M.L. 2003, Chp. 128, Art. 1, Sec. 9, Subd 11(a)

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Dodge Nature Center Main and Marie Units Restoration Plan

11(a)

Path through an oak knob on the Marie Tract, February, 2004

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Dodge Nature Center
Main and Marie Units
Restoration Plan

Compiled by
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Great River Greening

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Great River Greening (GRG), a nonprofit organization, helps communities coordinate cost-effective and sustained efforts to manage ecosystems of the Mississippi, Minnesota and St. Croix River valleys in the Twin Cities metropolitan area. We are primarily an implementing organization, providing on-the-ground ecological restoration and management of both public and private land. We engage thousands of volunteers in the planting of native vegetation, removal of exotic weeds, native seed collection and stewardship—work that results in an informed and involved citizenry. GRG also acts as a catalyst, creating effective partnerships among agencies, municipalities, and private landowners responsible for managing river valleys and their natural resources. Restoration ecologists and other scientists provide technical expertise. (See Appendix E for more information about Great River Greening.)

Fred Harris has a Ph.D. in Botany from the University of Kansas and currently works as the Lead Ecologist with Great River Greening. He conducts ecological inventories and analysis and writes restoration and management plans. Previously, he worked for many years with the Minnesota Department of Natural Resources as a plant ecologist with the Minnesota County Biological Survey and as an ecologist for the Minnesota Chapter of The Nature Conservancy.

Summary

This restoration management plan for the Main and Marie Units of Dodge Nature Center focuses on the following three objectives: A.) to document the current land cover in the Main and Marie Units of Dodge Nature Center to the extent possible with late fall and winter inventories; B.) to propose potential native plant communities and species for restoring or reconstructing native habitats on the units; and C.) to discuss strategies for managing and reconstructing those native habitats. This information can be used by Dodge Nature Center to identify specific restoration projects and timelines for completion of various tasks need to accomplish those projects.

Suggested priorities for restoration at Dodge Nature Center are: 1.) focus on the maintaining and improving the oak woodland/forest remnants, which are the highest quality remnants in the nature center; 2.) contain and reduce exotic and invasive species populations, particularly common buckthorn and Tartarian honeysuckle; and 3.) restore and improve disturbed natural vegetation, such as box elder stands, wetlands with heavy reed canary grass cover that have some promise of native seed bank recovery, or old fields adjacent to focus areas for restoration.

Physiographically, Dodge Nature Center is a very complex area with many of the landscape features and soils typical of the St. Croix End Moraine, ranging from excessively drained sandy knobs to ponded, muck filled depressions. A broad diversity of potential native plant communities could exist within this diverse landscape.

Appendices to the management plan provide technical information to supplement the recommendations, including detailed plant species lists of target native plant communities, information on direct seeding of native tree species, information about controlling exotic species, and a list of resource professionals for assistance.

Acknowledgements

Julie Allen, restoration specialist at Dodge Nature Center, provided helpful background information, a tour of the management units, and information on ongoing restoration efforts at the Nature Center. Hannah Dunevitz, plant ecologist for the Minnesota Department of Natural Resources (MNDNR) provided advance copies of species lists compiled from relevés in east-central Minnesota. Richard Peterson, Faribault Area Forester in the MNDNR, provided useful information on direct seeding and tree planting methodology. Dr. Sue Galatowitsch and Julia Bohnen, researchers at the University of Minnesota, provided much useful information on wetland restoration, particularly on sites infested with reed canary grass. Dan Tix, Dan Shaw and Wiley Buck provided substantial comments and assistance with the text and ideas in this plan.

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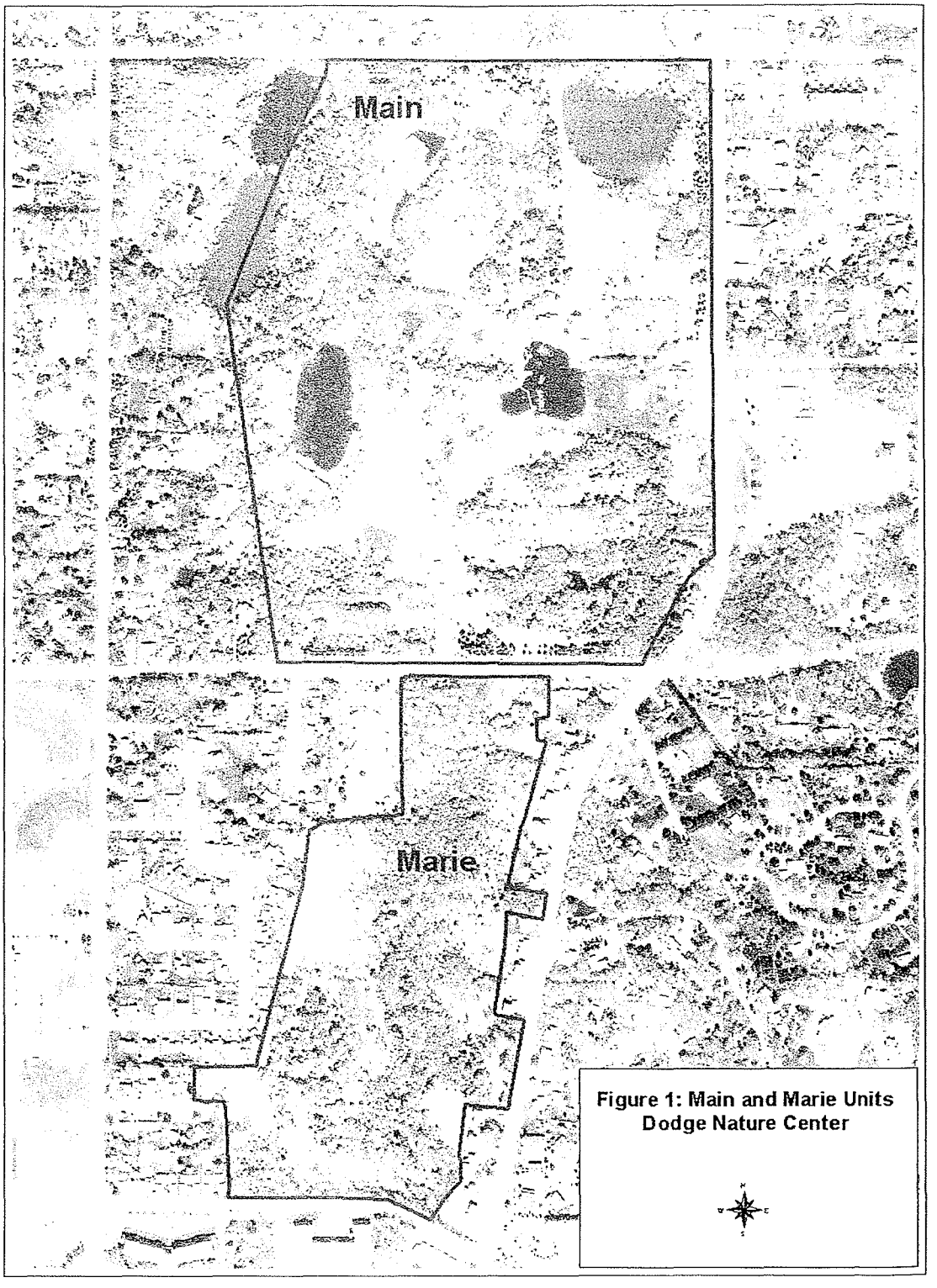


Figure 1: Main and Marie Units
Dodge Nature Center

Description of Project Area

Geological Context

Dodge Nature Center occurs within the St. Paul Baldwin Plains and Moraines Subsection of the Eastern Broadleaf Forest Ecological Section of Minnesota (MNDNR, Ecological Classification System). This is part of the transitional zone of deciduous forest that separates the Prairie and the Northern Coniferous forest regions of the state.

The landform creating the setting for the nature center is the St. Croix End Moraine, a broad band of rugged hills which formed at the terminus of the Superior Lobe of the Late Wisconsinan glaciation. This moraine consists of reddish, sandy loam till formed from reddish felsite rocks and sandstone scoured out of the Lake Superior basin (Wovcha et al 1995). The moraine also contains frequent areas of poorly sorted sand and gravel (Hobbs et al. 1990). Because it is sourced in the Lake Superior basin, this till is less calcareous than that of the limestone-containing Des Moines lobe till which was deposited a few miles to the west of the nature center's location. The steeply rolling topography and potential for erosion, stoniness, and drought-prone soils in dry years have made most of this area poorly suited to cultivation (NRCS 1983).

Soils

According to the Dakota County Soil Survey (NRCS 1983), eight soil types occur in the Main and Marie Units (Figures 2 and 3). Brief descriptions of these soil types given below are excerpted from this soil survey. Interpretations of conditions for soil formation are from Brady (1974) and Weikle (pers. comm.). Additional recommendations on suitable plant communities for the different soil types are interpretations from the author of this report.

Soil survey polygon attributes and boundaries are created on a county-wide scale and may not be completely accurate at a very small scale. Close examination of the digital soil data in Figures 2 and 3 will reveal a slight disagreement between the topo lines from the USGS quadrangle maps and the digital soil survey units: the soil survey map units are offset slightly to the west of where they should be on the quad maps. This is particularly evident in the Marie Unit. Better, more accurate information on the soils of the two units would be determined by soil sampling and analysis within the two units and might describe or map the soil units slightly differently than the general countywide survey.

Overall, all upland soil units in the Nature Center are classified as alfisols, soils that form under wooded vegetation and lack the deep, dark surface horizon (mollic epipedon) that forms under prairie vegetation.

Most of the land area in Dodge Nature Center consists of the Kingsley and Auburndale soils, however, which are now classified as mollic alfisols, meaning they contain dark upper horizons formed under prairie that are not deep enough to classify as true prairie soils (Weikle, pers. comm.). These two soils are therefore intermediate between forest

and prairie soils and reflect the retreat and advance of prairies and woodlands along the prairie – forest border. These mollic alfisols fit very well with Marschner's (1974) mapping of the area's original vegetation as woodlands and savanna transitional between prairie and deciduous forest.

There are two mollisols (grassland or other graminoid soils) in the site, the Quam and Aquoll soils, which are on low, poorly-drained terrain. The remaining soil type is Palms muck, a histosol containing a significant amount of organic matter in the surface horizons.

Non-mollic Alfisols:

Antigo silt loam - This soil is a silt loam that was formed in a silty mantle underlain by sandy outwash deposited by glacial meltwaters during recession of the St Croix end moraine. These are well-drained soils. Surface horizons are silt loam; subsurface horizons are sand to gravelly coarse sand. This soil is a woodland soil suitable for mesic plant communities.

Chetek sandy loam - This is an excessively-drained soil formed on hilltops in sandy deposits of the St Croix end moraine. The subsoil is gravelly, making the soil prone to drought. This soil is a weakly developed woodland soil (Weikle, pers. comm.). Suitable plant communities on this soil type are dry-mesic on low to mid- side slopes and dry on hill tops.

Jewett silt loam - This is a well-drained, silt loam that formed in silty loess deposits on hilltops on top of the loamy glacial till of the St. Croix End Moraine. Soil permeability is moderate and significantly less rapid than the Kingsley soils. This soil is a well-developed, woodland soil suitable for dry- mesic to mesic plant communities.

Spencer silt loam – A deep, moderately well drained silt loam formed in a silt mantle underlain by loamy glacial till on end moraines. This soil is a well developed woodland soil and is suitable for mesic plant communities.

Mollic alfisols:

Auburndale silt loam - This is a poorly-drained, mineral soil occurring in low areas between hills. It formed in silty deposits on loamy glacial till. Since the 1983 soil survey, this soil is has been re-classified as a mollic alfisol, indicating it is intermediate between woodland and prairie soils with a dark surface horizon that is not deep enough to be classified as a true prairie soil (Weikle, pers. comm.). Plant communities in these soils are wet to wet-mesic.

Kingsley sandy loam - These soils constitute most of the uplands and hence most of the land in both the Main and Marie Units. This is a well-drained sandy loam formed on slopes and hilltops in sandy glacial till of the St. Croix end moraine. This soil is classified as a mollic alfisol, indicating that it formed mostly under wooded vegetation

but with periods of prairie cover. It has a shallow, dark surface horizon about 8 inches thick that is not deep enough to classify the soil as a prairie soil. Beneath this are alternating layers of loamy sand and sandy loam. This soil is suitable mostly for dry-mesic plant communities, with mesic communities on steep north-facing slopes and toe slopes.

Mollisols:

Quam silt loam – This soil is a very poorly drained mineral soil in closed depressions between end moraine hills on glacial till. These soils formed in silty eolian (loess) or lacustrine sediments. This soil has deep black surface horizons (mollic epipedon) and formed in wet conditions under grassland. Suitable plant communities on this type are wet to wet-mesic communities in mineral soil, such as wet to wet-mesic prairies.

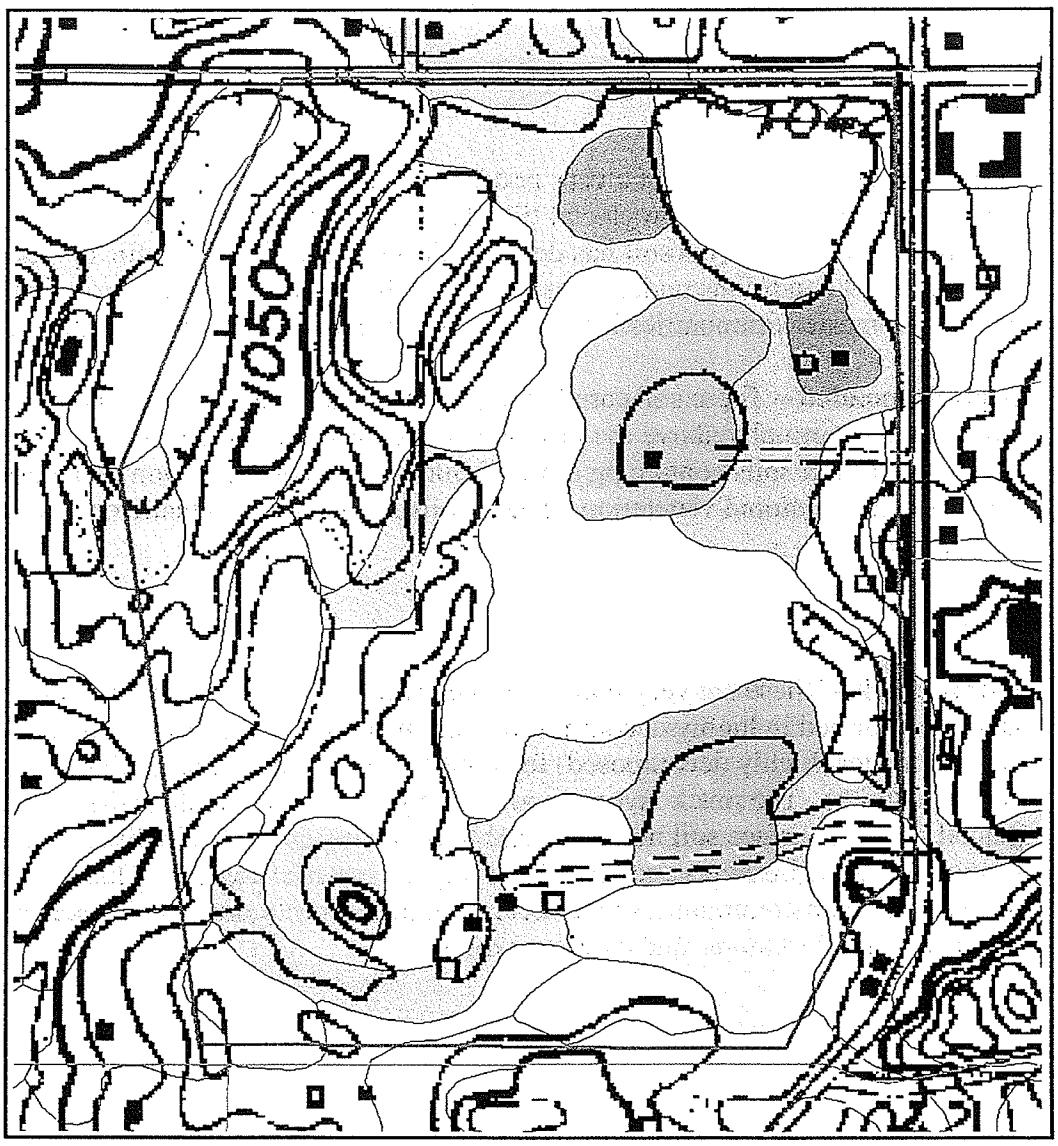
Aquolls, ponded – These soils are formed predominantly in depressions in which the water table is normally above the ground surface throughout the year. These are depressional, wet soils containing a mollic surface horizon (epipedon), suggesting formation in graminoid vegetation. These soils formed under aquatic or emergent vegetation.

Histosol:

Palms muck – These are very poorly drained soils in depressions between hills. Surface layers are formed in highly decomposed plant material, varying from mostly sapric organic matter (highly decomposed) to some hemic material (intermediate in decomposition). The muck layer is underlain by loamy mineral deposits formed in glacial till. The surface soil horizons tend to be acidic to mildly alkaline. This soil formed in wet depressions and has a high organic material content. This soil is suitable for wetland plant communities that occur on muck or peaty muck soils such as wet meadows, shrub swamps, and emergent marshes.

Figure 2: Soil Types in the Main Unit, Dodge Nature Center

(Source: NRCS, Soil Survey of Dakota County.)



Soil Type

- Antigo silt loam, well drained
- Aquolls, ponded
- Auburndale silt loam, poorly drained
- Chetek sandy loam, excessively drained
- Jewett silt loam, well drained
- Kingsley sandy loam, well drained
- Palms muck, very poorly drained
- Quam silt loam, very poorly drained
- Spencer silt loam, moderately drained
- Udorthents [disturbed ground]

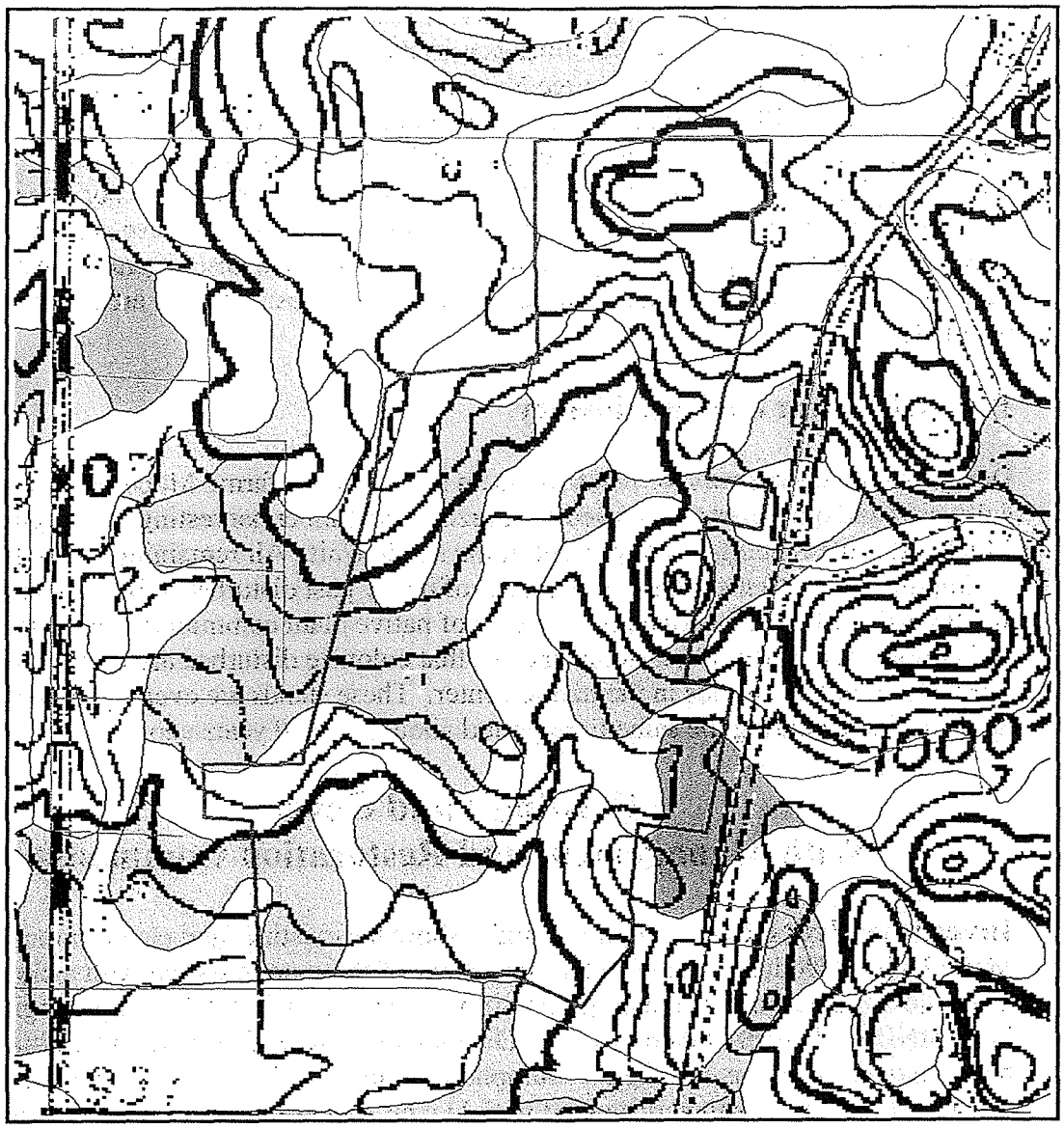
- Main Unit Boundary
- Roads

N W E S

GREAT RIVER GREENING

Figure 3: Soil Types in the Marie Unit, Dodge Nature Center

(Source: NRCS, Soil Survey of Dakota County.)



Soil Type

- Auburndale silt loam, poorly drained
- Jewett silt loam, well drained
- Kingsley sandy loam, well drained
- Quam silt loam, very poorly drained
- Spencer silt loam, moderately drained
- Udorthents [disturbed ground]

- Marie Unit Boundary
- Roads

N W E S

GREAT RIVER GREENING

Pre-settlement Vegetation

In the 1920s, Frances J. Marschner mapped the pre-settlement vegetation of Minnesota using data and observations recorded in 1847-1855 by staff of the Public Land Survey as they marked off the grid of section lines across the state. Marschner (1974) mapped the presettlement vegetation of the Dodge Nature Center area as "Oak Openings and Barrens." On the 1974 reprint of Marchner's map, Heinselman interpreted these map units as "a fire maintained buffer between prairie and Big Woods [deciduous forest],..typically on well-drained, sandy soils." Modern interpretations of this area suggest that it consisted of oak woodlands and savannas. Fires in these areas were occasional but not frequent enough to maintain a treeless expanse of prairie over long periods of time. Numerous small wetlands occurred in basins in low areas within the rolling terrain.

Post-settlement land-use history

Dodge Nature Center was for many years an active family farm. Much of the area was cultivated and other parts were used for grazing and timber harvesting (see Figure 1). Much old cattle fencing is still present in the Marie Unit. All remaining vegetation within the Nature Center shows the impact of heavy past disturbance by humans, and a small portion of the area contains remnants of native plant community types. Box elder and cottonwood, early successional species that colonize disturbed areas, are probably the most common tree species in the nature center. These stands are even-aged and appear to have originated during the same time period about 50 to 80 years ago.

Existing Land Cover
With Management and Restoration Comments

Inventory Procedure. Figures 4 and 5 show the existing land cover in the Main and Marie Units at Dodge Nature Center. Inventory of these units started with a close inspection of color infrared photography of the area, using 1:15,840 fall photography from MNDNR Forestry taken in 1994. Distinct areas were identified and digitized as a polygon overlay on top of a digital orthophoto in the ArcView 3.1 GIS program (ESRI). The resulting map was then discussed with Dodge Nature Center staff. Field visits to the Main and Marie Units were conducted over several days in November 2003 to ground truth aerial photograph interpretations and survey the plant species and the condition of the two units. The digital maps were subsequently revised and descriptions of remaining vegetation in the units were written and are given below. Later field visits in March 2004 were conducted to refine the map and resolve questions. Because the inventory was conducted in very late autumn and winter, it was not possible to survey much herbaceous vegetation in the two units.

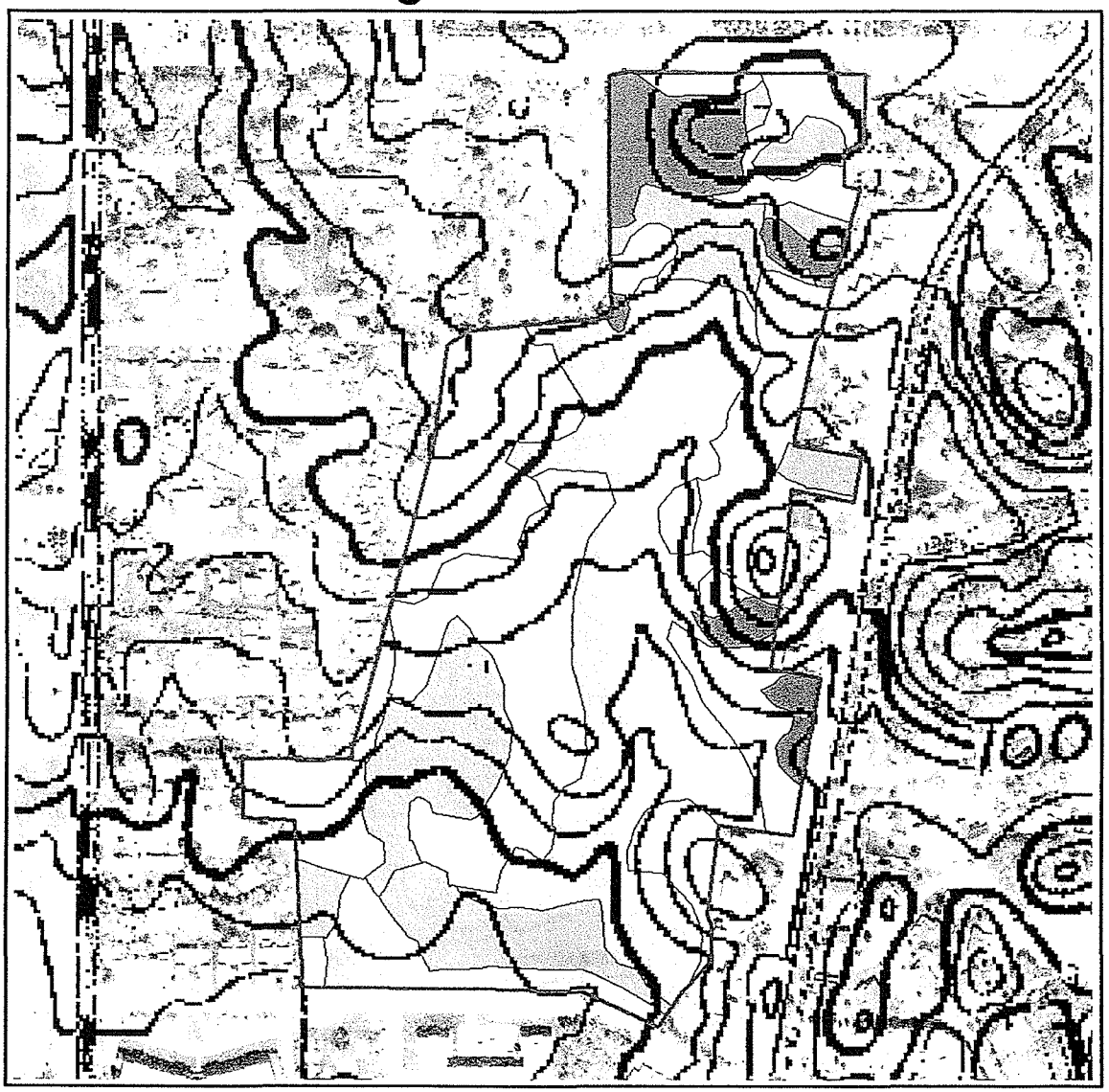
Figure 4: Existing Vegetation at the Main Unit Dodge Nature Center

- prairie reconstruction
- dry-mesic oak woodland/forest
- boxelder woods
- boxelder/cottonwood forest
- shrub swamp
- marsh
- disturbed poor fen/marsh
- reed canary grass
- amur maple grove
- planted conifers
- old field/pasture

Main Unit Boundary

GREAT RIVER GREENING

Figure 5: Existing Vegetation in the Marie Unit Dodge Nature Center



dry-mesic oak woodland/forest
boxelder woods
boxelder/cottonwood forest
shrub swamp
aspen clone
old field/pasture

Main Unit Boundary

Dry-Mesic Oak Woodland/Forest. Areas mapped as this type are the vegetation remnants closest to the original vegetation of the area at pre-settlement times. These stands are dominated by open-grown bur oak, northern pin oak and white oak. Pin oak – red oak hybrids are common and are identified by their intermediate characteristics, such as acorns with caps of intermediate depth between that of red and pin oaks. There are virtually no trees in these units that appear to be pure red oak – one good red oak was seen in the Main Unit in the shallow ravine extending northward and upslope from the lake with the large dike at its south end. Red oaks were probably more common in the nature center at the time of European settlement.

Most of these remnants are woodland-like, as they have thin canopy cover of open-grown trees. Yet they also have some subcanopy development, which indicates succession to a forest community. A return of fire could bring them back to woodland or savanna communities. With the continued lack of fire, they will succeed further into forest structure. Given their long history of past grazing, buckthorn infestation and shaded conditions, it is highly unlikely that these wooded areas still retain much of a savanna/prairie flora in the seed bank.

The largest area of oak-dominated woods is on a well-drained ridge in the northwest corner of the Main Unit, west and south of the disturbed poor fen remnant. This stand has numerous large, open-grown white oaks as well as scattered, smaller northern pin oaks, pin-red oak hybrids, paper birch, black cherry, and occasional green ash. Young box elders are common; Missouri gooseberry and prickly gooseberry are particularly abundant shrubs; buckthorn is very abundant in this stand; and Tartarian honeysuckle is also present.

The largest example of this type in the Marie Unit is on the top of the large knob at the north end of the Unit. This stand is notable for its diversity of mature oaks, including open-grown white oak, northern pin oak, bur oak, and the red oak – pin oak hybrid. The canopy is thin on the top of the knob, as the large trees are well spaced apart. Side slopes, particularly the west side of the knob, have heavier canopy cover. As in other stands throughout the Unit, buckthorn is abundant here.

Elsewhere in the Marie Unit, there are several very small, isolated clusters of open-grown oaks of the same species as in the two stands mentioned above. These are on steep, south- or west-facing side slopes of knobs. They have heavy buckthorn cover underneath the oaks.

Management Comments:

Continue removal of buckthorn, Tartarian honeysuckle and prickly ash as has been already started in some of these stands. Allow recruitment of other oak tree seedlings into the canopy in these stands by cutting and stump-treating weedy trees such as box elder that may be suppressing oak seedlings. Native shrub species should be planted in these areas including American hazel, chokecherry, gray dogwood, nannyberry, and

downy arrowwood (see Appendix A), though not in places where they might shade oak seedlings.

Red-berried elder is abundant in some stands and can be a problem by creating too much shade for tree seedlings and native herbs. Thickets of this plant, such as in on the ridge in the northwest corner of the Main Unit, should be thinned out.

