

COTTAGE GROVE RAVINE REGIONAL PARK

NATURAL RESOURCE MANAGEMENT PLAN



Ravine Lake from the southeast.

Prepared for:
South Washington Watershed District
and
Washington County Parks Division

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EXECUTIVE SUMMARY

In 2017 an updated master plan was developed for Cottage Grove Ravine Regional Park (SRF Consulting Group, Inc., 2017). As a comprehensive plan, it provides an overview of existing park conditions and a general framework for ecological restoration, along with many other recreational features and plans for the park. This natural resource management plan focuses on the improving the ecological features of the park, as described in the master plan, by restoring native plant communities for wildlife habitat, biodiversity, carbon storage, and climate resiliency. This plan provides details on the existing ecological conditions throughout the park, summarizes the restoration projects that have occurred, and provides recommendations for expanding restoration efforts, including detailed methodology, cost estimates, and long-term monitoring.

Friends of the Mississippi River (FMR) prepared an ecological restoration plan for the southern half of Cottage Grove Ravine Park in 2013. Since then, FMR and Washington County Parks have obtained grant funds, primarily from the Outdoor Heritage Fund, and undertaken restoration projects on 220 acres of the park. The current 2021 plan was written for the entire 522-acre park and was funded by the South Washington Watershed District.

The park provides important assets for wildlife due to its relatively large size, its location within a corridor of connected natural areas, and its proximity to the Mississippi River. The south half of the park was ranked by the Minnesota Department of Natural Resources (DNR) as moderate biological diversity. It is located within the Metro Conservation Corridors, a regional land protection plan of the DNR that identifies ecologically important areas, and is adjacent to an Important Bird Area, a global designation of the Audubon Society. Three rare species, blundings turtle (*Emydoidea blandingii*) (threatened), lark sparrow (*Chondestes grammacus*) (special concern), kittentail (*Besseyia bullii*), (threatened) have been recorded at the park but all records were at least 10 years old. The park is ranked by The Nature Conservancy as “average” to “more” resilient to climate change, indicating good potential for restoration.

Prior to European settlement, most of park and surrounding area was probably savanna. Today it is almost entirely oak woodland and forest, with some sizable grasslands in the southwest and northeast and other scattered patches. Several small relict prairie patches occupy woodland openings on south-facing slopes, and native prairie species were found in a few of the grasslands. Most areas are degraded by a dominance of non-native invasive species – buckthorn and garlic mustard in wooded areas, smooth brome in the grasslands, and reed canary grass in the wetlands. Restoration to the pre-settlement condition is not recommended over most of the site because it would be to detrimental to wildlife and too costly. Succession has been occurring for too many decades and most of the former savanna is now established oak forest or woodland.

The top priority units for restoration are the 188 acres where management is underway. The next priorities were to restore native prairie to the grassland units, especially those that retain some native prairie relicts, and those of the largest acreage. Invasive woody removal throughout the park is a high priority, especially in the northernmost oak forest units, which

are the largest unmanaged wooded area. So while some areas are low priority for full restoration, invasive woody removal will be prioritized as funding becomes available.

The total top priority units are 267 acres, including the 188 acres under current management. The restoration goals are 207 acres of oak forest restoration, 10 acre savanna, 44 acres prairie, and 6 acres of native prairie management. Restoration of the oak woodland units will primarily entail invasive shrub removal, prescribed burning, follow-up herbicide, and overseeding. Savanna restoration in oak forested units will include removal of invasive woody trees and shrubs, plus intensive tree harvest to release existing bur oaks, follow-up site preparation and seeding. Restoration of the grasslands to savanna and prairie would include prescribed burns, herbicide treatment, mowing, and seeding and planting. The savanna and prairie restoration processes will take one to two years for site preparation and three to five years for follow-up establishment.

The estimated restoration costs for the top priority units for three to five years is \$592,000, which is about \$2,200 per acre. Friends of the Mississippi River expects to have approximately \$150,000 from the Outdoor Heritage Fund for restoration and management in 2022 and 2023. Those funds can be used to addressed all of the existing managed areas, plus expansion into about 30 acres.

INTRODUCTION

This Natural Resource Management Plan builds on the ecological restoration and management recommendations of the 2017 Cottage Grove Ravine Regional Park Master Plan for the park. Based on the detailed site evaluation and vegetation surveys to assess the ecological condition of the plant communities, adjacency to other priority areas within the park, and the restoration potential, this plan identifies the highest priority areas to restore and provides specific details on how to proceed. This plan includes the entire 522-acre¹ Cottage Grove Ravine Regional Park; it replaces the 2013 plan completed by Friends of the Mississippi River (FMR) that applied to only the 300-acre south half of the park.

Cottage Grove Ravine Regional Park was established as a local park in 1969 and was incorporated into the Metropolitan Regional Parks system in 1974. It has been managed by Washington County Parks (WCP) for recreational purposes, with an extensive hiking/skiing trail system, new visitor building, and fishing piers. While the park had lakeshore management and other modest projects over the years, the native plant communities throughout the park had little significant management until 2015, when FMR obtained grant funds from the Outdoor Heritage Fund (OHF), as part of the Clean Water, Land and Legacy Amendment, and began management and restoration on about 35 acres, including native prairie remnants. WCP received OHF funds the following year and expanded the restoration by 100 acres. FMR added another 30 acres in 2018, and 55 acres in 2021, primarily with funding from the OHF. The total acres under restoration as of 2021 was 220.

The main feature of the park, for which it was named, is a long north-south ravine that carves through the southern part of Washington County, terminating at the Mississippi River. The biggest attraction the park, however, is the lake, which receives runoff and groundwater flow from the surrounding hills and from the ravine to the north. The lake has no permanent inlet stream but does have an outlet stream that carries continuous flow to the river.

