not germinate until the following spring.	**F**
Sow **F**resh Seed in Special Soil **M**ix	• Sow freshly collected seed in a 1-to-1 mix of potting medium and composted leaf litter from a beech-maple forest.	**FM**
Inoculation	• Coat seed with appropriate bacterial inoculant (see Inoculum for Legumes under Sources of Materials, Specialized Equipment and Services) just prior to seeding.	**I**

Appendix C: Site-Preparation Key

Step 1. Is vegetation present?

Yes: Go to Step 4.

No: Go to Step 2.

Step 2. Has the topsoil been removed?

Yes: Test the remaining soil for pH (see Soil Analysis Services under Sources of Materials, Specialized Equipment and Services). Most plants prefer a range of pH 6 to 7.5. Since vegetation and seed bank are not present on this site, take advantage of the situation and seed or plant as soon as possible. If this is not an option, plant a cover crop such as annual oats, which will discourage the establishment of weeds and prevent erosion. Go to Step 9.

No: Go to Step 3.

Step 3. Has the site been used to grow agricultural crops?

Yes: Check history of herbicide use (i.e., persistence in the soil). Some chemicals remain active in the soil for several years. If persistent herbicides are not present, allow the seed bank to germinate and go to Step 4. If persistent herbicides are present, check label information to determine which plants are resistant and sow a resistant cover crop. Wait until the residue is no longer active and go to Step 9.

No: Allow the seed bank to germinate and go to Step 4.

Step 4. Are prairie/meadow plants present?

Yes: Go to Step 5.

No: Go to Step 7.

Step 5. Are the desirable plants scattered (as opposed to grouped) throughout the site?

Yes: Go to Step 6.

No: Protect prairie/meadow plant groupings in specific areas by flagging them, and go to Step 8.

Step 6. Option 1: **Do-nothing approach.** The approach of allowing the vegetation to grow in the hope that a native plant community will eventually result on its own is not recommended for prairie creation and is only marginally successful for meadow creation. It is discussed here only because restorationists are often asked why a site shouldn't be left to naturalize on its own. It has a chance of success only if adequate numbers of desirable plants are growing nearby to provide the seed source. Usually, though, the seeds that come into the site are largely weeds and invasive species.

Option 2: **Hands-on approach for prairie sites.** Glyphosate-based herbicide application and/or cultivation are not options since they will harm the very plants requiring protection. Conduct a prescribed burn (see Maintenance and Monitoring) in early spring to stress the undesirable vegetation and stimulate the *warm season* prairie plants. Take advantage of the stressed non-native vegetation and the upcoming spring rains, and seed or plant using a no-till technique such as hand planting or seed drilling.

Option 3: **Hands-on approach for meadow sites (and prairie sites when burning is not possible).** Mow vegetation as close to the ground as possible and remove cut stems. On larger projects, a hay baler provides a convenient way to gather and remove the cut stems. Seed or plant using a no-till technique.

Step 7. Is the site currently in turf grass?

Yes: Spray turf with a glyphosate-based herbicide. Allow the site to green up, and spray again. Seed or plant using a no-till technique. If no-till equipment is unavailable, plough under any vegetation still present, and go to Step 10.

No: Go to Step 8.

Step 8. Are perennial weeds present?

Yes: Glyphosate-based herbicide is a fairly effective treatment for perennial weeds. Cultivation alone may compound the problem by cutting roots into many small pieces, each of which can grow into a new plant. Begin by spraying the site with glyphosate-based herbicide in fall or early spring. Allow vegetation to die back and then let the site green up until weeds are 10 to 15 centimetres tall. Spray again. Repeat this process until you are satisfied that weed control is acceptable. It is most important to gain control of perennial and biennial weeds. This may take an entire growing season or longer for very difficult weeds such as Canada thistle. Go to Step 9.

No: Go to Step 9.

Step 9. Will a no-till seeding/planting technique be used?

Yes: Spray a glyphosate-based herbicide one final time as soon as weeds are greened up in the spring, and then seed or plant as soon as possible after herbicide has dried.

No: Plough under any vegetation still present. Go to Step 10.

Step 10. Are plugs being planted?

Yes: Allow the site to green up until weeds are 10 to 15 centimetres tall, and disc to a depth of 10 to 15 centimetres. Some restorationists recommend two passes at right angles to each other. Allow to green up again, and disc to a depth of 5 to 10 centimetres. Allow to green up and then disc to a depth of 2 to 3 centimetres. Plant.

No: Allow the site to green up until weeds are 10 to 15 centimetres tall, and disc to a depth of 5 to 6 centimetres. Allow to green up again, and disc to a depth of 2 to 3 centimetres. Allow to green up and then disc the surface lightly. Plant the seed.

Appendix D: Common and Botanical Names of Plant Species Referred to in This Guide

Native Species

Common Name	Botanical Name
Big bluestem	*Andropogon gerardii*
Black-eyed Susan	*Rudbeckia hirta*
Blue vervain	*Verbena hastata*
Boneset	*Eupatorium perfoliatum*
Butterfly milkweed	*Asclepias tuberosa*
Canada wild rye	*Elymus canadensis*
Closed gentian	*Gentiana andrewsii*
Common evening-primrose	*Oenothera biennis*
Dense blazing star	*Liatris spicata*
Fringed gentian	*Gentianopsis crinita*
Gray goldenrod	*Solidago nemoralis*
Gray-headed coneflower	*Ratibida pinnata*
Hoary puccoon	*Lithospermum canescens*
Indian grass	*Sorghastrum nutans*
Narrow-leaved blue-eyed-grass	*Sisyrinchium mucronatum*
Prairie cord grass	*Spartina pectinata*
Prairie white-fringed orchid	*Platanthera leucophaea*
Round-headed bush-clover	*Lespedeza capitata*
Showy tick-trefoil	*Desmodium canadense*
Shrubby false-indigo	*Amorpha fruticosa*
Sneezeweed	*Helenium autumnale*
Spotted Joe-pye-weed	*Eupatorium maculatum*
Swamp milkweed	*Asclepias incarnata*
Tall sunflower	*Helianthus giganteus*
Virginia Culver's-root	*Veronicastrum virginicum*
Wild bergamot	*Monarda fistulosa*
Wild lupine	*Lupinus perennis*
Wild strawberry	*Fragaria virginiana*