Buckthorn will continue to be a difficult management issue in these woodlands due to the thin canopy cover. Areas of thin or patchy canopy cover are especially prone to dense buckthorn infestations due to its need for some sunlight. One effective strategy in oak woods is to cut and treat buckthorn plants greater than 1 inch in diameter and knock out smaller buckthorn with repeated burnings carried by oak leaf litter, followed in later years by regular, less frequent burns (see discussion of buckthorn control in the section on General Recommendations for Restoration).

Over the long term, buckthorn should eventually be less of a problem in sites being restored to well-shaded forest cover, due to greater shade. This will be truer for forests on mesic and wet-mesic sites, as they have denser canopies than forests on dry-mesic to dry sites.

Prairie reconstruction. This planted prairie in a former old field on the Main Unit was not inventoried for this report. The arm of old field extending westward at the south end of the prairie is dominated mostly by Kentucky bluegrass, but has a low diversity of prairie plant species include Indian grass, big bluestem, switchgrass, bergamot, Canada goldenrod, and stiff goldenrod. Early spring herbicide application targeted on cool season, exotic grasses after they green up will help the natives, especially in addition to spring controlled burning.

Aspen clone. The Marie Unit has three areas with quaking aspen clones consisting of dense clusters of young aspen trees (Figure 5). The clone in the far southwest corner of the unit is on low, wet to wet-mesic ground. This stand contains much young box elder, abundant Tartarian honeysuckle, and grades eastward into an area of much small American elm. Management of this stand should focus on controlling the honeysuckle, cutting and stump treating of box elder trees and seedlings, and introduction of other tree species of wet-mesic forest, particularly black ash, green ash, basswood, and slippery elm.

The other two aspen clones are on well-drained uplands. These clones could be left to become a component of dry-mesic oak forest vegetation. A small localized aspen clone should be no problem. The clones will spread out into open areas, such as into the old field on top of the knob on the east edge of the unit. Aspen can be girdled, or cut and stump-sprayed with herbicide. Girdling is less labor intensive and eliminates the cost and introduction of chemicals into the environment. Girdling is done with a tool called a 'spud' made from a leaf spring or any similar tool that will not damage the meristem of the tree (a single layer of cells beneath the bark) yet remove the bark (see Appendix C).

Controlled burns will be unsuccessful in controlling the spread of aspen, as it will readily stump sprout following a burn. Aspen is unlikely to invade adjacent well-shaded areas but it will invade tree plantings. Shrubs and herbs to plant in the upland aspen clones following removal of invasives would be the same as those for dry-mesic oak forest.

Box elder Woods. Areas mapped with this unit consist predominantly of young, even-aged box elder on well-drained or moderately drained uplands. These are early successional stands originating from disturbance and are not classifiable as remnants of Minnesota's native vegetation. Most of these trees are approximately 50 years old and must have colonized non-forested ground when the Center was a working farm. These stands have a very low abundance of other trees species present. Occasional trees in box elder stands in the nature center include several oak species, cottonwood, green ash, and American elm. Nearly all of these stands have very heavy infestations of buckthorn, except in places where the staff have been cutting and treating it. These stands appear to have very low native species diversity, which could not be fully assessed in this project, and very heavy garlic mustard infestations.

The largest upland stand dominated by box elder is on the well-drained ridge in the northwest corner of the Main Unit. This stand includes a few tall white pine and silver maples on the west edge of the ridge along the lake. Within this stand is a young grove of cottonwoods. A small number of sugar maples occur in this area. Shrubs include large thickets of red-berried elder and buckthorn. Some highbush cranberrys were also noted. The ground has very heavy cover of garlic mustard. This stand contains a small old field dominated by exotic grasses and a dense thicket of staghorn sumac. This area lacks seed sources and a diversity of native trees for regeneration. Native species will have to be reintroduced from elsewhere.

The Marie Unit also has a couple of stands mapped as box elder woods. These stands are highly disturbed and have a very low diversity of native trees, shrubs or herbs. The stand in the southwest corner of the Marie Unit is particularly disturbed, with heavy infestations of buckthorn, Tartarian honeysuckle, burdock, and garlic mustard.

Management Comments:

Short term goals should be to control buckthorn, Tartarian honeysuckle, and box elder. These stands have too much shade to allow for much oak reproduction. Sugar maple will continue to reproduce in some of these stands and eventually dominate in dense seedling and subcanopy layers, a condition that will suppress the diversity and abundance of many native herbaceous plants and tree seedlings. If this occurs, the sugar maple should also be thinned out. The garlic mustard may be controlled some time in the future with biological control if an ecologically appropriate biocontrol insect is identified. In the meantime, garlic mustard control is achieved primarily by cutting plants with a weed whip when the plants begin to flower. Taking on garlic mustard in this way cannot be applied throughout the nature center, but can be concentrated in a few priority areas for restoration. Box elder reproduction should be reduced by focusing cutting/stump treating or girdling trees, especially on seed-producing trees.

Reconstruction/Restoration Comments:

The target community for box elder stands in the two units would be mesic oak-basswood forest on lower slopes and dry-mesic oak forest on ridges, hill tops, or upper slopes (see Figures 6 and 7). This would involve replacing box elders with a diversity of oaks and hardwoods other than sugar maple (see section on General Recommendations for Restoration).

Box elder/Cottonwood Forest. These are disturbed, early successional stands not classifiable as remnants of Minnesota's native vegetation. They occur on poorly to very poorly-drained soils with a large portion dominated by cottonwood and less-drained areas dominated by box elder. American elm tends to be fairly abundant as subcanopy trees in many of these stands. Other occasional trees present in the canopy or subcanopy include green ash, black willow, hackberry, and silver maple. These stands have very heavy garlic mustard infestations. Shrubs in these woods include red-berried elder.

The largest area mapped as this type occurs on poorly-drained soils along the drainage running down the length of the Marie Unit. This area has concentrations of huge cottonwoods forming a supercanopy over other trees in the wettest parts of the ravine. Young to mid-size cottonwoods are abundant in parts. Mature and subcanopy size box elder trees are also abundant and in many places form a matrix containing the cottonwoods. Understory size American elms are abundant. Buckthorn is abundant in much of this stand but thins out in the areas of heaviest shade. Garlic mustard is highly abundant throughout the stand. Bare soils with areas of stream bank erosion are common along the drainages and provide a perfect setting for invasion of garlic mustard.

The large stand in the southeast corner of the Main Unit consists of large, even-aged cottonwoods along wet pools with some smaller box elder and green ash present. The stand also has two small planted swamp white oaks. It appears that the ground is mostly bare soil with much garlic mustard.

Management comments:

Control buckthorn and other exotic shrubs. Control garlic mustard when/if biocontrol agents are available in the future. In the meantime, manual methods for garlic mustard control should be used in focus areas for restoration (see General Recommendations for Restoration). In the long term, encourage replacement of box elder and young cottonwoods with other hardwood tree species found in wet-mesic hardwood forests. Box elder reproduction should be reduced by focusing cutting/stump treating or girdling on seed-producing trees.

Restoration/Reconstruction Comments:

As with disturbed box elder stands, clearing out large patches of box elder and cottonwood is recommended for re-establishing desirable tree species (see the section on General Recommendations for Restoration and Reconstruction). The target plant community for areas mapped as this type is predominantly wet-mesic hardwood forest, and trees to emphasize for restoration include black ash, green ash, basswood, and slippery elm. Of these species, black ash and green ash are particularly appropriate for the most poorly drained areas on the margins of pools. Hackberry, American elm, ironwood, and cottonwood are likely to seed themselves in to these stands. Bur oak also can occur in wet-mesic forests and would have to be planted in open areas with direct sunlight. Do not plant box elder or sugar maple. Paper birch, rock elm and bitternut hickory may also be planted but these are usually fairly minor components of these forests in this region. Swamp white oak is native to floodplains along the Mississippi River downstream from the Twin Cities and does not naturally occur elsewhere in Minnesota.

Most of the trees of wet-mesic sites are not as dependent on direct sunlight for seedling growth as oaks, though seedlings of these species must have some sunlight to reach the canopy. Thus, a second approach to restoration would be to try planting trees without extensive patch clearing. This should still involve severely thinning or eliminating box elder in the vicinity of plantings. A more cost effective strategy for widespread box elder control is to focus on cutting or girdling seed-producing trees.

Shrub Swamp. These areas are very poorly drained areas with heavy infestations of exotic species. In addition to shrub dominated wetlands, this map unit also includes areas that are dominated by scattered mature trees such as black willow and green ash.

At the south end of the Marie property, the swamp has scattered black willows and green ash within a dense matrix of reed canary grass. This area is more of a hardwood swamp than shrub swamp, though the trees are very scattered and the site would have essentially the same species composition as a shrub swamp. Red osier dogwood is abundant in parts. There is a dense infestation of purple loosestrife on the west end. Tussock sedge (*Carex stricta*) is still present within the thicket of purple loosestrife and indicates that this swamp would have high potential for successful restoration.

On the Main Unit, another map unit mapped as this type is on the zone of Palms muck soil along a drainage channel that extends northward from the main marsh area. This area contains small groves of silver maples, black willows and some cottonwoods with abundant, young box elder. The open areas between groves are dominated by reed canary grass. Clumps of brush are present and consist of red osier dogwood in wetter areas and Missouri gooseberry in better-drained areas. Buckthorn and Tartarian honeysuckle are present. River grape is abundant. Garlic mustard is abundant under tree cover. Some planted silver maple trees are present.

A third swamp is a small basin on the east side of the Main unit, south of the educational center buildings. This basin is dominated by reed canary grass and river bulrush at its north end, and has a thicket of sand bar willow at the south end.

Management Comments:

The major immediate objective should be to control and contain the spread of exotic species, particularly purple loosestrife. Continue to promote the biological control of purple loosestrife. Hand pulling of purple loosestrife also helps in specific sites targeted for restoration. Reed canary grass control is very difficult and requires an adaptive management approach to adjust strategies as the community responds or does not respond to management efforts (see Wetlands section in General Recommendations for Restoration/Reconstruction). There is a good chance of a native seed bank still existing under the reed canary grass cover in parts of the nature center that were not drained and cultivated in the past.

Restoration/Reconstruction Comments:

The target communities for these areas include sedge meadow and willow-dogwood [black willow] swamp. Restoration to a native condition in these areas will depend on purple loosestrife and reed canary grass control (see discussion of these species in the Wetlands section in General Recommendations for Restoration of Native Plant Communities).

Disturbed poor fen/marsh. The central floating mat in this wetland basin appears to be a highly disturbed remnant of a poor fen, a community that occurs on a floating sphagnum mat in small, steep-sided basins with a very limited surrounding watershed and very limited surface water runoff into the basin. The pH of the surface water in the sphagnum of intact fens tends to be somewhat more acidic than in other wetland types, ranging from 4.5 to 7.0. High quality, undisturbed examples of poor fens have a dense, pillowy sphagnum mat that extends completely across the basin. Poor fens are severely degraded by mineral inputs, such as road salt or fertilizers, from surface water runoff into the basin, causing the retreat of sphagnum from the edges and the formation of a large moat. This site appears to have been degraded in this way.

Presently, this wetland basin has a small amount of sphagnum present in the center of the mat, with the remainder of the mat dominated by wetland grasses, sedges, and exotic species. Native species present include Canada bluejoint, marsh fern, swamp satin grass, lake sedge, blue flag iris, boneset, and red osier-dogwood. There is no evidence of any ericads or cottongrasses, which are typical species of intact poor fens. Some early season poor fen species, such as bog violets, were not detectable in this survey and might be present. The north end of the floating mat is being invaded by silver maples. Exotics include a heavy infestation of purple loosestrife and some reed canary grass. Numerous well-used deer beds occur in the middle of the wetland. Canid scat was also noted on the floating mat.

Management comments:

It would be worth monitoring the site for surface water runoff into this basin from the road located along the north edge of the Main Unit. Steps to redirect significant surface water runoff so that it does not enter this wetland basin would be worth taking to see if the sphagnum community eventually rebounds and expands – no doubt a long term project. It may be that the other species dominating the non-sphagnum areas of the mat are too well established.

The exotic species in this wetland should be controlled, specifically purple loosestrife and reed canary grass. Eventually in the future, if surface water inputs are controlled and the sphagnum community rebounds, some typical poor fen species such as large cranberry, cottongrasses, and the typical sedges including *Carex chordorrhiza* and *Carex lasiocarpa* could be translocated into the wetland (see Appendix A).

Marsh. This unit consists of marshes and wet meadows in wetland basins on edge of open water. Dominant species in these areas include cattails, reed canary grass, and river bulrush. Other natives growing in this wetland include lake sedge and swamp satin grass. Species appearing in dredge spoils recently deposited on the margin of the open water include softstem bulrush, giant bur reed, and a species of water plantain (*Alisma* sp.).

The cattails present in the marsh are dominated by an invasive, non-local species of narrow leaf cattail (*Typha angustifolia*) or its hybrid with the locally native broad leaf cattail (*Typha latifolia*). Narrow leaf cattail is aggressive and can completely overtake a wetland. Its dominance over native sedges is strongly promoted by road salt and nutrient runoff into the wetland.

Management Comments:

To mitigate heavy cattail dominance, examine and correct where possible sources of nutrient and road salt inputs from surface water entering the wetland. Assess and amend other conditions that promote reed canary grass, such as frequent water table fluctuations and siltation (for an extensive discussion of reed canary grass, see the Wetlands discussion in the General Recommendations for Restoration section).

The presence of native seed in dredge spoils is encouraging and suggests the presence of a native seed bank. Confirmation of native seed bank can be done by removing exotic species where they occur in the marsh and monitoring to see what native species germinate (see discussion in Wetlands section of General Comments for Restoration).

Reed canary grass. These areas are covered by dense swards of reed canary grass and appear to have little diversity of native plant species.

Management Comments:

Reed canary grass is difficult to control. Conversion of reed canary sites to a native plant community is an adaptive management process. See discussion under Wetlands section in General Recommendations for Restoration of Native Plant Communities.

An initial management objective should be to stop expansion of reed canary grass into potential habitats it has not yet invaded and to amend conditions that promote reed canary grass. Steps to achieve this include stopping the potential flow of reed canary grass seed into the nature center. Reed canary grass seed floats and is transported in runoff water. Sources of erosional silt accumulation in wetlands in the nature center should be ameliorated, as they are prime sites for reed canary grass invasion. Fertilizer inputs into the wetlands in the nature center also promote invasion and expansion of reed canary grass, as well as frequent water table fluctuations.

Restoration Comments:

See extensive discussion of reed canary grass in the Wetlands section in General Recommendations for Restoration of Native Plant Communities.

Planted Conifers. These are the larger concentrations of planted pines or spruces. Some scattered conifers also occur in areas mapped as old fields. These conifer stands tend to have heavy shade, much needle litter on the ground, and little herb diversity.

Restoration/Reconstruction Comments:

These trees create dense shade and will have to be removed in stands that are to be restored to native plant communities.

Amur maple grove. Areas of numerous Amur maples planted together. Amur maples also occur in some of the other areas in the Nature Center.

Management Comments:

Where desired, cut trees and treat the stumps with herbicide to control resprouting.

Old field/pasture. Sites mapped as this unit include formerly cultivated and formerly pastured land dominated mostly by exotic grasses such as smooth brome, reed canary grass and Kentucky bluegrass. These areas also contain abundant, grazing tolerant plants such as Canada goldenrod or giant goldenrod. Both well-drained uplands and more poorly-drained lowlands were included in this map unit. Some areas mapped as old fields have scattered groves of trees, including include planted spruces and pines, Amur maples, small clusters or rows of box elders, green ash and cottonwood. Several old

fields have dense clones of smooth or staghorn sumac. Fact sheets on the control of many of these invasive species are included in Appendix C.

Restoration/Reconstruction Comments:

Reconstructing native forests in old fields adjacent to existing forested areas would be a significant contribution to reducing fragmentation and edge-to-interior space for forested areas in the Nature Center.

Reconstruction of wooded or prairie communities on old fields poses a different set of challenges than in box elder stands. Sites lacking trees do not have the problem of clearing undesirable tree species, but do require site preparation focused on the exotic or weedy herbaceous plant cover. To reestablish forest cover, the MN DNR Department of Forestry recommends mowing the grass in August to early September, applying herbicide on resprouted grasses that have grown back several inches, and then tilling the ground black (DNR Forestry Direct Seeding of Hardwoods brochure). Great River Greening has used glyphosate (Roundup) on weeds and grass, or clopyralid (Transline) when composites and legumes dominate the site. Once cleared and planted, the site needs to be managed to control competing weeds. In areas of planted trees, mulch of wood chips at least 4 inches thick is very useful for this purpose. In planted prairie vegetation, spot applications of herbicide and controlled burns timed to attack target exotic species at the time for maximum effect (usually as they begin to flower) are important.

Developed land. This map unit contains all areas of the working farm, nature center, educational facilities, parking lots, and residential areas.

Priorities for Restoration and Reconstruction of Native Plant Communities

Summary

The ongoing restoration or reconstruction of native plant communities at Dodge Nature Center is clearly a long term process with many possibilities. There are many potential, large, long term projects that could be done. The diversity of existing land cover types, habitat types, and potential target communities in the Main and Marie units make this a for many possible target communities for restoration.

There is more than one potential target community that could be restored in many parts of the units. Deciding on whether to reconstruct savanna or prairie communities versus forest communities depends on the overall goals of Dodge Nature Center, currently existing land cover, the ease of restoration, and available funding. Reestablishing a mature forest is a longer term undertaking than recreating savanna or prairie due to the time for growing trees. Reconstruction of native forest cover in old fields adjacent to existing woods is highly recommended, however, for decreasing forest fragmentation,

buffering existing woods, and increasing interior forest space. The Marie unit would be a natural place for restoring old fields to forest cover.

It was not in the scope of this project to determine timelines and implementation schedules for specific restoration projects at the Nature Center. There are several categories of restoration activities, however, which are listed in the following section according to suggested priority. Lists of major activities are also given – see the General Recommendations for Restoration and Appendix C for more details on procedures to accomplish these steps.

Top Priority: Maintain and Enhance Oak Forest/Woodland Remnants

The highest priority areas for restoration should be management and restoration of existing oak forests/woodland remnants, as these are the most intact native plant community remnants in the nature center. The two main focus areas for this should be the two largest of these remnants, one in the northwest corner of the Marie Unit and one in the northwest corner of the Main Unit. Steps to take in these areas include:

- Removal of buckthorn, Tartarian honeysuckle, box elder
    - Combination of cutting, stump treating, and controlled burning carried by oak leaves
- Containment of garlic mustard to the extent possible
    - In priority areas, such as oak forests, concentrate on cutting it as it flowers to prevent seed set; utilize biological controls if possible in the future
- Thinning of invasive shrubs and trees that suppress oak reproduction in priority areas
    - Cutting and thinning red-berried elder where it forms thickets
- Promote oak reproduction
    - Provide enough light for oak seedling recruitment by clearing competing vegetation; try direct seeding acorns in gaps; protect seedlings from herbivory and controlled burns until they are large enough to withstand both
- Enhance diversity of native shrubs and herbs of oak woodlands/forests
    - Planting or direct seeding; protect from herbivory and controlled burns

Medium Priority: Adaptive Management to Contain and Reduce Invasives and Exotics in the Nature Center

There are several populations of exotic and invasive species that are thriving in the Nature Center. The objective is to contain the spread of these populations and reduce them where possible. The following is a list of the more problematic species. Further discussion on details of control methods are given in the section on Exotics, below, and in fact sheets in Appendix C.

- Buckthorn
    - Cutting and stump treating; controlled burning to kill small buckthorn where sufficient fuels are present; focus first on seed producing trees
- Tartarian Honeysuckle
    - Cut and treat with herbicide
- Garlic mustard
    - Cutting in areas of focus for restoration to prevent seed production; monitor for and eliminate new, pioneer populations; otherwise wait for biological control in the future
- Box elder
    - Focus first on seed producing trees so as to limit its reproduction and invasion into focus areas for restoration; thinning or clearing, and stump treating; can be done progressively in stages from one edge of a stand
- Reed canary grass
    - Identify and ameliorate conditions that promote a reed canary grass population
- Purple loosestrife
    - Promote biological control by spreading insects from one infestation to another; hand pulling at flowering in small focus areas for restoration

Third Priority: Restoration of Disturbed Remnants of Native Habitats and Old Fields

There are numerous areas of disturbed native habitats left within the Nature Center. These include areas of woods dominated by box elder or box elder/cottonwood, cattail marsh, and wetlands infested with reed canary grass. Of these potential areas the largest units may be the highest priority for restoration action. Each of these is a major undertaking. Decisions on whether to take on these activities really depend on the Nature Center's priorities and resources. These areas are listed below:

- Major tracts of box elder forest or box elder/cottonwood forest:
  - Marie Property Ravine Box elder and Cottonwood Forest
  - Box elder woods in Northwest Corner of Main Unit
  - Box elder/Cottonwood stand along pools in southeast corner of Main Unit
  - Box elder and box elder/cottonwood stand in southwest corner of Main Unit

Steps are:

- In stages, progressively clear out box elder
- In opened or thinned areas for replanting; prep site by clearing undesirable trees and shrubs, exotics, and their resprouts
- Direct seed or plant tree seedlings of species appropriate for the site according to figures 6 and 7; protect from herbivory
- Mulch or take steps to control competing brush and trees that impede the growth of planted species
- Eventually plant native herbs by planting bare root stock or containerized seedlings

- Wetlands with potential for seed bank recovery (see details in Wetlands section below):
  - The main marsh and adjacent reed canary-dominated areas south of farm in Main Unit
  - The black willow/shrub swamp at the south end of the Marie Unit
  - Disturbed poor fen

  Steps to take:

  - Assess and ameliorate conditions promoting exotic species invasion
  - Contain purple loosestrife
  - Remove reed canary grass (see discussion of methods below) and promote native seed bank recovery
  - Adaptive management to keep reed canary at bay while seed bank recovers
  - Seek alternatives, such as seeding or planting seedlings of wetland species if seed bank recovery is not successful

- Numerous areas of old fields exist within the Nature Center. Priority areas for reconstruction of native plant communities should be areas adjacent to other areas that have been the focus of restoration efforts, such as oak forest areas or disturbed woods being restored. See discussion of old fields in following section. Potential priority areas for this work include:

  - Small old field on the ridge top surrounded by woods in the northwest quarter of the Main unit
  - The large upland field currently planted with conifers in the southeast corner of the Main Unit (known as "Paul Bunyan Land")
  - Old fields at north end of Marie Unit east of the large oak knob
  - Other old field areas adjacent to the main body of disturbed woods in the large ravine in the Marie Unit.

General Recommendations for Restoration of Native Plant Communities

Reconstruction of Native Tree Canopies:

Clearing to Establish Forest Cover:

For reconstruction of native forests at the nature center, a good approach is to mimic the process of succession, as discussed by Sauer, 1998. Reconstruction of upland forests in old fields or box elder sites on mesic, dry-mesic or dry soils should focus primarily on establishing oaks, as they should be the main dominant trees. Oaks do not reproduce well under established tree canopies, and require nearly full sunlight as in canopy gaps. To

reconstruct native mesic or dry-mesic oak forest in areas dominated by box elder, large openings should be created by cutting box elder and cottonwood trees. To systematically replace a box elder stand, move across the area in stages clear by cutting an area of box elder and cottonwood (if present on uplands) and planting each opened area with oaks and a few other gap-phase tree species, such as bitternut hickory, black cherry, and paper birch.

Clearing could be "non-selective" (bulldozer or the equivalent) if there are no existing species in the area to be cleared that you would want to save. "Selective" clearing in areas with species to be retained includes cutting and stump-treating selected large and small undesirable trees, and weed-wrenching or herbiciding seedlings. Be sure to maintain direct sunlight for oak seedling growth. Some species, such as gooseberries and Pennsylvania sedge are likely to reseed themselves fairly quickly into the area and do not need to be spared in clearing an area. Cut stumps of box elder trees and saplings should be treated with herbicide.

In cleared areas, the trunks and slash should be cut to a size small enough for the material to have contact with the ground and then be left to enhance the organic matter of the soil. Cut trees lacking seed can be chipped to provide mulch for reducing brush that would shade out seedlings.

Tree Planting in Cleared Areas:

In reconstructing mesic or dry forests dominated by oaks from cleared areas and old fields, the primary focus should be on establishing native oak cover. In mesic forests, the primary oak species should be red oak; in dry-mesic forest, equal parts red oak, white oak and bur oak would be appropriate; in dry forests, the major species should be white oak, bur oak and northern pin oak. 4+ inches of wood chip mulch is useful for reducing competition around growing tree seedlings.

Other gap-colonizing species in mesic and dry-mesic oak forest should also be planted in cleared areas or old fields, including bitternut hickory, paper birch, black cherry, and walnut. Aspen should not be planted because of its vigorous clonal reproduction. Black walnuts are reputed to have an allelopathic effect on some species, though it is worth some experimentation so see if this is really an issue in forest reconstruction. Other, non-gap phase species that would be worth including in initial plantings include basswood, and slippery elm on mesic and dry-mesic sites.

A caution about sugar maple: Sugar maple prolifically reproduces under well shaded canopies. Once a seed source is well established in a mesic or wet-mesic forest, sugar maple has a tendency to overtake the tree seedling and understory tree layers. Eventually, by succession, it will also co-dominate the tree canopy. The result is extremely heavy shade from many layers of maples. This heavy shade can cause thinning or complete denudation of the herbaceous plant community resulting in exposed soils prone to erosion. For these reasons, we recommend that sugar maple not be planted in the initial phases of reconstruction of mesic or dry-mesic hardwood forest, even though it is often a major component of many natural stands. If there is any seed source in the vicinity, sugar

maple will eventually seed itself into a reconstructed stand and become well established. Most mesic oak forests in the prairie-forest border zone did not contain sugar maple at the time of European settlement but most have undergone sugar maple invasion since then as a result of fire suppression.

Trees can be reestablished by direct seeding, transplanting seedlings grown in a nursery established on site, planting container-grown stock from a commercial nursery, planting commercial bare-root stock, or by allowing seeding in from nearby trees.

We recommend direct seeding with seed collected at or near the nature center for establishing a large number of trees in an area at minimal cost. Ecologically this is the most appropriate method for establishing local ecotypes of trees. The process for establishing many different tree species by direct seeding is outlined in a brochure from the DNR Division of Forestry in Appendix B. The Minnesota DNR has had better success with direct seeding for some species than with transplanting seedlings from nursery – especially with oaks (Richard Peterson, pers. comm.). The long and sensitive taproot of trees like bur oak makes seedling transplantation difficult. Direct seeding is an easier and cost effective way to establish a large number of oak trees in an area. This method makes the whole process of nurserying essentially unnecessary. Volunteer events can be organized around collecting, processing and planting the tree seeds. Seed from many tree species and shrub species, such as basswood, ash species, bitternut hickory, will have to be collected from off site with landowner permission. One source of information on potential sites for collecting tree seed is the DNR's County Biological Survey map for Dakota County (MCBS 1997). Also see Dakota County's resource assessment (Dakota County Soil and Water Conservation District).

Container-grown trees of local stock are recommended for small plantings. The downside of containerized stock is that it is more expensive than direct seeding, the trees are often not of local genetic stock as many local nurseries purchase stock from out of state, and trees may be in poor condition (e.g. root-bound) and may not establish well.

Bare root seedlings are also an option for planting. These are less expensive than containerized seedlings and can be used to establish greater numbers of trees than containerized stock. Bare root stock can be obtained through Outback Nursery. Local source of ecotype depends on the species: many of the more obscure, less commercially available stock may be produced by local growers and be more likely to be local ecotype. To enhance bud break, some tree species should go through a process of "sweating" in which the roots are warmed up in plastic bags. These must be planted in early spring and sufficiently watered until the plants become established.

Tree Planting Density:

Great River Greening has used several different planting approaches to reconstructing forests in old fields or other similar disturbed sites lacking tree cover using tree seedlings (for an analysis of these approaches, see Lane and Raab, 2002). The two most relevant planting strategies for old fields or cleared areas differ in the initial cost and long term

maintenance costs. Dodge Nature Center will have to decide on an approach that best suits available funds and maintenance abilities.

The "dense initial" strategy consists of planting trees at a greater density than the target density of a mature community. Trees are planted 5 feet apart on center and shrubs are planted 4 feet apart on center with a shrub to tree ratio of 3:1 for forest. This strategy is more expensive initially because of the larger amount of plant material used. These sites are usually mulched with a minimum of 4 inches of wood chips. Less long-term maintenance is required as the trees mature and begin to shade out the open spaces between trees (Lane and Raab, 2002). A less regular patterning of trees would result in a less planted appearance. To achieve a completely random pattern for tree planting, try a free extension for ArcView GIS obtainable from the MNDNR that will enable one to locate randomized points within a given polygon. Coordinates for these points can be located on the ground using GPS units. However, in a natural state the trees are not likely to be randomly arranged anyways, so planting randomly by sight may be acceptable.

The "final spacing" strategy consists of planting trees and shrubs in the same density as anticipated in a mature community. In this method, trees are spaced 20 to 30 feet apart on center starting with trees that require open conditions and are heat and drought tolerant, such as oaks. Shade tolerant trees and shrubs are added later as the initial plantings mature. This approach is much less expensive for the initial costs of plant material but requires more initial and longer term maintenance to control invasive plants from becoming established between the trees (Lane and Raab, 2002).

The DNR Forestry Department recommends a planting density for direct seeding of oak stands at 4 bushels of acorns per acre or about 12,000 acorns per acre or roughly 1 acorn every 3-4 square feet or every 2'x2' (R. Peterson, pers. Comm.). This high density results in complete "crown closure" after as little as 3 years and greatly cuts down on site maintenance costs. The resulting dense stand, however, will resemble a tree plantation with straight-boled trees and little space for other woody plants such as shrubs. Thinning trees at a later date could achieve the desired spacing and patterns.

Protecting Seedlings:

As Dodge Nature Center restoration staff already know, the survival of tree seedlings is much enhanced by protective structures that prevent herbivory (see Stange 1998). Tubex tubing is recommended for installing in plantings of large numbers of trees in areas supporting a substantial deer population. Otherwise, hardware cloth, as is already used at Dodge Nature Center, is sufficient for keeping at bay.

Establishing Herbaceous Plants in Woodlands:

For establishing native herbs of forest communities in a fairly large area, we recommend planting bare root stock of native herbs, which is less expensive than plugs or potted plants. These dormant plants should be planted as early as possible in the year when the frost goes out of the ground, so that the plants will be in the soil when it is moist and do

not need watering. There are not many suppliers for bare root stock of native woodland herbs, and some have plants that are not Minnesota stock. Prairie Moon Nursery (Winona, MN; see their website) may be the best source for bare roots, which they dig out of beds in their nursery. In addition, they can provide information on genetic sources of the seedlings. There also may be some salvage companies that supply bare root stock, but these are not likely to be of local origin.

Plugs are less expensive than potted plants. These are generally not available until well into spring. Depending on site characteristics and rainfall, planting plugs or potted plants may require periodic watering. Late season planting runs the risk of plants not becoming rooted into the ground and frost-heaving. Landscape Alternatives may be the best source of local plants in pots.

Prairie herbs must be planted in areas with sufficient sunlight. Many of these plants will not survive in areas with some dappled shade cover.

Some trees known to have an allelopathic effect on herbs include box elder, black walnut, and buckthorn.