The terrain of the park includes steep hills that flank the ravine and lake, leveling off to the east and west sides. Prior to European settlement, the vegetation at the park was described as “oak openings and barrens” as well as prairie. Oak openings and barrens includes intermixed savanna, grassland and woodland. Prairie would have dominated south-facing slopes on sandy soils, and other upland areas where fire would have been common, especially the more level hilltops. Low areas and ravines were more fire-protected and would have been more forested. The lake and associated wetland areas were likely similar to present day. The plant communities throughout the property were altered by many decades of agricultural uses, lack of natural fire, and invasion of non-native species. Vegetated cover is currently dominated by oak woodland, grassland, and other altered areas of mixed grasses and trees.

This plan was developed to:

- Evaluate the existing condition of natural communities in the project area
- Identify target natural communities and restoration goals

¹ The park acreage is based on the park boundary shapefile provided by the county. This acreage differs from what is presently shown on the county website or other documents.

- Describe methods for achieving target communities
- Identify opportunities to engage the local community in volunteer activities

Ecological Management Goals for the Property

When conducting ecological restoration at site, the pre-European condition (mid-1800's) is typically used as a guideline, but it is not necessarily the desired goal in all cases, depending on how far ecological succession has progressed and what other cultural goals there may be for the site. The over-arching goal for the Ravine Park is to restore ecological functions to the native plant communities as much as possible. Specific ecological goals are to:

- Restore a complement of native plant communities
- Improve wildlife habitat
- Increase biological diversity
- Increase habitat resilience to shifting climate conditions
- Enhance and expand the ecological functions of the property and of the larger Metro Conservation Corridor

SITE INFORMATION

PROPERTY INFORMATION

Site name, address, city/township, county, and phone

Cottage Grove Ravine Regional Park
9653 Keats Ave. S.
Cottage Grove, MN 55016

Acres: 522

Township, range, section: T27N, R21W, portions of sections 14, 22, 23, 26, 27

Watershed: South Washington County, East Ravine subwatershed

Watershed Management Organization: South Washington Watershed District

Element occurrence: One record of blanding's turtle (*Emydoidea blandingii*) in 2002, and one population of kittentails (*Besseyia bullii*) in 2000, both of which are state threatened. One record of lark sparrow (*Chondestes grammacus*) from 2012, state threatened. None of these was re-located in 2021. Important plant communities documented in 1987 were: dry sand-gravel prairie and northern bulrush-spikerush marsh. Both were degraded in 2021. Element occurrences are discussed in more detail in the [Rare Features section](#).

LANDSCAPE CONTEXT AND CLIMATE RESILIENCE

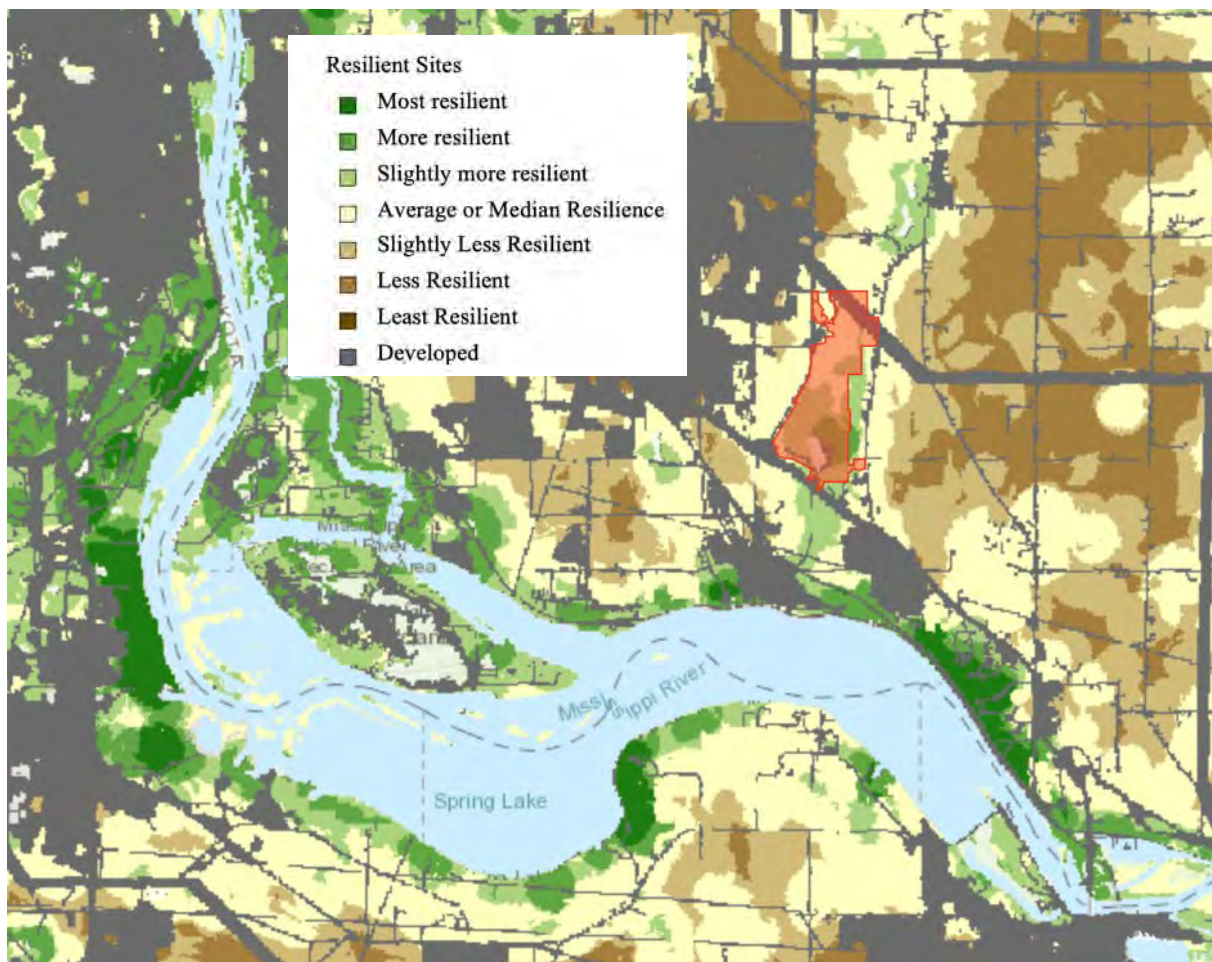
Cottage Grove Ravine Regional Park lies within the Metro Conservation Corridors, a regional land protection plan of the Department of Natural Resources (DNR) ([Map 2](#)). The corridors identify natural connections across the landscape, which are critical for the movement of plant and animal species. The site is especially significant for its proximity and connectivity to the Mississippi River, about 1.2 miles to the south, to which it is linked via the stream that drains from Ravine Lake and via the forested corridor surrounding that stream at the 3M property to the south. The Mississippi River corridor through the Twin Cities Metropolitan area is an Important Bird Area, a global designation of the Audubon Society. It is a migratory corridor for 40 percent of North American Waterfowl, and for dozens of other species. Ravine Park lies just outside of the IBA, but is an important connection to that system, providing valuable resting and breeding habitat for many bird species.

