CHAPTER 3

Managing and Restoring Woodland and Forest Communities

CONTENTS

Jack-in-the-pulpit

(continued)

SIDEBAR

FIGURES

Wild sarsaparilla

CHAPTER 3

Managing and Restoring Woodland and Forest Communities

Figure 1: ECS province map

Introduction

At the time of the Public Land Survey in Minnesota (1847-1907), the Eastern Broadleaf Forest Province was primarily comprised of savannas, woodlands and deciduous forest. The Laurentian Mixed Forest Province covering the northern and eastern part of the state was primarily comprised of northern hardwood-coniferous forests and pine forests. (See Figure 1.)

These are the natural communities we seek to preserve, manage and restore on state trails, canoeing and boating routes, and water access sites.

Forest or Woodland?

A **forest** is a dominant cover type of a landscape:

- ❒ It is a closed-canopy, wooded natural community that is not dependent on fire to maintain itself.
- ❒ It is often an area large enough to have a more or less undisturbed interior environment.
- ❒ A forest typically has four vegetation layers: a canopy; an understory of shade-tolerant small trees; shrubs; and a herbaceous layer of forest forbs.

A **woodland** is a natural community in which, in contrast to a forest, trees form an open canopy, with a ground layer made up of shrubs, grasses and forbs:

- ❒ A woodland may be an area differing in composition and appearance from the surrounding landscape (for instance, expanses of agricultural land may be the dominant cover type).

❒ Woodlands occur primarily in vegetation transition zones from prairie to forest.

❒ It often lacks adequate size to contain an undisturbed interior environment.

❒ It is very susceptible to disturbances, such as exotic species invasion, because it has a high amount of edge environment.

❒ It is a natural community that is often fire dependent.

Trails and Canoeing/Boating Routes in the Laurentian Mixed Forest Region

Trails consist of narrow corridors within a large forest expanse. Vegetation management here consists of keeping trail treadways clear of brush on a yearly basis. Trail access sites, as well as water access sites, are managed and restored individually as needed.

State trails in the Laurentian Mixed Forest region include (see Figure 2, page 4):

Arrowhead State Trail
Taconite State Trail
North Shore State Trail
Willard Munger State Trail
(Minnesota/Wisconsin border segment)

State Trails below are located in areas of mixed land use, woodland, farmland and urban development; they are located on abandoned railroad rights-of-way.

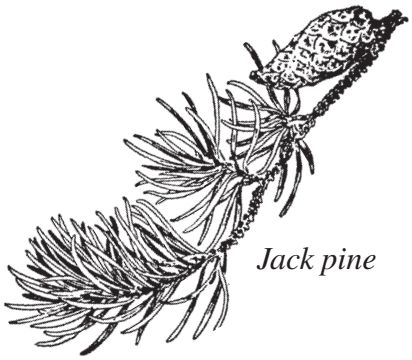
Heartland State Trail	aspen/birch, mixed hardwood and pine
Paul Bunyan State Trail	jack pine, mixed hardwood and pine, northern hardwoods
Willard Munger State Trail (Hinkley Fire segment)	pine, aspen/birch

Canoeing/boating routes in the Laurentian Mixed Forest region include (see Figure 3, page 5):

Big Fork River
Little Fork River
Red Lake River (eastern section)
Vermilion River
St. Louis River
Cloquet River
Mississippi River (northern section)
Pine River
Crow Wing River
Rum River
Snake River
Kettle River
St. Croix River
(northern section)

Trails and Canoeing/Boating Routes in the Eastern Broadleaf Forest Region

Trails, canoeing and boating routes, and water access sites crossing woodland/forest communities are most often located in areas of mixed land use, such as farmland and urban development. Trails are primarily located on abandoned railroad rights-of-way.



Jack pine

State trails that are within woodland/forest environments include (see Figure 2, page 4):

Luce Line State Trail	two-thirds maple-basswood forest
Sakatah Singing Hills State Trail	half maple-basswood forest
Douglas State Trail	some maple-basswood forest
Blufflands State Trail system	oak forest, some maple-basswood forest

Canoeing/boating routes within woodland/forest environments include (see Figure 3, page 5):

North Fork Crow River
Rum River
St. Croix River (southern section)
Mississippi River (southern section)
Minnesota River (eastern section)
Cannon River
Straight River
Zumbro River
Whitewater River
Root River