It is worth keeping an eye out for earthworm infestations, as they affect the diversity of wildflowers in forests and may promote buckthorn populations. Earthworms are not native to Minnesota, as the state was inhospitable to earthworms when it was covered by glaciers approximately 10,000 years ago. Heavy infestations of earthworms are a significant problem for establishment and maintenance of many native forest wildflowers whose roots or tubers are established in the humus. Typical signs of heavy earthworm invasion are bare mineral soils lacking duff and abundant earthworm castings on the ground surface.

There currently are no methods to prevent earthworm invasion or eradicate them after they have arrived. A simple sampling method is available to determine the presence of exotic earthworms and could be conducted to confirm their presence or absence. For further information on earthworms, please go to the website for the Minnesota Worm Watch at the University of Minnesota Duluth: www.nrri.umn.edu/worms/Default.htm.

Heavy populations of deer also have a negative influence on many wildflowers in forests. Deer can finish off what wildflowers remain in an area infested with earthworms. Some projects have put up large deer exclosures to protect native herbaceous plants and tree seedlings from herbivory. These can help to determine the extent to which herbivory is a problem.

Prairie and Savanna Communities:

This report will not go into prairie reconstruction in detail, as this is the focus of a previous plan for the Lilly Property at Dodge Nature Center. There are many good references to use for prairie and savanna restorations including Kilde (2000), Shirley (1994), Packard and Mutel, Ed.s (1997), and the website for Prairie Restorations, Inc.

Some considerations of interest to nature centers include recent research indicating that the prairie restorations most successful in approximating the native species richness and functioning of a native prairie ecosystem are those that maximize the diversity of plant species in the restoration. Evidence for greater functioning in more diverse prairie restorations has been shown for indicators such as Lepidoptera (Reed 1997) and small mammals (DeGolier et al. 2002). There is a need for much more research on the long term success of restorations and reconstructions in recreating ecologically functioning target communities. There is an extra cost associated with maximizing species diversity due to the high cost of forb seed.

To maximize plant species diversity in a prairie or savanna restoration, aggressively spreading species should be proportionally de-emphasized in the seed mix (Weber 1999). Some researchers studying long term trends in reconstructed prairies have advocated starting with only forbs and interseeding grasses later (Kindscher and Fraser, 2000).

On the Main Unit, the small, excessively drained knob on the Chetek soil type on the south edge of the existing prairie restoration stands out as a place to restore to dry oak savanna, due to the dryness of the soils and its position as a transition from the wooded ravine in the southwest corner of the Main Unit to prairie restoration.

Wetlands:

Dodge Nature Center has several wetlands choked with reed canary grass that show some promise for restoration. The shrub/black willow swamp at the south end of the Marie Unit may be an ideal place to begin a wetland restoration project. Tussock sedge is still present within a thicket of purple loosestrife and surrounded by reed canary grass. If control of these two invasive species can be accomplished, it is possible that native propagules already present may sprout and recolonize the area. Other wetland areas mapped as reed canary grass have high potential for restoration, as well as the outer edges of the large marsh basin surrounding the boardwalk lake in the Main Unit.

Restoring wetlands choked with reed canary grass is a difficult challenge without a single clear strategy. There is no established method for dealing with this problem and it is the focus of some research interest (Galatowitsch and Bohnen, pers. comm.). Several methods are being used and it would be worth experimenting with different approaches to compare results, provided sufficient funding is obtained. Comparative studies of these techniques would provide educational opportunities for visiting students at the nature center and would be useful information to restorationists.

Mitigating Conditions that Promote Reed Canary Grass Infestation:

Long-term reed canary grass control will require addressing environmental conditions that promote reed canary grass over native sedges. Conditions that promote reed canary grass include: frequent fluctuations in water levels in a wetland; nutrient enrichment

(especially nitrogen) from runoff; silt deposition from erosion; and transport of reed canary grass seed via runoff water into a wetland from elsewhere. Large changes in water levels will kill many native species and provide bare soil for reed canary establishment (Galatowitsch and Bohnen, pers. comm.). These conditions should be examined and ameliorated for sites targeted for wetland restoration.

Methods for Reed Canary Grass Removal:

Galatowitsch and Bohnen (pers. comm.) have found that the fall is the best time for a controlled burn of reed canary grass followed by herbicide treatments targeted on resprouting plants. Begin by burning the stand of reed canary grass in mid to late August. This will eliminate the thick sward of dead leaf material that will soak up and waste a lot of herbicide. Later the same fall, apply herbicide (Rodeo) to the reed canary grass that resprouts and greens up. This method allows direct application of herbicide to actively growing plants. Another 1-2 herbicide applications will be needed early the following spring to take out resprouting plants. Spring application should be timed as early as possible to avoid herbicide effects on natives germinating from the seed bank, which should be slower to germinate in the spring than reed canary grass.

Rusty Schmidt (pers. comm., URS, a consulting company) recommends a different approach: thoroughly spraying reed canary grass in the fall and then burning off the stand very early in the following spring as soon as the snow has gone. This helps heat up the wetland in the spring and stimulates rapid reed canary grass resprouting which can be then sprayed again with herbicide early in the spring. This application of herbicide should be in April which is early enough to take out reed canary grass before affecting natives that may resprout from the seed bank. Later spot spraying of surviving reed canary grass around emerging natives may be needed.

Schmidt also has had success removing reed canary grass using bulldozers, which he uses whenever he can. This is best done in the winter on wet sites but can be done in the summer on fairly dry sites. Care must be taken to peel off just the dense reed canary grass mat on the surface of the wetland. This gets all the rhizomes and much of the reed canary grass seed. The reed canary grass mat actually rolls off. One local site where this was done is at Sargent's Lake at Fort Snelling. Some local spot spraying may be necessary after removal of the reed canary grass mat to take out any resprouting reed canary grass if there is any.

Follow up after Reed Canary Grass Removal:

Reed canary grass is a prolific seed producer, and it is a challenge to deal with resprouts coming from the seed bank that out-compete desirable species emerging from the seedbank. To assess native seed banks, Galatowitch recommends first removing reed canary grass from an infested area and observing the wetland to see what native species, if any, may emerge from the seed bank. She recommends this over collecting and growing out soil samples (by sampling soils from various depths in the soil profile of the wetland, then potting and watering them to see what native species emerge) that can take

4-8 months. Resprouting reed canary grass that is significantly taller than any native species can be treated by wick application of herbicide glyphosate (Roundup) focused only on the reed canary plants.

Evidence from Wisconsin has suggested that reed canary grass do not resprout well when a canopy of other plants has been established above it and blocks direct sunlight (Galatowitsch and Bohnen, pers. comm.). Thus, establishing native vegetation quickly should be a primary goal one reed canary has been knocked back. This is probably best accomplished by transplanting nursery grown native plants into an area, though this can be quite expensive. For sedges, it is really the most effective method because seed storage of these plants results in a loss of viability. Rhizome cuttings have also been used for tussock sedge, a dominant species in this plant community, though with less success than planted seedlings (Galatowitsch et al. 1999).

After removal of a reed canary mat with a bulldozer, Schmidt follows up by reseeding the wetland with a standard wetland mix containing wetland sedges and grasses used by the Board of Soil and Water Resources (BWSR) and thus cannot comment on native seed bank recovery in these sites.

Seed mixes are more affordable than seedlings, but seed often does not establish as quickly as transplants. Seeds can be introduced from donor seed banks if one is available. This method requires a nearby wetland from which soil can be collected and transported to the restoration site. More information on this procedure is available in van der Valk and Pederson (1989). Furthermore, native hay can be collected from a nearby site and added as mulch, which is less damaging to donor site. This does not contain as much viable seed or species richness as a seed bank donation (Galatowitsch et al. 1999), nor has its effectiveness been shown in wetlands. Another consideration when adding seed to a site is that flooding can carry seed away or kill many young seedlings. Thus, it is advisable to control water levels when performing such projects.

Controlling Exotics:

The general strategy for controlling exotic species in the nature center should be to restrict the expansion and further growth of the existing exotic population, mitigating the consequences of the exotics such as by planting or otherwise promoting native species in areas where the exotic has been set back or removed, and finally eliminating the exotic species from the area.
With limited resources and time for exotic species control, efforts should be focused primarily on areas where restoration efforts are underway. Throughout the nature center, control can be focused on seed-producing plants of dioecious species such as common buckthorn and box elder.

Fact sheets, with added comments by the author, on the control of the more problematic invasive or exotic plants in the nature center are given in Appendix C.

Monitoring:

It is important to monitor restoration sites in order to assess the effectiveness of management techniques and track changes and outcomes in restoration efforts. We recommend permanently marked macroplots sampled with the relevé method for documenting and tracking the structure and composition of the vegetation in a restoration area. The relevé method is a widely used, semi-quantitative method that is fairly easy to use and analyze. The DNR's relevé handbook (Almendinger, 1987, currently undergoing revision) gives detailed guidelines on how to conduct relevés. Analysis of species-area curves in Minnesota has resulted in a convention of sampling forested communities with 20x20 meter plots (400 square meters) and sampling non-forested communities with 10x10 meter plots (100 square meters). The location of a permanent plot can be marked with a stake in the ground at one corner of the relevé. The plot can then be relocated if its sides were oriented along cardinal directions and notes were taken to indicate which corner of the plot was marked. Results in relevés differ throughout the year, so sampling for comparison over time must be done at the same time of year. Great River Greening staff can provide training in conducting relevés.

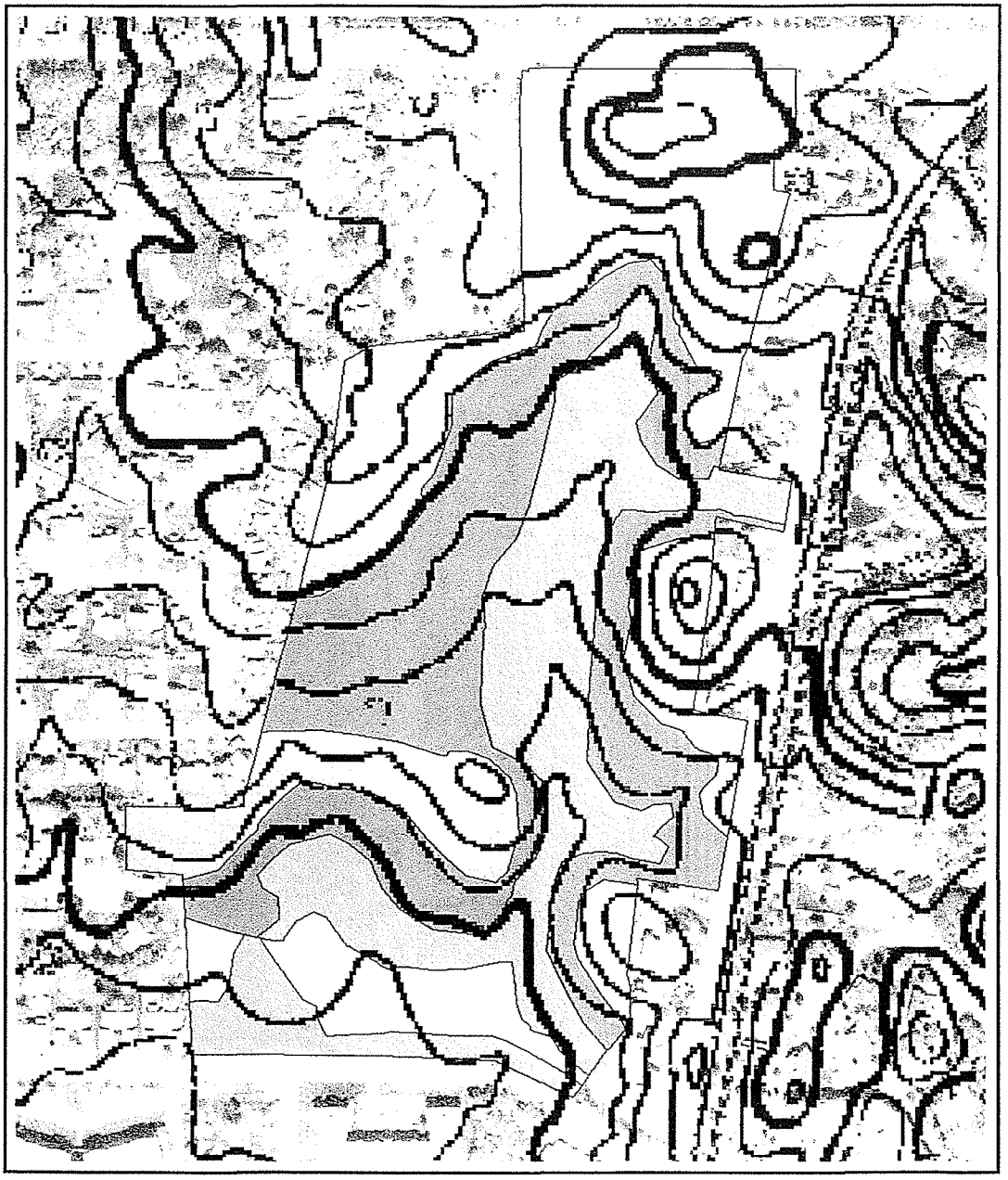
Target Plant Communities for Restoration

There are several different native plant communities that may be identified as targets for restoration at Dodge Nature Center. Suggested community types are mapped in Figures 6 and 7. The following plant community descriptions, with accompanying species lists in Appendix A, are excerpted primarily from recent compilations for east-central Minnesota in a joint project of the Minnesota DNR, Great River Greening, and Ecological Strategies, LLC (Dunevitz and Lane 2004). These descriptions and lists were developed from analysis of vegetation plots (relevés) collected mostly between 1990 and 1999 by ecologists with the Minnesota County Biological Survey, a program of the Minnesota DNR, see also Great River Greening's website.

Figure 6: Potential Vegetation at the Main Unit
Dodge Nature Center

- Dry Oak Savanna; Dry Prairie
- Dry-Mesic Oak Forest; Mesic Prairie
- Mesic Oak-Basswood Forest; Mesic Prairie
- Wet-Mesic Hardwood Forest; Wet Prairie
- Sedge Meadow; Willow-Dogwood Shrub Swamp
- Poor Fen; Sedge Meadow; Mixed Cattail Marsh
- Mixed Cattail Marsh

Figure 7: Potential Vegetation at the Marie Unit Dodge Nature Center



Dry-Mesic Oak Forest; Mesic Prairie
Mesic Oak-Basswood Forest; Mesic Prairie
Wet-Mesic Hardwood Forest; Wet Prairie
Sedge Meadow; Willow-Dogwood Shrub Swamp

Wet-Mesic Hardwood Forest: These are wet-mesic forests on seasonally-saturated, mineral soils. The dominant trees include black ash, green ash, basswood, and American elm. These stands may also contain rock elm, red elm, hackberry, bur oak, cottonwood, and sometimes sugar maple. Understory trees mostly include those of the canopy, but may also include blue beech or quaking aspen. Shrubs, usually sparse in well-canopied stands, commonly include chokecherry, red-berried elder, Missouri gooseberry, and prickly gooseberry. The herb layer is often dominated by cleavers and Virginia waterleaf; wood nettle often dominates in silty sites with thin canopy cover later in the season. Common graminoids include Virginia wild rye, ambiguous sedge, and Sprengel's sedge. Other common forbs include false rue anemone, tall scouring rush, ostrich fern, and goldenglow. Vines may be very common, particularly wild grape and Canada moonseed.

Mesic Oak-Basswood Forest: Forest on moist, well-drained soils. Canopy typically dominated by red oak; other important canopy trees include white oak, bur oak, green ash, bitternut hickory, sugar maple and basswood. Paper birch, black cherry and quaking aspen are often present but infrequent in the canopy. Common subcanopy trees include ironwood, bitternut hickory, sugar maple, and basswood. With a closed tree canopy, oaks are generally very sparse to absent as understory trees or seedlings. Stands with heavy sugar maple cover in understory and seedling layers are succeeding to eventual co-dominance by sugar maple. The shrub layer is sparse under dense tree canopies and denser under thin canopies, with prickly gooseberry, Missouri gooseberry, and chokecherry particularly abundant. Common graminoids include bottlebrush grass, bearded shorthusk, black-fruited rice grass, charming sedge, graceful sedge, and stellate sedge. The groundlayer consists of shade tolerant herbs, usually including wild geranium, pointed-leaved tick trefoil, enchanter's nightshade, yellow bellwort, hog peanut, bloodroot, lopseed, Clayton's sweet cicely, and white snakeroot. These stands tend to have fewer early spring ephemeral plant species typical of maple-basswood forest.

Southern Dry-Mesic Oak Forest: Forest on well-drained uplands on upper slopes and hill tops on sandy loam soils. These stands typically have a thin canopy dominated by red oak, white oak, and basswood. Other trees may include bur oak, northern pin oak, quaking aspen, big-toothed aspen, black cherry, bitternut hickory, and paper birch. Many large trees may have an open grown form. Sugar maple is generally absent. Understory trees consist of those in the canopy, though oaks are generally uncommon to sparse due to shade. Common shrubs include gooseberries, American hazel, downy arrowwood, and gray dogwood. Common graminoids include Pennsylvania sedge, mountain rice-grass, stellate sedge, and bottlebrush grass. Typical forbs are widespread species that tolerate shade and dry-mesic conditions, commonly including wild geranium, wild sarsaparilla, Clayton's sweet cicely, hog peanut, white snakeroot, and lopseed.

Dry Oak Savanna: [Excerpted from the Minnesota Natural Heritage Program 1991]. This is a dry to dry-mesic community dominated principally by bur oak and northern pin oak. The stature and spacing of trees is somewhat variable. Small, gnarly, open-grown trees are most common. Tree spacing ranges from sparsely and evenly distributed to

strongly clumped in moderately dense patches. Shrub cover is variable. On sandier soils, prairie willows, New Jersey tea, American hazelnuts, sand cherries and juneberries are usually present. Dominant graminoids in open areas include little bluestem, sideoats grama, Wilcox's panic grass, plains muhly grass, and sand dropseed in the driest areas on hill tops. Big bluestem and Indian grass are often co-dominant on lower, more dry-mesic slopes. Native herbs include many species of open, dry prairie, including stiff sunflower, prairie smoke, pasque flower, hoary puccoon, purple prairie-clover, silky aster, and tall cinquefoil. Other species tolerant of low to moderate shade in areas of clumped oaks may also be present, including: hog peanut, northern bedstraw, starry false solomon's seal, sky-blue aster, wild geranium, wild sarsaparilla, and spreading dogbane.

Dry Prairie, sand-gravel subtype: On the St Croix Moraine, dry prairies were located primarily on sand-gravel deposits on hill tops. Another variant, dry prairie hill subtype, may have occurred on the tops of hills composed of more loamy till deposits. Dominant graminoids in the most excessively-drained areas are mid to short grasses, including porcupine grass, little bluestem, side-oats grama, june grass, and sun-loving sedge (*Carex heliophila*). Areas of loose sand with little soil development typically have concentrations of hairy grama grass and may also contain sand reed grass. Big bluestem is usually present but co-dominant only on dry-mesic areas, such as on side slopes. Common forbs on sandy variants of this type include pasque flower, stiff sunflower, silky aster, gray goldenrod, Missouri goldenrod, narrow-leaved puccoon, rough blazing star, tooth-leaved evening primrose and purple prairie clover. This community is very similar in composition to dry oak savanna but lacks the scattered to clumped oaks and species adapted to low to moderate shade.

Mesic Prairie: A diverse, tallgrass prairie community on moderate-well drained to well-drained sites on uplands. This community type ranges from dry mesic to wet mesic in nature. Dominant graminoids are big bluestem, Indian grass, porcupine grass, prairie dropseed, and little bluestem. Other important graminoids include Leiberg's panic grass, switchgrass, Mead's sedge, Kalm's brome, and slender wheatgrass. Little bluestem, sideoats grama grass, and porcupine grass are more common in dry-mesic phases of this type. Switch grass, prairie cordgrass, and slender wheatgrass are more common in the wet-mesic phase. Some of the more common forbs include heart-leaved alexanders, Canada goldenrod, wild bergamot, Maximilian sunflower, gray-headed coneflower, purple prairie clover, and prairie phlox. Shrubs, varying from well scattered to clumped, typically include lead plant and prairie rose. Species occurring only in the dry mesic phase of this type are designated in Appendix A with "dm," and those occurring only in the wet mesic phase are designated "wm."

Wet Prairie: This is a wetland prairie community that occurs on poorly-drained mineral soils that are commonly flooded for part of the year. Dominant graminoids are prairie cord-grass, big bluestem, bluejoint, woolly sedge, switchgrass, and Buxbaum's sedge. Common forbs include Virginia mountain mint, giant goldenrod, golden alexanders, spotted water-hemlock, New England aster, and giant sunflower. Shrubs, generally well scattered or clumped, commonly include red-osier dogwood, slender willow, pussy willow, and Bebb's willow.

Sedge Meadow: Sedge meadows are open, graminoid-dominated communities with less than 25% shrub cover. This community occurs in basins on poorly-drained, shallow muck or sapric peat, or occasionally mineral soils. The dominant graminoids may consist of a mosaic of patches of several species, or as one or two species throughout most of the wetland. Dominant graminoids typically consist of lake sedge, beaked sedge, tussock sedge, or bluejoint. Tussock sedge is often prevalent on wetland margins in areas of groundwater seepage. Lake sedge predominates in areas where the water table persists above the ground surface for most of the growing season. Other common graminoids include fowl meadow grass, fowl manna-grass, marsh muhly, and swamp satin-grass. Common shrubs include Bebb's willow, pussy willow, slender willow, wild black current, meadowsweet, and red osier dogwood. Typical forbs include joe-pye weed, northern marsh fern, American water hore-hound, boneset, marsh bellflower, and cut-leaved bugleweed. This community commonly succeeds to heavy, continuous cover of tall shrubs when it is ditched and drained, or the water table is lowered by other means.

Willow-Dogwood Shrub Swamp: Willow-Dogwood Swamps occur in very poorly drained areas of mineral or shallow muck soils, have greater than 25% shrub cover: typically pussy willow, slender willow and Bebb's willow, and red-osier dogwood. Herbaceous species characteristic of the Sedge Meadow community are common. The most common herbs are tussock sedge, lake sedge, blue-joint, northern marsh fern and jewel weed. Some sites also have scattered trees, particularly black willow or green ash and structurally may be considered as hardwood swamps.

Mixed Cattail Marsh: This is a class of community types consisting of emergent marsh communities dominated by cattails in wetland basins where the water table stays above the ground surface for all or nearly all of the growing season. Cattails are the dominant species, usually with greater than 50% cover. The cover and composition of forbs is highly variable. Other graminoids often present include giant bur reed, bluejoint and lake sedge. Shrubs are absent or sparse, with willows and red-osier dogwood most common. These communities often include areas of open water.

Northern Poor Fen: This is a wetland community that occurs on floating mats of sphagnum and sphagnum peat in small wetland basins that have minimal groundwater runoff from the surrounding landscape. Surface water in well-developed examples of this community tends to be acidic (pH 4.2 to 5.5). This is primarily a northern plant community, with very few occurrences in the Twin Cities region, which is at the southernmost extent of its range in Minnesota.

Examples of this community type in this part of the state are generally not typical of this more northern plant community, as they tend to lack the indicators of more acidic conditions on sphagnum, such as the ericaceous shrub bog laurel. The centermost part of the floating mat in these southernmost fens most closely resembles the flora and structure of poor fens found farther north. In southern examples of poor fens, shrubs may be scattered or in large clumps, including include bog birch, slender willow, and bog willow. The low shrub, large cranberry is present in good examples of these sites. Often, these

wetlands are fairly zonal with dense sphagnum in the center surrounded by outer zones dominated by wiregrass sedge (*Carex lasiocarpa*) and an outermost zone dominated by lake sedge or beaked sedge. Sedges common on dense sphagnum include the sedge *Carex chordorrhiza* and narrow-leaved cottongrass. Characteristic forbs on sphagnum in undisturbed remnants of this community include bog violet, and the orchid rose pogonia. Forbs found throughout but mainly the outer zones of the wetland often include arrow leaved tearthumb, willow herbs, marsh fern, and marsh cinquefoil. Broad-leaved arrowhead may be abundant on the outermost margins of the wetland.

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Appendix A: Species Lists for Potential Native Plant Communities at Dodge Nature Center

The descriptions and lists given here are from Dunevitz and Lane (2004) and were edited by the author of this report to more specifically fit the geographic location and conditions at Dodge Nature Center. The original lists and accompanying text may be viewed in the Great River Greening website (www.greatrivergreening.org). Species in the lists that are recommended for planting or promoting are marked with asterisks. Species lacking an asterisk include invasive species or species that are fairly marginally associated with the particular community in question and would not be relevant for the nature center.

Included with these species lists are figures for abundance, frequency and overall importance value for each species (see footnotes for explanations). The values for these numbers were calculated directly from the number of relevés and relative percent cover for each species within the group of relevés used in the analysis of each particular community class or type. It should be noted that these represent a reference condition and should not necessarily be translated directly in to proportions of plants to be used in planting lists. Certain aggressively spreading species should not be planted at the same proportion as they are represented in the target condition, or even should not be planted at all.

Species in the lists that are lacking values for frequency, abundance and importance are species that were added to the lists by the author of this report and were not in the original relevé data set used to create the lists

For the purpose of analysis, species too taxonomically similar to confidently separate were lumped into species complexes which are abbreviated according the following table (from Dunevitz and Lane 2004):

Complex name	Species included in complex
***Agrimonia* cmx**	***A. gryposepala, striata***
***Amelanchier* cmx**	**Species with shrub forms: *A. laevis, interior, humilis, arborea***
Crataegus cmx	**C. punctata, macracantha, succulenta, calpodendron**
***Epilobium* cm1**	**E. coloratum, glandulosa**
***Epilobium* cm2**	*E. leptophyllum, palustre, strictum*
***Hackelia* cmx**	**H. deflexa, virginiana**
***Impatiens* cmx**	*I. capensis, pallida*
***Nymphaea* cmx**	*N. odorata and tuberosa*
***Oxalis* cmx**	*O. acetosella, stricta, dillenii*
***Parthenocissus* cmx**	*P. quinquefolia, vitacea*
***Pilea* cmx**	**P. fontana, pumila**
***Rosa* cmx**	*R. acicularis, blanda*
***Rubus* cm1**	Tall blackberries: *R. allegheniensis* and similar species
***Rubus* cm2**	Trailing blackberries: *R. flagellaris* and similar species
***Senecio* cmx**	**S. aureus, pseudaureus**
***Symphoricarpos* cmx**	**S. albus, occidentalis**
***Smilax* cmx**	
***Viola* cm1**	Herbaceous species: *S. ecirrata, herbacea, illinoensis*
***Viola* cm2**	Stemless blue violets: *V. cucullata, missouriensis, nephrophylla, nova-angliae, pratincola, sororia*
***Viola* cm3**	Small white violets: *V. incognita, macloskeyi*
***Viola* cm4**	Small blue violets with cauline leaves: *V. adunca, conspersa, labradorica*
***Zigadenus* cmx**	Large violets with cauline leaves: *V. canadensis, pubescens*
	Z. elegans, glaucus

Native Plant Community Species Lists modified for Dodge Nature Center from Dunevitz and Lane (2004) [1]

Class: Southern Wet-Mesic Hardwood Forest MHs49

Genus	Species	Common Name	[2]Freq	[3]Abund	[4][5]Index	*Spp. Recc.'d for Planting
Canopy Trees (>10 m)						
Fraxinus	*nigra*	Black ash	100	18	1800	*
Tilia	*americana*	Basswood	100	16	1600	*
Acer	*negundo*	Box elder	57	24	1368	
Acer	*saccharum*	Sugar maple	29	39	1131	
Fraxinus	*pennsylvanica*	Green ash	43	12	516	*
Ulmus	*rubra*	Slippery elm	43	10	430	*
Celtis	*occidentalis*	Hackberry	57	6	342	*
Carya	*cordiformis*	Bitternut hickory	14	15	210	*
Ulmus	*thomasii*	Rock elm	14	5	70	*
Ostrya	*virginiana*	Ironwood	14	5	70	
Betula	*papyrifera*	Paper-birch	14	3	42	
Ulmus	*americana*	American elm	29	1	29	
Quercus	*macrocarpa*	Bur oak	14	1	14	*
Populus	*deltoides*	Cottonwood	14	1	14	
Understory Trees						
Ulmus	*rubra*	Slippery elm	71	27	1917	*
Acer	*saccharum*	Sugar maple	57	30	1710	
Fraxinus	*nigra*	Black ash	86	10	860	*
Celtis	*occidentalis*	Hackberry	100	8	800	*
Ostrya	*virginiana*	Ironwood	71	8	568	
Tilia	*americana*	Basswood	57	10	570	*
Carya	*cordiformis*	Bitternut hickory	57	9	513	*
Acer	*negundo*	Box elder	57	6	342	
Fraxinus	*pennsylvanica*	Green ash	57	6	342	*
Ulmus	*thomasii*	Rock elm	29	9	261	*
Carpinus	*caroliniana*	Blue beech	14	15	210	*
Ulmus	*americana*	American elm	43	3	129	
Populus	*tremuloides*	Quaking aspen	14	3	42	
Populus	*deltoides*	Cottonwood	14	3	42	
Shrubs						
Prunus	*virginiana*	Chokecherry	86	15	1290	*
Sambucus	*racemosa*	Red-berried Elder	29	21	609	
Ribes	*missouriense*	Missouri gooseberry	57	10	570	
Ribes	*cynosbati*	Prickly gooseberry	57	7	399	
Crataegus	*punctata*	Hawthorn	29	9	261	
Cornus	*alternifolia*	Pagoda dogwood	57	3	171	*
Viburnum	*lentago*	Nannyberry	29	3	87	
Cornus	*racemosa*	Gray dogwood	14	3	42	
Low Shrubs						
Rubus	*idaeus*	Red raspberry	29	3	87	
Vines						
Vitis	*riparia*	Wild grape	57	4	228	
Menispermum	*canadense*	Canada moonseed	29	4	116	*
Parthenocissus	*spp.*	Virginia creeper	43	2	86	
Smilax	*hispida*	Green-briar	14	3	42	
Rubus	*pubescens*	Dwarf raspberry	14	3	42	*
Celastrus	*scandens*	Climbing bittersweet	14	1	14	
Forbs						
Hydrophyllum	*virginianum*	Virginia waterleaf	86	23	1978	*
Laportea	*canadensis*	Wood-nettle	71	21	1491	
Enemion	*biternatum*	False rue-anemone	57	13	741	*
Galium	*aparine*	Cleavers	100	5	500	*
Erythronium	*albidum*	White trout-lily	43	11	473	*
Asarum	*canadense*	Wild ginger	86	4	344	*
Sanguinaria	*canadensis*	Bloodroot	43	7	301	*
Osmorhiza	*longistylis*	Anise-root	29	9	261	*
Geum	*canadense*	White avens	71	3	213	*
Viola	cm1	Violet	57	4	228	*

Native Plant Community Species Lists modified for Dodge Nature Center from Dunevitz and Lane (2004) [1]