Most of the southern half of the park was classified by the DNR in 1990 as moderate biodiversity significance, indicating the site has been impacted by past uses but still provides very good native habitat. By the time major restoration work began in 2015 the ecological conditions at the park had deteriorated significantly from invasive species. But the overall structure was still intact and restoration potential was high.

Further evaluation of the landscape context of the park was available by applying the [Resilient Land Mapping Tool](#) developed by The Nature Conservancy (TNC). According to the website, “A site’s Resilience Score estimates its capacity to maintain species diversity and ecological function as the climate changes. It was determined by evaluating and quantifying physical characteristics that foster resilience, particularly the site’s landscape diversity and local connectedness. The score is calculated within ecoregions based on all cells of the same geophysical setting and is described on a relative basis as above or below the average.”

Overall Ravine Park scored average for resilience, local connectedness and landscape diversity. However, different areas within the park scored higher than others. The dark and light green areas on the map (Map 1) were areas of above average (shown as “more resilient”) and slightly above average resilience. This was due in large part to the diverse topography of the site and associated microclimates.

MAP 1. CLIMATE RESILIENCE

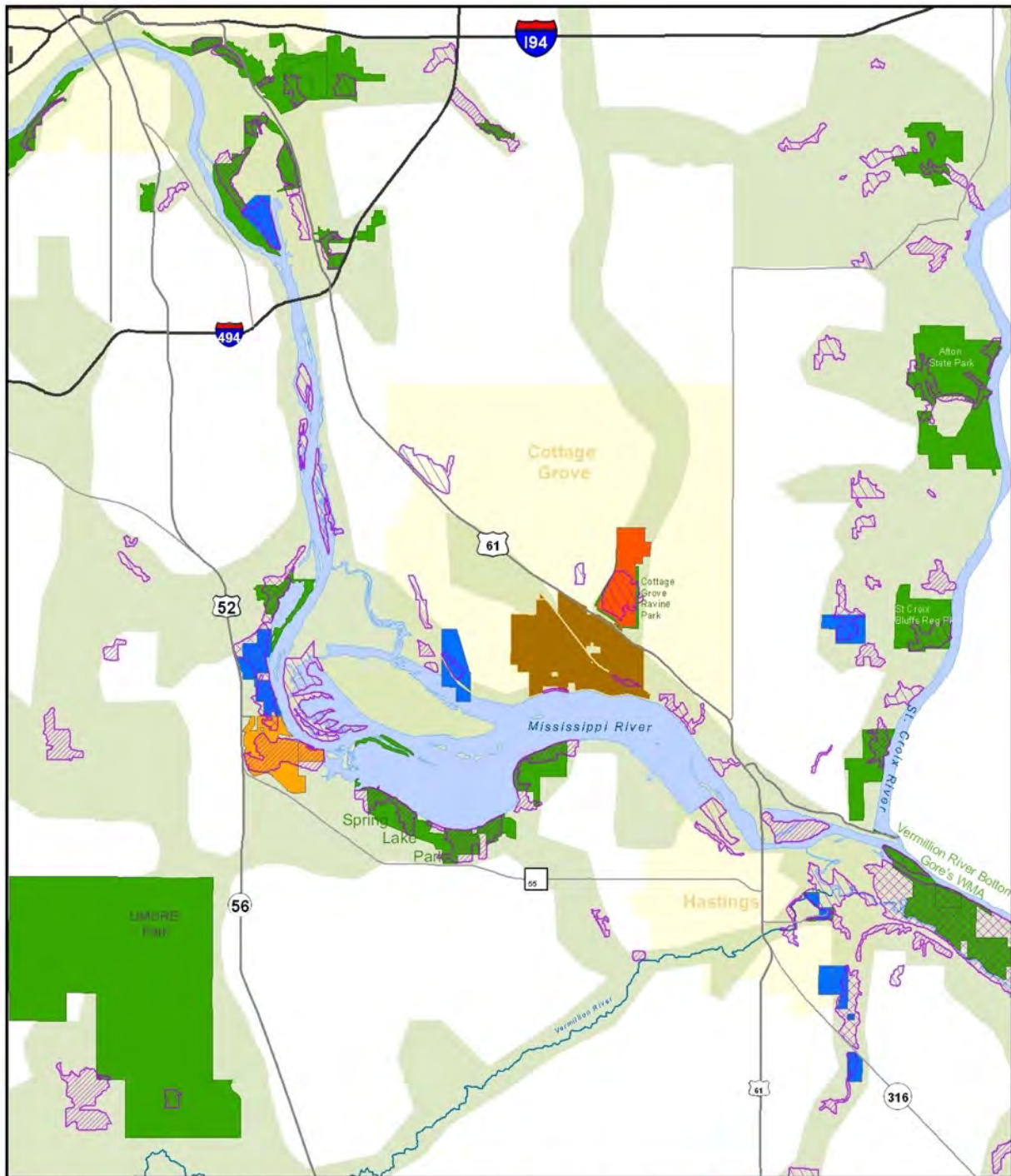


The site also scored high-average to high for climate flow. Climate flow refers to “the gradual movement of populations in response to changes in the climate. This analysis highlights

connections that are important for population movement because they are connected with natural cover and track climatic gradients to provide climate relief (upslope, northward, riparian). High current flow indicates areas of concentrated flow where movements will accumulate or be channeled through a pinch point. Average current flow indicates areas of moderate flow; often highly natural settings where species movements are diffuse. Low current flow indicates areas with low permeability where movement may be blocked” (TNC 2016).