Weed Species

Common Name	Botanical Name
Black locust (tree)	*Robinia pseudo-acacia*
Canada thistle	*Cirsium arvense*
Chicory	*Cichorium intybus*
Common barnyard grass	*Echinochloa crusgalli*
Common ragweed	*Ambrosia artemisiifolia*
Dog-strangling vine	*Cynanchum* spp.
Giant ragweed	*Ambrosia trifida*
Ox-eye daisy	*Chrysanthemum leucanthemum*
Quack grass	*Elymus repens*
Queen Anne's lace	*Daucus carota*
Red clover	*Trifolium pratense*
Smooth brome	*Bromus inermis*
White sweet-clover	*Melilotus alba*

Crop Species

Annual oats	*Avena sativa*
Rye grain	*Secale cereale*
Rye grass	*Lolium* spp.
Winter wheat	*Triticum aestivum*

Appendix E: Metric and Imperial Measures Conversion Table

	When you know	Multiply by	To find
Length	centimetres	0.39	inches
	metres	3.28	feet
	kilometres	0.62	miles
	inches	2.54	centimetres
	feet	0.305	metres
	miles	1.61	kilometres
Area	square metres	10.8	square feet
	hectares	2.47	acres
	square kilometres	0.391	square miles
	square feet	0.093	square metres
	acres	0.405	hectares
	square miles	2.59	square kilometres
Mass (weight)	kilograms	2.20	pounds
	pounds	0.454	kilograms
Mass/Area	kilograms per hectare	0.88	pounds per acre
	pounds per acre	1.14	kilograms per hectare

Glossary

adventive Spreading from a native or naturalized source, but not yet well established.

annual A plant with a life span of one growing season.

biennial A plant that completes its life cycle in two growing seasons, usually flowering and fruiting during the second season.

biodiversity The variety of living things, both plants and animals, that live in a particular place.

biomass The total quantity or weight of organisms in a given area or of a given species.

clay An inorganic soil component having particles that are less than 0.002 millimetres in diameter.

cool season Describes a plant that achieves most of its growth early in the growing season, and then later in the cool fall season.

core species Species that are common in a particular ecological community and geographical area. Planting projects should make use of the core species occurring within the county or municipality where the project is located in order to complete a locally appropriate, balanced and diverse planting.

damping off The collapse of seedling plants at the soil level; caused by fungal growth and encouraged by overwatering, poor drainage, overcrowding or poor handling techniques.

diatomaceous earth A substance made from the silica cell walls of microscopic algae that kills soft-bodied invertebrates by puncturing their skin.

dibble A hand-held tool with a pointed end; used for making holes in the ground for plug plants.

ecological community A naturally occurring group of organisms that live and interact together.

ecology The study of plants and animals and their environment.

endangered Describes a plant, animal or ecological community threatened with extinction throughout all or a significant portion of its range.

exotic Describes a plant (i.e., most weeds) or animal that is not native to the region in question, having originated in another region.

firebreak A barrier that stops a fire and contains it in a controlled area. A firebreak can be a road, a river, a ploughed strip of ground or a bare, burned patch of ground.

flora The plants of a particular geographical area, or a document listing the plant species found in a particular area.

forb A specialized term for any non-grassy herbaceous plant. Used particularly for the broad-leaved plants of prairies.

genetic diversity The variability, within a species, of the genetic material that forms the basis of inherited qualities.

germination The beginning of the growth of a seed into a plant.

girdle To kill a woody plant by removing bark in a ring around the trunk.

grass Any plant having narrow leaves with parallel veins, small flowers and stems with joints that appear as easily visible bulges where the leaves attach – that is, any plant of the Grass family (whose botanical name is Poaceae).

habitat The place where a plant or animal lives.

harden off Adjusting plants that are raised indoors or in a greenhouse to outdoor conditions. This is usually achieved by gradual exposure to outdoor conditions.

herbaceous Describes an annual, biennial or perennial plant that is not woody and dies back at the end of the growing season.

herbicide A chemical that is used to kill plants.

invasive plant A plant that reproduces so aggressively that it displaces other plant species in the area.

invertebrate An animal that does not possess a backbone – for example, insects and spiders.

legume A plant having seeds in pods and usually root nodules able to "fix" nitrogen from the air – that is, any plant of the Pea, Bean or Legume family (whose botanical name is Fabaceae, formerly Leguminosae).

loam A class of soil texture that is composed of sand, silt and clay. Silt is an inorganic soil component with particles ranging between 0.002 and 0.02 millimetres in diameter.

mesic Habitat containing a moderate amount of moisture – that is, having average moisture conditions.

natural gardening A gardening approach that involves the use of mostly native plants, usually with emphasis on form, colour and texture. Arrangement of plants is usually based on naturalistic rather than formal patterns. Plants are not necessarily native to the place where they are planted.

naturalization Any effort to convert managed landscapes to more natural and naturally evolving landscapes, relatively free of human intervention.

No-Pest® strip A resin vaporizer strip impregnated with insecticide, which is typically used to kill flies and mosquitoes indoors.

no-till A technique used to plant seed or plants in the soil without turning over the soil (i.e., no ploughing or discing). This technique helps reduce soil erosion and seed-bank germination.

perennial A plant that has a life span of more than two growing seasons.

pH A number used to indicate the degree of acidity or alkalinity of soils and solutions. Values lower than about 7 indicate acidity; higher values indicate alkaline conditions.

plug A seedling plant growing in a cylinder of soil, with roots fully formed and some top growth unless dormant. Plugs are grown individually in separate cells in a tray. Trays vary in depth, size and number of cells.

prescribed burn A carefully planned and authorized set and controlled fire.

remnant The small portion that remains of an ecological community that was once much larger but that is now nearly destroyed.

restoration The process of renewing and maintaining ecosystem health by turning a degraded or altered site back into a biologically diverse natural state. More precisely, it restores an ecosystem that formerly existed on the site, with the use of appropriate native plant material from local sources.