Class: Southern Wet-Mesic Hardwood Forest MHs49

Sanicula	*marilandica*	Mariland black snakeroot	14	15	210	*
Geranium	*maculatum*	Wild geranium	71	3	213	*
Caulophyllum	*thalictroides*	Blue cohosh	57	3	171	*
Uvularia	*grandiflora*	Yellow bellwort	57	3	171	*
Phlox	*divaricata*	Blue phlox	43	4	172	*
Dicentra	*cucullaria*	Dutchman's-breeches	43	4	172	*
Ranunculus	*abortivus*	Kidney-leaf buttercup	57	3	171	*
Urtica	*dioica*	Stinging nettle	57	3	171	
Viola	cm4	Violet	43	3	129	*
Rudbeckia	*laciniata*	Goldenglow	43	3	129	*
Solidago	*flexicaulis*	Zig-zag goldenrod	43	3	129	*
Allium	*tricoccum*	Wild leek	43	3	129	*
Thalictrum	*dioicum*	Early meadow-rue	43	3	129	*
Circaea	*lutetiana*	Canada enchanter's nightshade	29	4	116	*
Claytonia	*virginica*	Virginia spring-beauty	29	4	116	*
Smilax	*echirrata cmx.*	Carrion-flower	43	2	86	*
Ranunculus	*hispidus*	Hispid buttercup	29	3	87	
Galium	*triflorum*	Three-flowered bedstraw	29	3	87	*
Smilacina	*racemosa*	Racemose false Solomon's-seal	29	3	87	*
Actaea	*rubra*	Red baneberry	14	5	70	*
Anemone	*canadensis*	Canada anemone	14	5	70	*
Arisaema	*triphyllum*	Jack-in-the-pulpit	29	2	58	*
Pilea	*spp.*	Clearweed	14	3	42	
Campanula	*americana*	Tall bellflower	14	3	42	*
Cryptotaenia	*canadensis*	Honewort	14	3	42	*
Fragaria	*virginiana*	Common strawberry	14	3	42	
Mitella	*diphylla*	Two-leaved miterwort	14	3	42	*
Osmorhiza	*claytonii*	Clayton's sweet cicely	14	3	42	*
Allium	*canadense*	Wild garlic	14	3	42	
Smilacina	*stellata*	Starry false Solomon's-seal	14	3	42	*
Aster	*cordifolius*	Heart-leaved aster	14	3	42	*
Hackelia	*spp.*	Stickseed	14	1	14	
Trillium	*cernuum*	Nodding trillium	14	1	14	*
Phryma	*leptostachya*	Lopseed	14	1	14	*
Erigeron	*philadelphicus*	Philadelphia fleabane	14	1	14	
Trillium	*grandiflorum*	Large-flowered trillium	14	1	14	*
Grasses, Rushes and Sedges						
Carex	*sprengelii*	Sprengel's sedge	43	8	344	*
Carex	*blanda*	Charming sedge	29	10	290	*
Carex	*pensylvanica*	Pennsylvania sedge	43	5	215	
Elymus	*hystrix*	Bottlebrush grass	43	4	172	*
Carex	*amphibola*	Ambiguous sedge	29	3	87	*
Elymus	*virginicus*	Virginia wild rye	14	5	70	*
Festuca	*subverticillata*	Nodding fescue	14	5	70	
Carex	*hirtifolia*	Hairy-leaved sedge	29	2	58	*
Brachyelytrum	*erectum*	Bearded shorthusk	14	3	42	*
Carex	*albursina*	White bear-sedge	14	3	42	*
Carex	*pedunculata*	Long-stalked sedge	14	3	42	*
Ferns and Fern Allies						
Equisetum	*hyemale*	Tall scouring-rush	29	45	1305	*
Matteuccia	*struthiopteris*	Ostrich-fern	57	7	399	*
Athyrium	*filix-femina*	Lady-fern	29	3	87	*
Dryopteris	*cristata*	Wood-fern				*

[1]Dunevitz and Lane, 2004. *Species Lists for Terrestrial and Palustrine Native Plant Communities in East-central Minnesota*

[2]Frequency: Number of releve plots in which species occurs divided by total number of releve plots, multiplied by 100

[3]Abundance: Total percent cover of species divided by number of releve plots in which species occurred

[4]Index of Commonness: Frequency multiplied by Abundance

[5]Species lacking values for Frequency, Abundance, and Index were added by the author of this report

Native Plant Community Species Lists modified for Dodge Nature Center from Dunevitz and Lane (2004) [1]
Class: Southern Mesic Oak-Basswood Forest MHs38

Genus	Species	Common Name	[2]Freq	[3]Abund	[4,5]Index	*Spp. Recc.'d for Planting
Canopy Trees (>10 m)						
Acer	*saccharum*	Sugar maple	89	41	3649	
Quercus	*rubra*	Northern red oak	78	39	3042	*
Tilia	*americana*	Basswood	89	20	1780	*
Fraxinus	*pennsylvanica*	Green ash	39	13	507	*
Carya	*cordiformis*	Bitternut hickory	28	15	420	*
Quercus	*alba*	White oak	22	11	242	*
Ulmus	*americana*	American elm	22	8	176	
Fraxinus	*nigra*	Black ash	17	7	119	*
Quercus	*macrocarpa*	Bur oak	17	6	102	*
Ulmus	*rubra*	Slippery elm	33	2	66	*
Betula	*papyrifera*	Paper-birch	17	2	34	*
Populus	*tremuloides*	Quaking aspen	6	5	30	
Prunus	*serotina*	Black cherry	6	3	18	*
Understory Trees						
Acer	*saccharum*	Sugar maple	89	42	3738	
Ostrya	*virginiana*	Ironwood	94	26	2444	*
Carya	*cordiformis*	Bitternut hickory	78	10	780	*
Tilia	*americana*	Basswood	78	8	624	*
Ulmus	*rubra*	Slippery elm	50	4	200	*
Quercus	*rubra*	Northern red oak	89	2	178	*
Fraxinus	*pennsylvanica*	Green ash	44	4	176	*
Fraxinus	*nigra*	Black ash	44	4	176	*
Carpinus	*caroliniana*	Blue beech	22	7	154	*
Prunus	*serotina*	Black cherry	39	2	78	*
Celtis	*occidentalis*	Hackberry	22	3	66	
Ulmus	*americana*	American elm	17	4	68	
Quercus	*macrocarpa*	Bur oak	22	2	44	*
Quercus	*alba*	White oak	11	2	22	*
Betula	*papyrifera*	Paper-birch	6	3	18	*
Acer	*negundo*	Box elder	17	1	17	
Populus	*grandidentata*	Big-toothed aspen	6	1	6	
Populus	*tremuloides*	Quaking aspen	6	1	6	
Shrubs						
Prunus	*virginiana*	Chokecherry	72	7	504	*
Ribes	*cynosbati*	Prickly gooseberry	83	4	332	
Cornus	*alternifolia*	Pagoda dogwood	61	4	244	*
Zanthoxylum	*americanum*	Prickly ash	72	3	216	
Viburnum	*rafinesquianum*	Downy arrow-wood	17	7	119	*
Lonicera	*prolifera*	Grape honeysuckle	6	15	90	*
Ribes	*missouriense*	Missouri gooseberry	17	4	68	
Sambucus	*racemosa*	Red-berried elder	28	2	56	*
Cornus	*racemosa*	Gray dogwood	17	3	51	*
Viburnum	*lentago*	Nannyberry	11	3	33	*
Dirca	*palustris*	Leatherwood	11	2	22	*
Amelanchier	cmx.	Juneberry	6	3	18	*
Lonicera	*dioica*	Wild Honeysuckle	6	3	18	
Lonicera	*canadensis*	Fly honeysuckle	6	3	18	
Corylus	*americana*	American hazelnut	6	3	18	*
Symphoricarpos	cmx	Snowberry	6	1	6	
Viburnum	*opulus*	High-bush cranberry	6	1	6	
Low Shrubs						
Toxicodendron	*rydbergii*	Poison ivy	67	3	201	
Rubus	*idaeus*	Red raspberry	22	6	132	
Rubus	cm1	Blackberry	6	1	6	
Vines						
Parthenocissus	*spp.*	Virginia creeper	83	6	498	*
Menispermum	*canadense*	Canada moonseed	22	4	88	*
Smilax	*hispida*	Green-briar	22	3	66	*
Vitis	*riparia*	Wild grape	28	2	56	
Celastrus	*scandens*	Climbing bittersweet	17	2	34	*

Native Plant Community Species Lists modified for Dodge Nature Center from Dunevitz and Lane (2004) [1]
Class: Southern Mesic Oak-Basswood Forest MHs38

Clematis	*virginiana*	Virgin's bower	6	5	30	*
Forbs						
Circaea	*lutetiana*	Canada enchanter's nightshade	83	7	581	*
Uvularia	*grandiflora*	Yellow bellwort	72	8	576	*
Amphicarpaea	*bracteata*	Hog-peanut	50	11	550	*
Osmorhiza	*claytonii*	Clayton's sweet cicely	83	6	498	*
Phryma	*leptostachya*	Lopseed	78	5	390	*
Solidago	*flexicaulis*	Zig-zag goldenrod	61	6	366	*
Thalictrum	*dioicum*	Early meadow-rue	72	4	288	*
Viola	cm4	Violet	72	4	288	*
Sanguinaria	*canadensis*	Bloodroot	78	3	234	*
Desmodium	*glutinosum*	Pointed-leaved tick-trefoil	56	4	224	*
Asarum	*canadense*	Wild ginger	28	8	224	*
Geranium	*maculatum*	Wild geranium	72	3	216	*
Smilax	cmx.	Carrion-flower	72	3	216	*
Laportea	*canadensis*	Wood-nettle	33	6	198	
Arisaema	*triphyllum*	Jack-in-the-pulpit	61	3	183	
Smilacina	*racemosa*	Racemose false Solomon's-seal	56	3	168	*
Anemone	*quinquefolia*	Wood-anemone	56	3	168	*
Cryptotaenia	*canadensis*	Honewort	56	3	168	*
Aster	*cordifolius*	Heart-leaved aster	33	5	165	*
Anemone	*acutiloba*	Sharp-lobed hepatica	39	4	156	*
Caulophyllum	*thalictroides*	Blue cohosh	50	3	150	*
Galium	*triflorum*	Three-flowered bedstraw	50	3	150	*
Galium	*aparine*	Cleavers	28	5	140	*
Hydrophyllum	*virginianum*	Virginia waterleaf	44	3	132	*
Aralia	*nudicaulis*	Wild sarsaparilla	33	4	132	*
Polygonatum	*pubescens*	Hairy Solomon's-seal	44	3	132	*
Eupatorium	*rugosum*	Common snakeroot	22	6	132	*
Sanicula	*marilandica*	Mariland black snakeroot	39	3	117	*
Ranunculus	*abortivus*	Kidney-leaf buttercup	39	3	117	*
Maianthemum	*canadense*	Canada mayflower	39	3	117	*
Aquilegia	*canadensis*	Columbine	17	6	102	*
Geum	*canadense*	White avens	50	2	100	*
Sanicula	*gregaria*	Gregarious black snakeroot	22	4	88	*
Galium	*concinnum*	Elegant bedstraw	22	4	88	*
Polygonatum	*biflorum*	Giant Solomon's-seal	28	3	84	*
Orchis	*spectabilis*	Showy orchis	28	3	84	*
Actaea	*rubra*	Red baneberry	33	2	66	*
Trillium	*cernuum*	Nodding trillium	22	3	66	*
Impatiens	cmx.	Spotted touch-me-not	22	3	66	
Aralia	*racemosa*	American spikenard	22	3	66	*
Hackelia	cmx.	Stickseed	22	3	66	
Allium	*tricoccum*	Wild leek	28	2	56	*
Anemonella	*thalictroides*	Rue-anemone	17	3	51	*
Galium	*boreale*	Northern bedstraw	17	2	34	*
Monotropa	*uniflora*	Indian pipe	17	2	34	
Prenanthes	*alba*	White rattlesnake-root	11	3	33	*
Phlox	*divaricata*	Blue phlox	11	3	33	*
Campanula	*americana*	Tall bellflower	11	3	33	*
Apocynum	*androsaemifolium*	Spreading dogbane	11	2	22	
Ranunculus	*recurvatus*	Hooked crowfoot	11	2	22	
Viola	cm1	Violet	11	2	22	
Mitella	*diphylla*	Two-leaved miterwort	11	2	22	*
Triosteum	*perfoliatum*	Horse-gentian	6	3	18	*
Asclepias	*exaltata*	Poke milkweed	6	3	18	*
Zizia	*aurea*	Golden alexanders	6	3	18	*
Fragaria	*virginiana*	Common strawberry	6	3	18	*
Trillium	*grandiflorum*	Large-flowered trillium	6	3	18	*
Lactuca	*spp.*	Wild lettuce	6	3	18	
Veronicastrum	*virginicum*	Culver's root	6	3	18	
Pyrola	*elliptica*	Common pyrola	6	3	18	*
Rudbeckia	*laciniata*	Goldenglow	6	3	18	
Dioscorea	*villosa*	Wild yam	6	3	18	*
Campanula	*rotundifolia*	Harebell	6	3	18	

Native Plant Community Species Lists modified for Dodge Nature Center from Dunevitz and Lane (2004) [1]
Class: Southern Mesic Oak-Basswood Forest MHs38

Cardamine	*concatenata*	Cut-leaved toothwort	6	3	18	*
Viola	cm3	Dog violet	6	3	18	*
Dicentra	*cucullaria*	Dutchman's-breeches	6	3	18	*
Lilium	*michiganense*	Michigan lily	11	1	11	
Aplectrum	*hyemale*	Putty-root	6	1	6	*
Aster	*lateriflorus*	Side-flowering aster	6	1	6	*
Corallorhiza	spp	Coral-root				*
Grasses, Rushes and Sedges						
Carex	*pedunculata*	Long-stalked sedge	50	10	500	*
Carex	*pensylvanica*	Pennsylvania sedge	67	5	335	*
Brachyelytrum	*erectum*	Bearded shorthusk	33	5	165	*
Oryzopsis	*racemosa*	Black-fruited rice-grass	28	5	140	*
Carex	*blanda*	Charming sedge	33	3	99	*
Carex	*radiata*	Stellate sedge	28	3	84	*
Elymus	*hystrix*	Bottlebrush grass	28	3	84	*
Schizachne	*purpurascens*	False melic grass	17	4	68	*
Oryzopsis	*asperifolia*	Moutain rice-grass	17	3	51	*
Festuca	*subverticillata*	Nodding fescue	17	3	51	*
Bromus	*altissimus*	Broad-glumed brome	17	3	51	*
Carex	*gracillima*	Graceful sedge	17	2	34	*
Carex	*deweyana*	Dewey's sedge	17	2	34	*
Carex	*rosea*	Rolled-up sedge	11	2	22	*
Carex	*sprengelii*	Sprengel's sedge	6	3	18	*
Carex	*leptonervia*	Fine-nerved sedge	6	3	18	*
Carex	*hirtifolia*	Hairy-leaved sedge	6	3	18	*
Milium	*effusum*	Woodland millet grass	6	1	6	*
Carex	*debilis*					*
Ferns and Fern Allies						
Athyrium	*filix-femina*	Lady-fern	56	3	168	*
Adiantum	*pedatum*	Maidenhair fern	50	3	150	*
Botrychium	*virginianum*	Rattlesnakefern	61	2	122	
Osmunda	*claytoniana*	Interrupted fern	11	3	33	*
Cystopteris	*fragilis*	Fragile bladder-fern	11	3	33	*
Equisetum	*spp.*	Horsetail	11	2	22	
Equisetum	*pratense*	Meadow horsetail	6	3	18	

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[4]Index of Commonness: Frequency multiplied by Abundance
[5]Species lacking values for Frequency, Abundance, and Index were added by the author of this report.

Native Plant Community Species Lists; Reprinted from Dunevitz and Lane (2004) [1]; Edited for Dodge Nature Center

Class: Southern Dry-Mesic Oak Forest MHs37

Genus	Species	Common Name	[2]Freq	[3]Abund	[4,5]Index	*Spp. Recc.'d for Planting
Canopy Trees (>10m)						
Quercus	*rubra*	Northern red oak	100	31	3100	*
Quercus	*alba*	White oak	60	46	2760	*
Ulmus	*americana*	American elm	40	8	320	
Tilia	*americana*	Basswood	40	4	160	*
Carya	*cordiformis*	Bitternut hickory	40	3	120	*
Acer	*negundo*	Box elder	20	1	20	
Celtis	*occidentalis*	Hackberry	20	1	20	
Betula	*papyrifera*	Paper-birch	20	1	20	*
Fraxinus	*pennsylvanica*	Green ash	20	1	20	*
Prunus	*serotina*	Black cherry	20	1	20	*
Quercus	*ellipsoidalis*	Northern pin oak				*
Quercus	*macrocarpa*	Bur oak				*
Understory Trees						
Carya	*cordiformis*	Bitternut hickory	80	12	960	*
Tilia	*americana*	Basswood	80	12	960	*
Prunus	*serotina*	Black cherry	100	9	900	*
Ostrya	*virginiana*	Ironwood	100	8	800	*
Ulmus	*rubra*	Slippery elm	60	11	660	*
Ulmus	*americana*	American elm	40	15	600	
Acer	*negundo*	Box elder	60	7	420	
Acer	*saccharum*	Sugar maple	40	9	360	
Quercus	*rubra*	Northern red oak	80	3	240	*
Celtis	*occidentalis*	Hackberry	60	2	120	
Fraxinus	*pennsylvanica*	Green ash	20	5	100	*
Quercus	*alba*	White oak	20	3	60	*
Betula	*papyrifera*	Paper-birch	20	3	60	*
Carpinus	*caroliniana*	Blue beech	20	3	60	*
Shrubs						
Ribes	*cynosbati*	Prickly gooseberry	100	12	1200	
Cornus	*alternifolia*	Pagoda dogwood	100	6	600	
Corylus	*americana*	American hazelnut	40	9	360	*
Prunus	*virginiana*	Chokecherry	60	4	240	*
Viburnum	*rafinesquianum*	Downy arrow-wood	40	3	120	*
Ribes	*missouriense*	Missouri gooseberry	40	3	120	
Sambucus	*racemosa*	Red-berried elder	40	3	120	
Zanthoxylum	*americanum*	Prickly ash	40	2	80	
Symphoricarpos	cmx	Snowberry	20	3	60	
Cornus	*racemosa*	Gray dogwood	20	1	20	*
Viburnum	*lentago*	Nannyberry	20	1	20	*
Rosa	*blanda*	Smooth wild rose	20	1	20	
Low Shrubs						
Toxicodendron	*rydbergii*	Poison ivy	80	4	320	
Rubus	cml	Blackberry	20	15	300	
Rubus	*idaeus*	Red raspberry	60	2	120	
Vines						
Parthenocissus	*spp.*	Virginia creeper	100	6	600	
Vitis	*riparia*	Wild grape	60	6	360	
Smilax	*hispida*	Green-briar	20	15	300	
Forbs						
Desmodium	*glutinosum*	Pointed-leaved tick-trefoil	80	18	1440	*
Osmorhiza	*claytonii*	Clayton's sweet cicely	80	10	800	*
Geranium	*maculatum*	Wild geranium	100	7	700	*
Phryma	*leptostachya*	Lopseed	100	6	600	*
Circaea	*lutetiana*	Canada enchanter's nightshade	80	8	640	*
Aralia	*nudicaulis*	Wild sarsaparilla	60	6	360	*
Thalictrum	*dioicum*	Early meadow-rue	100	4	400	*
Uvularia	*grandiflora*	Yellow bellwort	100	3	300	*
Hydrophyllum	*virginianum*	Virginia waterleaf	60	4	240	*
Geum	*canadense*	White avens	80	3	240	*
Osmorhiza	*longistylis*	Anise-root	60	4	240	*
Arisaema	*triphyllum*	Jack-in-the-pulpit	60	4	240	*
Amphicarpaea	*bracteata*	Hog-peanut	60	4	240	*
Smilacina	*racemosa*	Racemose false Solomon's-seal	80	3	240	*
Sanguinaria	*canadensis*	Bloodroot	80	3	240	*

Native Plant Community Species Lists; Reprinted from Dunevitz and Lane (2004) [1]; Edited for Dodge Nature Center
Class: Southern Dry-Mesic Oak Forest MHs37

Sanicula	*marilandica*	Mariland black snakeroot	60	3	180	*
Galium	*triflorum*	Three-flowered bedstraw	60	3	180	*
Cryptotaenia	*canadensis*	Honewort	60	3	180	*
Maianthemum	*canadense*	Canada mayflower	60	3	180	*
Actaea	*rubra*	Red baneberry	60	2	120	*
Ranunculus	*abortivus*	Kidney-leaf buttercup	40	3	120	*
Eupatorium	*rugosum*	Common snakeroot	40	3	120	*
Caulophyllum	*thalictroides*	Blue cohosh	40	3	120	*
Polygonatum	*biflorum*	Giant Solomon's-seal	40	3	120	*
Erigeron	*philadelphicus*	Philadelphia fleabane	40	3	120	
Hackelia	*spp.*	Stickseed	40	3	120	
Viola	cm4	Violet	60	2	120	*
Aralia	*racemosa*	American spikenard	40	2	80	*
Urtica	*dioica*	Stinging nettle	40	2	80	
Sanicula	*gregaria*	Gregarious black snakeroot	40	2	80	*
Aquilegia	*canadensis*	Columbine	20	3	60	*
Mitella	*diphylla*	Two-leaved miterwort	20	3	60	*
Laportea	*canadensis*	Wood-nettle	20	3	60	
Apocynum	*androsaemifolium*	Spreading dogbane	20	3	60	*
Dioscorea	*villosa*	Wild yam	20	3	60	*
Fragaria	*vesca*	Wood strawberry	20	3	60	*
Ranunculus	*recurvatus*	Hooked crowfoot	20	3	60	
Galium	*concinnum*	Elegant bedstraw	20	3	60	*
Veronicastrum	*virginicum*	Culver's root	20	3	60	*
Polygonatum	*pubescens*	Hairy Solomon's-seal	20	3	60	*
Smilax	cmx.	Carrion-flower	20	3	60	*
Monotropa	*uniflora*	Indian pipe	20	1	20	
Lathyrus	*ochroleucus*	Pale vetchling	20	1	20	*
Fragaria	*virginiana*	Common strawberry	20	1	20	
Stellaria	*longifolia*	Long-leaved chickweed	20	1	20	*
Anemonella	*thalictroides*	Rue-anemone				*
Grasses, Rushes and Sedges						
Carex	*pensylvanica*	Pennsylvania sedge	40	2	80	*
Festuca	*subverticillata*	Nodding fescue	20	3	60	
Carex	*radiata*	Stellate sedge	20	3	60	*
Carex	*blanda*	Charming sedge	20	1	20	*
Elymus	*hystrix*	Bottlebrush grass				*
Oryzopsis	*asperifolia*	Mountain rice grass				*
Carex	*peckii*	Peck's sedge				*
Ferns and Fern Allies						
Athyrium	*filix-femina*	Lady-fern	100	5	500	*
Osmunda	*claytoniana*	Interrupted fern	40	5	200	*
Pteridium	*aquilinum*	Bracken	20	5	100	*
Botrychium	*virginianum*	Rattlesnakefern	20	5	100	

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[5]Species lacking values for Frequency, Abundance, and Index were added by the author of this report.

Native Plant Community Species Lists modified for Dodge Nature Center from Dunevitz and Lane (2004)[1]
Type: Dry Sand-Gravel Oak Savanna UPs14b

Genus	Species	Common Name	[2]Freq	[3]Abund	[4,5]Index	*Spp. Recc.'d for Planting[6]
Canopy Trees (>10 m)						
Populus	*tremuloides*	Quaking aspen	11	15	165	
Quercus	*macrocarpa*	Bur oak	11	15	165	*
Quercus	*ellipsoidalis*	Northern pin oak	22	3	66	*
Understory Trees						
Quercus	*macrocarpa*	Bur oak	100	9	900	*
Populus	*tremuloides*	Quaking aspen	33	10	330	
Juniperus	*virginiana*	Red cedar	33	6	198	
Quercus	*ellipsoidalis*	Northern pin oak	22	2	44	*
Prunus	*serotina*	Black cherry	22	1	22	s
Fraxinus	*pennsylvanica*	Green ash	11	1	11	s
Shrubs						
Rhus	*glabra*	Smooth sumac	22	32	704	
Corylus	*americana*	American hazelnut	67	7	469	*s
Rosa	*arkansana*	Prairie rose	89	2	178	*
Salix	*humilis*	Prairie willow	22	5	110	*
Prunus	*virginiana*	Chokecherry	33	2	66	s
Symphoricarpos	cmx.	Snowberry	22	3	66	
Amelanchier	cmx.	Juneberry	56	1	56	*s
Prunus	*pumila*	Sand cherry	11	3	33	*
Ribes	*cynosbati*	Prickly gooseberry	11	1	11	s
Cornus	*racemosa*	Gray dogwood				s
Low Shrubs						
Amorpha	*canescens*	Lead-plant	56	3	168	*
Artemisia	*frigida*	Prairie sagewort	11	15	165	*
Toxicodendron	*rydbergii*	Poison ivy	33	4	132	s
Rubus	*idaeus*	Red raspberry	11	3	33	s
Rubus	cm2	Blackberry	11	1	11	s
Vines						
Parthenocissus	cmx.	Virginia creeper	33	2	66	s
Forbs						
Helianthus	*pauciflorus*	Stiff sunflower	33	15	495	*
Amphicarpaea	*bracteata*	Hog-peanut	22	21	462	*s
Helianthemum	*bicknellii*	Hoary frostweed	89	4	356	*
Lechea	*stricta*	Prairie pinweed	67	5	335	*
Physalis	*virginiana*	Ground-cherry	100	3	300	*
Geum	*triflorum*	Prairie smoke	44	7	308	*
Artemisia	*ludoviciana*	Western mugwort	44	7	308	
Smilacina	*stellata*	Starry false Solomon's-seal	44	7	308	*s
Ambrosia	*psilostachya*	Western ragweed	67	4	268	
Lithospermum	*canescens*	Hoary puccoon	89	3	267	*
Galium	*boreale*	Northern bedstraw	33	8	264	*s
Antennaria	*spp.*	Pussytoes	89	3	267	*
Dalea	*purpurea*	Purple prairie-clover	78	3	234	*
Coreopsis	*palmata*	Stiff tickseed	44	4	176	*
Viola	*pedatifida*	Prairie bird-foot violet	67	3	201	*
Aster	*oolentangiensis*	Sky-blue aster	56	3	168	*
Conyza	*canadensis*	Horseweed	44	4	176	
Campanula	*rotundifolia*	Harebell	56	3	168	*
Solidago	*nemoralis*	Gray goldenrod	44	3	132	*
Dalea	*candida*	White prairie-clover	44	3	132	*
Erigeron	*strigosus*	Daisy fleabane	56	2	112	*
Aster	*sericeus*	Silky aster	33	4	132	*
Potentilla	*arguta*	Tall cinquefoil	67	2	134	*
Asclepias	*syriaca*	Common milkweed	56	2	112	
Anemone	*cylindrica*	Long-headed thimbleweed	33	3	99	*
Achillea	*millefolium*	Yarrow	33	3	99	
Aster	*ericoides*	Heath aster	44	2	88	*
Liatris	*aspera*	Rough blazing star	44	2	88	*
Lespedeza	*capitata*	Round-headed bush-clover	44	2	88	*
Rumex	*acetosella*	Red sorrel	33	2	66	*

Native Plant Community Species Lists modified for Dodge Nature Center from Dunevitz and Lane (2004)[1]
Type: Dry Sand-Gravel Oak Savanna UPs14b

Asclepias	*ovalifolia*	Oval-leaved milkweed	33	2	66	*
Oxalis	cmx.	Wood-sorrel	33	2	66	
Cerastium	*arvense*	Field chickweed	33	2	66	s
Euphorbia	*glyptosperma*	Ridge-seeded spurge	22	3	66	
Anemone	*patens*	Pasque-flower	22	3	66	*
Hedeoma	*hispida*	Mock pennyroyal	22	3	66	
Lathyrus	*venosus*	Veiny pea	44	2	88	*
Solidago	*speciosa*	Showy goldenrod	22	3	66	*
Mirabilis	*hirsuta*	Hairy four-o'clock	22	3	66	*
Penstemon	*gracilis*	Slender beard-tongue	22	3	66	*
Apocynum	*androsaemifolium*	Spreading dogbane	11	5	55	*s
Lithospermum	*caroliniense*	Hairy puccoon	33	2	66	*
Rudbeckia	*hirta*	Black-eyed Susan	33	2	66	*
Scutellaria	*leonardi*	Leonard's skullcap	22	2	44	*
Pedicularis	*canadensis*	Wood-betony	11	3	33	
Euphorbia	*corollata*	Flowering spurge	11	3	33	
Fragaria	*virginiana*	Common strawberry	11	3	33	s
Geranium	*maculatum*	Wild geranium	11	3	33	*s
Oenothera	*biennis*	Common evening-primrose	11	3	33	
Comandra	*umbellata*	Bastard toad-flax	11	3	33	
Monarda	*fistulosa*	Wild bergamot	11	3	33	
Solidago	*missouriensis*	Missouri goldenrod	11	3	33	*
Arabis	*hirsuta*	Hairy rock-cress	33	1	33	
Artemisia	*campestris*	Tall wormwood	11	3	33	*
Ambrosia	*artemisiifolia*	Common ragweed	11	3	33	
Allium	*stellatum*	Prairie wild onion	11	3	33	*
Solidago	*rigida*	Stiff goldenrod	11	3	33	*
Asclepias	*tuberosa*	Butterfly-weed	11	3	33	*
Anaphalis	*margaritacea*	Pearly everlasting	11	3	33	*
Delphinium	*carolinianum*	Prairie larkspur	22	1	22	*
Smilax	cmx.	Carrion-flower	22	1	22	
Heuchera	*richardsonii*	Alum-root	11	1	11	*
Thalictrum	*dasycarpum*	Tall meadow-rue	11	1	11	
Lathyrus	*ochroleucus*	Pale vetchling	11	1	11	*
Penstemon	*grandiflorus*	Large-flowered beard-tongue	11	1	11	*
Lactuca	*spp.*	Wild lettuce	11	1	11	
Chenopodium	*desiccatum*	Narrow-leaved lamb's quarters	11	1	11	
Sisyrinchium	*campestre*	Field blue-eyed grass	11	1	11	*
Desmodium	*canadense*	Canadian tick-trefoil	11	1	11	*
Aralia	*nudicaulis*	Wild sarsaparilla	11	1	11	*s
Silene	*antirrhina*	Sleepy catchfly	11	1	11	*
Prenanthes	*racemosa*	Smooth rattlesnake-root	11	1	11	*
Ranunculus	*rhomboideus*	Prairie buttercup	11	1	11	
Arabis	*divaricarpa*	Spreading rock-cress	11	1	11	
Chrysopsis	*villosa*	Prairie golden aster	11	1	11	*
Amphicarpaea	*bracteata*	Hog-peanut				s
Helianthus	*strumosus*	Woodland sunflower				s
Grasses, Rushes and Sedges						
Stipa	*spartea*	Porcupine-grass	67	26	1742	*
Schizachyrium	*scoparium*	Little bluestem	78	22	1716	*
Andropogon	*gerardii*	Big bluestem	100	10	1000	*
Sporobolus	*heterolepis*	Prairie dropseed	67	10	670	*
Bouteloua	*curtipendula*	Side-oats grama	33	15	495	*
Carex	*siccata*	Hay sedge	78	6	468	
Sorghastrum	*nutans*	Indian grass	67	5	335	*
Eragrostis	*spectabilis*	Purple lovegrass	78	3	234	
Koeleria	*pyramidata*	June-grass	67	3	201	*
Cyperus	*lupulinus*	Hop-like cyperus	67	3	201	*
Carex	*pensylvanica*	Pennsylvania sedge	44	4	176	s
Panicum	*perlongum*	Long-leaved panic grass	44	3	132	
Panicum	*lanuginosum*	Hairy panic grass	33	4	132	*
Elymus	*trachycaulus*	Slender wheatgrass	33	3	99	*
Calamovilfa	*longifolia*	Sand reed-grass	22	4	88	*
Panicum	*oligosanthes*	Few-flowered panic grass	22	4	88	*
Bromus	*kalmii*	Kalm's brome	11	5	55	*

Native Plant Community Species Lists modified for Dodge Nature Center from Dunevitz and Lane (2004)[1]
Type: Dry Sand-Gravel Oak Savanna UPs14b

Panicum	*linearifolium*	Linnear-leaved panic grass	22	2	44	
Setaria	*viridis*	Green foxtail	22	2	44	
Bouteloua	*gracilis*	Blue grama	11	3	33	*
Bouteloua	*hirsuta*	Hairy grama	11	3	33	*
Muhlenbergia	*cuspidata*	Plains muhly	11	3	33	*
Aristida	*basiramea*	Base-branched three-awn	11	3	33	*
Agrostis	*hyemalis*	Rough bent-grass	11	3	33	
Carex	*brevior*	Short sedge	11	3	33	
Ferns and Fern Allies						
Equisetum	*laevigatum*	Smooth scouring-rush	33	2	66	*
Selaginella	*rupestris*	Rock spikemoss	11	1	11	*

[1]Dunevitz and Lane, 2004. *Species Lists for Terrestrial and Palustrine Native Plant Communities in East-central Minnesota*
[2]Frequency: Number of releve plots in which species occurs divided by total number of releve plots, multiplied by 100
[3]Abundance: Total percent cover of species divided by number of releve plots in which species occurred
[4]Index of Commonness: Frequency multiplied by Abundance
[5]Species lacking values for Frequency, Abundance, and Index were added by the author of this report.
[6] Species occurring within shaded microhabitats.