Minnesota State Trails

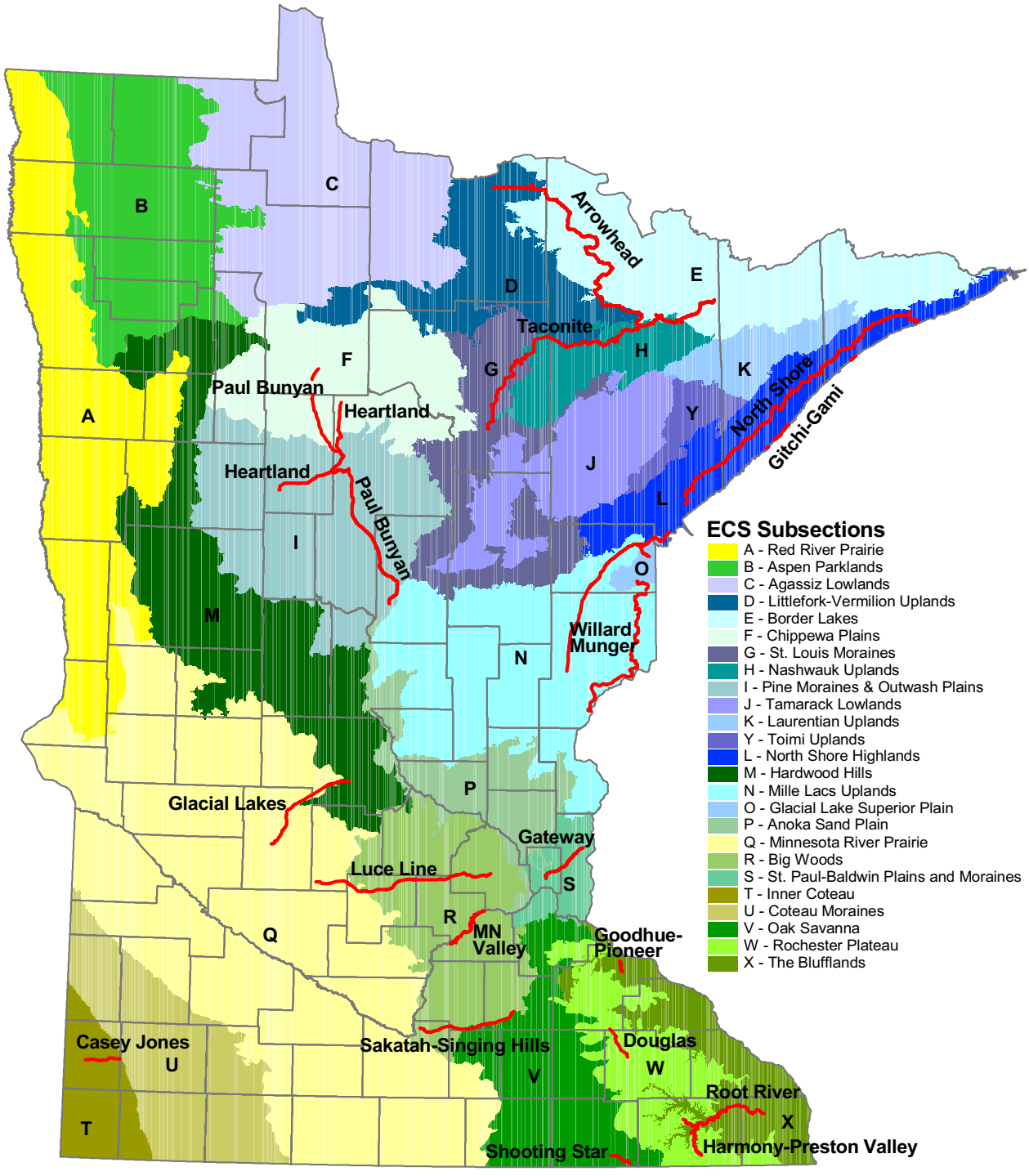


Figure 2: Minnesota state trails

Minnesota Canoeing/Boating Routes

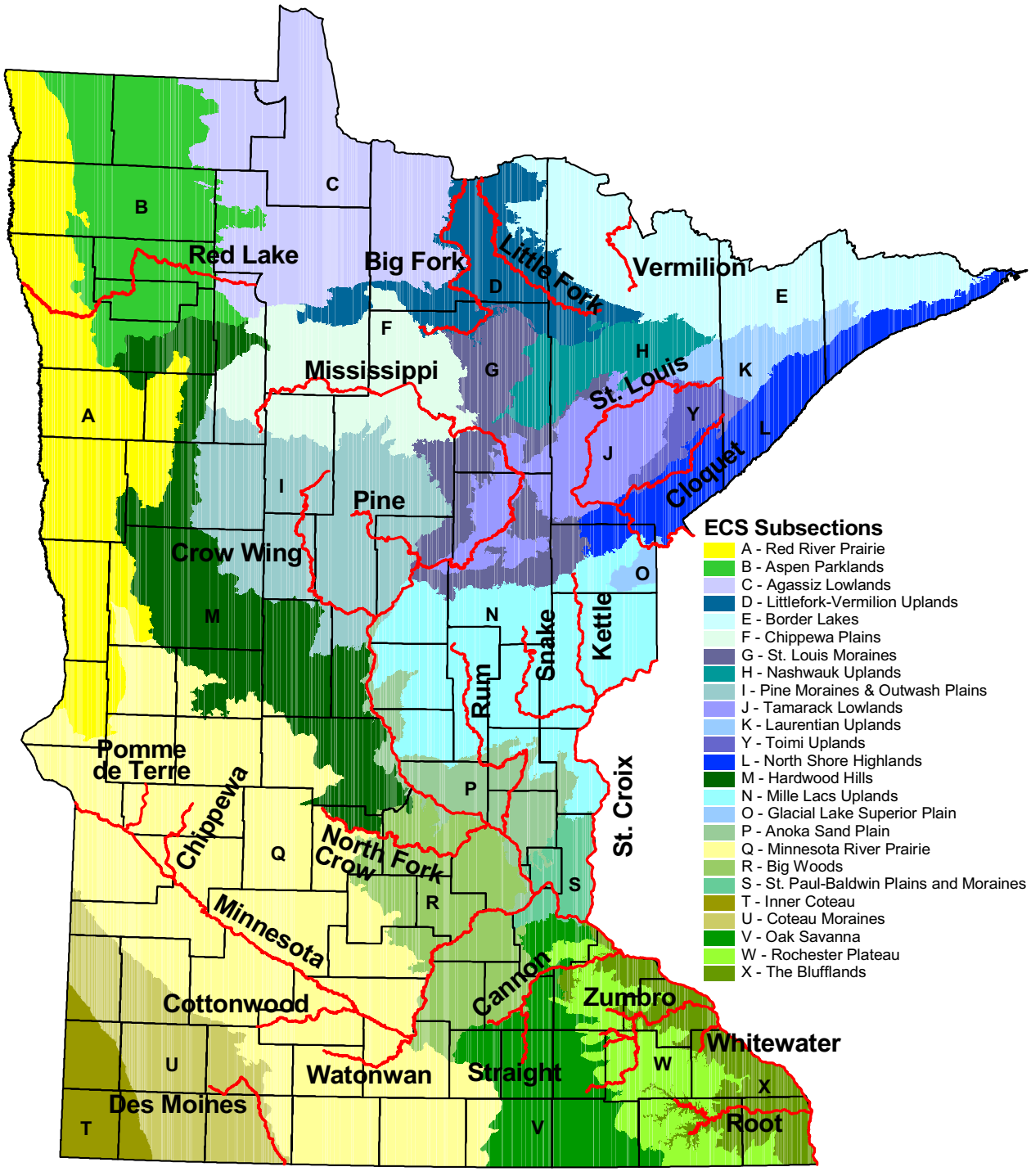
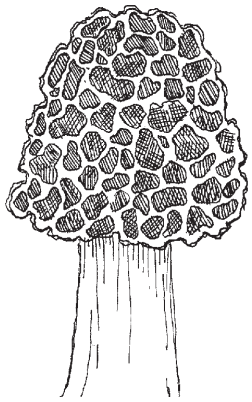


Figure 3: Minnesota canoeing/boating routes

Guiding Principle

To enhance the ecological quality of state trails, canoeing and boating routes, and water access sites, thereby increasing the quality of the recreational experience and fostering user awareness and appreciation.



Morel mushroom

This principle can be achieved by:

- ❒ **Preserving and managing woodland/forest communities** with high species diversity.
- ❒ **Identifying degraded woodland/forest communities,** and evaluating, ranking and restoring them if feasible.
- ❒ **Encouraging regeneration of native species** by removing exotic species.
- ❒ **Minimizing construction disturbance.**
- ❒ **Replanting disturbances** with locally native species.
- ❒ **Interpreting plant communities** and associated management and restoration activities.

Canada mayflower

Assessing Site-Specific Needs: Management or Restoration?

When is management of a community sufficient? When is restoration the preferred approach?

Management means taking care of what's already there: encouraging and improving the continued growth and enhancement of natural communities already in place at a particular site. Management can also be considered a form of restoration—trying to improve a site ecologically.

Restoration can be thought of as nursing biodiversity back to health through such activities as burning, exotic species control, interseeding and interplanting.