reverse fertilization See *soil impoverishment*.

sand An inorganic soil component whose particles range between 0.02 and 2 millimetres in diameter.

savanna A type of ecological community that is similar to prairie but also contains widely spaced oak, red cedar, hickory, ash, plum or hawthorn trees.

sedge A grass-like herbaceous plant having stems that are triangular in cross-section; found mainly in damp and marshy habitats.

soil impoverishment A technique that temporarily reduces the amount of nitrogen available to plants. This is done by incorporating high-carbon material, such as sawdust, into the soil of the planting site. Nitrogen in the soil assists in the decomposition of this material and is unavailable to plants during the time it does so.

stewardship The process and attitude of taking responsibility for fostering a healthy environment and for passing such an environment on to future generations. Stewardship is an especially important aspect of landownership.

stratification The simulation of the soil conditions of fall and winter. Seeds are placed in a moist, sterile potting medium or sand, or kept in a cold dry place – depending on the treatment strategy (see Appendix B).

succession A series of natural changes that occur in an ecological community over time – for example, the changes that occur as a piece of bare ground eventually turns into a forest.

threatened Describes a plant or animal that is likely to become endangered if limiting factors are not reversed.

topography The surface features of a landscape.

viability Describes the likelihood that a seed will germinate.

vulnerable A species of special concern because of characteristics that make it particularly sensitive to human activities or natural events.

warm season Describes a plant that starts its growth relatively late in the spring, after the soil has warmed up, and typically remains active even through dry periods of the summer (e.g., many species of prairie ecosystems).

weed A plant that is growing where it is not wanted.

weed diversity The variety of weed species in a particular area or planting.

wildlife Term for all wild living animals and plants.

wildlife diversity The variety of species of wild living things in a particular ecosystem.

Sources of Information

This section provides a list of recommended reading materials (some of which are referenced in the text) for further information on the concepts discussed in this guide, and a list of helpful organizations.

Recommended Reading, Annotated

Prairie Ecology and Natural History

Bakowsky, W.D. 1993. A review and assessment of prairie, oak savannah and woodland in Site Regions 7 and 6 (Southern Region). Draft report. Gore & Storrie Ltd. for Ontario Ministry of Natural Resources, Southern Region, Aurora.
Available from Natural Heritage Information Centre, Ontario Ministry of Natural Resources, P.O. Box 7000, 300 Water Street, Peterborough, ON K9J 8M5.

Catling, P.M., and V.R. Catling. 1993. Floristic composition, phytogeography and relationships of prairies, savannas and sand barrens along the Trent River, Eastern Ontario. *Canadian Field-Naturalist* 107(1):24–45.

Catling, P.M., V.R. Catling and S.M. McKay-Kuja. 1992. The extent, floristic composition and maintenance of the Rice Lake Plains, Ontario, based on historical records. *Canadian Field-Naturalist* 106(1):73–86.

Costello, D.F. 1969. *The Prairie World: Plants and Animals of the Grassland Sea*. New York: Thomas Y. Crowell.
- Somewhat dated, but still good overall information on the ecology of shortgrass, mixed grass and tallgrass prairies.

Madson, J. 1982. *Where the Sky Began: Land of the Tallgrass Prairie*. Boston: Houghton Mifflin.
- One of the best-written overviews of tallgrass prairie – a classic – describing the historical context, the ecological context as well as changes by humans to these "Lawns of God."

Madson, J. 1993. *Tallgrass Prairie*. Billings, MT: Falcon Press in cooperation with The Nature Conservancy.
- Excellent photos, text on tallgrass prairie appreciation. More than just a coffee table book.

Reichman, O.J. 1987. *Konza Prairie: A Tallgrass Natural History*. Lawrence, KS: University Press of Kansas.
- Excellent ecological perspective on tallgrass prairie ecology, with particular reference to the research at the 3500-hectare Konza Prairie research area of Kansas State University.

Rodger, L. 1998. *Tallgrass Communities of Southern Ontario: A Recovery Plan*. Report prepared for World Wildlife Fund Canada and the Ontario Ministry of Natural Resources.
Available electronically from <http://www.tallgrass-ontario.org>. *Click on* Publications, Recovery Plan.

Schramm, P. 1990. Prairie restoration: a twenty-five year perspective on establishment and management. In *Proceedings of the Twelfth North American Prairie Conference*, ed. D.D. Smith and C.A. Jacobs, 169–177. Cedar Falls, IA: University of Northern Iowa.

Szeicz, J.M., and G.M. MacDonald. 1991. Postglacial vegetation history of oak savanna in southern Ontario. *Canadian Journal of Botany* 69:1507–1519.

Weaver, J.E. 1954. *North American Prairie*. Lincoln, NB: Johnsen Publishing.
- A classic from one of the original prairie researchers.

Weaver J.E. 1968. *Prairie Plants and Their Environment: A Fifty Year Study in the Midwest*. Lincoln, NB: University of Nebraska Press.
- Excellent scientific detail on prairie plant ecology.

Wickett, R.G., and P.D. Lewis. 1995. *Ojibway Tallgrass Prairie*. Windsor, ON: City of Windsor Department of Parks and Recreation.
Available from Ojibway Nature Centre (see Helpful Organizations) ($3).

Wickett, R.G., P.D. Lewis, A. Woodliffe and P. Pratt, eds. 1994. *Proceedings of the Thirteenth North American Prairie Conference: Spirit of the Land, Our Prairie Legacy. Available from Department of Parks and Recreation, 2450 McDougall Avenue, Windsor, ON N8X 3N6 ($30).*

Papers include:
- Bakowsky, W., and J.L. Riley. A survey of the prairies and savannas of Southern Ontario.
- Faber-Langendoen, D., and P.F. Maycock. A vegetation analysis of tallgrass prairie in Southern Ontario.

A total of seventeen North American Prairie Conferences have been held. For a complete listing and ordering details, see Morgan, Collicutt and Thompson, 1995, *Restoring Canada's Native Prairies: A Practical Manual*, or Web site <http://www.unk.edu/departments/biology/Conference.html>.