Native Plant Community Species Lists modified for Dodge Nature Center from Dunevitz and Lane (2004) [1]
Type: Dry Sand-Gravel Prairie (Southern) UPs13b

Genus	Species	Common Name	[2]Freq	[3]Abund	[4,5]Index	*Spp. Recc.'d for Planting
Understory Trees						
Juniperus	*virginiana*	Red cedar	36	2	72	
Quercus	*macrocarpa*	Bur oak	27	2	54	
Ulmus	*rubra*	Slippery elm	9	5	45	
Quercus	*ellipsoidalis*	Northern pin oak	18	2	36	
Prunus	*serotina*	Black cherry	9	3	27	
Quercus	*rubra*	Northern red oak	18	1	18	
Shrubs						
Rhus	*glabra*	Smooth sumac	64	5	320	
Prunus	*virginiana*	Chokecherry	18	8	144	
Rosa	*arkansana*	Prairie rose	18	3	54	*
Zanthoxylum	*americanum*	Prickly ash	18	2	36	
Rosa	cmx	Smooth wild rose	9	3	27	
Corylus	*americana*	American hazelnut	9	1	9	
Ceanothus	*americanus*	American New Jersey tea	9	1	9	*
Prunus	*americana*	Wild plum	9	1	9	
Symphoricarpos	cmx	Snowberry	9	1	9	
Low Shrubs						
Artemisia	*frigida*	Prairie sagewort	18	26	468	*
Amorpha	*canescens*	Lead-plant	45	4	180	*
Rubus	*occidentalis*	Black raspberry	18	4	72	
Toxicodendron	*rydbergii*	Poison ivy	9	1	9	
Vines						
Vitis	*riparia*	Wild grape	18	3	54	
Parthenocissus	cmx.	Virginia creeper	9	1	9	
Forbs						
Ambrosia	*psilostachya*	Western ragweed	64	7	448	
Lepidium	*densiflorum*	Green-flowered pepper-grass	18	20	360	
Aster	*ericoides*	Heath aster	18	19	342	*
Artemisia	*campestris*	Tall wormwood	45	7	315	
Solidago	*nemoralis*	Gray goldenrod	73	4	292	*
Lespedeza	*capitata*	Round-headed bush-clover	36	8	288	*
Aster	*sericeus*	Silky aster	45	6	270	*
Hedeoma	*hispida*	Mock pennyroyal	64	4	256	
Dalea	*purpurea*	Purple prairie-clover	55	4	220	*
Helianthus	*pauciflorus*	Stiff sunflower	36	6	216	*
Tradescantia	*occidentalis*	Western spiderwort	36	6	216	*
Liatris	*punctata*	Dotted blazing star	45	4	180	*
Conyza	*canadensis*	Horseweed	27	6	162	
Aster	*oblongifolius*	Aromatic aster	18	9	162	*
Asclepias	*verticillata*	Whorled milkweed	18	9	162	
Comandra	*umbellata*	Bastard toad-flax	36	4	144	*
Penstemon	*grandiflorus*	Large-flowered beard-tongue	45	3	135	*
Achillea	*millefolium*	Yarrow	45	3	135	
Silene	*antirrhina*	Sleepy catchfly	36	3	108	*
Anemone	*cylindrica*	Long-headed thimbleweed	36	3	108	*
Physalis	*virginiana*	Ground-cherry	36	3	108	
Potentilla	*arguta*	Tall cinquefoil	36	3	108	*
Physalis	*heterophylla*	Clammy ground-cherry	36	3	108	
Campanula	*rotundifolia*	Harebell	27	4	108	*
Senecio	*plattensis*	Prairie ragwort	27	4	108	*
Erigeron	*strigosus*	Daisy fleabane	27	4	108	*
Anemone	*patens*	Pasque-flower	27	4	108	*
Asclepias	*viridiflora*	Green milkweed	45	2	90	*
Mirabilis	*hirsuta*	Hairy four-o'clock	45	2	90	*
Coreopsis	*palmata*	Stiff tickseed	18	5	90	*
Delphinium	*carolinianum*	Prairie larkspur	18	5	90	*
Lithospermum	*caroliniense*	Hairy puccoon	27	3	81	*
Viola	*pedatifida*	Prairie bird-foot violet	27	3	81	*
Calylophus	*serrulata*	Toothed evening primrose	27	3	81	*
Astragalus	*crassicarpus*	Buffalo-bean	27	3	81	*
Monarda	*fistulosa*	Wild bergamot	27	3	81	*

Native Plant Community Species Lists modified for Dodge Nature Center from Dunevitz and Lane (2004) [1]
Type: Dry Sand-Gravel Prairie (Southern) UPs13b

Antennaria	*spp.*	Pussytoes	27	3	81	*
Kuhnia	*eupatorioides*	False boneset	18	4	72	*
Euphorbia	*corollata*	Flowering spurge	18	4	72	
Chrysopsis	*villosa*	Prairie golden aster	18	4	72	*
Arabis	*divaricarpa*	Spreading rock-cress	18	4	72	
Allium	*stellatum*	Prairie wild onion	18	4	72	*
Verbena	*stricta*	Hoary vervain	27	2	54	
Lithospermum	*incisum*	Narrow-leaved puccoon	27	2	54	*
Aster	*oolentangiensis*	Sky-blue aster	27	2	54	*
Euphorbia	*glyptosperma*	Ridge-seeded spurge	27	2	54	
Linum	*sulcatum*	Grooved yellow flax	18	3	54	*
Solidago	*missouriensis*	Missouri goldenrod	18	3	54	*
Solidago	*rigida*	Stiff goldenrod	18	3	54	*
Asclepias	*syriaca*	Common milkweed	18	3	54	
Ambrosia	*artemisiifolia*	Common ragweed	9	5	45	
Ratibida	*pinnata*	Gray-headed coneflower	9	5	45	*
Liatris	*aspera*	Rough blazing star	18	2	36	*
Artemisia	*ludoviciana*	Western mugwort	18	2	36	*
Asclepias	*ovalifolia*	Oval-leaved milkweed	18	2	36	*
Lactuca	*spp.*	Wild lettuce	18	2	36	
Chenopodium	*desiccatum*	Narrow-leaved lamb's quarters	9	3	27	
Onosmodium	*molle*	False gromwell	9	3	27	*
Dalea	*villosa*	Silky prairie-clover	9	3	27	*
Cirsium	*flodmani*	Prairie thistle	9	3	27	*
Dalea	*candida*	White prairie-clover	9	3	27	*
Oenothera	*biennis*	Common evening-primrose	9	3	27	
Penstemon	*gracilis*	Slender beard-tongue	9	3	27	*
Lathyrus	*venosus*	Veiny pea	9	3	27	
Solidago	*ptarmicoides*	Upland white aster	9	3	27	*
Pediomelum	*argophyllum*	Silvery scurf-pea	9	3	27	*
Solidago	*canadensis*	Canada goldenrod	9	3	27	
Cirsium	*discolor*	Field thistle	9	3	27	
Polygonum	*tenue*	Slender knotweed	9	3	27	
Aster	*prenanthoides*	Crooked-stemmed aster	9	3	27	*
Zizia	*aptera*	Heart-leaved alexanders	9	3	27	*
Rudbeckia	*hirta*	Black-eyed Susan	9	3	27	*
Thalictrum	*dasycarpum*	Tall meadow-rue	9	3	27	
Artemisia	*dracunculus*	Estragon	9	3	27	
Erysimum	*inconspicuum*	Small-flowered wallflower	9	3	27	
Helianthemum	*bicknellii*	Hoary frostweed	9	3	27	*
Veronicastrum	*virginicum*	Culver's root	9	3	27	*
Aster	*laevis*	Smooth aster	9	3	27	*
Solidago	*speciosa*	Showy goldenrod	9	3	27	*
Isanthus	*brachiatus*	False pennyroyal	9	3	27	*
Asclepias	*tuberosa*	Butterfly-weed	27	1	27	*
Desmodium	*illinoense*	Illinois tick-trefoil	9	1	9	*
Cycloloma	*atriplicifolium*	Winged pigweed	9	1	9	
Pediomelum	*esculentum*	Prairie-turnip	9	1	9	*
Scutellaria	*leonardi*	Leonard's skullcap	9	1	9	*
Oxalis	cmx.	Wood-sorrel	9	1	9	
Grasses, Rushes and Sedges						
Schizachyrium	*scoparium*	Little bluestem	64	39	2496	*
Sorghastrum	*nutans*	Indian grass	36	17	612	*
Andropogon	*gerardii*	Big bluestem	55	11	605	*
Stipa	*spartea*	Porcupine-grass	55	11	605	*
Bouteloua	*curtipendula*	Side-oats grama	64	7	448	*
Koeleria	*pyramidata*	June-grass	73	5	365	*
Stipa	*comata*	Needle-and-thread grass	9	38	342	*
Sporobolus	*cryptandrus*	Sand dropseed	45	7	315	*
Cyperus	*schweinitzii*	Schweinitz' cyperus	27	11	297	*
Panicum	*perlongum*	Long-leaved panic grass	18	15	270	
Muhlenbergia	*cuspidata*	Plains muhly	27	8	216	*
Bouteloua	*hirsuta*	Hairy grama	27	7	189	*
Sporobolus	*heterolepis*	Prairie dropseed	45	4	180	*
Cyperus	*lupulinus*	Hop-like cyperus	27	6	162	

Native Plant Community Species Lists modified for Dodge Nature Center from Dunevitz and Lane (2004) [1]
Type: Dry Sand-Gravel Prairie (Southern) UPs13b

Carex	*pensylvanica*	Pennsylvania sedge	18	9	162	
Panicum	*oligosanthes*	Few-flowered panic grass	45	3	135	*
Elymus	*canadensis*	Canada wild rye	9	15	135	*
Panicum	*wilcoxianum*	Wilcox's panic grass	27	3	81	*
Aristida	*basiramea*	Base-branched three-awn	18	4	72	*
Calamovilfa	*longifolia*	Sand reed-grass	18	4	72	*
Elymus	*trachycaulus*	Slender wheatgrass	18	3	54	*
Carex	*siccata*	Hay sedge	9	5	45	
Cyperus	*spp.*		9	5	45	
Eragrostis	*spectabilis*	Purple lovegrass	27	2	54	
Panicum	*leibergii*	Leiberg's panic grass	9	3	27	
Vulpia	*octoflora*	Eight-week fescue	9	3	27	*
Bromus	*kalmii*	Kalm's brome	9	3	27	*
Carex	*muhlenbergii*	Muhlenberg's sedge	9	3	27	*
Cenchrus	*longispinus*	Sandbur	9	1	9	
Setaria	*viridis*	Green foxtail	9	1	9	
Ferns and Fern Allies						
Selaginella	*rupestris*	Rock spikemoss	18	15	270	*
Equisetum	*laevigatum*	Smooth scouring-rush	18	3	54	*

[1]Dunevitz and Lane, 2004. *Species Lists for Terrestrial and Palustrine Native Plant Communities in East-central Minnesota*
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[4]Index of Commonness: Frequency multiplied by Abundance
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Native Plant Community Species Lists modified for Dodge Nature Center from Dunevitz and Lane (2004) [1]
Class: Southern Mesic Prairie UPs23

Genus	Species	Common Name	[2]Freq	[3]Abund	[4,5]Index	*Spp. Recc.'d for Planting[6]
Trees						
Populus	*tremuloides*	Quaking aspen	50	9	450	
Quercus	*macrocarpa*	Bur oak	75	2	150	
Quercus	*ellipsoidalis*	Northern pin oak	17	8	136	
Juniperus	*virginiana*	Red cedar	25	3	75	
Shrubs						
Corylus	*americana*	American hazelnut	50	5	250	
Rhus	*glabra*	Smooth sumac	25	10	250	
Rosa	*arkansana*	Prairie rose	58	3	174	*
Symphoricarpos	cmx.	Snowberry	25	4	100	
Rosa	cmx.	Smooth wild rose	8	3	24	
Salix	*humilis*	Prairie willow	8	3	24	*
Prunus	*americana*	Wild plum	17	1	17	
Cornus	*sericea*	Red-osier dogwood	8	1	8	wm
Prunus	*virginiana*	Chokecherry	8	1	8	
Prunus	*pumila*	Sand cherry	8	1	8	*dm
Rhus	*typhina*	Staghorn sumac	8	1	8	
Low Shrubs						
Amorpha	*canescens*	Lead-plant	58	10	580	*
Rubus	*idaeus*	Red raspberry	8	5	40	
Artemisia	*frigida*	Prairie sagewort	8	3	24	*dm
Amorpha	*nana*	Fragrant false indigo	8	1	8	*
Rubus	*occidentalis*	Black raspberry	8	1	8	
Vines						
Parthenocissus	cmx.	Virginia creeper	17	3	51	
Clematis	*virginiana*	Virgin's bower	8	3	24	
Vitis	*riparia*	Wild grape	8	3	24	
Forbs						
Solidago	*rigida*	Stiff goldenrod	58	10	580	*
Aster	*oolentangiensis*	Sky-blue aster	67	7	469	*
Solidago	*canadensis*	Canada goldenrod	67	7	469	
Coreopsis	*palmata*	Stiff tickseed	58	8	464	*
Galium	*boreale*	Northern bedstraw	42	9	378	*
Monarda	*fistulosa*	Wild bergamot	50	7	350	*
Aster	*ericoides*	Heath aster	58	6	348	*
Helianthus	*maximiliani*	Maximilian's sunflower	17	20	340	*
Solidago	*gigantea*	Giant goldenrod	33	9	297	*
Helianthus	*pauciflorus*	Stiff sunflower	58	5	290	*
Ratibida	*pinnata*	Gray-headed coneflower	33	7	231	*
Artemisia	*ludoviciana*	Western mugwort	42	5	210	
Comandra	*umbellata*	Bastard toad-flax	58	3	174	*
Veronicastrum	*virginicum*	Culver's root	58	3	174	*
Smilacina	*stellata*	Starry false Solomon's-seal	17	9	153	*
Dalea	*purpurea*	Purple prairie-clover	50	3	150	*
Pycnanthemum	*virginianum*	Virginia mountain-mint	50	3	150	*
Ambrosia	*psilostachya*	Western ragweed	17	8	136	
Pedicularis	*canadensis*	Wood-betony	17	8	136	*
Fragaria	*virginiana*	Common strawberry	33	4	132	*
Lespedeza	*capitata*	Round-headed bush-clover	42	3	126	*
Liatris	*aspera*	Rough blazing star	42	3	126	*
Phlox	*pilosa*	Prairie phlox	42	3	126	*
Artemisia	*dracunculus*	Estragon	8	15	120	
Dalea	*candida*	White prairie-clover	50	2	100	*
Desmodium	*canadense*	Canadian tick-trefoil	25	4	100	*
Thalictrum	*dasycarpum*	Tall meadow-rue	25	4	100	
Zizia	*aptera*	Heart-leaved alexanders	25	4	100	*
Achillea	*millefolium*	Yarrow	33	3	99	
Liatris	*ligulistylis*	Northern plains blazing star	33	3	99	*
Stachys	*palustris*	Woundwort	33	3	99	*
Viola	*pedatifida*	Prairie bird-foot violet	33	3	99	*
Cirsium	*discolor*	Field thistle	42	2	84	

Native Plant Community Species Lists modified for Dodge Nature Center from Dunevitz and Lane (2004) [1]
Class: Southern Mesic Prairie UPs23

Apocynum	*androsaemifolium*	Spreading dogbane	25	3	75	
Apocynum	*sibiricum*	Clasping dogbane	25	3	75	*wm
Asclepias	*tuberosa*	Butterfly-weed	25	3	75	*dm
Lithospermum	*canescens*	Hoary puccoon	25	3	75	*
Solidago	*nemoralis*	Gray goldenrod	25	3	75	*
Zizia	*aurea*	Golden alexanders	25	3	75	*
Artemisia	*campestris*	Tall wormwood	17	4	68	*dm
Solidago	*missouriensis*	Missouri goldenrod	17	4	68	*dm
Lathyrus	*palustris*	Marsh vetchling	33	2	66	*wm
Antennaria	*spp.*	Pussytoes	17	3	51	*
Aster	*lanceolatus*	Panicled aster	17	3	51	*
Aster	*novae-angliae*	New England aster	17	3	51	*wm
Campanula	*rotundifolia*	Harebell	17	3	51	*
Gentiana	*billingtonii*	Closed gentian	17	3	51	
Helianthus	*giganteus*	Giant sunflower	17	3	51	*wm
Lithospermum	*caroliniense*	Hairy puccoon	17	3	51	*dm
Polygala	*sanguinea*	Purple milkwort	17	3	51	wm
Potentilla	*simplex*	Old-field cinquefoil	17	3	51	
Anemone	*cylindrica*	Long-headed thimbleweed	25	2	50	*dm
Asclepias	*syriaca*	Common milkweed	25	2	50	
Liatris	*pycnostachya*	Gayfeather	25	2	50	*wm
Oenothera	*biennis*	Common evening-primrose	25	2	50	*
Rudbeckia	*hirta*	Black-eyed Susan	25	2	50	*
Euphorbia	*corollata*	Flowering spurge	8	5	40	
Kuhnia	*eupatorioides*	False boneset	8	5	40	*
Solidago	*ptarmicoides*	Upland white aster	8	5	40	*
Vernonia	*fasciculata*	Bunched ironweed	8	5	40	
Ambrosia	*artemisiifolia*	Common ragweed	17	2	34	
Heuchera	*richardsonii*	Alum-root	17	2	34	*
Lathyrus	*venosus*	Veiny pea	17	2	34	*
Lilium	*philadelphicum*	Wood lily	17	2	34	*
Physalis	*heterophylla*	Clammy ground-cherry	17	2	34	
Potentilla	*arguta*	Tall cinquefoil	17	2	34	*
Scutellaria	*leonardi*	Leonard's skullcap	17	2	34	
Allium	*stellatum*	Prairie wild onion	8	3	24	*
Anemone	*virginiana*	Virginia thimbleweed	8	3	24	*
Anemone	*canadensis*	Canada anemone	8	3	24	*
Asclepias	*ovalifolia*	Oval-leaved milkweed	8	3	24	*
Aster	*laevis*	Smooth aster	8	3	24	*
Astragalus	*agrestis*	Field milk-vetch	8	3	24	*
Chrysopsis	*villosa*	Prairie golden aster	8	3	24	*dm
Cirsium	*muticum*	Swamp thistle	8	3	24	*wm
Cirsium	*flodmani*	Prairie thistle	8	3	24	*
Euthamia	*graminifolia*	Grass-leaved goldenrod	8	3	24	
Glycyrrhiza	*lepidota*	Wild licorice	8	3	24	*
Hedeoma	*hispida*	Mock pennyroyal	8	3	24	
Heliopsis	*helianthoides*	Ox-eye	8	3	24	*
Hypoxis	*hirsuta*	Yellow star-grass	8	3	24	*wm
Lactuca	*spp.*	Wild lettuce	8	3	24	
Lobelia	*spicata*	Rough-spiked Lobelia	8	3	24	*
Oxalis	cmx.	Wood-sorrel	8	3	24	
Pediomelum	*argophyllum*	Silvery scurf-pea	8	3	24	*
Physalis	*virginiana*	Ground-cherry	8	3	24	
Prenanthes	*racemosa*	Smooth rattlesnake-root	8	3	24	
Silphium	*perfoliatum*	Cup-plant	8	3	24	*wm
Solidago	*speciosa*	Showy goldenrod	8	3	24	dm
Viola	*pedata*	Bird-foot violet	8	3	24	*
Viola	cm4	Violet	8	3	24	
Viola	cm1	Violet	8	3	24	
Allium	*canadense*	Wild garlic	8	1	8	
Astragalus	*canadensis*	Canada milk-vetch	8	1	8	*
Erigeron	*strigosus*	Daisy fleabane	8	1	8	*
Geum	*triflorum*	Prairie smoke	8	1	8	*dm
Helenium	*autumnale*	Autumn sneezeweed	8	1	8	wm
Krigia	*biflora*	Two-flowered Cynthia	8	1	8	wm

Native Plant Community Species Lists modified for Dodge Nature Center from Dunevitz and Lane (2004) [1]
Class: Southern Mesic Prairie UPs23

Mirabilis	*hirsuta*	Hairy four-o'clock	8	1	8	dm
Sisyrinchium	*campestre*	Field blue-eyed grass	8	1	8	*
Tradescantia	*bracteata*	Bracted spiderwort	8	1	8	*dm
Vicia	*americana*	American vetch	8	1	8	
Grasses, Rushes and Sedges						
Andropogon	*gerardii*	Big bluestem	100	30	3000	*
Sorghastrum	*nutans*	Indian grass	100	21	2100	*
Stipa	*spartea*	Porcupine-grass	33	21	693	*
Sporobolus	*heterolepis*	Prairie dropseed	42	13	546	*
Schizachyrium	*scoparium*	Little bluestem	33	13	429	*
Carex	*bicknellii*	Bicknell's sedge	33	6	198	*
Panicum	*oligosanthes*	Few-flowered panic grass	33	4	132	*dm
Spartina	*pectinata*	Prairie cord-grass	33	4	132	wm
Carex	*muhlenbergii*	Muhlenberg's sedge	8	15	120	*dm
Panicum	*leibergii*	Leiberg's panic grass	33	3	99	*
Panicum	*virgatum*	Switchgrass	17	4	68	*
Carex	*meadii*	Mead's sedge	17	3	51	*
Bromus	*kalmii*	Kalm's brome	25	2	50	*
Elymus	*canadensis*	Canada wild rye	25	2	50	*
Muhlenbergia	*mexicana*	Mexican satin-grass	8	5	40	
Muhlenbergia	*glomerata*	Clustered muhly grass	8	5	40	*wm
Koeleria	*pyramidata*	June-grass	17	2	34	*dm
Elymus	*trachycaulus*	Slender wheatgrass	8	3	24	*
Eragrostis	*spectabilis*	Purple lovegrass	8	3	24	
Muhlenbergia	*frondosa*	Swamp satin-grass	8	3	24	*wm
Muhlenbergia	*racemosa*	Marsh muhly grass	8	3	24	
Panicum	*perlongum*	Long-leaved panic grass	8	3	24	
Panicum	*commonsianum*	White-haired panic grass	8	3	24	
Panicum	*capillare*	Witch grass	8	3	24	
Carex	*scoparia*	Pointed-broom sedge	8	3	24	wm
Carex	*siccata*	Hay sedge	8	3	24	
Ferns and Fern Allies						
Equisetum	*laevigatum*	Smooth scouring-rush	25	2	50	*
Equisetum	*hyemale*	Tall scouring-rush	8	3	24	
Equisetum	*arvense*	Field horsetail	8	1	8	

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[3]Abundance: Total percent cover of species divided by number of releve plots in which species occurred
[4]Index of Commonness: Frequency multiplied by Abundance
[5]Species lacking values for Frequency, Abundance, and Index were added by the author of this report.
[6] wm=species only in wet mesic phase of mesic prairie; dm=species only in dry mesic phase of mesic prairie.

Native Plant Community Species Lists modified for Dodge Nature Center from Dunevitz and Lane (2004) [1]
Class: Southern Wet Prairie WPs54

Genus	Species	Common Name	[2]Freq	[3]Abund	[4,5]Index	*Spp. Recc.'d for Planting
Understory Trees						
Fraxinus	*pennsylvanica*	Green ash	20	9	180	
Ulmus	*americana*	American elm	10	3	30	
Populus	*tremuloides*	Quaking aspen	10	1	10	
Acer	*negundo*	Box elder	10	1	10	
Quercus	*macrocarpa*	Bur oak	10	1	10	
Shrubs						
Cornus	*sericea*	Red-osier dogwood	40	7	280	
Salix	*petiolaris*	Slender willow	40	6	240	
Salix	*discolor*	Pussy willow	40	6	240	
Salix	*bebbiana*	Bebb's willow	40	6	240	
Spiraea	*alba*	Meadowsweet	20	3	60	
Cornus	*racemosa*	Gray dogwood	10	5	50	
Low Shrubs						
Toxicodendron	*rydbergii*	Poison ivy	20	3	60	
Vines						
Vitis	*riparia*	Wild grape	10	1	10	
Forbs						
Thalictrum	*dasycarpum*	Tall meadow-rue	70	17	1190	
Solidago	*canadensis*	Canada goldenrod	60	13	780	
Euthamia	*graminifolia*	Grass-leaved goldenrod	30	22	660	
Fragaria	*virginiana*	Common strawberry	60	9	540	
Pycnanthemum	*virginianum*	Virginia mountain-mint	80	7	560	*
Solidago	*gigantea*	Giant goldenrod	80	5	400	
Zizia	*aurea*	Golden alexanders	50	6	300	*
Cicuta	*maculata*	Spotted water-hemlock	60	5	300	*
Lycopus	*americanus*	Cut-leaved bugleweed	60	5	300	*
Aster	*umbellatus*	Flat-topped aster	40	7	280	*
Eupatorium	*maculatum*	Spotted Joe-pye weed	40	7	280	*
Aster	*novae-angliae*	New England aster	30	8	240	*
Helianthus	*giganteus*	Giant sunflower	30	8	240	*
Lycopus	*uniflorus*	Northern bugleweed	80	3	240	*
Cirsium	*muticum*	Swamp thistle	80	3	240	
Viola	cm1	Violet	20	9	180	
Campanula	*aparinoides*	Marsh bellflower	40	4	160	
Achillea	*millefolium*	Yarrow	60	2	120	
Lysimachia	*quadriflora*	Prairie loosestrife	30	4	120	*
Gentiana	*billingtonii*	Closed gentian	40	3	120	
Pedicularis	*lanceolata*	Swamp lousewort	40	3	120	*
Eupatorium	*perfoliatum*	Common boneset	30	3	90	
Aster	*firmus*	Red-stemmed aster	20	4	80	*
Krigia	*biflora*	Two-flowered Cynthia	20	4	80	
Phlox	*pilosa*	Prairie phlox	20	4	80	*
Rubus	*pubescens*	Dwarf raspberry	20	4	80	
Senecio	*aureus*	Golden ragwort	20	4	80	*
Silphium	*perfoliatum*	Cup-plant	20	4	80	*
Anemone	*canadensis*	Canada anemone	30	2	60	*
Epilobium	cm2	Willow-herb	30	2	60	*
Vicia	*americana*	American vetch	30	2	60	
Calystegia	*sepium*	Hedge bindweed	20	3	60	
Aster	*lanceolatus*	Panicled aster	20	3	60	*
Lobelia	*spicata*	Rough-spiked lobelia	20	3	60	*
Lythrum	*alatum*	Wing-angled loosestrife	20	3	60	*
Oxypolis	*rigidior*	Cowbane	20	3	60	*
Ambrosia	*trifida*	Great ragweed	10	5	50	

Native Plant Community Species Lists modified for Dodge Nature Center from Dunevitz and Lane (2004) [1]
Class: Southern Wet Prairie WPs54

Apios	*americana*	Groundnut	10	5	50	*
Apocynum	*sibiricum*	Clasping dogbane	10	5	50	*
Asclepias	*incarnata*	Swamp milkweed	30	2	60	*
Galium	*triflorum*	Three-flowered bedstraw	10	5	50	*
Helianthus	*grosseserratus*	Sawtooth sunflower	10	5	50	
Hypoxis	*hirsuta*	Yellow star-grass	10	5	50	*
Lathyrus	*palustris*	Marsh vetchling	30	2	60	*
Liatris	*pycnostachya*	Gayfeather	10	5	50	*
Senecio	cmx.	Golden ragwort	10	5	50	*
Smilacina	*stellata*	Starry false Solomon's-seal	10	5	50	
Castilleja	*coccinea*	Indian paintbrush	20	2	40	
Teucrium	*canadense*	Germander	20	2	40	
Verbena	*hastata*	Blue vervain	20	2	40	
Ambrosia	*artemisiifolia*	Common ragweed	10	3	30	
Geum	*canadense*	White avens	10	3	30	
Habenaria	*psycodes*	Small purple fringed-orchid	10	3	30	
Habenaria	*lacera*	Ragged fringed-orchid	10	3	30	
Iris	*virginica*	Southern blue flag	10	3	30	
Iris	*versicolor*	Northern blue Flag	10	3	30	
Lathyrus	*venosus*	Veiny pea	10	3	30	
Liatris	*ligulistylis*	Northern plains blazing star	10	3	30	*
Lysimachia	*ciliata*	Fringed loosestrife	10	3	30	*
Mimulus	*ringens*	Purple monkey-flower	10	3	30	
Oenothera	*perennis*	Perennial evening-primrose	10	3	30	
Polygala	*sanguinea*	Purple milkwort	10	3	30	
Polygonum	*amphibium*	Water smartweed	10	3	30	*
Scutellaria	*galericulata*	Prairie skullcap	10	3	30	
Solidago	*riddellii*	Riddell's goldenrod	10	3	30	*
Vernonia	*fasciculata*	Bunched ironweed	10	3	30	
Geum	*aleppicum*	Yellow avens	20	1	20	
Helenium	*autumnale*	Autumn sneezeweed	20	1	20	*
Lilium	*michiganense*	Michigan lily	20	1	20	
Agastache	*foeniculum*	Blue giant-hyssop	10	1	10	
Chelone	*glabra*	White turtlehead	10	1	10	*
Chenopodium	*desiccatum*	Narrow-leaved lamb's quarters	10	1	10	
Liparis	*loeselii*	Loesel's twayblade	10	1	10	*
Lobelia	*siphilitica*	Great lobelia	10	1	10	*
Mentha	*arvensis*	Common mint	10	1	10	*
Polygala	*senega*	Seneca snakeroot	10	1	10	*
Prenanthes	*racemosa*	Smooth rattlesnake-root	10	1	10	*
Stachys	*palustris*	Woundwort	10	1	10	*
Grasses, Rushes and Sedges						
Spartina	*pectinata*	Prairie cord-grass	80	32	2560	*
Carex	*haydenii*	Hayden's sedge	40	36	1440	*
Andropogon	*gerardii*	Big bluestem	50	27	1350	*
Calamagrostis	*canadensis*	Bluejoint	30	19	570	*
Carex	*pellita*	Woolly sedge	50	11	550	*
Carex	*interior*	Inland sedge	40	10	400	*
Bromus	*ciliatus*	Fringed brome	50	4	200	*
Poa	*palustris*	Fowl meadow-grass	50	3	150	*
Glyceria	*striata*	Fowl manna-grass	50	3	150	*
Eleocharis	*compressa*	Flattened spike-rush	10	15	150	*
Carex	*buxbaumii*	Buxbaum's sedge	40	4	160	*
Elymus	*trachycaulus*	Slender wheatgrass	40	3	120	*
Muhlenbergia	*glomerata*	Clustered muhly grass	30	4	120	*
Carex	*bebbii*	Bebb's sedge	50	2	100	*
Carex	*tetanica*	Wood-sedge	30	4	120	*
Carex	*conoidea*	Field sedge	30	4	120	*
Carex	*lacustris*	Lake-sedge	30	4	120	