Restoration represents a more intensive effort. It is a process of returning a degraded natural community to its original structure and species composition.

Areas in need of restoration usually offer the "basic ingredients" necessary to represent a natural community, but the quality of the overall community is less than what it should be. Restoration efforts focus on enhancing what's already there, to improve the overall quality and long-term viability of the natural community.

Restoration can be thought of as nursing biodiversity back to health through such activities as burning, exotic species control, interseeding and interplanting.

Green ash

Understanding Forest Succession as a Factor in Restoration and Management Decisions

A natural plant community is never static. It changes its form and composition continually. This constant change is called **succession.** Consideration of successional principles must guide all restoration and management decisions.

Under natural conditions, a new forest is usually initiated as the result of a catastrophic disturbance. The five recognized stages in the natural development of a forest are:

Stage 1: Herb, shrub and seedling stage
Stage 2: Young forest (pioneer trees)
Stage 3: Mature forest
Stage 4: Subclimax old-growth forest
Stage 5: Climax old-growth forest

If uninterrupted by disturbances (either natural or induced by human activities), a forest will eventually become a climax forest. Small-scale and large-scale disturbances, such as windfalls, disease, forest fires or clearcuts, assure constant change in the composition of a forest, displaying various successional stages within the forest.

Each successional stage is characterized by specific tree species: pioneer species, gap phase species, subclimax and climax species. Pioneer species establish first after a catastrophic disturbance (natural or artificial). They dominate in the early stages of succession, providing shade and shelter to gap phase species.

Pioneer species in Minnesota include jack pine, red pine, aspen, white birch and bur oak. White pine is sometimes also considered a pioneer species, because it originates after forest fires and is less shade tolerant. Pioneer species have a shorter life span than successional species, with the exception of red and white pine and oak, which are long-lived and often survive to dominate sub-climax old growth forests.

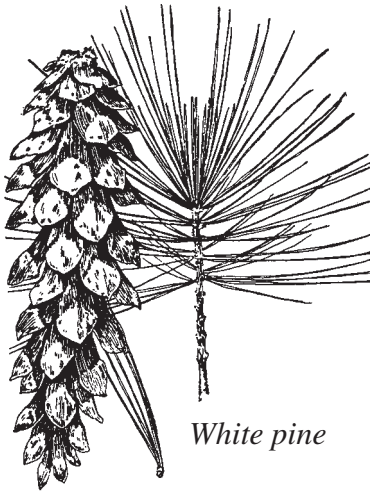
A mature forest is a stand that has reached its potential height, is even-aged, is capable of sexual reproduction, and has harvestable timber.

Gap phase species in Minnesota include red oak, red maple, yellow birch, basswood, white spruce and white pine. More shade tolerant than pioneer species, gap phase species fill in when a gap appears in the canopy, such as dying individual pioneer species.

Subclimax species in Minnesota include white pine, red pine, oak and Douglas fir; they are not shade tolerant and often persist in climax old growth forests.

Climax species in Minnesota include sugar maple and balsam fir, but also white cedar and white spruce. Climax species reproduce and persist under low light conditions. They are more sensitive to moisture stress and less resilient toward fire and animal damage.

Adapted from “Forest Ecology” factsheet, by K.A. Rusterholz, Natural Heritage Program, Minnesota Department of Natural Resources.



White pine

Conducting a Comprehensive Site Analysis

Conducting a comprehensive site analysis is the first step in evaluating a specific site. A site analysis should include the following steps:

❒ Learn about the biological history of the site.

• Refer to *The Natural Vegetation of Minnesota at the Time of the Public Land Survey: 1847-1907*.

• Consult Minnesota County Biological Survey (MCBS) maps and descriptions.

❒ Survey and evaluate existing vegetation on the site.

• Consult *Minnesota Native Plant Communities Classification Version 2.0*

• Consult *Field Guide to the Native Plant Communities of Minnesota,* 2004-2006

• Solicit help from a botanist or ecologist, or learn to identify plants.

❒ Determine whether any listed plant or animal species are present.

• Check the Minnesota listing.

• Solicit help from an ecologist.

❒ Analyze soil types and characteristics.

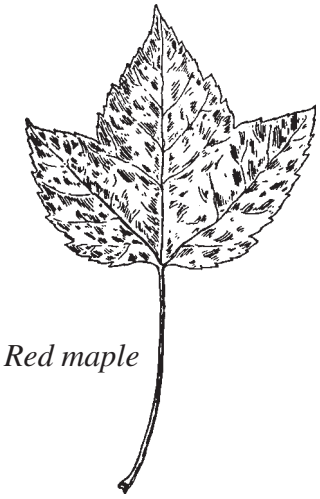
• Refer to *Soil Surveys by County: NRCS in Cooperation with Minnesota Agricultural Experiment Station*, from the U.S. Department of Agriculture.