The TNC map shows that the park stands out as a natural area in a largely urban and agricultural landscape. This highlights the importance of the park for wildlife habitat and connectivity to the Mississippi River, but also demonstrates its vulnerability and susceptibility to invasive species, climate change and other threats. In the face of ever mounting threats, the need to protect, improve and restore the ecological functions of the native plant communities at this park become more pressing.

MAP 2. LOCATION AND LANDSCAPE CONTEXT



Source: DNR data deli, DNR Natural Heritage database.



4/17/12

1:149,239

1 0.5 0 1 2 Miles



Biodiversity significance

- Outstanding
- High
- Moderate

- Cottage Grove Ravine Park
- Scientific & Natural Areas
- Parks, WMAs, SNAs
- 3M property
- Metro Conservation Corridors
- Flint Hills Resources

SITE GEOLOGY

Geologic formation and bedrock

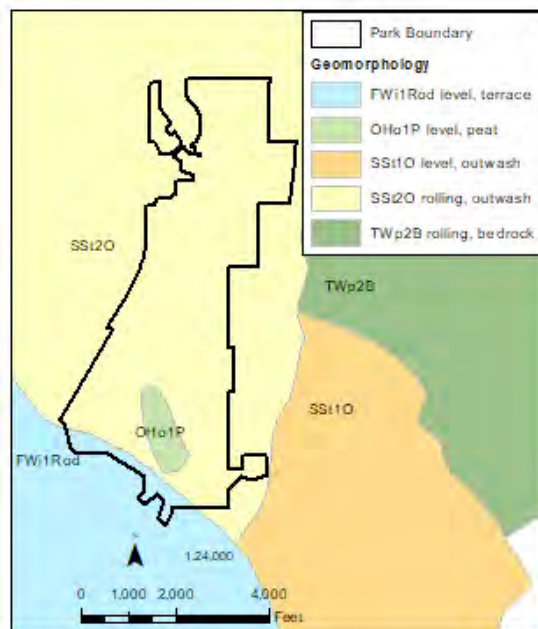
Glaciers were the primary force that shaped the present-day landscape of the Twin Cities metropolitan area. They determined the existing soil types, which in turn affected the types of plant communities that developed. Glacial activity carved the landscape of the region, worked and re-worked the land surface, and deposited tremendous amounts of till and outwash. Soils at Ravine Park formed primarily on outwash deposits left by the Superior lobe (Map 3) which advanced and retreated several times in the late Wisconsin period, 30,000 to 14,000 years ago, leaving a rolling terrain at this site. The outwash consists of sand, loamy sand, and gravel, with cobbles in places. It is typically covered by two to five feet of loess.

The ravine, a rift over a mile long in the park and about ¼ mile across, is a “tunnel valley” formation, caused when glacial water melted under the ice and carved a tunnel as it flowed. Ravine lake was formed when a buried ice block, insulated by peat and sediments for hundreds or thousands of years after the glaciers retreated, eventually melted (Meyer et al 1990).

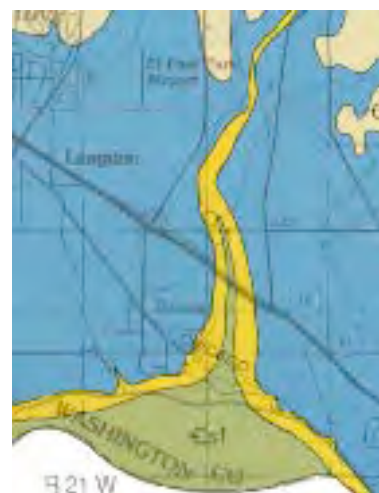
The depth to bedrock ranges from about 51 feet to 250 feet, with the shallower depths at the higher elevations in the southwest, and the deeper depths in the lowest areas of the ravine. All bedrock in the Twin Cities areas is marine sedimentary rock, which formed when shallow seas covered southeastern MN during the Early Paleozoic era (525-400 mybp). The Prairie du Chien group, which is primarily dolostone, underlies much of Ravine Park (Map 4). In the ravine, however, the Prairie du Chien was carved away by erosion, leaving Jordan Sandstone along the ravine walls. The bottom of the ravine is underlain by St. Lawrence Formation, consisting of dolomitic shale and siltstone, and by the fine-grained sandstone Franconia Formation.

Prairie du Chien bedrock contains the Prairie du Chien aquifer over much of its expanse. This aquifer underlies most of Washington County and is a primary

MAP 3. SURFICIAL GEOLOGY



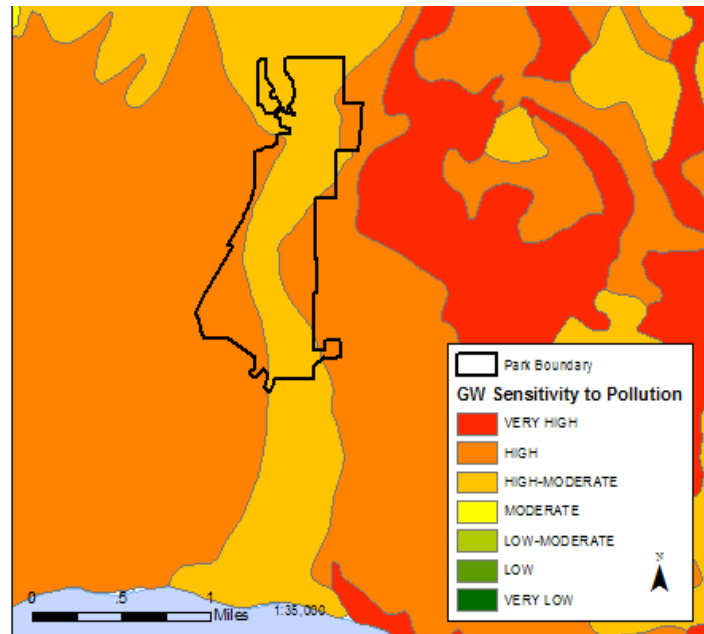
MAP 4. BEDROCK GEOLOGY



The St. Lawrence and Franconia Formation is at the center of the ravine (green), flanked by Jordan Sandstone (yellow) and the Prairie du Chien group beyond (blue).