Native Plant Community Species Lists modified for Dodge Nature Center from Dunevitz and Lane (2004) [1]
Class: Southern Wet Prairie WPs54

Juncus	*tenuis*	Path rush	40	3	120	
Hierochloe	*odorata*	Sweet grass	20	4	80	*
Carex	*tenera*	Marsh-straw sedge	20	4	80	
Carex	*sartwellii*	Sartwell's sedge	20	4	80	*
Juncus	*dudleyi*	Dudley's rush	20	3	60	*
Carex	*scoparia*	Pointed-broom sedge	20	3	60	*
Eriophorum	*angustifolium*	Narrow-leaved cotton-grass	10	5	50	*
Carex	*stipata*	Awl-fruited sedge	20	2	40	
Agrostis	*hyemalis*	Rough bent-grass	10	3	30	
Calamagrostis	*stricta*	Bog reed-grass	10	3	30	
Muhlenbergia	*frondosa*	Swamp satin-grass	10	3	30	
Sphenopholis	*obtusata*	Prairie wedge-grass	10	3	30	*
Juncus	*nodosus*	Knotty rush	10	3	30	
Juncus	*vaseyi*	Vasey's rush	10	3	30	
Scirpus	*atrovirens*	Dark green bulrush	10	1	10	*
Scirpus	*cyperinus*	Wool-grass	10	1	10	*
Ferns and Fern Allies						
Thelypteris	*palustris*	Northern marsh-fern	50	5	250	
Onoclea	*sensibilis*	Sensitive fern	30	8	240	
Equisetum	*arvense*	Field horsetail	40	3	120	
Ophioglossum	*pusillum*	Adder's-tongue	30	3	90	
Equisetum	*pratense*	Meadow horsetail	10	5	50	

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Native Plant Community Species Lists; Reprinted from Dunevitz and Lane (2004) [1]; Edited for Dodge Nature Center
Type: Sedge Meadow WMn82b

Genus	Species	Common Name	[2]Freq	[3]Abund	[4,5]Index	*Spp. Rec.'d for Planting
Understory Trees						
Fraxinus	*pennsylvanica*	Green ash	5	15	75	
Betula	*papyrifera*	Paper-birch	14	3	42	
Populus	*tremuloides*	Quaking aspen	14	2	28	
Ulmus	*americana*	American elm	5	1	5	
Acer	*negundo*	Box elder	5	1	5	
Ulmus	*rubra*	Slippery elm	5	1	5	
Shrubs						
Salix	*petiolaris*	Slender willow	47	12	564	
Cornus	*amomum*	Silky dogwood	5	63	315	
Salix	*discolor*	Pussy willow	38	7	266	
Cornus	*sericea*	Red-osier dogwood	19	9	171	
Salix	*bebbiana*	Bebb's willow	24	5	120	
Spiraea	*alba*	Meadowsweet	29	2	58	
Salix	*eriocephala*	Heart-leaved willow	10	3	30	
Betula	*pumila*	Bog-birch	5	5	25	
Salix	*exigua*	Sandbar willow	5	5	25	
Alnus	*incana*	Speckled alder	10	2	20	
Salix	*candida*	Sage-leaved willow	10	2	20	
Spiraea	*tomentosa*	Steeple-bush	5	3	15	
Forbs						
Lycopus	*uniflorus*	Northern bugleweed	76	8	608	*
Sagittaria	*latifolia*	Broad-leaved arrowhead	43	14	602	*
Bidens	*spp.*	Beggar-ticks	33	16	528	
Impatiens	*spp.*	Touch-me-not	43	10	430	*
Pilea	*spp.*	Clearweed	24	15	360	
Aster	*firmus*	Red-stemmed aster	19	18	342	*
Triadenum	*fraseri*	Marsh St. John's-wort	48	7	336	*
Typha	*spp.*	Cattail	43	7	301	
Sparganium	*eurycarpum*	Giant bur-reed	14	19	266	*
Polygonum	*amphibium*	Water smartweed	29	9	261	*
Lysimachia	*thyrsiflora*	Tufted loosestrife	62	4	248	*
Campanula	*aparinoides*	Marsh bellflower	57	4	228	*
Eupatorium	*maculatum*	Spotted Joe-pye weed	43	5	215	*
Solidago	*canadensis*	Canada goldenrod	10	21	210	
Viola	cm2	Violet	19	10	190	*
Rumex	*orbiculatus*	Great water dock	62	3	186	*
Scutellaria	*galericulata*	Marsh skullcap	52	3	156	*
Asclepias	*incarnata*	Swamp milkweed	67	2	134	*
Lycopus	*americanus*	Cut-leaved bugleweed	33	4	132	*
Eupatorium	*perfoliatum*	Common boneset	43	3	129	*
Polygonum	*sagittatum*	Arrow-leaved tearthumb	43	3	129	*
Potentilla	*palustris*	Marsh cinquefoil	29	4	116	*
Galium	*trifidum*	Three-cleft bedstraw	29	4	116	*
Solidago	*gigantea*	Giant goldenrod	38	3	114	*
Cicuta	*bulbifera*	Bulb-bearing water-hemlock	33	3	99	*
Scutellaria	*lateriflora*	Mad-dog skullcap	14	7	98	
Rubus	*pubescens*	Dwarf raspberry	10	9	90	
Epilobium	cm2	Willow-herb	29	3	87	*
Lathyrus	*palustris*	Marsh vetchling	43	2	86	*
Mentha	*arvensis*	Common mint	19	4	76	*
Lycopus	*asper*	Rough bugle-weed	5	15	75	
Pycnanthemum	*virginianum*	Virginia mountain-mint	5	15	75	*
Epilobium	cm1	Willow-herb	24	3	72	*
Galium	*tinctorium*	Small bedstraw	24	3	72	*
Iris	*versicolor*	Northern blue Flag	33	2	66	*
Caltha	*palustris*	Swamp marsh-marigold	14	3	42	*
Galium	*labradoricum*	Marsh bedstraw	14	3	42	*
Cicuta	*maculata*	Spotted water-hemlock	14	3	42	*
Apocynum	*sibiricum*	Clasping dogbane	10	3	30	*
Boehmeria	*cylindrica*	False nettle	10	3	30	
Chelone	*glabra*	White turtlehead	10	3	30	*

Gentiana	*billingtonii*	Closed gentian	10	3	30	
Pedicularis	*lanceolata*	Swamp lousewort	10	3	30	*
Sium	*suave*	Water-parsnip	14	2	28	*
Aster	*lanceolatus*	Panicled aster	14	2	28	*
Verbena	*hastata*	Blue vervain	14	2	28	
Potentilla	*norvegica*	Rough cinquefoil	14	2	28	
Acorus	*calamus*	Sweet flag	5	5	25	
Hypericum	*majus*	Large St. John's-wort	5	5	25	*
Lemna	*spp.*	Lesser duckweed	10	2	20	
Alisma	*triviale*	Ordinary water-plantain	10	2	20	
Cirsium	*muticum*	Swamp thistle	10	2	20	*
Lysimachia	*terrestris*	Yellow loosestrife	10	2	20	
Ranunculus	*pensylvanicus*	Bristly buttercup	10	2	20	
Aster	*pubentior*	Flat-topped aster	10	2	20	*
Conyza	*canadensis*	Horseweed	5	3	15	
Teucrium	*canadense*	Germander	5	3	15	
Anemone	*canadensis*	Canada anemone	5	3	15	*
Erechtites	*hieracifolia*	Pilewort	5	3	15	
Helenium	*autumnale*	Autumn sneezeweed	5	3	15	*
Helianthus	*giganteus*	Giant sunflower	5	3	15	*
Stellaria	*longifolia*	Long-leaved chickweed	5	3	15	*
Aster	*borealis*	Bog aster	5	3	15	*
Geum	*aleppicum*	Yellow avens	5	3	15	*
Viola	*renifolia*	Kidney-leaf violet	5	3	15	*
Smilacina	*stellata*	Starry false Solomon's-seal	5	3	15	
Stachys	*palustris*	Woundwort	5	3	15	*
Polygonum	*punctatum*	Dotted smartweed	5	3	15	*
Fragaria	*virginiana*	Common strawberry	10	1	10	
Habenaria	*psycodes*	Small purple fringed-orchid	5	1	5	
Veronica	*scutellata*	Marsh speedwell	5	1	5	
Urtica	*dioica*	Stinging nettle	5	1	5	
Calla	*palustris*	Wild calla	5	1	5	*
Polygonum	*lapathifolium*	Nodding smartweed	5	1	5	
Polygonum	*hydropiperoides*	Mild water-pepper	5	1	5	
Erigeron	*philadelphicus*	Philadelphia fleabane	5	1	5	
Thalictrum	*dasycarpum*	Tall meadow-rue	5	1	5	
Saxifraga	*pensylvanica*	Swamp saxifrage	5	1	5	*
Apios	*americana*	Groundnut	5	1	5	
Echinocystis	*lobata*	Wild cucumber	5	1	5	
Grasses, Rushes and Sedges						
Carex	*stricta*	Tusssock-sedge	52	53	2756	*
Carex	*lacustris*	Lake-sedge	67	32	2144	*
Calamagrostis	*canadensis*	Bluejoint	67	13	871	*
Carex	*lasiocarpa*	Wire-sedge	33	15	495	*
Scirpus	*cyperinus*	Wool-grass	33	13	429	*
Carex	*aquatilis*	Water sedge	5	38	190	*
Leersia	*oryzoides*	Rice cut grass	14	8	112	
Carex	*utriculata*	Beaked sedge	19	6	114	*
Scirpus	*validus*	Softstem bulsush	10	9	90	*
Carex	*prairea*	Prairie sedge	19	4	76	*
Juncus	*canadensis*	Canada rush	5	15	75	
Scirpus	*atrovirens*	Dark green bulrush	5	15	75	*
Carex	*haydenii*	Hayden's sedge	5	15	75	*
Carex	*scoparia*	Pointed-broom sedge	19	3	57	*
Poa	*palustris*	Fowl meadow-grass	14	4	56	*
Spartina	*pectinata*	Prairie cord-grass	14	3	42	
Bromus	*ciliatus*	Fringed brome	10	4	40	*
Eriophorum	*angustifolium*	Narrow-leaved cotton-grass	10	4	40	*
Carex	*diandra*	Lesser-panicled sedge	10	4	40	
Carex	*buxbaumii*	Buxbaum's sedge	10	4	40	
Glyceria	*grandis*	Tall manna-grass	10	2	20	*
Carex	*bebbii*	Bebb's sedge	10	2	20	*
Glyceria	*striata*	Fowl manna-grass	5	3	15	*
Phragmites	*australis*	Common reed	5	3	15	
Muhlenbergia	*racemosa*	Marsh muhly grass	5	3	15	*

Native Plant Community Species Lists; Reprinted from Dunevitz and Lane (2004) [1]; Edited for Dodge Nature Center
Type: Sedge Meadow WMn82b

Leersia	*virginica*	White grass	5	3	15	
Carex	*sartwellii*	Sartwell's sedge	5	3	15	*
Carex	*interior*	Inland sedge	5	3	15	*
Carex	*stipata*	Awl-fruited sedge	5	3	15	*
Carex	*cephalantha*	Bunched sedge	5	3	15	*
Scirpus	*acutus*	Hard-stemmed bulrush	5	3	15	*
Carex	*tribuloides*	Blunt-broom sedge	5	3	15	*
Carex	*pellita*	Woolly sedge	5	3	15	*
Carex	*vesicaria*	Inflated sedge	5	3	15	
Agrostis	*hyemalis*	Rough bent-grass	5	1	5	
Eleocharis	*compressa*	Flattened spike-rush	5	1	5	*
Ferns and Fern Allies						
Thelypteris	*palustris*	Northern marsh-fern	76	12	912	*
Onoclea	*sensibilis*	Sensitive fern	24	6	144	
Equisetum	*fluviatile*	Water horsetail	10	3	30	*
Equisetum	*arvense*	Field horsetail	5	1	5	

[1]Dunevitz and Lane, 2004. *Species Lists for Terrestrial and Palustrine Native Plant Communities in East-central Minnesota*
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[3]Abundance: Total percent cover of species divided by number of releve plots in which species occurred
[4]Index of Commonness: Frequency multiplied by Abundance
[5]Species lacking values for Frequency, Abundance, and Index were added by the author of this report.

Native Plant Community Species Lists modified for Dodge Nature Center from Dunevitz and Lane (2004) [1]
Type: Willow-Dogwood Shrub Swamp WMn82a

Genus	Species	Common Name	[2]Freq	[3]Abund	[4,5]Index	*Spp. Recc.'d for Planting
Trees						
Populus	*tremuloides*	Quaking aspen	25	4	100	
Ulmus	*americana*	American elm	25	3	75	
Betula	*papyrifera*	Paper-birch	13	3	39	
Fraxinus	*nigra*	Black ash	25	1	25	
Salix	*nigra*	Black willow				
Fraxinus	*pennsylvanica*	Green ash				
Shrubs						
Salix	*petiolaris*	Slender willow	100	25	2500	*
Salix	*discolor*	Pussy willow	100	12	1200	*
Cornus	*sericea*	Red-osier dogwood	100	12	1200	*
Betula	*pumila*	Bog-birch	75	11	825	*
Spiraea	*alba*	Meadowsweet	25	10	250	*
Ribes	*americanum*	Wild black currant	13	15	195	*
Salix	*serissima*	Autumn willow	13	15	195	*
Ribes	*hirtellum*	Swamp gooseberry	50	3	150	
Alnus	*incana*	Speckled alder	38	4	152	
Salix	*bebbiana*	Bebb's willow	50	3	150	*
Spiraea	*tomentosa*	Steeple-bush	13	5	65	*
Salix	*eriocephala*	Heart-leaved willow	13	3	39	
Viburnum	*opulus*	High-bush cranberry	13	1	13	*
Cornus	*racemosa*	Gray dogwood	13	1	13	
Salix	*lucida*	Shining willow	13	1	13	
Low Shrubs and Vines						
Parthenocissus	*spp.*	Virginia creeper	25	3	75	
Rubus	*idaeus*	Red raspberry	25	2	50	
Forbs						
Eupatorium	*maculatum*	Spotted Joe-pye weed	75	9	675	*
Lycopus	*uniflorus*	Northern bugleweed	75	5	375	*
Pilea	*spp.*	Clearweed	50	6	300	
Epilobium	cm2	Willow-herb	88	3	264	*
Potentilla	*palustris*	Marsh cinquefoil	88	3	264	*
Galium	*trifidum*	Three-cleft bedstraw	63	4	252	*
Scutellaria	*galericulata*	Marsh skullcap	75	3	225	*
Sagittaria	*latifolia*	Broad-leaved arrowhead	50	4	200	*
Campanula	*aparinoides*	Marsh bellflower	50	4	200	*
Impatiens	*spp.*	Touch-me-not	50	4	200	
Rubus	*pubescens*	Dwarf raspberry	50	4	200	*
Aster	*borealis*	Bog aster	50	4	200	*
Lysimachia	*thyrsiflora*	Tufted loosestrife	38	4	152	*
Rumex	*orbiculatus*	Great water dock	50	3	150	*
Cicuta	*bulbifera*	Bulb-bearing water-hemlock	50	3	150	*
Galium	*labradoricum*	Marsh bedstraw	50	3	150	*
Lycopus	*americanus*	Cut-leaved bugleweed	63	2	126	*
Eupatorium	*perfoliatum*	Common boneset	63	2	126	*
Aster	*lanceolatus*	Panicled aster	25	4	100	*
Senecio	*aureus*	Golden ragwort	25	4	100	*
Bidens	*spp.*	Beggar-ticks	38	2	76	
Lathyrus	*palustris*	Marsh vetchling	38	2	76	*
Caltha	*palustris*	Swamp marsh-marigold	38	2	76	*
Asclepias	*incarnata*	Swamp milkweed	38	2	76	*
Viola	cm2	Violet	25	3	75	*
Epilobium	cm1	Willow-herb	25	3	75	*
Solidago	*gigantea*	Giant goldenrod	25	3	75	*
Polygonum	*sagittatum*	Arrow-leaved tearthumb	25	3	75	*
Thalictrum	*dasycarpum*	Tall meadow-rue	25	3	75	
Pycnanthemum	*virginianum*	Virginia mountain-mint	25	2	50	*
Cirsium	*muticum*	Swamp thistle	13	3	39	*
Pedicularis	*lanceolata*	Swamp lousewort	13	3	39	*
Polygonum	*punctatum*	Dotted smartweed	13	3	39	*
Polygonum	*amphibium*	Swamp smartweed	13	3	39	*

Native Plant Community Species Lists modified for Dodge Nature Center from Dunevitz and Lane (2004) [1]
Type: Willow-Dogwood Shrub Swamp WMn82a

Lysimachia	*terrestris*	Yellow loosestrife	13	3	39 *
Mentha	*arvensis*	Common mint	13	3	39 *
Sium	*suave*	Water-parsnip	13	3	39 *
Lobelia	*siphilitica*	Great lobelia	13	3	39 *
Aster	*firmus*	Red-stemmed aster	13	3	39 *
Agalinis	*tenuifolia*	Slender-leaved gerardia	13	3	39
Triadenum	*fraseri*	Marsh St. John's-wort	13	3	39 *
Chelone	*glabra*	White turtlehead	25	1	25 *
Anemone	*canadensis*	Canada anemone	13	1	13 *
Galium	*asprellum*	Rough bedstraw	13	1	13
Gentianopsis	*crinita*	Wide-leaved fringed gentian	13	1	13
Gentianopsis	*procera*	Smaller fringed gentian	13	1	13
Alisma	*subcordatum*	Heart-leaved water-plantain	13	1	13 *
Aster	*umbellatus*	Flat-topped aster	13	1	13 *
Liparis	*loeselii*	Loesel's twayblade	13	1	13
Spiranthes	*cernua*	Nodding ladies'-tresses	13	1	13
Grasses, Rushes and Sedges					
Calamagrostis	*canadensis*	Bluejoint	88	23	2024 *
Carex	*stricta*	Tusssock-sedge	50	36	1800 *
Carex	*lacustris*	Lake-sedge	63	28	1764 *
Carex	*lasiocarpa*	Wire-sedge	63	12	756 *
Carex	*canescens*	Silvery sedge	13	38	494 *
Sparganium	*eurycarpum*	Giant bur-reed	13	38	494 *
Typha	*spp.*	Cattail	38	11	418
Muhlenbergia	*glomerata*	Clustered muhly grass	25	15	375 *
Bromus	*ciliatus*	Fringed brome	25	4	100 *
Carex	*diandra*	Lesser-panicled sedge	25	3	75
Carex	*pseudocyperus*	Cyperus-like sedge	25	3	75 *
Muhlenbergia	*racemosa*	Marsh muhly grass	13	5	65 *
Leersia	*oryzoides*	Rice cut grass	13	5	65
Carex	*utriculata*	Beaked sedge	13	5	65 *
Carex	*comosa*	Bristly sedge	13	5	65 *
Poa	*palustris*	Fowl meadow-grass	13	3	39 *
Muhlenbergia	*frondosa*	Swamp satin-grass	13	3	39 *
Glyceria	*striata*	Fowl manna-grass	13	3	39 *
Scirpus	*cyperinus*	Wool-grass	13	3	39 *
Carex	*buxbaumii*	Buxbaum's sedge	13	3	39 *
Carex	*sartwellii*	Sartwell's sedge	13	1	13 *
Carex	*interior*	Inland sedge	13	1	13 *
Ferns and Fern Allies					
Thelypteris	*palustris*	Northern marsh-fern	88	17	1496 *
Onoclea	*sensibilis*	Sensitive fern	25	3	75 *
Dryopteris	*cristata*	Crested fern	25	2	50 *
Equisetum	*palustre*	Marsh horsetail	13	3	39 *
Osmunda	*regalis*	Royal fern	13	1	13

[1]Dunevitz and Lane, 2004. *Species Lists for Terrestrial and Palustrine Native Plant Communities in East-central Minnesota*
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Native Plant Community Species Lists modified for Dodge Nature Center from Dunevitz and Lane (2004) [1]

Class: Southern Mixed Cattail Marsh MRs83

Genus	Species	Common Name	[2]Freq	[3]Abund	[4,5]Index	*Spp. Recc'd for Plantng
Shrubs						
Cornus	*sericea*	Red-osier dogwood	20	9	180	*
Amorpha	*fruticosa*	False indigo	10	15	150	*
Spiraea	*tomentosa*	Steeple-bush	20	3	60	
Betula	*pumila*	Bog-birch	10	3	30	
Salix	*petiolaris*	Slender willow	10	3	30	*
Forbs						
Typha	*spp.*	Cattail	90	28	2520	
Lemna	*spp.*	Lesser duckweed	50	30	1500	
Impatiens	cmx.	Touch-me-not	50	17	850	
Sparganium	*eurycarpum*	Giant bur-reed	30	26	780	*
Eupatorium	*maculatum*	Spotted Joe-pye weed	40	15	600	*
Scutellaria	*galericulata*	Marsh skullcap	60	5	300	*
Bidens	*spp.*	Beggar-ticks	40	7	280	
Mentha	*arvensis*	Common mint	40	6	240	*
Cicuta	*bulbifera*	Bulb-bearing water-hemlock	30	8	240	*
Sagittaria	*latifolia*	Broad-leaved arrowhead	50	5	250	*
Rumex	*orbiculatus*	Great water dock	60	3	180	*
Lycopus	*americanus*	Cut-leaved bugleweed	50	3	150	*
Campanula	*aparinoides*	Marsh bellflower	40	4	160	*
Acorus	*calamus*	Sweet flag	40	4	160	*
Polygonum	*sagittatum*	Arrow-leaved tearthumb	30	4	120	*
Polygonum	*amphibium*	Water smartweed	30	4	120	*
Cuscuta	*spp.*	Dodder	30	3	90	
Lysimachia	*thyrsiflora*	Tufted loosestrife	30	3	90	*
Asclepias	*incarnata*	Swamp milkweed	30	3	90	*
Pilea	cmx.	Clearweed	20	4	80	
Polygonum	*punctatum*	Dotted smartweed	20	4	80	*
Helianthus	*grosseserratus*	Sawtooth sunflower	20	4	80	
Galium	*trifidum*	Three-cleft bedstraw	30	2	60	*
Viola	cm1	Violet	20	3	60	*
Epilobium	cm2	Willow-herb	20	3	60	*
Lycopus	*uniflorus*	Northern bugleweed	20	3	60	*
Stachys	*palustris*	Woundwort	20	3	60	*
Lathyrus	*palustris*	Marsh vetchling	20	3	60	*
Aster	*firmus*	Red-stemmed aster	20	3	60	*
Cicuta	*maculata*	Spotted water-hemlock	20	3	60	*
Nymphaea	cmx.	Waterlily	10	5	50	
Lysimachia	*ciliata*	Fringed loosestrife	10	5	50	*
Eupatorium	*perfoliatum*	Common boneset	10	5	50	*
Boehmeria	*cylindrica*	False nettle	10	5	50	
Epilobium	cm1	Willow-herb	10	3	30	*
Polygonum	*amphibium*	Swamp smartweed	10	3	30	*
Polygonum	*pensylvanicum*	Pennsylvania smartweed	10	3	30	*
Polygonum	*lapathifolium*	Nodding smartweed	10	3	30	*
Sium	*suave*	Water-parsnip	10	3	30	*
Lysimachia	*quadriflora*	Prairie loosestrife	10	3	30	*
Lythrum	*alatum*	Wing-angled loosestrife	10	3	30	*
Rumex	*maritimus*	Golden dock	10	3	30	
Rorippa	*palustris*	Icelandic yellow cress	10	3	30	
Caltha	*palustris*	Swamp marsh-marigold	10	3	30	*
Pedicularis	*lanceolata*	Swamp lousewort	10	3	30	*
Stellaria	*longifolia*	Long-leaved chickweed	10	3	30	
Aster	*pubentior*	Flat-topped aster	10	3	30	*
Teucrium	*canadense*	Germander	10	3	30	

Native Plant Community Species Lists modified for Dodge Nature Center from Dunevitz and Lane (2004) [1]

Class: Southern Mixed Cattail Marsh MRs83

Solidago	*gigantea*	Giant goldenrod	10	3	30	
Aster	*borealis*	Bog aster	10	3	30	
Thalictrum	*dasycarpum*	Tall meadow-rue	10	3	30	
Lobelia	*siphilitica*	Great lobelia	10	3	30	
Galium	*tinctorium*	Small bedstraw	10	3	30	
Calystegia	*sepium*	Hedge bindweed	10	1	10	
Grasses, Rushes and Sedges						
Calamagrostis	*canadensis*	Bluejoint	70	15	1050	*
Carex	*lacustris*	Lake-sedge	30	34	1020	*
Phragmites	*australis*	Common reed	10	63	630	
Scirpus	*acutus*	Hard-stemmed bulrush	30	19	570	*
Carex	*comosa*	Bristly sedge	20	15	300	*
Carex	*stricta*	Tusssock-sedge	30	8	240	
Leersia	*oryzoides*	Rice cut grass	50	3	150	
Scirpus	*validus*	Softstem bulrush	10	15	150	*
Scirpus	*fluviatilis*	River bulrush	10	15	150	
Carex	*pellita*	Woolly sedge	20	4	80	*
Carex	*hystericina*	Porcupine sedge	20	4	80	
Muhlenbergia	*glomerata*	Clustered muhly grass	10	5	50	*
Cyperus	*bipartitus*	Brook nut sedge	10	5	50	
Carex	*haydenii*	Hayden's sedge	10	5	50	*
Carex	*interior*	Inland sedge	10	5	50	*
Cyperus	*odoratus*	Fragrant cyperus	10	3	30	
Carex	*stipata*	Awl-fruited sedge	10	3	30	*
Zizania	*palustris*	Wild rice	10	1	10	*
Ferns and Fern Allies						
Thelypteris	*palustris*	Northern marsh-fern	50	4	200	*
Equisetum	*fluviatile*	Water horsetail	10	3	30	*

[1]Dunevitz and Lane, 2004. *Species Lists for Terrestrial and Palustrine Native Plant Communities in East-central Minnesota*

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[3]Abundance: Total percent cover of species divided by number of releve plots in which species occurred

[4]Index of Commonness: Frequency multiplied by Abundance

[5]Species lacking values for Frequency, Abundance, and Index were added by the author of this report.

Native Plant Community Species Lists modified for Dodge Nature Center from Dunevitz and Lane (2004) [1] and Eggers (1992)[6]

Class: Northern Poor Fen APn81

Genus	Species	Common Name	[2]Freq	[3]Abund	[4,5]Index	*Spp. Recc.'d for Planting
Understory Trees						
Betula	*papyrifera*	Paper-birch	17	3	51	
Larix	*laricina*	Tamarack	33	1	33	
Fraxinus	*pennsylvanica*	Green ash				
Acer	*rubrum*	Red maple				
Shrubs						
Betula	*pumila*	Bog-birch	100	8	800	*
Spiraea	*tomentosa*	Steeple-bush	67	4	268	
Salix	*bebbiana*	Bebb's willow				
Cornus	*stolonifera*	Red-osier dogwood				
Low Shrubs						
Chamaedaphne	*calyculata*	Leather-leaf	100	54	5400	
Andromeda	*glaucophylla*	Bog-rosemary	33	15	495	
Vaccinium	*macrocarpon*	Large cranberry	17	15	255	*
Vaccinium	*myrtilloides*	Velvet-leaf blueberry	17	1	17	
Salix	*pedicellaris*	Bog willow				*
Spiraea	*alba*	Meadowsweet				
Forbs						
Bidens	*spp.*	Beggar-ticks	33	3	99	
Sagittaria	*latifolia*	Broad-leaved arrowhead	33	3	99	*
Polygonum	*sagittatum*	Arrow-leaved tearthumb	33	3	99	*
Lycopus	*uniflorus*	Northern bugleweed	17	5	85	*
Typha	*spp.*	Cattail	17	3	51	
Epilobium	cml	Willow-herb	17	3	51	
Potentilla	*palustris*	Marsh cinquefoil	17	3	51	*
Hypericum	*majus*	Large St. John's-wort	17	3	51	*
Scutellaria	*galericulata*	Marsh skullcap	17	1	17	*
Cicuta	*bulbifera*	Water-hemlock	17	1	17	
Drosera	*rotundifolia*	Round-leaved sundew				*
Viola	*cucullata*	violet				*
Pogonia	*ophiogossoides*	Rose pogonia				*
Triadenum	*fraseri*	Marsh St. Johnswort				*
Lysimachia	*thyrsiflora*	Tufted loosestrife				*
Menyanthes	*trifoliata*	Bog buckbean				*
Utricularia	spp.	Bladderwort				*
Galium	*asprellum*	Rough bedstraw				*
Rumex	*orbiculatus*	Great water dock				
Campanula	*aparinoides*	Marsh bellflower				*
Hypericum	*pyramidatum*	Giant St. John's wort				*
Ranunculus	spp.	Buttercup				*
Grasses, Rushes and Sedges						
Carex	*lasiocarpa*	Wire-sedge	100	15	1500	*
Eriophorum	*angustifolium*	Narrow-leaved cotton-grass	17	38	646	*
Carex	*utriculata*	Beaked sedge	17	15	255	*
Scirpus	*cyperinus*	Wool-grass	50	4	200	*
Eriophorum	*virginicum*	Virginia cotton-grass	33	4	132	*
Scirpus	*acutus*	Hard-stemmed bulrush	17	5	85	*
Rhynchospora	*alba*	White beak rush	17	3	51	
Carex	*cephalantha*	Bunched sedge	17	3	51	
Carex	*interior*	Inland sedge	17	1	17	*
Carex	*chordorrhiza*					*
Calamagrostis	*canadensis*	Canada blue-joint grass				
Carex	*hystericina*	Porcupine sedge				*
Carex	*lacustris*	Lake sedge				*
Eleocharis	*erythropoda*	Spikerush				*
Eriophorum	*spissum*	Cotttongrass				*

Native Plant Community Species Lists modified for Dodge Nature Center from Dunevitz and Lane (2004) [1] and Eggers (1992)[6]
Class: Northern Poor Fen APn81

Eriophorum	*viridicarinatum*	Cotttongrass				*
Dulichium	*arundinaceum*					*
Ferns and Fern Allies						
Thelypteris	*palustris*	Northern marsh-fern	17	5	85	*
Onoclea	*sensibilis*	Sensitive fern	17	3	51	*
Osmunda	*cinnamomea*	Cinnamon fern				*
Bryophytes						
Sphagnum	spp.	Sphagnum moss				*

[1]Dunevitz and Lane, 2004. *Species Lists for Terrestrial and Palustrine Native Plant Communities in East-central Minnesota*

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[3]Abundance: Total percent cover of species divided by number of releve plots in which species occurred

[4]Index of Commonness: Frequency multiplied by Abundance

[5]Species lacking values for Frequency, Abundance, and Index were added by the author of this report.