• Conduct a soil sampling onsite.

• Determine soil compaction or disturbance.

• Determine content of organic matter and nutrient levels.

• Determine pH factor.



Red maple

❒ **Determine soil moisture** gauged on a gradient from dry to mesic to wet.

• Determine drainage patterns. For example, sandy soils and hilltops are dry, and depressions and clay soils hold water and therefore are more moist.

❒ **Consider topographic features,** such as slope and aspect.

• Determine whether the site is hilly or level; identify degree of exposure to the sun (south, north, east or west).

❒ **Consider the microclimatic conditions** of the site, within the regional context.

❒ **Select the appropriate plant species** according to site conditions
and the specific landscape unit.

• Consult *Vascular Plants of Minnesota,* by G.B. Ownbey and T. Morley (1991).

• Consult the County Biological Survey database.

• Consult the *Restore Your Shore* CD ROM (includes an encyclopedia of native plants).

Things To Remember

✔Evaluate individual sites.

✔Prioritize by commu- nity type, rarity and level of degradation.

✔Monitor management activities and evaluate outcomes.

Focus on Management and Restoration

Restoring woodland/forest communities and interpreting the process will help recreational users understand the beneficial beauty of natural areas and re-establish basic function to these communities, thereby enhancing their ecological quality. Restorations serve three purposes:

❒ **Restoring ecological function:** While human intervention can not recreate complex natural ecosystems, basic functionality can be re-established.

❒ **Preserving landscape integrity:** Restoration of disturbed plant communities helps preserve overall landscape integrity and continuity.

❒ **Providing opportunities for user education:** Management and restoration, coupled with interpretation, build awareness and appreciation of native plant communities without impacting rare habitats.

White trillium

Conditions Encountered on Disturbed Sites

Conditions encountered may include:

- ❒ Presence of exotic species and other undesirable vegetation
- ❒ Single-species canopy of exotic or invasive native species
- ❒ Reduction in mature tree density
- ❒ Absence of tree reproduction
- ❒ Shift in species composition
- ❒ Soil compaction and reduced organic matter

Restoration Considerations

❒ **The process and success of restoring these plant communities** takes a long time and is significantly influenced by adjacent land use.

❒ **Give management/restoration priority** to the following sites:

- Sites that are not yet significantly degraded
- Sites having a higher frequency of conservative species in them (indicative of a relatively stable community)
- Communities that are less common in a specific area

❒ **Avoid further fragmentation** of the woodland. Strive for connectivity.

❒ **Promote compatible adjacent land use.**

❒ **Work with the beneficial aspects** of natural disturbances (including windthrow, fire and drought).

❒ **Consider past human intervention**, such as fire suppression, logging, soil disturbance and compaction, or pesticide use.

❒ **Control exotic species or other undesirable vegetation.** Initial restoration implementation steps may involve such common techniques as cutting and stump treatment, or basal bark spraying with herbicides, mulching, burning, and girdling of trees.

❒ **Remove excessive stocking** of native trees where dense tree or shrub reproduction prevents establishment of ground layer vegetation or tree reproduction.

The process and success of restoring these plant communities takes a long time and is significantly influenced by adjacent land use.

❒ **Manage woodland sites with low-intensity fires** in intervals of 1-3 years to reduce woody invasive or exotic plants.

• Burn when leaf litter is dry to aid in fueling the fire.

• Burn only one-third to two-thirds of a site on a yearly basis on a revolving schedule to avoid negative effects on insects or other wildlife populations; fall fires also destroy potential winter food and cover.

• Reduce the frequency of burns to between 10 and 20 years, as native herbaceous ground layer vegetation develops.

❒ **Investigate whether the absence of tree reproduction** may be caused
by soil compaction due to past grazing or use of heavy machinery.

• Soil compaction can be remedied by letting the site rest for several years, which will allow litter to build up, decompose and eventually become integrated by soil fauna (organisms that assist the decomposing of leaves).

• Aeration of the soil or adding composted leaves or wood chips may aid this process.

• Cultivation of the site should be avoided, because it may be too injurious to shallow-rooted species and bring up undesirable weed seeds.

Solomon's seal

❒ **Collect seed from similar nearby sites** and sow in opened-up areas
as undesirable brush and trees are removed. It may be advantageous to plant plugs and seedlings. Success may vary widely from species to species. It is difficult to predict the establishment and spreading of forest herbs and shrubs. Some species may depend on a particular animal for their dispersal; others may depend on a microorganism in the soil; and still others may require openings in the litter layer to flourish.