Restoration – General

Berger, J. 1985. *Restoring the Earth: How Americans Are Working to Renew Our Damaged Environment*. New York: Alfred A. Knopf.

Pollan, M. 1991. *Second Nature: A Gardener's Education*. New York: Atlantic Monthly Press.

Stein, S. 1993. *Noah's Garden: Restoring the Ecology of Our Own Back Yards*. New York: Houghton Mifflin.

Stevens, W. 1995. *Miracle Under the Oaks: The Revival of Nature in America.* Toronto: Pocket Books.

Restoration, Naturalization and Management

Aboud, S., and H. Kock. 1996. *A Life Zone Approach to School Yard Naturalization: The Carolinian Life Zone.* Revised ed.
Available from University of Guelph Arboretum (see *Helpful Organizations*) *($31).*

Alex, J.F. 1998. *Ontario Weeds*. Publication 505.
Available from Ontario Ministry of Agriculture, Food and Rural Affairs, 1 Stone Road West, Guelph, ON N1G 4Y2. 519-826-3700.

Cheskey, E.D. 1993. *Habitat Restoration: A Guide for Proactive Schools*. Kitchener, ON: Waterloo County Board of Education.
Available from Waterloo Regional District School Board, 51 Ardelt Avenue, Box 68, Kitchener, ON N2G 3X5 ($25).

Christensen, T. 1998. *Chemical and Mechanical Control of Pale Swallowwort (Cynanchum* spp.*)*. First year study results. Toronto: Urban Forest Associates.
Available from Urban Forest Associates, 331 Linsmor Crescent, Toronto, ON M4J 4M1. 416-423-3387.
- Discusses the chemical and mechanical control of dog-strangling vine (*Cynanchum* spp.), also known as pale swallowwort.

Collins, S.L., and L.L. Wallace (eds.). 1990. *Fire in North American Tallgrass Prairies*. Norman, OK: University of Oklahoma Press.
- Very good variety of papers presented at a Fire Symposium.

Daigle, J., and D. Havinga. 1996. *Restoring Nature's Place: A Guide to Naturalizing Ontario's Parks and Greenspace*. Toronto: Ecological Outlook Consulting and Ontario Parks Association.
Available from Ontario Parks Association, 1185 Eglinton Avenue East, Suite 404, North York, ON M3C 3C6. 416-426-7157.
- Very good, detailed discussion on restoring the major ecosystems of Ontario's landscape.

Exotic Species Compendium. 1992. Articles 1–43. Bend, OR: Natural Areas Association.
Available from Natural Areas Association (see *Helpful Organizations).*
- All the articles pertaining to exotic species from Volumes 1 through 12, Number 3, of the *Natural Areas Journal* have been reformatted and reprinted for this compendium.

Hagen, A 1996. *Planting the Seed: A Guide to Establishing Aquatic Plants*. Downsview, ON: Environment Canada, Environmental Conservation Branch.
Available from Environment Canada, Environmental Conservation Branch, Conservation Strategies Division, 4905 Dufferin Street, Downsview. ON M3H 5T4. 416-739-5829

Harker, D., S. Evans, M. Evans and K. Harker. 1993. *Landscape Restoration Handbook*. Boca Raton, FL: Lewis Publishers.

Henderson, C. 1981. *Landscaping for Wildlife*. St. Paul, MN: Minnesota Department of Natural Resources.
Available from Minnesota's Bookstore, 117 University Avenue, St. Paul, MN 55155. 612-297-3000.
- Excellent information and ideas on using native species in small and medium-sized landscaping and habitat-creation projects for wildlife.

Hilts, S., and P. Mitchell. 1998. *Caring for Your Land: A Stewardship Handbook for Carolinian Canada Landowners*. Guelph, ON: Centre for Land and Water Stewardship.
Available from the Carolinian Canada Coalition, 659 Exeter Road, London, ON N6E 1L3. 519-873-4645 ($10).

Hoffman, R., and K. Kearns (eds.). 1997. *Wisconsin Manual of Control Recommendations for Ecologically Invasive Plants*.
Available from Bureau of Endangered Resources, Department of Natural Resources, P.O. Box 7921, Madison, WI 53707.

Hough Woodland Naylor Dance and Gore & Storrie. 1995. *Restoring Natural Habitats: A Manual for Habitat Restoration in the Greater Toronto Bioregion*. Toronto: Waterfront Regeneration Trust.
Available from Waterfront Regeneration Trust, 207 Queen's Quay West, Suite 403, Toronto, ON M5J 1A7. 416-943-8080 ($15).

Johnson, L. 1995. *The Ontario Naturalized Garden.* Vancouver: Whitecap.

Johnson, L. 1998. *Grow Wild! Native Plant Gardening in Canada and Northern United States*. Toronto: Random House of Canada.

Joyce, J. 1990. *Prairie Grasslands Guide Book: A Management Manual.*
Available from Manitoba Natural Resources, Public Information Unit, Box 38, 1495 St. James Street, Winnipeg, MB R3H 0W9. 204-945-6784.

Laman, K., and D. Cronin. 1996. *Building a Prairie.* Windsor, ON: Friends of Ojibway Prairie.
Available from Ojibway Nature Centre (see *Helpful Organizations) ($10).*

Martin, L. 1990. *The Wildflower Meadow Book*. 2nd ed. Chester, CT: Globe Pequot Press.

Mitchell, P., C. Plosz, A. Booth and S. Hilts. 1997. *Greening the Land: Principles, Guidelines and Cases*. Guelph, ON: University of Guelph.
Available from Centre for Land and Water Stewardship, University of Guelph, Guelph, ON N1G 2W1. 519-824-4120 ext. 8329 ($12).

Morgan, J.P., D.R. Collicutt and J.D. Thompson. 1995. *Restoring Canada's Native Prairies: A Practical Manual*. Argyle, MB: Prairie Habitats.
Available from the Rural Lambton Stewardship Network (see Helpful Organizations) ($20).
- Excellent background and much technical detail involving the "how to" of prairie restoration, e.g., mechanical seed harvesting for large-scale projects and the calibration of seeding equipment.