[6] Eggers 1992 (U.S. Army Corps of Engineers): data from 1 site in Eden Prairie Township, Hennepin County: data were added to augment the list of Dunevitz and Lane 2004.

Appendix B: Direct Seeding of Native Hardwood Trees (from: MN DNR Division of Forestry)

Direct Seeding of Native Hardwood Trees

An innovative approach to hardwood regeneration

Establishing hardwood trees by sowing seed is a relatively new method hat has several advantages over traditional planting of seedlings.

Better and quicker establishment: Direct seeding establishes thousands of seedlings per acre rather than hundreds per acre with traditional planting. Trees reach "crown closure" and begin shading out grass and weed competition earlier. Follow-up grass and weed control typically only needs to be done for 2 years after seeding, instead of 8 to 12 years with planting.

Higher quality timber: Greater density of seedlings forces trees to grow straighter due to side competition from nearby stems. Competition decreases pruning needs and produces higher quality hardwood saw logs.

Better use of natural selection: Trees best suited to a particular site will dominate because of large numbers of seed and species.

Better adaptation to variations in site conditions: Small variances in site conditions aren't planned for when planting seedlings. With direct seeding, species and specimens best suited will take over in each area.

More natural appearance: Direct seeding is a much closer approximation of mother nature's hardwood establishment method than seedling planting in rows.

Better ability to withstand animal predation: Animals such as deer, while still causing damage by browsing, will be less likely to devastate a direct seeding than a traditional seedling plantation due to far greater stems per acre.

A native hardwood seeding showing nine growing seasons.

POTENTIAL DISADVANTAGES OR PROBLEMS WITH DIRECT SEEDING INCLUDE:

Higher initial cost: Establishing seeds may be somewhat higher than planting seedlings ($500/ acre vs. $350/ acre average). Keep in mind, however, that part of the higher cost can often be offset by government cost-share assistance or by collecting some seed yourself or doing your own tillage. Follow-up care costs will be compressed into the first 2 to 3 years, but may total a bit less than with seedling planting, due to earlier crown closure.

Inconsistent seed availability: Seed for inconsistent seed producing trees like red oak may not be available every year. Some years, supplemental seedling planting or delay of direct seeding may be necessary for oaks or other species.

Site accessibility: Direct seeding requires access by site preparation machinery, so some very steep sites and sites already wooded do not lend themselves to establishment by direct seeding. Seedlings will need to continue as the regeneration method of choice for these sites.

Collecting Seed for Hardwood Tre

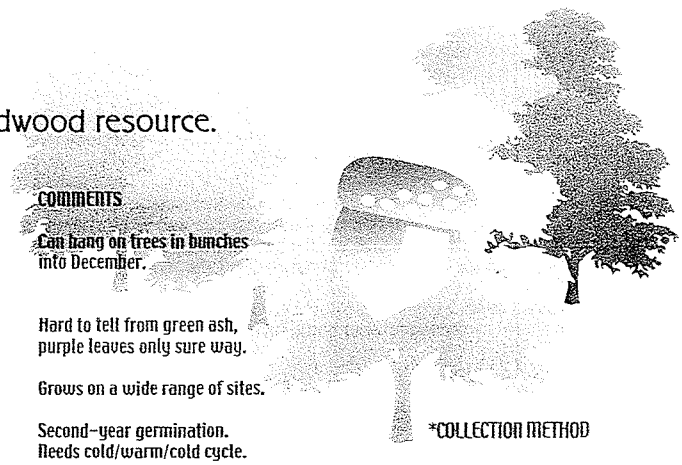
Collecting, storing, and delivering large quantities of high-quality seed is critical t

SPECIES	SEED CROP FREQUENCY	TIME TO COLLECT SEED	SHAPE AND APPEARANCE	COLLECTION METHOD*
Black Ash	1–3 years	October to December	Flat exclamation point	H, T/S, P
White Ash	3–5 years	Late September to late November	Flat exclamation point	H, T/S, P
Green Ash	1 year	October to January	Flat exclamation point	H, T/S, P
Basswood	1+ years	September to December	Brown peas with propeller on a stalk	Rake, T/S, H
Black Cherry	1–5 years	August to September	Purple–black berries	Rake, T/S, H
Hackberry	?	October to December	Purple–black berries	Rake, T/S, H
Shagbark Hickory	1–3 years	September to December	Four football–shaped segments together	H, Rake
Silver Maple	1 year	June	Green to brown propellers	Rake
Sugar Maple	3–5 years	Late September to early November	Green to brown propellers	Rake, T/S, H
Bur Oak	2–3 years	August to September	Acorn almost fully covered by cap, which has a furry fringe	Rake, B–A–H, Pick
Red Oak	3–5 years	September to early October	Reddish–brown acorn	Rake, B–A–H, Pick
White Oak	4–10 years	Late August to September	Tan to light–brown acorn, thinner and smaller than most red oak acorns	Rake, B–A–H, Pick
Black Walnut	1–2 years	October	Golfball–size nut with green to black husk	Rake, B–A–H, Pick
Gray Dogwood	1 year	July to August	Pea–sized white berries in clusters	H
Redosier Dogwood	1 year	July to September	Pea–sized white berries in clusters	H
Choke Cherry	1–2 years	August to September	Pea–sized dark red to purple berries	H
Highbush Cranberry	1–2 years	August to September	Pea–sized bright red berries in clusters	H

Sources of information for chart: *Se*

e Establishment

to the success of regenerating our hardwood resource.



	CLEANING	STORAGE UNTIL SEEDED IN FALL	COMMENTS
	Remove stems and leaves	Keep dry – Can be stored in feed sacks in a 40° F cooler for several weeks	Can hang on trees in bunches into December.
	Remove stems and leaves	Same as above	Hard to tell from green ash, purple leaves only sure way.
	Remove stems and leaves	Same as above	Grows on a wide range of sites.
	Crush stems and wings, separate hard, round seed	Dry – Store in moisture-proof container at 40° F or lower	Second-year germination. Needs cold/warm/cold cycle.
	Mascerate soft fruit, separate hard seed, dry	Dry – Store in moisture-proof container at 40° F	Collect from high-quality trees.
	None	Store dried fruits or cleaned seeds in moisture proof container at 40° F	
	Remove leaves and twigs	Can be stored in feed bags at 40° F	Stay within natural range.
	Remove stems and leaves	Plant as soon as possible in early summer	Seed shallow.
	Remove stems and leaves	Dry, store in small seed sacks at 40° F	One bushel per person per day is maximum yield for hand picking.
k	Cut open a handful to test for viability; hand sort	Only for a few weeks at 40° F – Soak overnight before storage	Race with squirrels and deer for acorns.
k	Float, then remove "floaters" or hand sort	Only for a few weeks at 40° F – Soak overnight – Sow in fall	Race with squirrels and deer for acorns.
k	Float, then remove "floaters" or hand sort	Only for a few weeks at 40° F – Soak overnight – Sow in fall	Race with squirrels and deer for acorns.
k	Remove leaves and twigs	Only for a few weeks – Small piles to prevent heating of seed	Stay within natural range. Nuts have been stored too long if warm and black, like tar.
	Remove leaves and twigs	Seed extraction from fruit is not necessary	Sow in fall as soon as possible after collection.
	Remove leaves and twigs	Seed extraction from fruit is not necessary – Prevent heating of seed	Sow in fall as soon as possible after collection. Attractive red twigs.
	Remove leaves and twigs	Seed extraction from fruit is not necessary – Surface dry fruit is okay for sowing	Sow in fall as soon as possible after collection. Prevent heating in storage.
	Remove leaves and twigs	Seed extraction from fruit helpful in some *Viburnum* species	Often second-year germination. Prevent heating in storage.

*COLLECTION METHOD

H- Hand pick from cut or standing trees

T/S- Tarp ground and shake branches when seed is ready to fall

P- Pruning hook on a long pole

B-A-N- Bag-A-Nut machine

RAKE- Rake fallen seed from street or lawns

PICK- Gather fallen seed by hand from ground

BAGGING SEED FOR SHIPPING

Oak seed should be put into breathable, woven poly bags or burlap.
Ash and maple seed should be put into paper or burlap bags after drying.
Walnuts should be kept in small, open containers or small piles.
Label all bags with species, date and place collected.
Do not overfill bags.

Site preparation: Sites covered by grass must be clipped in mid August to early September. The grass is then allowed to grow back several inches and is killed with a broadcast treatment of herbicide. After dieback, the field must be tilled black. As an alternative, discing a number of times through the summer is best. If a site is in an annual crop such as oats, corn or soybeans, a light discing is all that is necessary, unless field was "no-till" drilled, then a heavy discing or chisel plowing followed by discing. In either case, grass waterways and contour strips should be left to minimize erosion. Apply a pre-emergent herbicide in fall or spring for annual grass control. Contact local forester for advice.

Seed collection and storage: Seed collection and storage is often more than a landowner can tackle alone. Knowledge of characteristics of many kinds of seed (ripening times, moisture and storage requirements, etc.) is a must. There are vendors who sell seed from experienced collectors. This is often the best method for landowners to obtain viable, high quality seed. If landowners wish to collect seed on their own, they should contact their local forester for species specific handling and storage advice.

Seeding rates: Depending on your site, the following species and rates are commonly recommended. Your forester can adjust species and rates as needed for your particular project:

Red Oak	1 to 2	Black Cherry	1/4 to 1/2 pound
White Oak	1/4 to 1	Hackberry	1/4 to 1/2 pound
Bur Oak	1/2 to 1	Kentucky Coffee Tree	5 to 10 pounds
Black Walnut	10 to 20		
Shagbark Hickory (within its range)	1/4 to 1/2	SHRUBS:	
Swamp White Oak (lowland sites)	1/4 to 1/2	Grey or Redosier Dogwood	1/4 pound
Ash (Green, White, Black)	1/4 to 1	Highbush Cranberry	1/4 pound
Sugar Maple	1/4 to 1/2	Choke Cherry	1/4 pound
		Wild Plum	1/4 pound

Seeding: First, large seed - acorns, walnuts, hickory nuts - are typically broadcast with a fertilizer spreader over the entire field and then disced in to a depth of 1 to 2 inches. The lighter seed - ash, maple, cherry (and shrubs if any) - is broadcast and dragged in lightly.

Weed control: Controlling grass and weed competition until seedlings reach "crown closure" (which often happens in year 3) is crucial to the success of any seeding project. If weeds are not controlled, tree seedlings will be out-competed for moisture and sunlight. Typically a pre- or post-emergent herbicide is used early in the first season and a post-emergent herbicide is used later in the first year. If broadleaf weeds become a problem in year one, mow the area high, above the top of tree seedlings. A pre- or post-emergent herbicide application will be needed in year two. The area will need to be scouted often in order to determine weed control needs. Contact your local forester for specific herbicide recommendations.

Shrubs: Many sites would benefit from the addition of some under story shrubs for diversity and wildlife habitat. Grey and redosier dogwood, chokecherry, highbush cranberry, wild plum, nannyberry, blackberry elder, and American and beaked hazel are some common shrub species in much of Minnesota. Your forester will know which species will fit your site. Shrubs in direct seeding are relatively untried and are subject to failures due to seed handling problems and herbicide damage until more is known. Addition of shrubs will also raise costs.

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Lake City, MN 55041
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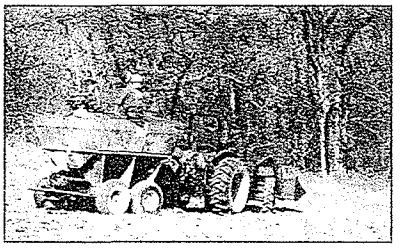
Willmar Area Forestry
4566 Hwy 71 N. Suite 1
Willmar, MN 56201
(320) 231-5164



Spreading acorns and walnuts.

Minnesota Department of Natural Resources

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Appendix C: Fact Sheets for Selected Exotic and Invasive Species

The following pages contain information on the habitat, phenology and niche of exotic and invasive plants found in Dodge Nature Center. These species are troublesome plants, both native and exotic, which compete with the native plants typical of undisturbed native communities and threaten the integrity, structure and function of those communities. Active management to control invasive plant species is essential to restoring the health of plant communities and the habitats they provide for a diverse group of native animals.

Invasive trees and shrubs:	
Common buckthorn *	*Rhamnus cathartica*
Tartarian Honeysuckle*	*Lonicera tartarica*
Poison ivy	*Rhus radicans*
Smooth sumac	*Rhus glabra*
Trembling aspen	*Populus tremuloides*
Invasive Forbs:	
Garlic mustard *	*Alliaria petiolata*
Sweet clovers *	*Melilotus officinalis*
	M. alba
Purple loosestrife*	*Lythrum salicaria*
Invasive Grasses:	
Bluegrass *	*Poa pratensis, P. compressa*
Reed canary grass *	*Phalaris arundinacea*

* exotic species

Common Buckthorn *(Rhamnus cathartica)*

Effects of Invasion

Common buckthorn is a problem species in the understory of maple-basswood and oak woodlands, oak savannas, and prairies. It is characterized by long-distance dispersal, prolific reproduction by seed, and wide habitat tolerance. The fruit has a severe laxative effect; birds readily distribute its seeds after eating the fruit. Once established, common buckthorn has the potential to spread very aggressively in large numbers because it thrives in habitats ranging from full sun to shaded understory. Common buckthorn leafs out very early and retains its leaves late in the growing season, thereby shading out herbaceous and low-shrub communities and preventing the establishment of tree seedlings.

Size: 18–25 feet in height with a comparable spread.

Habit: Large shrub or low-branched tree with a rounded, bushy crown of crooked, stoutish stems.

Leaves: Dull green, ovate-elliptic-shaped, and smooth on both surfaces with minute teeth on the margins, and pointed tips.

Stem: Slender, somewhat grayish, often having thorn-like spurs.

Bark: Generally gray to brown with prominent, often elongate, light-colored or silvery lenticels.

Fruit: Female plants have ¼-inch-diameter clusters of black, rounded fruit.

Origin: Europe and Asia.

Range: Nova Scotia to Saskatchewan, south to Missouri and east to New England.

Mechanical Control

- Prescribed burns in early spring and fall may kill seedlings, larger stems, and top-killed mature buckthorns. Burning is preferable for fire-adapted communities but should not be used if it adversely affects the community. Burning annually or biannually to control buckthorn may need to be continued for several years depending on the extent of establishment and the seed bank, which generally lasts 3–5 years. It is usually difficult to burn in dense buckthorn stands because the understory is typically well shaded, allowing little fuel build-up.
- Hand pull or weed-wrench seedlings.
- Weed wrench saplings up to 1inch in diameter at breast height.
- Trees of 1–3 inches in diameter at breast height may be weed wrenched if they are growing in sandy soils; otherwise, cut and apply herbicide to the stump.

Chemical Control

- Cut and apply herbicide to tree stumps greater than 3 inches in diameter at breast height.
- Basal bark treatment may be used on trees located near power lines, in difficult terrain, or in areas where it is not important to create openings in the woodland floor for reintroduction of native species.
- In high-quality natural areas and aquatic environments where surface water is present, apply an herbicide formulated for use over water.
- Repeat both mechanical and chemical control methods for at least 3–5 years to stop new plants emerging from the seed bank as well as the continual spread of seed from bird droppings. Underplanting disturbed areas with tolerant native species may hinder reinvasion by common buckthorn.

Cut and spray

- May to October (between first budding in May, through summer, to hard freeze in fall): Spray 25% Triclopyr diluted in water on cut stumps during the growing season. Herbicide should be sprayed immediately after cutting. Avoid spring sap flow. Chemical treatment is generally less effective during the growing season, and there is more risk of affecting non-target plants.
- Winter (from first hard freeze to first budding in May): Spray 25% Triclopyr (formulated for oil dilution) diluted in diesel fuel or dilutent oil on cut stumps. Herbicide should be sprayed immediately after cutting. Chemical treatment is most effective at this time of year.
- May to October (between first budding in May, through summer, to hard freeze in fall): Apply 25% glyphosate solution formulated for use over water in high-quality natural areas and in aquatic environments where surface water is present. Herbicide should be sprayed immediately after cutting.

Basal bark treatment

- Apply a band of 6% Triclopyr with oil in diesel fuel or dilutent oil on the lower 10 inches of bark, including the root collar.

Controlled burning

In oak woods with accumulations of oak leaf litter, controlled burning carried by oak leaves can be a successful strategy for controlling small buckthorn plants of an inch or less in diameter that remain after removal of larger buckthorn plants. In stands dominated by red oak and northern pin oak, fire to control small buckthorn works best in the spring when the trees drop their leaves. In stands dominated by white oak and bur oak, late fall after leaves drop is a better time to burn. Once buckthorn has been set back in this way after a couple of years, oak seedlings can be encouraged to grow. If desirable seedlings already exist in an area to be burned for buckthorn control, leaves can be raked or blown away from the seedling to prevent it from burning. Such seedlings can also be wet down prior to the burn.

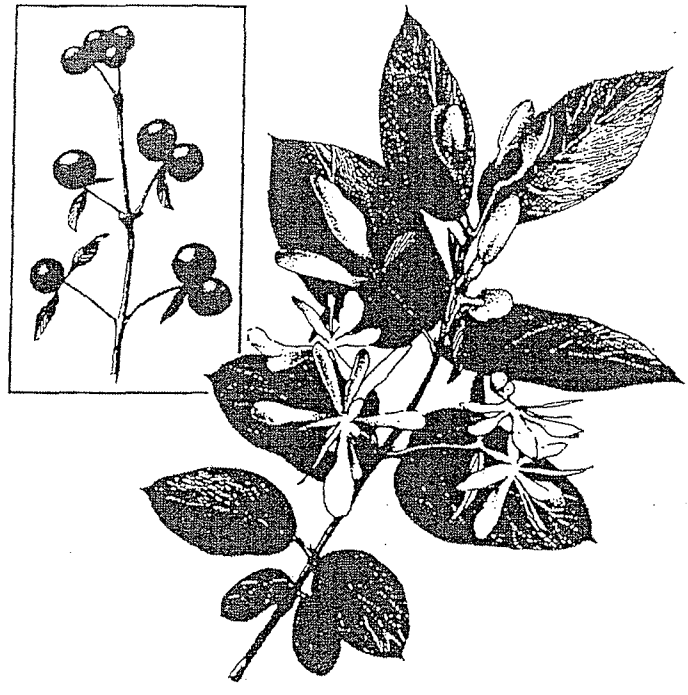
In areas that cannot be burned, buckthorn control may be accomplished by applying Krenite as a bud inhibitor or Garlon 3a as a foliar application. This can be sprayed on seedlings after an explosion of germinating seeds in a recently cleared area.

Long term considerations

Buckthorn is a plant that prefers wooded areas with thin canopies and a moderately high amount of light penetration, such as under the thin canopy of open grown oaks. Areas that are restored to forest structure with heavier tree canopies should have less buckthorn invasion due under the heavier shade. Once removed, buckthorn can be replaced with native shrubs and understory trees, though this may inhibit recruitment of desirable tree seedlings into the canopy. If there is enough light present, a good strategy would be to replace buckthorn thickets with trees such as oaks that need the light to reach the canopy.

Source: Wisconsin Department of Natural Resources, 1997, with additions by the author.

Tartarian Honeysuckle *(Lonicera tartarica)*



Effects of Invasion
Tartarian honeysuckle can live in a broad range of plant communities with varying moisture and shade levels. Woodlands are most affected and are particularly vulnerable if the habitat is already disturbed. The vigorous growth of Tartarian honeysuckle inhibits development of native shrub and ground-layer species; eventually, they may entirely replace native species by shading and depleting soil moisture and nutrients. The early leafing of this species is particularly injurious to spring ephemerals, which have evolved to bloom before trees and shrubs have leafed out.

Size: 3–10 feet in height with a 10-foot spread.
Habit: Upright, strongly multi-stemmed. Upper branches are arched, with the overall effect of a dense, twiggy mass.
Leaves: Smooth, hairless, opposite, simple, smooth beneath, ovate, bluish-green leaves. Leaf development begins early in the spring, before native species.
Stem: Green at first, finally brownish.
Bark: Older stems are shaggy.
Fruit: Red, ¼-inch-diameter berry that colors in late June into July and August.
Flower: Fragrant, tubular pink-to-crimson flowers arranged in pairs.
Origin: Central Asia to southern Russia.
Range: New England south to North Carolina and west to Iowa.

Mechanical Control

- Small to medium-sized plants can often be dug, pulled, or weed-wrenched, especially in spring, when the soil is moist. Mechanical removal can result in profuse re-sprouting of the plant if a portion of the root breaks off and remains in the soil.

Chemical Control

- Cut and apply herbicide to any honeysuckle regardless of size if soil conditions are not appropriate for mechanical control.
- In high-quality natural areas and in aquatic environments where surface water is present, apply an herbicide formulated for use over water.
- Repeat control methods for at least 3–5 years to stop new plants emerging from the seed bank. Underplanting disturbed areas with tolerant native species may hinder reinvasion of Tartarian honeysuckle.

Cut and spray

- May to October (between first budding in May, through summer, to hard freeze in fall): Spray 25% glyphosate solution on cut stumps. Herbicide should be sprayed immediately after cutting. Chemical treatment is generally less effective during the growing season and may have to be repeated on re-sprouts.
- Winter (from first hard freeze to first budding in May): Spray 25% Triclopyr (formulated for oil dilution) diluted in diesel fuel or dilutent oil on cut stumps. Herbicide should be sprayed immediately after cutting. Chemical treatment is most effective at this time of year.
- May to October (between first budding in May, through summer, to hard freeze in fall): In high-quality natural areas and in aquatic environments where surface water is present, apply 25% glyphosate solution formulated for use over water.
- This is a particularly tough shrub to control. Thorough application of at least 25% Triclopyr (Garlon) is recommended to cut stumps. Applications should not be done in the spring. Crossbow is a new herbicide with potential for foliar application on resprouts.

Source: Wisconsin Department of Natural Resources, 1997, with additions from the author.

Poison Ivy *(Rhus radicans)*

Effects of Invasion
Although poison ivy is not harmful to other native flora, it can cause severe irritation to humans. It is commonly found in disturbed areas such as trails, parks, yards, and recreation areas where human contact is most likely to occur.

Habit: Occurs as an upright growing woody shrub or as a vine that climbs the trunks of trees or grows along the ground.
Size: 24 inches in height in the shrub form.
Leaves: Compound with 3 large shiny leaflets that are variable in outline.
Stem: Erect on the shrub form; supported by aerial roots on the vine form.
Fruit: Yellowish-white berries.
Flower: Clusters of up to 25 yellow-green flowers blooming from leafless lateral branches.
Origin: North America.

Mechanical Control

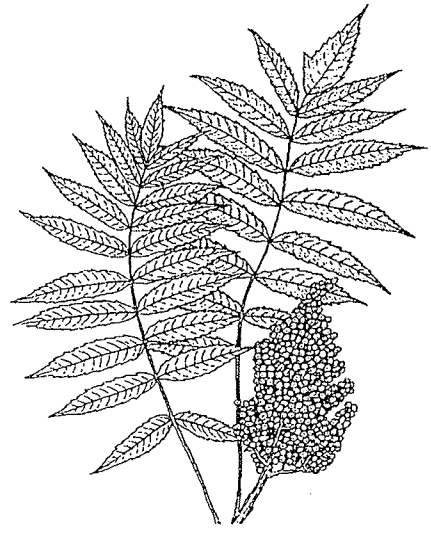
- Uproot individual plants in the fall, either before or after the leaves have fallen. Remove entire root to avoid re-sprouting. Repeat for several years to deplete seed bank. Caution: Wear gloves and protective clothing. Do not compost or burn plants.

Chemical Control

- In the late spring or early summer apply glyphosate or 2,4-D to the foliage with a sponge or sprayer as recommended on the label. Repeat for several years to deplete seed bank.

Source: Wisconsin Department of Natural Resources, 1997.

Staghorn Sumac *(Rhus typhina)*
Smooth Sumac *(Rhus glabra)*



Effects of Invasion
Both smooth sumac and staghorn sumac are opportunistic, native prairie shrubs. These aggressive shrubs occur in clones that spread outward by rootstocks or seeds. Sumac sprouts easily and grows rapidly but requires direct sunlight to persist. Re-sprouts grow rapidly and can reach 3 feet in 1 year. Sumac can eliminate or reduce the abundance of many other species that cannot persist in the shade sumac creates. Sumac grows in a variety of habitats, including disturbed sites, such as abandoned fields, roadsides, and fence rows. Sumac also grows in native communities, such as upland prairies, oak savanna, and oak woodlands and forests. Because sumac is a native species, the management objective is usually to keep sumac under control, not to eliminate it.

Size: 10 feet in height with a spreading crown of dense, multi-stemmed clones.
Habit: A large, loose, open, spreading shrub with a flattish crown.
Leaves: Pinnately compound with 7–31 leaflets that are green on the upper surface and nearly white on the lower surface. Leaves turn brilliantly red in fall.
Stem: Twigs are smooth, stout, angular, and hairless on smooth sumac and highly pubescent on the staghorn sumac.
Bark: Light brown and smooth on young plants. Pubescent on older stems of staghorn sumac. Smooth sumac has smooth bark on both young and old stems.
Fruit: Red drupes develop at the end of the stems in late summer and persist into winter. Each drupe is round, has short hairs, and contains a single seed.
Flower: Dioecious, greenish yellow, June to early July. Female borne in dense hairy panicles, 4–8" long; male in a bigger, looser, wider panicle.
Origin: Quebec to Ontario, south to Georgia, Indiana, and Iowa.

Mechanical Control

- Double-cut (once in July and once in August). Cutting may need to repeat for several consecutive years to effectively control in dense populations.
- Mow with a sickle-bar every year in mid to late July.
- Conduct prescribed burns for prairies in spring, then hand cut stems at ground level in July and August. Sumac will re-sprout after each cutting, but dense vegetation may prevent sumac from receiving enough sunlight, causing leaves to turn yellow and eventually die.
- Mow in mid-summer and conduct spring burns to stimulate herbaceous vegetation.
- Keep small populations under control by conducting prescribed burns every 3–4 years.

Chemical Control

- During July and August apply a 20% concentration of glyphosate to freshly cut stumps.
- Apply oil-based Triclopyr as directed on label to the entire circumference of each stem of the clone; no cutting is done.
- Foliar application of water-based Triclopyr as directed on label or 1%–2% solution of glyphosate in areas with little to no native vegetation.

Caution: The sap of sumac species may cause dermatitis in some people.

Source: Wisconsin Department of Natural Resources, 1997

Quaking (Trembling) Aspen *(Populus tremuloides)*
Big Tooth (Large Tooth) Aspen *(Populus grandidentata)*

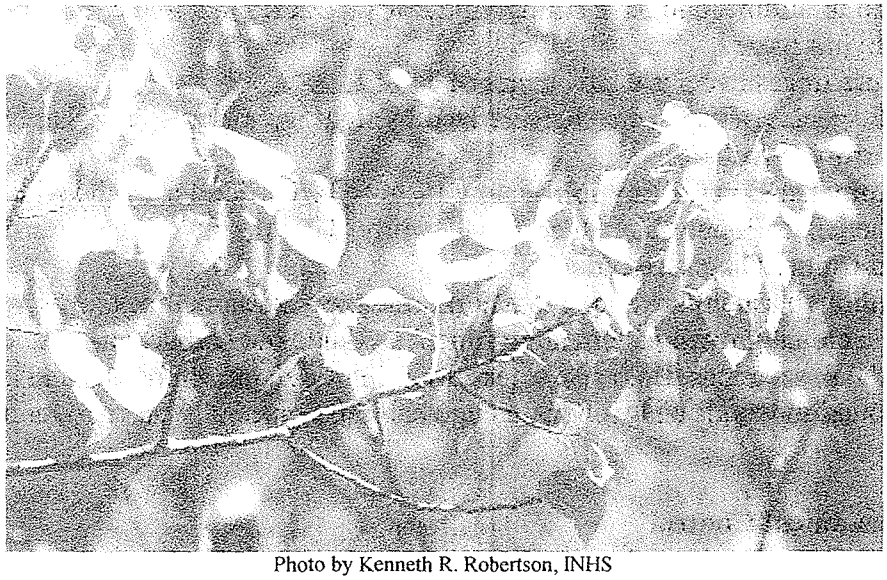


Photo by Kenneth R. Robertson, INHS

Effects of Invasion

Big-toothed aspen is a gap-phase tree of importance in the dry to mesic forests of Minnesota. It requires soil disturbance for establishment, and is usually found in forest gaps created by fires or harvests. The ashes found on burned soil surfaces offer optimal conditions for germination. Quaking aspen is a pioneer invader following forest fires, logging, or other episodes of disturbance.

Both species produce an abundance of wind-dispersed seeds. Aspens flower in March and April; fruit ripens 4-6 weeks after flowering, generally from May to June. The seeds are small, very widely dispersed, and must germinate within a few days of their dispersal. Seedlings grow extremely fast, often at a rate exceeding three feet per year for the first decade. Clones expand radially by sprouting 3-6 feet of shallow, horizontal roots per year, depending on the site. By the time aspen individuals are 20 to 30 years old, their canopies expand and shade out other clones in the stand, thus encouraging fungal diseases to attack the shade-intolerant trees.

Both species have become a concern to some land managers. While they are a natural part of early successional woods, aspens become a problem in prairies that have not been managed with fire for some time. Both species thrive on a wide variety of sites. Typically, quaking aspen is found in moist woods and along streams, while big-toothed aspen grows in comparatively drier soil. Both are found in young woods after disturbance and at the edges of mature woods.

Size: Mature trees are 20 – 50 feet in height
Habit: Viewed from a distance, clonal stands of aspen look dome-shaped: the tallest, oldest individuals inhabit the center and the smallest, youngest shoots grow at the outer

edge of the clonal stand. Individual trees have short, rounded crowns. Branches are slender and slightly drooping.
Leaves: Leaves are alternate and simple with toothed edges. Leaves are broadly ovate to heart-shaped in outline, and have strongly flattened petioles that make leaves tremble even in a slight breeze.
Stem: Mature trees have a trunk diameter of 1 – 2 feet.
Bark: Both species of aspen are characterized by light, green-gray bark that becomes dark and furrowed with age.
Fruit: Cottony hairs on the tiny seeds cause them to be carried far by the wind.
Flower: The genus Populus is in the willow family. That family is characterized by flowers and fruits arranged in catkins.
Origin: Although aspens are native to Minnesota, they are sometimes invasive because their prolific clonal growth pattern allows them to shade out herbaceous species in prairies and oak savannas. Both species are found throughout Minnesota and are normally found in woods and woodland edge habitats, especially on cut over or burned land.