❒ **Be aware of seed germination requirements.**

• **Warm-moist stratification:** Herbaceous forest species with complex double dormancy requirements, such as trillium, Solomon's seal,
and jack-in-the-pulpit, need two treatments: one warm-moist stratification at 68-75 degrees Fahrenheit, followed by a cold-moist stratification. Each temperature period requires about 3 months.

• **Fresh seed:** Many spring flowering species (spring ephemerals), such as rue anemone, trilliums, bloodroot, spring beauty, and rushes and sedges, should be sown immediately after collection, as they lose their viability. Sedges will go dormant if not sown immediately. (See also "Collecting Seeds," page 30, in Chapter 2: Managing, Restoring and Re-establishing Priaire and Savanna Communities.)

Focus on Woodland/Forest Plantings

Newly developed trails and water access sites need to be revegetated after construction is completed. In devising a planting strategy, apply the following evaluation criteria:

- ❒ Existing trees on the site
- ❒ Future use of the site by recreational users
- ❒ Aesthetic appearance
- ❒ Ease of management
- ❒ Landscape integrity
- ❒ Ecological functionality

In-depth familiarity with the individual site and its surroundings is the first step in selecting a target community that will both fit the natural landscape pattern and help in the selection of the appropriate plant community.

Things To Remember

✔Select a target community.

✔Select a planting strategy.

✔Observe and manage according to natural succession principles.

Identifying Distinct Community Requirements

Each community has distinctly individual requirements for light, moisture, slope/aspect, soil makeup and the presence of undecomposed and decomposing material.

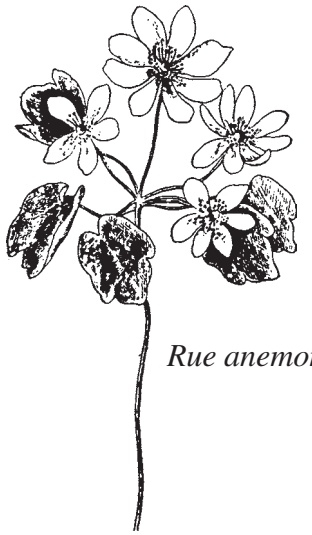
Light: While evergreen forest communities are deeply shaded all year, deciduous forest understories have low light levels in summer but much higher light levels in early spring. Light levels are also more intense or less intense, depending on the density of the tree canopy.

Moisture: Soil moisture is gauged on a gradient from dry to mesic to wet. Different moisture levels favor different populations of plants. For instance, pine and oak forest communities occur on relatively dry sites; maple basswood forest communities thrive on mesic soil; and floodplain forest communities require abundant moisture and tolerate temporary flooding.

Slope: The aspect and angle of a slope affect the composition of woodland/forest plant communities. For instance, north- and east-facing slopes, which are more protected from prevailing winds and direct sunlight, are favored by mesic communities. South- and west-facing slopes are favored by more drought-tolerant communities.

Soil: Soil characteristics to a great extent shape plant communities, as they relate to pH gradient, organic content and type of soil (sandy, clay, loam).

Undecomposed and decomposing material: Adding leaf compost or wood chips to a freshly disturbed site and letting it rest will aid the process of soil building.



Rue anemone

Planting Strategies

Great River Greening has utilized several planting strategies in its effort to enhance the ecological quality of the Mississippi River floodplain commercial area in St. Paul. These strategies can also be applied to Trails and Waterways sites in woodland and forest communities.

Great River Greening outlines five planting strategies, along with the advantages and disadvantages of each strategy:

Strategy 1: Final Spacing

With this method, plants are spaced at densities and proportions that consider the mature size of each plant. This very traditional approach is the most familiar to most people. It also requires the most maintenance for the individual plant.

Trees are typically spaced 15-25 feet apart, with shrubs planted in between. Maintenance mostly includes weeding and pruning to maintain some aesthetic appearance. Its ecological value is usually much less than a naturalized grove. Instead of mulching large areas, seed to a grass/forb ground cover.

Strategy 2: Dense Initial

Trees and shrubs are planted at greater densities (6-8 feet apart), allowing for self-thinning of plants as they mature. This method mimics natural processes much more effectively.

This method may require thinning of trees at a later stage. Tree and shrub canopy usually closes in 5 to 7 years. Less weeding and maintenance is needed after the first 4 years.

A greater variety of species can be planted, as plants support each other, shading the soil and thus maintaining more even soil temperature and moisture content. Increased leaf litter accumulation will improve the soil as well. Much more structural diversity will develop, and ecological value is increased.