source of drinking water. At Ravine Park, the depth to water table ranges from zero (at the lake), to approximately 100 feet at some of the higher elevations. The sensitivity of the Prairie du Chien-Jordan aquifer to pollution is rated as “high” in some the hillsides flanking the ravine, and “high-moderate” in the ravine (Meyer 1990) (Map 5). The estimated travel time for water-borne contaminants to reach the aquifer is several years to a decade in high-moderate areas, or weeks for high rated areas.

MAP 5. SENSITIVITY OF THE PRAIRIE DU CHIEN TO POLLUTION



Soils and Topography

The soils that formed at Ravine Park reflect the character of the sandy and loamy glacial deposits. Loamy sand is the predominant soil type, covering 55 percent of the site (Table 1. Soil Types). These soils are excessively drained, susceptible to drought, and have low fertility, factors that should be considered in any ecological restoration projects. Most of the soils in the park are also highly susceptible to erosion (Map 6). Consequently, any activities that will either disturb or expose soils need to consider potential erosion that could occur and should address avoidance and mitigation methods.

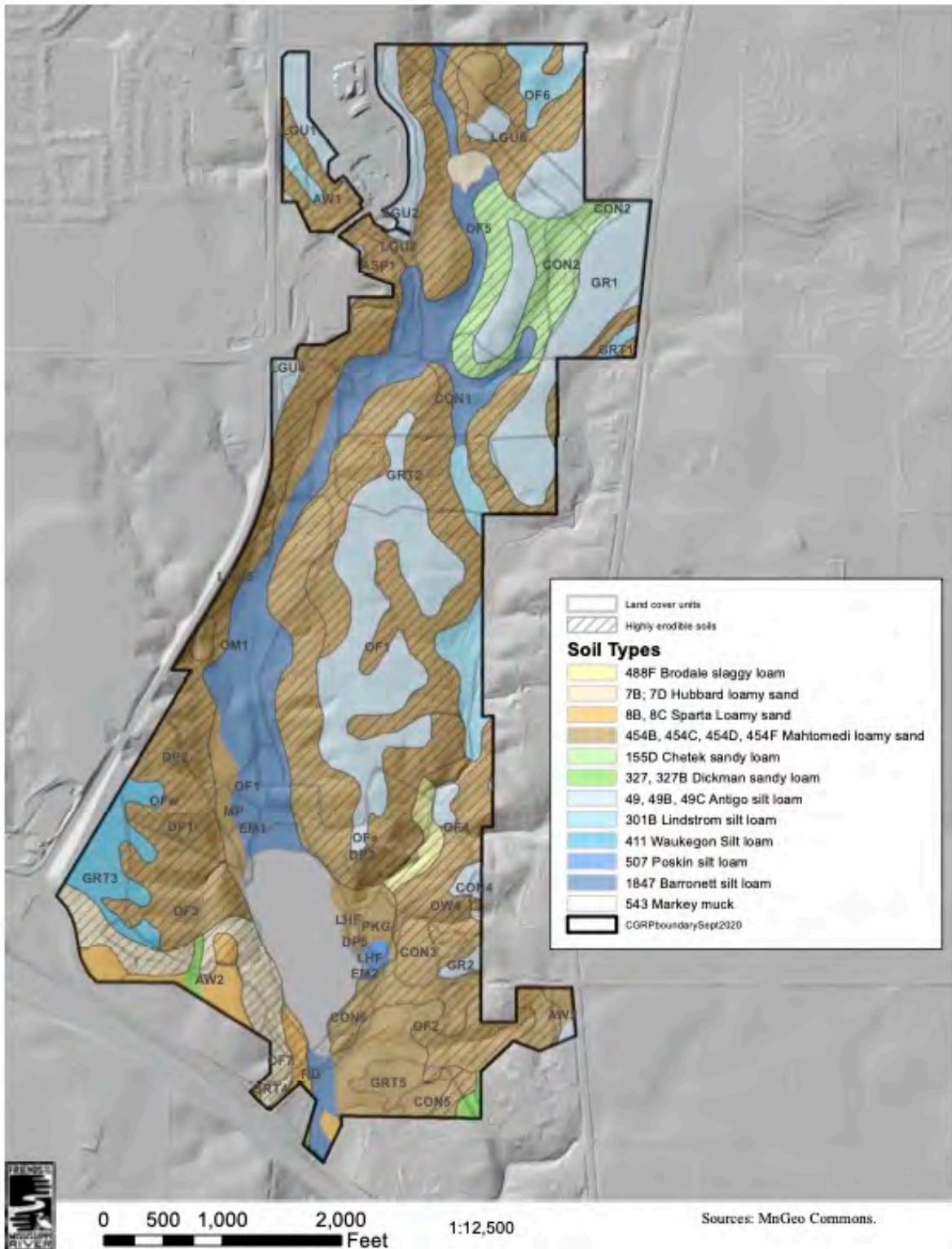
Table 1. Soil Types

Soil code	Name	Texture	Slope %	Acres	Percent	Erodibility*
7B	Hubbard	Loamy sand	2-6	1.9	0%	
7D	Hubbard	loamy sand	12-18	17	3%	H
8B	Sparta	loamy sand	2-6	6.6	1%	
8C	Sparta	loamy sand	6-15	3.8	1%	H
49B	Antigo	silt loam	2-6	68.9	13%	M
49C	Antigo	Silt loam	6-15	5.9	1%	
301B	Lindstrom	silt loam	2-4	17	3%	
327	Dickman	sandy loam	0-2	1.4	0%	