Nature Conservancy USA. 2000. *Elemental Stewardship Abstracts (ESAs)*, Wildland Weed Management & Research Program, Management Library. Web site <http://tncweeds.ucdavis.edu/>.
- These ESAs are species-management reports that summarize many aspects of nearly 100 species of exotic invasive plants, including their uses, ecology and specific control measures. The abstracts, complete with photographs, organize and summarize data from many sources, including the recent literature and resource managers actively implementing control measures.

Ontario Ministry of Natural Resources. 1998. *Management Options for Abandoned Farm Fields*. Extension Notes. Manotick, ON: LandOwner Resource Centre.
Available from the Ontario Ministry of Natural Resources Public Information Centre (1-800-667-1940) and the LandOwner Resource Centre (1-888-571-4636).

Packard, S., and C.F. Mutel (eds.). 1997. *The Tallgrass Restoration Handbook for Prairies, Savannas and Woodlands*. Washington, DC: Island Press.
- Excellent scientific background and discussion on tallgrass prairie and savanna restoration. Chock full of species lists, tips and scientific references. Written by well-respected, practical and practising prairie experts.

Pauly, W.R. 1988. *How to Manage Small Prairie Fires*. Madison, WI: Dane County Park Commission.
Available from the Dane County Parks Department, 4318 Robertson Road, Madison, WI, 53714 ($4 US).

Pyne, S.J. 1982. *Fire in America: A Cultural History of Wildland and Rural Fire*. Princeton, NJ: Princeton University Press.

Randall, J., and K. Marinelli (eds.). 1994. *Invasive Plants: Weeds of the Global Garden*. Brooklyn, NY: Brooklyn Botanic Garden.
Available from Brooklyn Botanic Garden, 1000 Washington Avenue, Brooklyn, NY, 11225-1099.

Royer, F., and R. Dickinson. 1999. *Weeds of Canada and the Northern United States*. Edmonton, AB: Lone Pine Publishing and University of Alberta Press.
- Provides a comprehensive description of 175 weed species in a concise and user-friendly form. The photographs are superb, and the close-ups emphasizing the identifying features of each weed species at every growth stage allow users to identify and match species in the field.

Shirley, S. 1994. *Restoring the Tallgrass Prairie: An Illustrated Manual for Iowa and the Upper Midwest*. Iowa City, IA: University of Iowa Press.

White, D.J., E. Haber and C. Keddy. 1993. *Invasive Plants of Natural Habitats in Canada*. Canadian Wildlife Service, Environment Canada, in cooperation with the Canadian Museum of Nature, Ottawa.
Available electronically at <http://www.ec.gc.ca/cws-scf>.
Click on Canadian Wildlife Service – Publications.

Plant Propagation and Cultivation

Art, H.W. 1994. *The Wildflower Gardener's Guide*. Storey Communications.
Available from Storey Communications, 105 Schoolhouse Road, Pownal, VT, 05261-9990.

Denholm, K.A., and L.W. Schut. 1993. *Field Manual for Describing Soils in Ontario*. 4th ed. Ed. D.E. Irvine. Ontario Centre for Soil Resource Evaluation, Guelph Agricultural Centre.
Available from the Land Resource Science Department, University of Guelph, Guelph, ON N1G 2W1. 519-824-4120 ext. 4359 ($25).

Johnson, L. 1999. *100 Easy-to-Grow Native Plants for Canadian Gardens*. Toronto: Random House of Canada.
- Excellent colour photos and handy profiles of many prairie and meadow plants, including propagation and cultivation tips.

Miles, B. 1996. *American Garden Classics: Wildflower Perennials for Your Garden*. Mechanicsburg, PA: Stackpole Books.
- A detailed guide to years of bloom from America's native heritage.

Philips, H.R. 1985. *Growing and Propagating Wildflowers: An Easy-to-Use Guide for All Gardeners*. Chapel Hill, NC: University of North Carolina Press.

Phillips, N. 1984. *The Root Book: A Concise Guide to Planting and Growing Wildflowers and Hardy Ferns*.
Available from Little Bridge Publishing Company, 6700 Splithand Road, Grand Rapids, MI, 55744.

Rock, H.W. 1981. *Prairie Propagation Handbook*. Milwaukee County Department of Parks, Recreation and Culture.
Available from Wehr Nature Center, Whitnall Park, 9701 West College Avenue, Franklin, WI, 53132 ($7 US).

Sperca, M. 1973. *Growing Wildflowers: A Gardener's Guide*. New York: Charles Scribner's Sons.

Taylor, K.S., and S.F. Hamblin. 1976. *Handbook of Wildflower Cultivation*. New York: Macmillan Publishing (Collier Books).
- Quite useful treatment of propagation techniques, species lists by habitat preference and individual species' requirements for many prairie and meadow species.

Wilson, W.H.W. 1993. *Landscaping with Wildflowers & Native Plants*. Ortho Books.
Available from Ortho Books, Chevron Chemical Company, Consumer Products Division, Box 5047, San Ramon, CA, 94583.

Young, J.A., and C.G. Young. 1986. *Collecting, Processing, and Germinating Seeds of Wildland Plants*. Portland, OR: Timber Press.

Native Plant Identification

Britton, N.L., and A. Brown. 1970. *An Illustrated Flora of the Northern United States and Canada* (3 vols). Don Mills, ON: General Publishing Company.
Available from General Publishing Company, 30 Lesmill Road, Don Mills, Toronto, ON M3B 2T6.

Brown, L. 1979. *Grasses: An Identification Guide*. New York: Houghton Mifflin.

Dore, W.G., and J. McNeill. 1980. *Grasses of Ontario*. Monograph 26. Ottawa: Biosystematics Research Institute, Research Branch, Agriculture Canada.

Duncan, W.H., and M.B. Duncan. 1999. *Wildflowers of the Eastern United States*. Athens, GA: University of Georgia Press.
- A richly illustrated manual that includes nearly 400 Southern Ontario species of forbs, grasses, rushes and sedges.

Gleason, H.A., and A. Cronquist. 1991. *Manual of Vascular Plants of Northeastern United States and Adjacent Canada*. 2nd ed. New York: The New York Botanical Garden. (See Holmgren et al. 1998.)