Depending on browsing pressure by wildlife, the planting may need some protection in the first 5 years after planting.

Strategy 3: Sparse Initial

This method would mimic a savanna community at first. Trees are planted in less than ultimately desired densities. A ground layer of sun-loving grasses and forbs is planted beneath.

As shade develops and grasses and forbs diminish, shade-tolerant trees and shrubs are added, such as sugar maple, pagoda dogwood, elderberry and chokecherry in southern forests; mountain maple and bush honeysuckle in northern forests.

No mulching is needed, as the ground is planted with a herbaceous layer. There may be a need to control weeds by mowing periodically.

Aspen

Strategy 4: Cover Crop

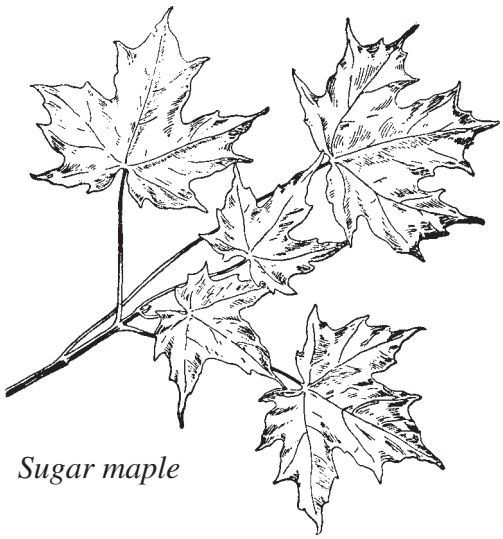
Plant short-lived, fast-growing tree species (pioneer species), such as poplar, willow, pin oak, green ash and silver maple. These species are tolerant of harsh conditions, including poor soil, fluctuating temperature and fluctuating moisture conditions.

These species act as cover crop, prepare the soil, and improve the microclimate for more sensitive species, which are added as shade develops and the soil improves. Spacing of initial plants should allow adding shade-tolerant species later.

Strategy 5: Natural Invasion

This method may be sufficient in small areas that have been disturbed by construction. Native species may naturally invade from a nearby site. Seeds could also be collected locally and seeded in a prepared area. The site will need monitoring for invasion by exotic species.

Note: Planting and caring for woody plants is addressed in Chapter 6: Planting and Pruning of Woody Plants.



Sugar maple

A Method for Assessing Buckthorn Infestation Levels in Woodland/Forest Situations

Buckthorn

In 1995, Minneapolis Parks and Recreation Board has developed criteria for assessing infestation levels of buckthorn to help standardize infestation terminology. These draft criteria will help resource managers assess individual sites through comparison. (Note: dbh = diameter at breast height)

Level I infestations include:

- ❒ No trees greater than 4 inches dbh
- ❒ Density of trees less than 1 per 100 sq. ft.
- ❒ Sapling density less than 5 per 100 sq. ft.
- ❒ Seedlings less than 3 per 10 sq. ft.

This level or less can be treated by pulling, cutting with stump treatment, and dormant spraying. Followup burns can help keep buckthorn in check.

Level II infestations include:

- ❒ Scattered trees greater than 4 inches dbh
- ❒ Density of trees less than 5 per 100 sq. ft.
- ❒ Sapling density less than 10 per 100 sq. ft.
- ❒ Seedlings less than 10 per 10 sq. ft.

This level can be slowed by removal of larger trees (2+ inches dbh) and regular fires. Fires will open the midstory and alter the species composition.

Level III infestations include:

- ❒ Trees larger than 4 inches dbh are common
- ❒ Density of trees greater than 5 per 100 sq. ft.
- ❒ Sapling density greater than 10 per 100 sq. ft.
- ❒ Seedling density greater than 10 per 10 sq. ft.

This level should receive the lowest priority for restoration because it is a pure stand of buckthorn. Removal will be very time consuming and expensive. The system will be shifted back to a grassy system with some large trees.

Control of common and glossy buckthorn is also addressed in: *Minnesota invasive non-native terrestrial plants,* an identification guide for resource managers 2003 or http://www.dnr.state.mn.us/terrestrialplants/index.html

Things To Remember

✔Control infestations in areas that have the most potential to recover on their own.

Monitoring Management and Restoration Sites

It is critical to monitor these sites, so that we can learn how natural systems respond and change over time. We need to use ecological knowledge, statistical inference and informed intuition to interpret these responses and changes.