Mechanical Control

- Although it is labor intensive, girdling is most successful in clonal stands where most individuals are larger than 1" in diameter. This method is not effective on young clones that have resprouted. All stems in the clone with a diameter greater than 1" should be girdled. The girdle should be at least 2" wide around the tree to prevent the bark from bridging across the girdle. Girdle aspens in the spring up until leaves reach full size in May or June. It is easiest to separate the bark from the tree at this time. The technique of girdling requires making a cut just through the bark to the outer layer of sapwood. These cuts can be made with a bark spud (made from a sharpened car spring) or a crowbar. On smaller stems, a beveled butter knife may be used. Avoid using saws because they may cut too deeply, thus stimulating resprouting. After making the cut, insert a sharpened bark spud into the natural dividing region between the bark and the sapwood. Rotate the girdling tool around the trunk to remove the bark. Leaving the sapwood intact allows trees to continue pulling water, nutrients, and carbohydrates up from the root system. Removal of the bark prevents the shoots from sending carbohydrates to feed the roots. Roots starve slowly, and the trees usually live for 1 year after girdling. If removing trees, wait until they are completely dead.
- Fire or ill-timed cutting of live aspen can make established clones very difficult to remove, and therefore is not recommended. Aspen responds to stem removal by generating an imbalance of hormones in the roots to promote the formation of root sprouts or suckers. Once the clones have been put into the hormonal "suckering mode," there are no known treatments to prevent their continued production of suckers. However, aspen may be controlled by using fire in August. Frost will kill reprouts.
- Stem cutting is much less effective than girdling, but can be used as a control method. In order to avoid the formation of suckers, cutting must be timed to coincide exactly with maximum leaf-out in mid to late July, when most resources have been translocated to stems and leaves and root resources are at their lowest. This initial cut

must be followed by repeated hand cutting of sprouts in the same growing season or again at maximum leaf-out in subsequent growing seasons. Follow-up cuttings should be made by hand to allow the competing, shade-producing vegetation to remain standing. Ideally, the initial, well-timed cut will cause up to a 50% reduction in stem density. Cutting can be done with loppers, a chain saw, power brush cutters, or a brush hog.

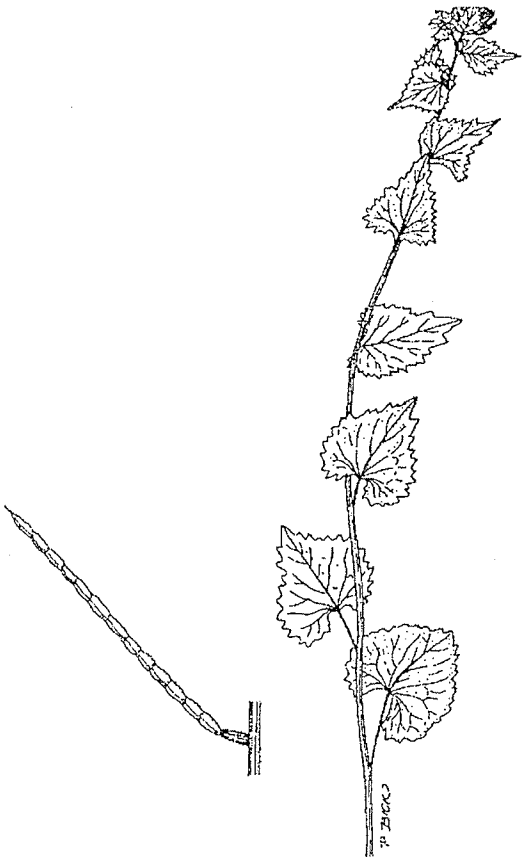
- Cutting can be effective if coordinated with some other mechanical control on sites other than natural areas. A large clone may have the overstory cut, followed by a leveling of the resprouts using heavy site scarification equipment. This has proven to be a cost-effective option in aspen control, but can be damaging to other vegetation in the area.
- Scarifiers such as roller choppers, discs, and root rakes can be used to mechanically control aspen. If possible, a single pass in July should be followed by a second pass in August (after resprouting) for optimal control. Based on field experience, multiple passes during the growing season are more effective than a single pass.

Chemical Control

- Basal injections or basal bark applications of triclopyr to uncut stems are the best means of controlling aspen chemically because application is easy and injury to other species is minimal. Every stem of the clone must be treated. Some damage to surrounding vegetation should be expected with these techniques.
- Young suckers or cut clones can be treated with a wick application of 25% glyphosate active ingredient (a.i.) on the stems, although this method has not proven completely effective. The herbicide 2-4D also works as a foliar application.

Source: Wisconsin Department of Natural Resources, 1999; Illinois Natural History Survey (INHS), 1990

Garlic Mustard *(Alliaria petiolata)*



Effects of Invasion
Garlic mustard is a rapidly spreading woodland weed that displaces native woodland wildflowers. It dominates the forest floor and can displace most native herbaceous species within 10 years. Garlic mustard is a biennial that produces hundreds of seeds per plant. Seeds are dispersed on the fur of mammals, by water, and by humans. The seeds can remain viable for 5 years.

Size: 12–48 inches in height as an adult flowering plant.
Leaves: First-year plants consist of a cluster of 3 or 4 round, scallop-edged, dark-green leaves rising 2–4 inches in a rosette. Second-year plants have alternate, round, scallop-edged, dark-green leaves progressing up the 1 or 2 stems.
Stem: Second-year plants generally produce 1 or 2 flowering stems.
Fruit: Slender capsules 1–2.5 inches long that produce a single row of oblong black seeds with ridged seed coats.
Flower: Second-year plants have numerous small white flowers that have 4 separate petals.
Root: Slender, white taproot with an S-shaped top.
Origin: Europe.

Mechanical Control

- Hand pull at or before the onset of flowering, making sure to remove at least the upper half of the root to eliminate budding at the root crown. This is not recommended for slopes, as it promotes erosion.
- Cut the flower stalk with a weed whip as close to the soil surface as possible just as flowering begins. Cutting before the plant flowers may promote re-sprouting.
- Burn in fall or early spring (before wild flower growth). Burn annually for 3–5 years until depletion of the seed bank.

Chemical Control

- Apply a 1%–2% glyphosate solution to the foliage during the late fall or early spring before wild flower growth.
- Apply a 1% Tryclopyr solution to the rosettes in early spring before wild flower growth.

Source: Wisconsin Department of Natural Resources, 1997, with additions from the author.

Additional Comments:

Biological Control

There are efforts underway in the Minnesota DNR to identify insects for biological control of this exotic plant. It will take several years to test potential control species before they will be released, if they find a good control agent. As with purple loosestrife, biological controls will not eradicate this plant but hopefully will keep the population down enough to allow the establishment of a continuous and diverse herbaceous plant community.

Yellow Sweet Clover (*Melilotus officinalis*)
White Sweet Clover (*Melilotus alba*)

Photo by John M. Randall, TNC

Effects of Invasion:
Sweet clovers are fire-influenced, aggressive, weedy plants that produce populations with high rates of fluctuation. Both species degrade native grasslands by overtopping and shading native sun-loving species. Sweet clovers are members of the legume family.

Both white and yellow sweet clovers are biennials. After germination in late spring or summer, the plants put their energy into developing a healthy root system. Plants are strictly vegetative in the first year and have a small, branched stem with clover-like leaves. First-year plants can be found in late summer. In the second year, plants may be seen in late April or early May. By that time, individuals have a strong taproot and a root crown from which new shoots appear. Plant height is dependent on root development and growing conditions; healthier plants are taller. Sweet clovers flower from late May through September, set seed, and die. Both plants produce small, hardy seeds that remain viable in the soil for as many as thirty years.

Burning produces excellent growing conditions for clover by scarifying seeds and stimulating germination. During the next year following a burn, many flowering plants generally emerge.

Size: In the second year, plants may appear bushy, and grow from three to six feet in height.
Habit: First year seedlings are leafy, green, few-stemmed and around a foot tall. Second year plants generally have three main stout stems arising from the root crown. The 3 – 6 foot plants are conical and bushy.
Leaves: Leaves are alternate, divided into three finely toothed leaflets, with the middle leaflet occurring on a distinct stalk.
Fruit: The legume is ovoid, leathery and wrinkled, longer than the calyx, and scarcely dehiscent, with one or two small seeds.
Flower: Yellow and white sweet clovers appear very similar except for the distinguishing yellow or white flowers. Yellow sweet clover is usually smaller than white sweet clover and blooms earlier. The flowers are packed densely on the top four inches of an elongated stem. Each small flower is attached to the stem by a minute stalk.
Origin: Sweet clovers are native to Europe and Asia. They were brought to North America in the late 1600's as an agricultural crop for forage and honey production. These clovers also fix nitrogen, and thus became popular as soil enhancers. The chemical used in the production of the blood thinner Warfarin was first discovered in sweet clover. Due to the economic values of white and yellow sweet clover, these species will continue to be planted despite the problems they pose for land managers.
Both species are found in all fifty states, although they are most frequently found in the states of the Upper Midwest and Great Plains. Sweet clovers grow well in direct sunlight or in partial shade. Neither species can tolerate complete shade. Sweet clovers seem to prefer calcareous or loamy soils, and are most frequently found in open, disturbed, upland habitats such as prairies, savannas, and dunes.

Mechanical Control
On grasslands managed with prescribed burning, it is possible to greatly reduce sweet clover by burning two years in a row. Burning should be done early the first year (before green-up--usually in early to mid-April) to stimulate germination. The burned area should be checked in late summer for first year plants. If plants are found, another burn should be conducted the next year in early to mid May. If burning is conducted before the buds are developed, the plants will resprout. Heavily infested areas may need this burning sequence repeated after a few years. The fire may be of low intensity--just enough to touch the stems. Damaged plants wither quickly if they are not completely destroyed by fire. For small patches or those areas not completely burned, a flame gun (torch) may be used when the vegetation is damp to avoid burning surrounding prairie. Another burning strategy is to mow later in the summer, allow the cut plants to dry, and then burn. This can be stressful to the native vegetation and should not be done annually.
Small amounts of sweet clover can be controlled by hand-pulling in late fall after first-year plant root-crown buds have developed, or in May or June before second-year plants flower. Pulling is easier when the soil is wet. Plants can also be cut at ground level with brush loppers. If pulling is tried too early, many plants may be missed, and those with succulent stems may break off and resprout. But pulling must be done before seeds are set; otherwise cut plants will have to be removed from the natural area. It is necessary to inspect the area a couple of times in summer for late flowering plants.

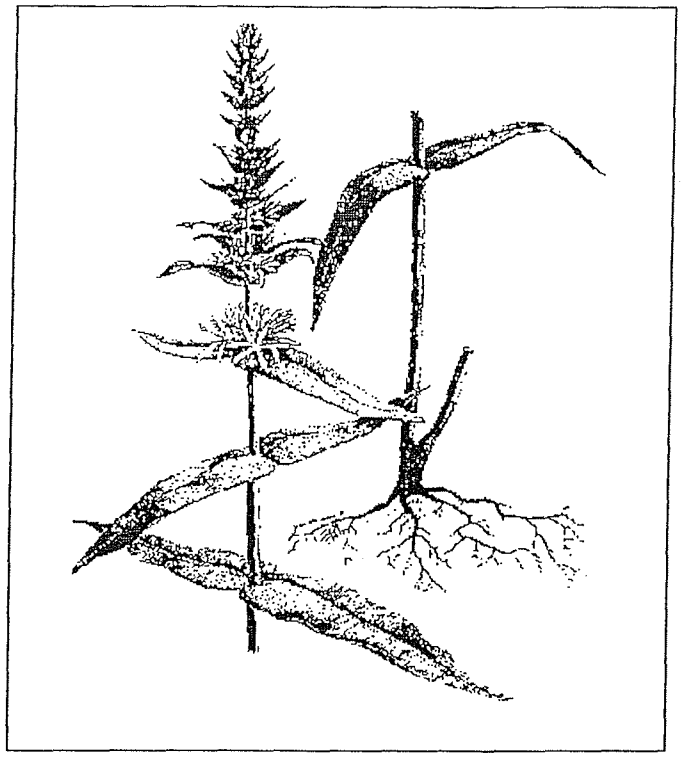
For very dense small patches, cutting with a power brush-cutter using a heavy duty saw blade is effective. The stand should be cut just before flowering, and checked a week later for individuals missed or partly cut.
It is necessary to conduct annual inspections to remove scattered individual plants. Disturbed areas such as fox dens provide habitats that can allow sweet clover to greatly increase over time if not controlled. Habitats adjacent to managed areas should also be inspected to reduce sweet clover invasion on managed sites. Due to the long viability of sweet clover seeds (up to 30 years) and continued agricultural use, these plants generally must be managed on a continuous basis.

Chemical Control

Sweet clover can be managed using mechanical controls, and should not require chemical use.

Source: Wisconsin Department of Natural Resources, 2002; The Nature Conservancy, 2002

Purple Loosestrife *(Lithrum Salicaria)*



Effects of Invasion
Purple loosestrife spreads mainly by seed, but it can also spread from roots or stems. A single stalk can produce 100,000–300,000 seeds per year. Sunny and partly shaded wetland is susceptible to invasion. Purple loosestrife generally builds up a large seed bank in the soil for several years before becoming dominant. After disturbance, loosestrife can spread rapidly, eventually taking over entire wetlands. Purple loosestrife degrades wetlands by displacing native wetland vegetation and decreasing habitat for wildlife species.

Habit: Purple loosestrife is a perennial herb 3–7 feet tall with a dense bushy growth of 1–50 stems.
Size: 3–7 feet tall.
Leaves: Leaves are opposite, nearly linear, and attached to 4-sided stems without stalks.
Stem: Stems range from green to purple.
Flower: Flowers vary from purple to magenta, have 5–6 petals and are aggregated into numerous long spikes. Flowering occurs from July to September.
Origin: Europe.

Mechanical Control
Small young plants can be hand pulled while older plants can be removed with a shovel. If possible, entire root systems should be removed to prevent re-sprouting. Soil

disturbance should be minimized to prevent seedling establishment. Plants should be controlled before the onset of seeds around the first week of August or seeds should be cut and bagged. Plant parts should be dried and disposed of accordingly. Follow-up treatments are recommended for at least 3 years after removal. Mowing and burning have not been effective with purple loosestrife. However, water-level manipulation has been successful. Water levels are reduced until loosestrife has sprouted, then levels are increased until stems are drowned.

Biological Control

Biocontrol is currently considered the most viable option for purple loosestrife control. Several natural insect enemies of purple loosestrife from Europe have been introduced. A species of weevil (*Hylobius transversovittatus*) lays eggs in the stem and upper root system of the plant and its larvae eat root tissue. In addition, two species of leaf-eating beetles (*Galerucella calmariensis* and *G. pusilla*) and a weevil that feeds on flowers (*Nanophyes marmoratus*) are being used. These insects almost exclusively feed on *Lythrum salicaria* and not native plants. The insects generally do not eradicate loosestrife but reduce the population to a state where it does not dominate native habitats.

Recent data show that we will never eradicate purple loosestrife from the area by using biocontrol agents alone (Skinner, pers. comm.). Once well established, the insects will have a cyclical, boom and crash population following expansion and contraction of the loosestrife population. Once the insects have eaten down existing loosestrife, the insect population will crash. Purple loosestrife, a prolific seed producer, will eventually recover from the seed bank. After a short lag, the biocontrol insect population will also recover and then knock back the purple loosestrife population again. The insects move around and once established within the nature center, they should also eventually find other purple loosestrife stands. Their dispersal could be aided by collecting and moving insects. In spite of the boom and bust cycle of purple loosestrife under biological control, native wetland plants cover has increased greatly in experimental trials. Hand pulling of purple loosestrife while it is in flower is effective in conjunction with biological control.

Chemical Control

Glyphosate is the most common chemical used for killing purple loosestrife. The formula designed for use on wet or standing water sites should be applied in late July or August. A 1% active ingredient (a.i.) solution should be used, and only 25% of the foliage of each plant needs to be covered. Glyphosate mixed to 3%–10% solution can also be used on freshly cut stems (this is effective on larger plants in areas of low loosestrife densities). Cut stems should be removed from the site and disposed of appropriately. Triclopyr formulated for water dilution is an effective herbicide for loosestrife. This broadleaf herbicide does not harm sedges or monocots. Foliar application should cover nearly all of the foliage.

Source: Wisconsin Department of Natural Resources, 1997, with additions from the author.

Kentucky Bluegrass (*Poa pratensis*)
Canada Bluegrass (*Poa compressa*)

(c) John M. Randall/The Nature Conservancy

Effects of invasion: Because bluegrass grows early in the season (when most other species are still dormant), it can spread very quickly. However, its shallow root system makes it susceptible to high soil temperatures and low soil moisture. Bluegrass has successfully invaded both remnant and restored prairies, savannas, and barrens. Establishment can be attributed to intentional introduction, past mowing, grazing, or cessation of fire. If left unattended, bluegrass can out-compete native prairie grasses and forbs, and will dominate shaded areas resulting from woody species invasions.

Description: Most of the cool season grasses that begin growing early are not native to Wisconsin prairies. Bluegrass can be distinguished vegetatively from other early grasses by its narrow blade, which is V-shaped in cross section, and by the leaf tip, which is shaped like the bow of a boat. Kentucky bluegrass is distinguished from Canada bluegrass by the shape of the stem. In Kentucky bluegrass the stem is round; Canada bluegrass has a flat stem. Their effects on the natural systems are equivalent and therefore should be treated as one problem. Many of the other cool-season European grasses (brome, timothy, orchard grass, quack grass, etc.) have similar growth habits and can be controlled using the techniques discussed below.

Distribution and habitat: Kentucky bluegrass was introduced as a cultivar from Europe, and has been bred into multiple cultivars since its introduction. Because of its extensive use for lawns and in pastures, it is common in most grasslands, even those managed for native species. Canada bluegrass is also naturalized from Europe. Kentucky bluegrass is a common lawn and pasture grass. Canada bluegrass is often mistaken for Kentucky bluegrass, but is distinguished by forming extensive sods in dry, sterile soils (especially acidic soils) that cannot sustain the more common Kentucky bluegrass. Kentucky

bluegrass is usually found on more mesic and fertile soils, although it will grow on dry neutral or alkaline soils.

Mechanical Control

A controlled fire can dramatically reduce bluegrass in a native or planted prairie, savanna, or barrens. Fire will also set back the woody species whose shade encourages the proliferation of cool-season grasses. In southern Wisconsin, a late April or early May burn will destroy three to eight inches of new growth. Timing of burns may change on a year-to-year basis depending on weather conditions. Observing bluegrass growth is essential for effective control by burning. Fire is most effective when bluegrass is three to eight inches high. Burning at this time kills new growth and removes accumulated leaf litter. Burning off the moisture-retaining blanket of leaf litter increases stress on the shallow-rooted bluegrass by exposing the darkened surface to the sun. This helps reduce the competitive ability of bluegrass by encouraging summer dormancy and decreasing the chance of flowering and seed production. The effect is most pronounced on dry prairies and barrens. Burning can reduce bluegrass by more than 90%, but it is rarely 100% effective. Burning at the right time also improves the competitive advantage of native, warm-season grasses and forbs. Native species emerge later and benefit from the elimination of duff and a darkened soil surface.

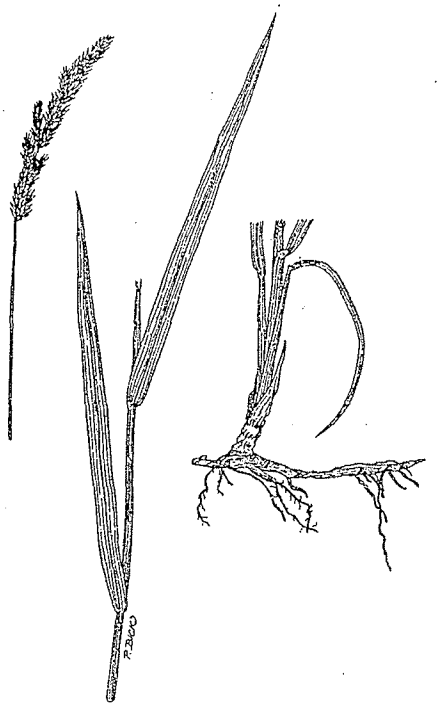
When converting areas dominated by cool-season grasses into prairie, it is helpful to reduce the grass cover and seed bank before planting native seeds. This can be accomplished by any combination of tilling, smothering the grass, or applying herbicide. Till several times a year for at least one season to expose the seed bank and prevent further growth of the grass sod. Herbicide use followed by a season of tilling is also effective. On small sites, grasses can be killed by covering with black plastic or layers of newspapers during the growing season.

Chemical Control

Herbicide use is not recommended to control bluegrass on grasslands or savannas where there are native prairie plants. However, herbicide may be required on severely degraded areas or where prairie restoration is beginning. In such cases, the herbicide glyphosate has proven effective when used according to label applications.

Source: Wisconsin Department of Natural Resources, 2002

Reed Canary Grass *(Phalaris arundinacea)*



Effects of Invasion
Reed canary grass reproduces by seed or creeping rhizomes and spreads aggressively. It prefers disturbed areas but can easily move into native wetlands. In less than 12 years, reed canary grass can form large, monotypic stands that harbor few other plant species and therefore are of little use to wildlife. Reed canary grass dominates an area by building up a tremendous seed bank that can eventually erupt, germinate, and recolonize treated areas. Reed canary grass is difficult to eradicate; no single control method is universally applicable.

Size: 2–9 feet in height.
Habit: A large, coarse, cool-season, sod-forming, perennial wetland grass. Sprouts early in spring, forming a thick rhizome system that dominates the subsurface soil.
Blades: Erect, hairless stem with gradually tapering leaf blades 3.5–10 inches long and .25–.75 inches wide. The ligule is highly transparent.
Panicles: Compact, erect or slightly spreading (depending on the plant's reproductive stage), ranging from 3–16 inches long with branches .5–1.5 inches long.
Flowers: Single flowers occur in dense clusters in May to mid-June. They are green to purple, changing to beige over time.
Seeds: Shiny brown.
Origin: Eurasia and North America.

Mechanical Control

- Small, discrete patches may be covered by black plastic for at least one growing season then seeded with native species. This method is not always effective and must be monitored because rhizomes can spread beyond the edge of the plastic.
- Prescribed burns in late spring or late fall may help reduce the population if repeated annually for 5–6 years. The application of 1.5% glyphosate solution will "brown off" reed canary grass enough to conduct burns. A late spring burn followed by mowing or wick application of glyphosate to the emerging flowering shoots will eliminate seed production for that year. Burning is ineffective in eliminating dense stands of reed canary grass that lack competition from native, fire-adapted sepias in the seed bank.
- Mowing twice yearly (early to mid-June and early October) may help control reed canary grass by removing seed heads before the seed matures and by exposing the ground to light, which promotes the growth of native wetland species. Discing the soil in combination with a mowing or burning regimen may help by opening the soil to other species.
- Hand-pulling or digging may work on small stands in the early stages of invasion.
- A bulldozer can be used to remove reed canary grass and rhizomes (12–18 inches deep), after which native species should be seeded. Discing or plowing can also be used in this way.
- Repeated cultivation for one full growing season followed by dormant seeding near the first-frost date. Combine with spot herbicide application in sections too wet for early or late cultivation.

Chemical Control

Cut and spray

- Tie the stems of small clones together just before they flower, then cut them and apply glyphosate in a 33% solution to the cut stems.
- Perform foliar application of a 5% glyphosate solution designed for use in wetlands in early spring when most native species are dormant to the foliage. Remove the dead leaves from the previous year before applying herbicide. Two herbicidal applications may be necessary to ensure complete coverage. Mow in mid-September then apply herbicide in October (after big bluestem is dormant).
- Perform wick application of a 5% glyphosate solution designed for use in wetlands in the first to third weeks of June, followed by a late June to mid-July burn. This technique reduces reed canary grass cover, depletes the seed bank, and stimulates native seed banks.
- In non-aquatic environments, apply Dalpon and trichloracetic in late fall or early winter at a rate of 20lbs.–40 lbs./acre on dried foliage.

Source: Wisconsin Department of Natural Resources, 1997.
Minnesota Department of Natural Resources, 1995.

Appendix D: Resources

Minnesota Department of Natural Resources (DNR)

Division of Wildlife:

Diana Regenscheid, Area Wildlife Manager
7151 190th Street West, Jordan, MN 55352
(952) 492-5266
diana.regensheid@dnr.state.mn.us

Division of Ecological Services:

Hannah Dunevitz, Regional Plant Ecologist
(expertise in native plant communities, rare species, resources for conservation)
1200 Warner Rd., St. Paul, MN 55106
(651) 772-7570
hannah.dunevitz@dnr.state.mn.us

Division of Forestry:

Richard Peterson, Forest Legacy Program Coordinator
(expertise in direct seeding of trees)
1810 NW 30th St., Faribault, MN 55021
(507) 333-2012
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Lillian Baker, Area Forester
1200 Warner Rd, St. Paul, MN 55106
(651) 772-7579
lillian.baker@dnr.state.mn.us

University of Minnesota Landscape Arboretum

Julia Bohnen, Wetland Restorationist
3675 Arboretum Dr.; Chaska, MN 55318
(952) 443-1400 x1498
julia@arboretum.umn.edu

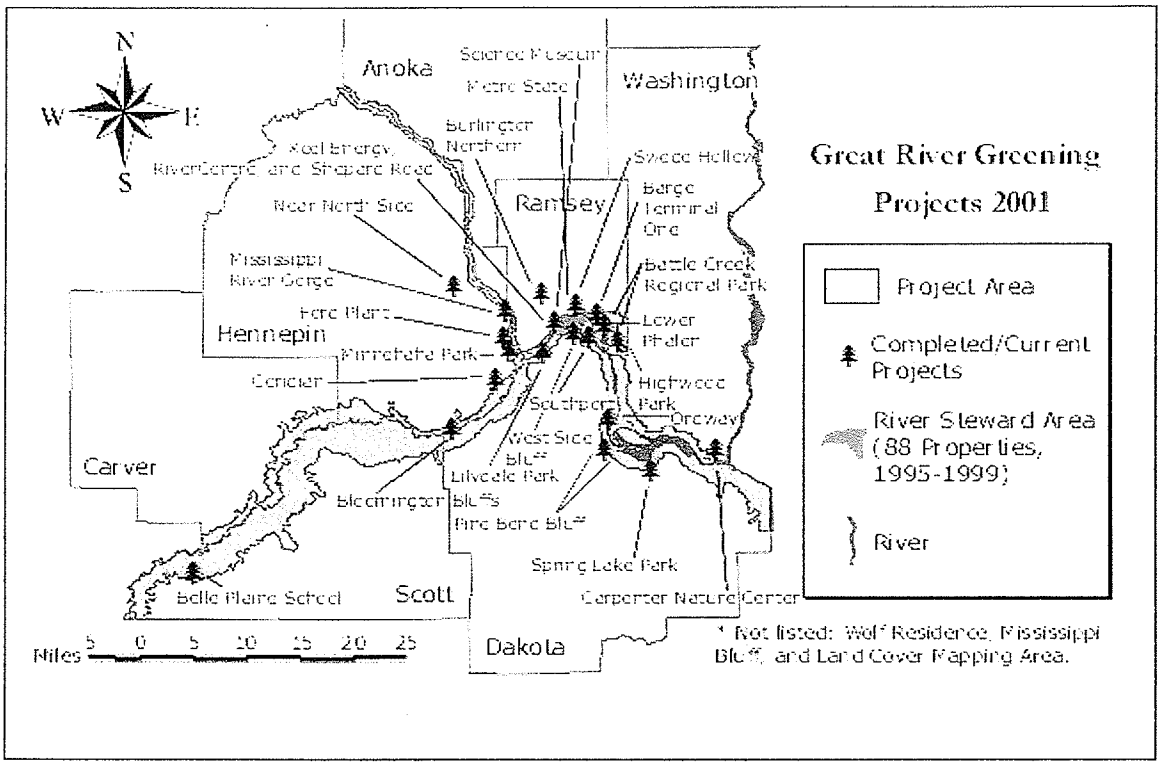
Dakota County

Soil and Water Conservation District

Jay Riggs, Urban Conservationist
(expertise in erosion and sedimentation control; GIS; conservation programs)
4100 200TH St. W.; Suite 102; Farmington, MN 55024
jay.riggs@co.dakota.mn.us

Appendix E: Great River Greening

Helping communities restore, manage and learn about their natural environment through volunteer involvement.



The Challenge

Erosion, trash, and the invasion of exotic and invasive plant species are degrading our urban river valleys, reducing ecological diversity destroying wildlife habitat. Many public and private organizations are working to protect the river valleys, but these programs often lack long-term community involvement and stewardship.

These problems are especially pressing in the Twin Cities metropolitan region, home to more than 2 million people. The river valleys in this area:

- Hold some of the region's last intact native landscapes
- Serve as vital wildlife corridors for hundreds of migratory bird species
- Provide a water source for millions of the region's residents
- Contain some of the region's most scenic sites and vistas

Great River Greening's response

Great River Greening, a nonprofit organization, helps coordinate a cost-effective and sustained effort to manage ecosystems of the three great river valleys of the metropolitan area: the Mississippi, Minnesota and St. Croix. We are primarily an implementing organization, providing on-the-ground ecological restoration and management of both public and private land. We engage thousands of volunteers in the planting of native

vegetation, removal of exotic and invasive weeds, native-seed collection, and stewardship—work that cultivates an informed and involved citizenry. We also act as a catalyst, creating effective partnerships among agencies, municipalities, and private landowners responsible for managing river valleys and their natural resources. Restoration ecologists and other scientists provide technical expertise.

Key values

Great River Greening bases its work on these values:

1. Native trees and other vegetation have ecological and sociological value: They contribute to the health and biodiversity of ecosystems; they beautify surroundings; and they enhance a community's natural heritage and sense of place.
2. People want opportunities for direct involvement in natural resource protection and management, which help them feel connected and committed to their local natural areas.
3. Volunteer involvement in restoration and planning is one of the most effective methods of environmental education. When people work side by side to improve their environment, their communities become stronger and more vital.
4. Environmental restoration and stewardship require collaboration and inclusiveness.

We are committed to:

- ☐ Citizen-based restoration, stewardship and education
- ☐ Ecologically sound implementation and evaluation
- ☐ Collaboration to help advance ecosystem-based management
- ☐ Long-term stewardship.

Accomplishments—highlights

Since 1995, Great River Greening has involved more than 10,700 volunteers in the planting of 35,000 trees and shrubs and 16,000 wildflowers and grasses, as well as exotic-species removal, prairie-seed collection and broadcasting, plant inventories, training programs, and ongoing stewardship. In 2000 alone, we organized 30 events attended by nearly 1,500 volunteers!

We've also provided design and ecological consulting for numerous groups, including the city of Saint Paul Parks and Recreation Division, the Saint Paul Port Authority, the Science Museum of Minnesota, River Center, and the Greater Minnesota Housing Fund.

Great River Greening's major partners

City of Saint Paul · Friends of the Minnesota Valley · Friends of the Mississippi River · Metropolitan Council · Minneapolis Park and Recreation Board · Minnesota Department of Natural Resources · National Park Service · Ramsey County Parks and Recreation · Saint Paul Audubon Society · Trust for Public Land · U.S. Fish and Wildlife Service · Private landowners

To Contact Us

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