Holmgren, N.H., P.K. Holmgren, R.A. Jess, K.M. McCauley and L. Vogel. 1998. *The Illustrated Companion to Gleason and Cronquist's Manual: Illustrations of the Vascular Plants of Northeastern United States and Adjacent Canada*. New York: The New York Botanical Garden.

Kindscher, K. 1987. *Edible Wild Plants of the Prairie: An Ethnobotanical Guide*. Lawrence, KS: University Press of Kansas.
- Interesting compendium of line drawings, range information, historical food uses and Indian names.

Ladd, D. 1995. *Tallgrass Prairie Wildflowers*. Billings, MT: Falcon Press Publishing in cooperation with The Nature Conservancy.
- Excellent photographic guide to many flowering prairie and meadow plant species. More than half occur in Ontario.

Levine, C. 1995. *A Guide to Wildflowers in Winter: Herbaceous Plants of Northeastern North America*. New Haven, CT: Yale University Press.
- Detailed descriptions and accurate line drawings of nearly 400 herbaceous plants in seed; especially useful when collecting seed in late fall.

Looman, J., and K.F. Best. 1987. *Budd's Flora of the Canadian Prairie Provinces*. Ottawa: Minister of Supply and Services Canada.

Niering, W.A., and N.C. Olmstead. 1998. *National Audubon Society Field Guide to North American Wildflowers: Eastern Region*. New York: Alfred A. Knopf.

Newcomb, L. 1977. *Newcomb's Wildflower Guide*. Toronto: Little, Brown and Company.

Newmaster, S.G., A.G. Harris and L.K. Kershaw. 1997. *Wetland Plants of Ontario*. Edmonton, AB: Lone Pine Publishing.
- Wet area plant identification and general ecological information on wet area plants, including some wet meadow species.

Oldham, M.J. 1999. *Natural Heritage Resources of Ontario: Rare Vascular Plants*. Peterborough, ON: Natural Heritage Information Centre (NHIC), Ontario Ministry of Natural Resources.
The NHIC Web site includes a listing of available publications (see Helpful Organizations).

Peterson, R.T., and M. McKenny. 1968. *A Field Guide to Wildflowers of Northeastern and Northcentral North America*. Boston: Houghton Mifflin.

Runkel, S., and D. Roosa. 1989. Wildflowers of the Tallgrass Prairie: The Upper Midwest. Ames, IA: Iowa State University Press.
- Very good photos and details of Aboriginal and early European settler uses of many prairie wildflowers, most of which occur in Ontario.

Semple, J.C. 1999. *The Goldenrods of Ontario*. 3rd ed. University of Waterloo Biology Series 39.
Available from Department of Biology, University of Waterloo, Waterloo, ON N2L 3G1 ($20).

Semple, J.C., S.B. Heard and C. Xiang. 1996. *The Asters of Ontario*. University of Waterloo Biology Series 38. *Available from Department of Biology, University of Waterloo, Waterloo, ON N2L 3G1 ($15)*.

Stokes, D., and L. Stokes. 1992. *The Wildflower Book East of the Rockies*. Toronto: Little, Brown and Company.

Regional Plant Lists

Banville, D. 1994. *Vascular Plants of Metropolitan Toronto*. 2nd ed. Toronto: Toronto Field Naturalists. *Available from the Toronto Field Naturalists, 605-14 College Street, Toronto, ON M5G 1K2 ($10)*.

Bruce-Grey Plant Committee. 1997. A *Checklist of Vascular Plants for Bruce and Grey Counties, Ontario*. 2nd ed. Owen Sound, ON: Owen Sound Field Naturalists. *Available from the Bruce-Grey Plant Committee, Box 401, Owen Sound, ON N4K 5P7 ($6)*.

Gartshore, M.E., J.D. McCracken and D.A. Sutherland. 1985–86. *The Natural Areas Inventory of the Regional Municipality of Haldimand-Norfolk* (2 vols). *Available from the Norfolk Field Naturalists, Box 995, Simcoe, ON N3Y 5B3 ($44)*.

Goodban, A.G. 1997. *The Vascular Plant Flora of the Regional Municipality of Hamilton-Wentworth, Ontario*. 1st ed. rev. Hamilton Region Conservation Authority. *Available from Hamilton Region Conservation Authority, P.O. Box 7099, 838 Mineral Springs Road, Ancaster, ON L9G 3L3. 905-648-4427 ($20)*.

Henderson, R.A. 1995. *Plant Species Composition of Wisconsin Prairies: An Aid to Selecting Species for Plantings and Restorations Based upon University of Wisconsin-Madison Plant Ecology Laboratory Data*. Technical Bulletin No. 188. Department of Natural Resources, WI.
- Excellent reference on species' site preferences across the various moisture regimes and soil types in Wisconsin, based on data from J. Curtis's *Vegetation of Wisconsin*.

Morton, J.K., and J.M. Venn. 1990. *A Checklist of the Flora of Ontario Vascular Plants*. University of Waterloo Biology Series 34. *Available from Department of Biology, University of Waterloo, Waterloo, ON N2L 3G1 ($20)*.

Newmaster, S.G., A. Lehela, P.W.C. Uhlig and M.J. Oldham. 1998. *Ontario Plant List*. Forest Research Information Paper No. 123. Queen's Printer for Ontario. *Available from Natural Resources Information Centre, Ontario Ministry of Natural Resources, P.O. Box 7000, 300 Water Street, Peterborough, ON K9J 8M5.*

Oldham, M.J. 1993. *Distribution and Status of the Vascular Plants of Southwestern Ontario*. Aylmer District, ON: Ontario Ministry of Natural Resources.

Riley, J.L. 1989. *Distribution and Status of the Vascular Plants of Central Region*. Open File Ecological Report SR8902. Richmond Hill, ON: Ontario Ministry of Natural Resources, Parks and Recreational Areas Section, Central Region.

Webber, J.M. 1984. *The Vascular Plant Flora of Peel County, Ontario*. *Available from Jocelyn Webber, 2535 Winthrop Crescent, Mississauga, ON L5K 2A9. 905-823-6815 ($10)*.