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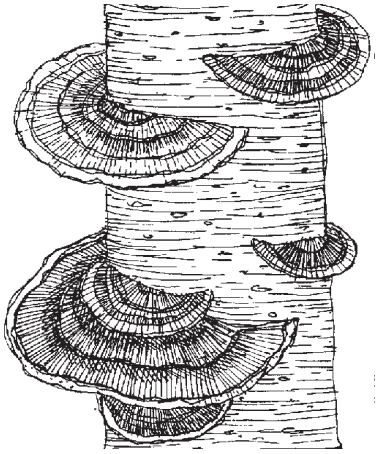
Our goal must be to design and implement a monitoring program that will best help us to track our progress in striving for ecological functionality and increased diversity of species on these sites.

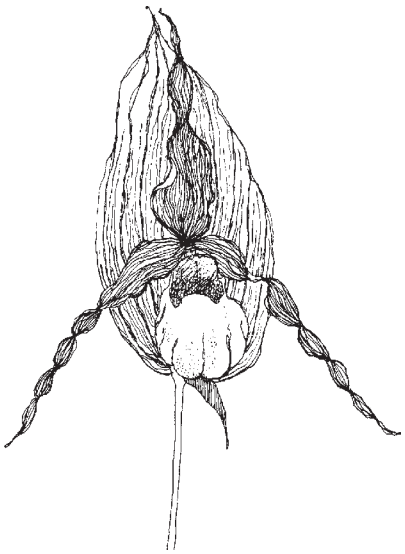
The following basic steps will help us get started:

- ❒ Establish a database for each site.
- ❒ Identify and implement appropriate management activities, including exotic species control, prescribed burning, mowing, planting and seeding.
- ❒ Record and evaluate changes to each site annually.
- ❒ Adjust management activities as needed.



Shelf fungus

Availability of Native Woody Plants



Lady's slipper

Nurseries grow a variety of woody plants native and non-native to Minnesota. While information on Minnesota source-identified stock is not readily available at this time, **be sure to ask for source identification when purchasing plants.**

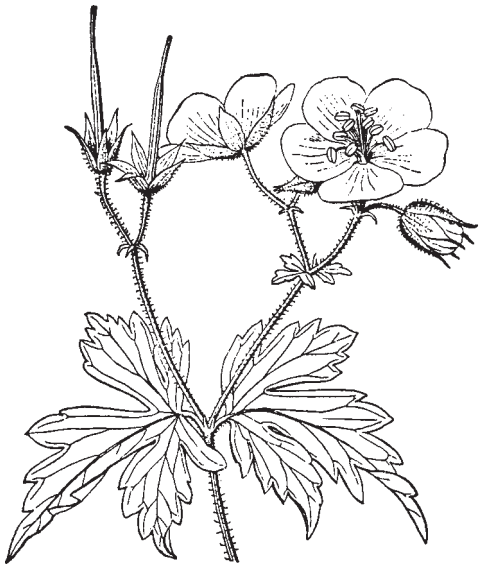
As the demand for truly native plant stock increases, suppliers will take notice and try to raise more native stock. As a result, availability of native stock will slowly increase, and nursery businesses and the public at large will begin to better understand the ecological importance of planting native species.

Exercise caution when ordering plants from local soil and water conservation districts (SWCDs). They are still promoting the use of some invasive exotic species, such as amur maple, honeysuckle, Russian olive, and out of natural range species such as blue spruce for wildlife plantings.

DNR's forestry nurseries encourage individual seed collection and will grow seedlings on contract for individual DNR division needs. Contact Badoura or General Andrews nurseries.

For Suppliers of Native Woody Plants go to:

http://www.dnr.state.mn.us/gardens/nativeplants/suppliers.html



Wild geranium

Juneberry

For Further Information

"Forest Ecology," by K.A. Rusterholz. Natural Heritage Program, Minnesota Department of Natural Resources.

Natural Landscaping, Designing with Native Plant Communities, by John Diekelmann and Robert Schuster. McGraw-Hill, New York, 1982.

Planting Strategies, Great River Greening Project, 35 West Water Street, Suite 201, St. Paul, Minnesota 55107. Phone: 651-665-9500.

The Tallgrass Restoration Handbook for Prairies, Savannas, and Woodlands, by Stephen Packard and Cornelia F. Mutel. Island Press, Washington, D.C., 1997.

"Woodland Restoration: An Overview," by Evelyn A. Howell. In *Restoration & Management Notes*, University of Wisconsin Press, Madison, Wisconsin, Summer 1986.

Restore Your Shore, CD ROM by the Minnesota Department ofNatural Resources. Copies are available through the Minnesota Bookstore; call 1-800-657-3757 for information on computer requirements and costs, 2001.

Wild ginger