327B	Dickman	sandy loam	2-6	0.8	0%	
411	Waukegan	silt loam	0-2	11	1%	
454B	Mahtomedi	loamy sand	0-6	6.7	1%	
454C	Mahtomedi	loamy sand	6-12	27.1	5%	
454D	Mahtomedi	loamy sand	12-25	86.6	17%	H
454F	Mahtomedi	loamy sand	25-40	138.6	27%	H
488F	Brodale	slaggy loam	20-50	3.9	1%	H
507	Poskin	silt loam		1.2	0%	
543	Markey	muck		23.2	4%	
1847	Barronett	silt loam		58	11%	
Total				522		52%

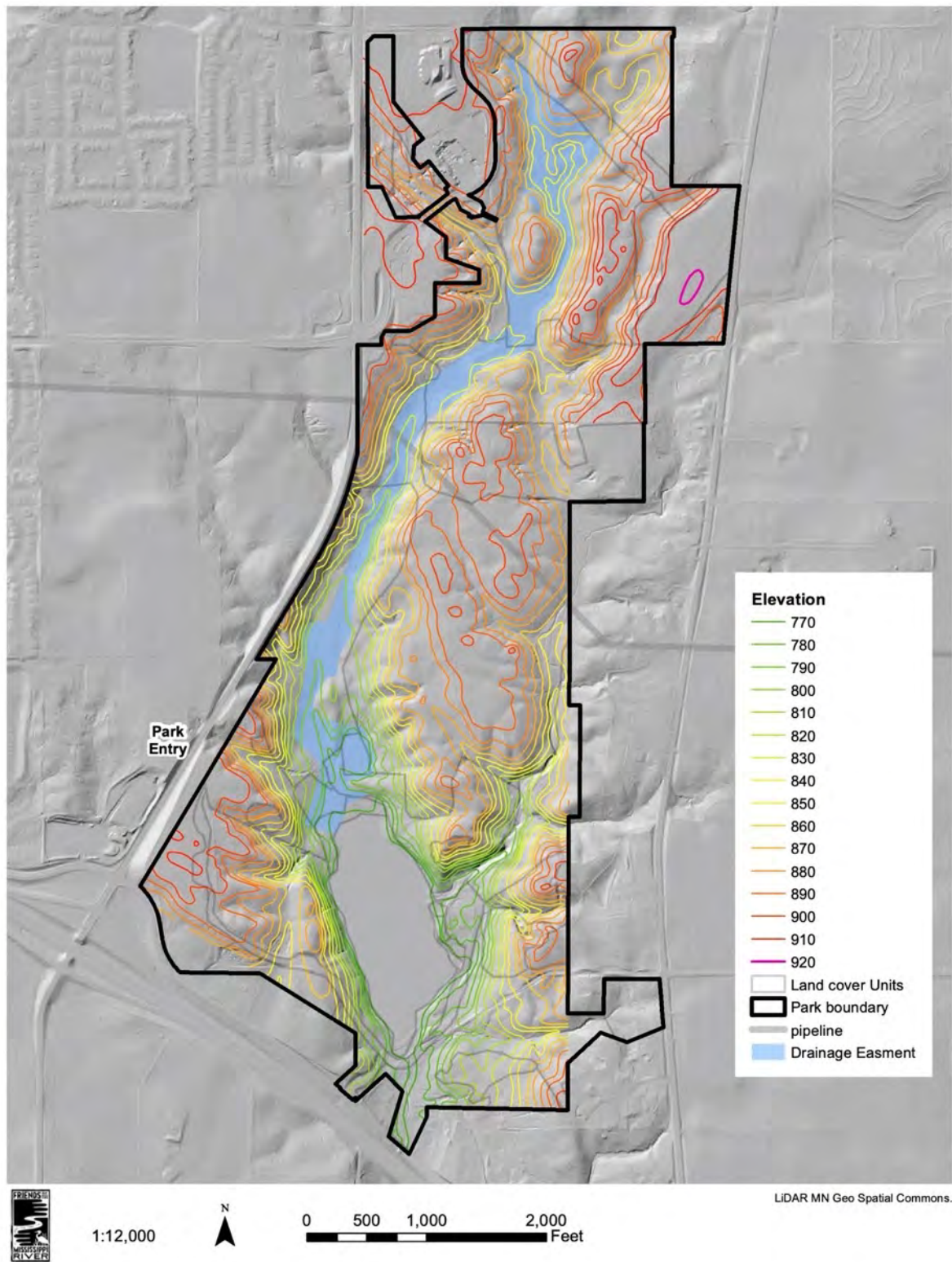
* H= high, M=Moderate

The overriding topographic feature of the park is the main north-south valley, with steep flanking slopes on either side. The rest of the park is rolling hills, dissected by ravines that drain to the lake. The elevation at the lakeshore is 770 feet, with hills rising to 910 feet at high points along either side of the ravine (Map 7). The highest point at the park is 920 feet, in the northeast grassland. The steepest slopes, up to 50 percent, are located in the woods to the north and east of the visitor building. Slopes along the west side of the lake are also very steep, up to 40 percent.

MAP 6. SOIL TYPES



Map 7. Topography



RARE FEATURES AND SPECIES OF CONSERVATION NEED

The MN Department of Natural Resources (DNR) Natural Heritage Database was searched for rare features within the park and within one mile of the park. Data included here were provided by the Division of Ecological and Water Resources and were current as of July 2019. These data are not based on an exhaustive inventory of the state. The lack of data for any geographic area does not mean that no significant features are present.