Fauna

Benyus, J. 1989. *The Field Guide to Wildlife Habitats of the Eastern United States*. Toronto: Simon & Schuster.

Brown, L. 1997. *Audubon Society Nature Guides: Grasslands*. New York: Alfred A. Knopf.
- Colour photographs of birds, insects, wildflowers, grasses and trees of prairies and meadows.

Herkert, J.R., R.E. Szafoni, V.M. Kleen and J.E. Schwegman. 1993. *Habitat Establishment, Enhancement and Management for Forest and Grassland Birds in Illinois*. Springfield, IL: Division of Natural Heritage, Illinois Department of Conservation.

Peterson Field Guide series. Includes field guides to mammals, birds, reptiles and amphibians, insects, butterflies and moths, and others. Boston: Houghton Mifflin.

Zimmerman, J.L. 1993. *The Birds of Konza: The Avian Ecology of the Tallgrass Prairie*. Lawrence, KS: University of Kansas Press.
- Excellent reference on avian ecology based on the research carried out at the 3500-hectare Konza Prairie research area of Kansas State University.

Helpful Organizations

City of Toronto Parks and Recreation Division
21st Floor, East Tower, City Hall
Toronto, ON M5H 2N2

High Park is a city park located at 1873 Bloor Street W. in Toronto. It is home to a remnant tallgrass savanna. Call 416-392-1748 for information about the High Park Volunteer Stewardship Program and organized walking tours conducted by the Natural Environment Subcommittee of the High Park Citizens' Advisory Committee. The High Park greenhouse produces native plants for naturalization projects in Toronto parks. It also holds public native-plant sales around Earth Day and Thanksgiving each year. Contact the plant production supervisor at 416-392-1417 for exact dates of plant sales.

Conservation Ontario
Box 11, 120 Bayview Parkway
Newmarket, ON L3Y 4W3
Phone: 905-895-0716
E-mail: <conserve@idirect.com>

Some conservation authorities manage prairie and meadows, and assist landowners with land-management projects. Contact Conservation Ontario for information about conservation authorities in the area.

Environment Canada, *EcoAction 2000* Community Programs Office, Ontario Region
4905 Dufferin Street
Downsview, ON M3H 5T4
Phone: 416-739-4734 or 1-800-661-7785

Since 1995, the federal government through the *EcoAction 2000 Community Funding Program* (formerly *Action 21*) has supported non-profit organizations with community involvement projects designed to improve wildlife habitat.

Environment Canada, *Great Lakes 2000 Cleanup Fund*
P.O. Box 5050, 867 Lakeshore Road
Burlington, ON L7R 4A6
Phone: 905-336-4459

Since 1990, the federal government, through the *Great Lakes 2000 Cleanup Fund*, has supported wildlife-habitat restoration projects in Great Lakes' Areas of Concern, in partnership with other government and non-government stakeholders.

Evergreen
355 Adelaide Street West, 5th Floor
Toronto, ON M5V IS2
Phone: 416-596-1495
E-mail: <info@evergreen.ca>
Web site: <http://www.evergreen.ca>

This organization is dedicated to encouraging people to enjoy nature through the enhancement of healthy natural areas on school grounds and in communities across Canada.

Federation of Ontario Naturalists (FON)
355 Lesmill Road
Don Mills, ON M3B 2W8
Phone: 416-444-8419 or toll-free 1-800-440-2366
E-mail: <info@ontarionature.org>
Web site: <http://www.ontarionature.org>

FON is a non-profit nature and conservation organization involved with environmental and natural history education, advocacy, research and protection projects. Publishes *Seasons* magazine quarterly and holds annual conferences.

Field Botanists of Ontario (FBO)
12 Cranleigh Court
Etobicoke, ON M9A 3Y3

FBO arranges field trips to areas of botanical interest in Ontario and provides publications and a newsletter for amateur field botanists.

Natural Areas Association
Box 1504, Bend,
OR 97709
Phone: 541-317-0199
E-mail: <naa@natareas.org>
Web site: <http://www.natareas.org/naa/htm>

This is a national, non-profit organization working to inform, unite and support persons engaged in identifying, protecting, managing and studying natural areas and biological diversity. Publishes *Natural Areas Journal* quarterly and holds annual conferences.

Natural Heritage Information Centre (NHIC),
Ontario Ministry of Natural Resources
300 Water Street, 2nd Floor, North Tower
Peterborough, ON K9J 8M5
Phone: 705-755-2159
Web site:
<http://www.mnr.gov.on.ca/mnr/nhic/about.html>

The NHIC compiles, maintains and provides information on rare, threatened and endangered species and spaces in Ontario.

Naturalist Clubs

Contact the Federation of Ontario Naturalists, Tallgrass Ontario or the local Stewardship Council for information on the clubs nearest you. These clubs have members who are knowledgeable about the local flora and fauna, and many are involved in

naturalization and restoration projects.

The Nature Conservancy of Canada
110 Eglinton Avenue West, Suite 400
Toronto, ON M4R 1A3
Phone: 416-932-3202
E-mail: <nature@natureconservancy.ca>

The Nature Conservancy of Canada is the only national organization dedicated to preserving biodiversity through the acquisition and protection of ecologically significant natural areas. The conservancy has helped to protect endangered prairie grasslands, woodlands and other ecologically significant habitat at more than 750 sites totalling over 640 thousand hectares.

North American Native Plant Society
Box 84, Postal Station D
Etobicoke, ON M9A 4X1
Phone: 416-680-6280
E-mail: <nativeplantsoc@yahoo.ca>

This organization is dedicated to the study, conservation, cultivation and restoration of North America's native flora. It holds an annual native-plant sale and a native-seed exchange.

Office for Integrated Roadside Vegetation Management
Centre for Energy and Environmental Education
University of Northern Iowa
1222 West 27th Street
Cedar Falls, IA 50614-0293
Phone: 319-273-2813

The newsletter of this organization, *Roader's Digest*, contains useful information regarding roadside prairie restoration.

Ojibway Nature Centre
5200 Matchette Road
Windsor, ON N9C 4E8
Phone: 519-966-5852
E-mail: <ojibway@city.windsor.on.ca>
Web site:
<http://www.city.windsor.on.ca/ojibway/index.htm>

Situated beside one of Ontario's largest prairie remnants, the Ojibway Nature Centre houses educational displays about prairie natural history and offers workshops, presentations and walking tours. Friends of Ojibway Prairie is a volunteer organization dedicated to promoting public awareness of the five natural areas known as the Ojibway Prairie Complex, which is close to downtown Windsor.

Ontario Heritage Foundation
10 Adelaide Street East
Toronto, ON M5C 1J3
Phone: 416-325-5000
E-mail: <programs@heritagefdn.on.ca>
Web site: <http://www.heritagefdn.on.ca>

The foundation preserves, protects and promotes Ontario's natural and cultural heritage. Acquisition of land and easements for significant prairie and savanna sites is of particular interest to the foundation. Another important objective is raising public awareness of prairie and savanna conservation.

Ontario Ministry of Natural Resources
Call or visit the nearest office. Dialling 1-800-667-1940 will provide a connection to any OMNR office in Ontario.

Ontario Stewardship

In 1995, OMNR established 39 stewardship coordinators (one each in most Southern Ontario counties) to facilitate local community stewardship of natural resources. Each coordinator has assembled a county Stewardship Council comprising community leaders who meet regularly to identify and implement high-priority projects that encourage stewardship of the natural resources in their local county. Contact 1-800-667-1940 to find out if the local Stewardship Network/Council is involved with a prairie or meadow restoration project.

Society for Ecological Restoration (SER)
1955 W. Grant Road #150
Tucson, AZ 85745
Phone: 520-622-5485. E-mail: <info@ser.org>
Web site: <http://www.ser.org>

Society for Ecological Restoration (SER) Ontario
(Ontario Chapter)
c/o Environmental and Resource Studies Program,
Trent University
Peterborough, ON K9J 7B8
Phone: 705-748-1634
E-mail: <ser_ont@trentu.ca>
Web site: <http://www.trentu.ca/ser>

SER is an international membership organization whose mission is to advance the science and art of restoring damaged ecosystems. The society produces a newsletter and two journals *(Restoration and Management Notes* and *Ecological Restoration/North America)*, holds an annual conference and runs various programs and workshops. The Ontario chapter organizes two field days annually (to profile restoration ecology efforts by various local groups), publishes a quarterly newsletter, produces a biennial directory of native-plant suppliers in Ontario and sponsors workshops on restoration ecology topics.

Tallgrass Ontario
(Ontario Tallgrass Prairie and Savanna Association)
659 Exeter Rd
London, ON N6E 1L3
Phone: 519-873-4631

E-mail: <info@tallgrassontario.org>
Web site: <http://www.tallgrassontario.org>

This is a network of organizations and individuals working to achieve the identification, conservation, management and restoration of tallgrass prairie, savanna and related ecological communities in Ontario.

University of Guelph Arboretum
Guelph, ON N1G 2W1
Phone: 519-824-4120 ext. 2113
Web site: <http://www.uoguelph.ca/~arboretu/>

The arboretum offers one-day workshops on growing native plants from seed, woody plant identification, fern identification and the naturalization process. It holds an annual fund-raising plant sale on the second Saturday of September, at which native plants are available with source identification.

Walpole Island Heritage Centre
R.R. 3
Wallaceburg, ON N8A 4K9
Phone: 519-627-1475
Web site: <http://www.bkejwanong.com>

Some of the finest remnant examples of the eastern tallgrass prairie and oak savanna occur on the property of the Walpole Island First Nation. The Walpole Island Heritage Centre seeks to preserve, interpret and promote the natural and cultural heritage of the Walpole Island First Nation community. Access is limited and permission is granted on a case-by-case basis through the Walpole Island Heritage Centre.

Sources of Materials, Specialized Equipment and Services

Commercial Herbicide Application Services

Commercial herbicide applicators must be licensed by the Ontario Ministry of Environment to apply herbicides in Ontario. They must hold a valid Operator Licence and appropriate Exterminator's Licence. Check the local Yellow Pages under Lawn Maintenance services and inquire if the company has the appropriate licences.

Greenhouse Supplies

Plant Products Company Limited
314 Orenda Road
Brampton, ON L6T 1G1
Phone: 905-793-7000
Supplier of non-chemical insect controls.

Inoculum for Legumes

Prairie Moon Nursery
Route 3, Box 163
Winona, MN 55987
Phone: 507-452-1362

Maps and Aerial Photos

Canada Map Company
63 Adelaide Street East
Toronto, ON M5C 1K6
Phone: 416-362-9297
Supplier of topographic maps (UTM series), 1:50,000.

Northway Map Technology Limited
44 Upjohn Road
Don Mills, ON M3B 2W1
Phone: 416-441-6025
Supplier of aerial photographs and related products and services.

Prescribed Burning Services

The local OMNR district office (see the Blue Pages in the telephone directory) or the OMNR prescribed fire specialist (705-564-6019) can direct you to the local OMNR fire-management office. The fire-management office can provide information on accredited contractors.

Seed and Plants

A variety of not-for-profit and educational organizations sell native seed and/or plants by various means, including periodic plant sales and seed exchanges. A growing number of private nurseries specialize in local-source native seed and plants. SER-Ontario publishes a biennial directory that lists more than 50 native-plant nurseries and seed suppliers, as well as those who provide contract seed collection and growing services. Contact SER-Ontario (see Helpful Organizations on page 53) for details.

Soil Analysis Services

Laboratory Services Division,
University of Guelph, 95 Stone Road West
P.O. Box 3650
Guelph, ON N1H 8J7
Phone: 519-767-6299
Web site: <http://www.uoguelph.ca/labserv>

Specialized Equipment

Truax Company
3609 Vera Cruz Avenue North
Minneapolis, MN 55422
Phone: 537-6639
Manufacturer of native-seed drills and wildflower seeders.

Prairie Habitats
Box 1, Argyle
MB R0C 0B0
Phone: 204-467-9371
Distributes hand-held native-seed strippers and ATV-pulled seed harvesters.

Notes