The database included two rare animals (Blandings turtle, lark sparrow) and one rare plant record (kittentails) within Ravine Park, as well as two plant communities (Table 2). All of the records were in the southern half of the park. Blandings turtle (*Emydoidea blandingii*), a state threatened species, was last recorded in 2002. Suitable habitat for this species still exists at the park, but the species was not noted in 2021. Blandings turtle has a state rank of 2, meaning it is imperiled due to rarity.

Lark sparrow (*Chondestes grammacus*) is a grassland species of special concern reported at the park in 2011 and 2012. It was not detected in 2021 but also was not searched for. There is potentially suitable habitat for it in the southwest grassland, which could be restored to native plant species to provide better resources for grassland birds.

Kittentails (*Besseyia bullii*), a threatened plant species with a state rank of 2, was last found in the park in 2000. A large population, about 200 plants, was present at that time. However, it has not been detected by ecologists in the past 10 years of site work. It is likely that as buckthorn matured and became extremely dense it choked out the kittentails. Suitable habitat is being restored and may provide an opportunity for the species to reappear or be reintroduced.

Two plant communities listed in the DNR database for the park were dry sand-gravel prairie (two locations) and northern bulrush-spikerush marsh. Both communities have a state rank of 2. The prairies were first recorded in 1987 and given a C-rank for fair estimated viability. A third prairie patch was found during the 2012 site survey. All prairie nodes are less than one acre, and all have declined significantly since the 1987 record. Invasive woody removal and other management since 2012 have improved their condition somewhat. Additional details on management and current conditions of the prairies are provided in the Ecological Evaluation section.

The marsh does not have a state rank. It had “fair viability” in 1988, but by the time of the 2012 ecological management plan it was very degraded, dominated by reed canary grass. That condition continued to 2021 and only scattered native species were found. All communities will be discussed in more detail in the Ecological Evaluation section.

In addition to listed species, several long-bearded hawkweed plants, (*Hieracium longipilum*) were found in the old field in the southwest corner of the park during the 2012 survey but were not relocated in 2021. This species does not have any state protection status but is on the DNR watch list. It was not recorded in the DNR database for Ravine Park, but it has occurred

within a mile of the park. FMR has also recorded dozens of the plants just to the south of the park at the 3M property.

Table 2. Element Occurrence records within Cottage Grove Ravine Park

Scientific name	Common name	State status*	State Rank**	Global Rank**	Last record	Viability Rank	DNR Description
<i>Emydoidea blandingii</i>	Blanding's Turtle	THR	2	4	5/17/02	Not ranked	One adult and three juvenile blanding's turtles observed at Cottage Grove Ravine Regional Park. The adult was photographed.
<i>Chondestes grammacus</i>	Lark Sparrow	SPC	3B	5	6/13/12	Not assessed	Breeding season observations in 2011 and 2012 (fledged young).
<i>Besseyia bullii</i>	Kittentails	THR	2	3	6/1/00	C - Fair estimated viability	The plant was first observed here in 1988. There were more than 200 plants observed on a sandy hillside. In 2000, the plants were observed to be abundant along a deer trail that ascends the slope. Dry oak forest on east/southeast facing slope. Shady canopy of <i>Quercus macrocarpa</i> . Scattered <i>Rhamnus cathartica</i> in shrub layer.
<i>Hieracium longipilum</i>	Long-bearded Hawkweed	Watchlist	None		9/10/1987	Extirpated but good viability at other site	The DNR record is now a housing development, but the species is known (FMR 2021) to be abundant just south of Hwy 61 at the 3M property.
UPs13b	Dry Sand - Gravel Prairie (Southern)		2	NR	9/22/87	C - Fair estimated viability	Dry sand prairie occurs on the southwest-facing bluff above the lake and north of the park shelter. The graminoid cover almost entirely <i>Stipa spartea</i> , with <i>Cyperus lupulinus</i> , <i>C. schweinitzii</i> , <i>Bouteloua curtipendula</i> , <i>B. hirsuta</i> , <i>Koeleria macrantha</i> , and <i>Andropogon gerardii</i> occasional. Few prairie forbs or invasive weeds occur in the dense sod of native grasses. Soils are sandy loam. Scattered oaks occur in the prairie and mixed oak forest occupies the lower slopes.
UPs13b	Dry Sand - Gravel Prairie (Southern)		2	NR	9/22/87	C - Fair estimated viability	Dry sand prairie occurs on a southwest-facing slope of a narrow ravine sloping southeast to the lake. The graminoid flora is diverse, dominated by <i>Bouteloua hirsuta</i> , <i>Cyperus schweintzii</i> , and <i>Digitaria cognata</i> , with several other species occasional. The soil is fine sands, erodible, and exposed in spots. Both sand prairie species and invasive weeds have colonized bare soil areas. Upper slope fenced and recently grazed.
Northern Bulrush-Spikerush Marsh MRn93	Northern Bulrush-Spikerush Marsh		NR	NR	7/20/88	C - Fair estimated viability	A small emergent marsh on northwest end of lake grades to wet meadow and old field. Dominant cover is graminoid, <i>Leersia oryzoides</i> and several species of <i>Cyperus</i> . The forb component is diverse with species typical of marsh, wet meadow, and some agricultural weeds. Characteristic native forbs are: <i>Polygonum lapathifolium</i> , <i>P. coccineum</i> , <i>Verbena hastata</i> , <i>Amaranthus tamaricina</i> , <i>Rumex meridimus</i> , <i>Mentha arvensis</i> , etc. <i>Lythrum salicaria</i> present in small numbers. Probably grazed in past

* THR = threatened ** 2 = imperiled due to rarity *** 3 = Vulnerable—At moderate risk of extinction due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors. 4=Apparently Secure—Uncommon but not rare; some cause for long-term concern due to declines or other factors.

Several other rare species occurrences are recorded within a mile of the park (Table 3. Element Occurrence records within 1 mile of Ravine Park). A few species, especially loggerhead shrike, western fox snake, and rusty-patched bumble bee are species that could also occur in the park, especially if restored habitats provide suitable conditions for them.

Table 3. Element Occurrence records within 1 mile of Ravine Park

Scientific name	Common name	State protection status	State Rank**	No. Records	Last record
<i>Falco peregrinus</i>	Peregrine Falcon	THR	2B	1	2012
<i>Lanius ludovicianus</i>	Loggerhead Shrike	THR	2B	3	1995
<i>Vireo bellii</i>	Bell's vireo	SPC	3B	2	2011
<i>Elaphe vulpina</i>	Western Fox Snake	NON	NR	2	1997
<i>Bombus affinis</i>	Rusty-patched Bumble Bee	END	1	2	1995
<i>Besseyia bullii</i>	Kitten-tails	THR	2	2	1998
<i>Hieracium longipilum</i>	Long-bearded Hawkweed	NON	NR	1	1987
Dry Sand - Gravel Oak Savanna (Southern) Type UPs14b	Dry oak savanna (southeast) sand-gravel subtype		2	2	1987
Dry Sand - Gravel Prairie (Southern) Type UPs13b	Dry prairie (southeast) sand-gravel subtype		2	2	1987

* END=endangered THR=threatened, NON=no official status, but tracked by state.

** 2=impaired, 3=vulnerable, 4=apparently secure

In addition to records of rare species, four species of greatest conservation need (SGCN), as defined by the DNR (2015), were noted during breeding bird surveys conducted by FMR from 2018-21: eastern towhee, wood thrush, yellow-billed cuckoo and northern rough-winged swallow. These are species whose populations have declined, primarily due to habitat loss and/or degradation. Also seen were scarlet tanagers, which are not rare, but are relatively uncommon and a spectacular sight.

Ravine Park is located in the St. Paul Baldwin Plains and Moraines ecological subsection. The key habitats that are needed in Washington County to support species of greatest conservation need (SGCN) are prairie and savanna. Surveys of the animal communities, especially birds and pollinators, would be valuable for documenting changes as the native plant communities are restored.

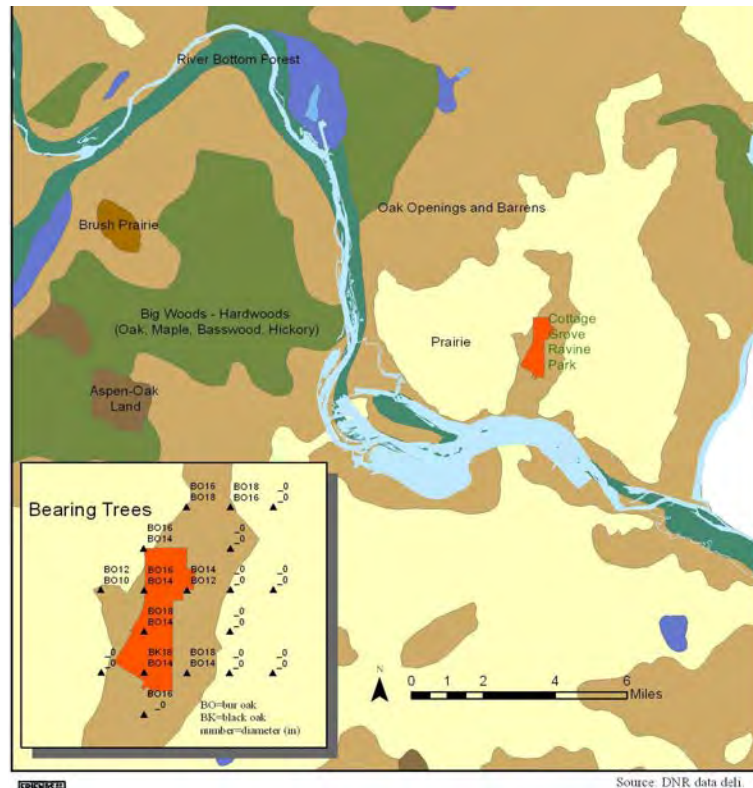
HISTORICAL VEGETATION AND LAND USE

The best information available on plant communities present at the time of European colonization comes from the 1850's land surveyor notes, which recorded plant species at each one-mile point in a grid across the state. Those notes were later compiled into a map, which shows that Ravine Park was within the plant community referred to as "oak openings and barrens" (Map 8). Today we commonly refer to this as oak savanna.

The bearing tree data – the actual record of species that the land surveyors recorded at 0.5 or 1-mile intervals – shows a preponderance of bur oak trees, which is consistent with an oak savanna type of cover. In addition, the existing on-site conditions strongly point to a history of savanna. Many of the large oak trees have wide spreading branches, an indication they grew up with much less tree cover around them. There are also many red cedars and the small remnant "prairie" openings, all indicative of a more open canopy in the past.

Another clue to past land cover is from historical aerial photographs. While the oldest available only go back to the 1940's – over 90 years after European settlement – they still provide some evidence of the historical condition. The 1945 aerial photograph (Map 9) shows a very open canopy, with tree cover generally greatest in ravines and some of the present-day oak forest units. Based on the photograph and the land surveyor data, it seems likely that the park was a more open savanna at the time of European colonization, with patchy woods in ravines and other fire-protected areas. With fire suppression after settlement, more trees became established, pushing the savanna more towards woodland. There is evidence of some of the agricultural uses in the 1945 aerial, especially haying and pasture. Some tree clearing was apparently done. It does not appear that there was a lot of agricultural cropland, likely due to the droughtiness of most of the soil types, as well as the terrain and susceptibility to erosion.

MAP 8. PRE-EUROPEAN COLONIZATION VEGETATION



Once established, the tree cover expanded quickly and by 1953 the area north of the lake appeared to have a nearly continuous canopy. Over subsequent decades trees continued to fill-in over most of the rest of the site, to reach the fairly dense canopy present today. In some areas, trees were also planted, especially red pine, scotch pine and Jack pine.

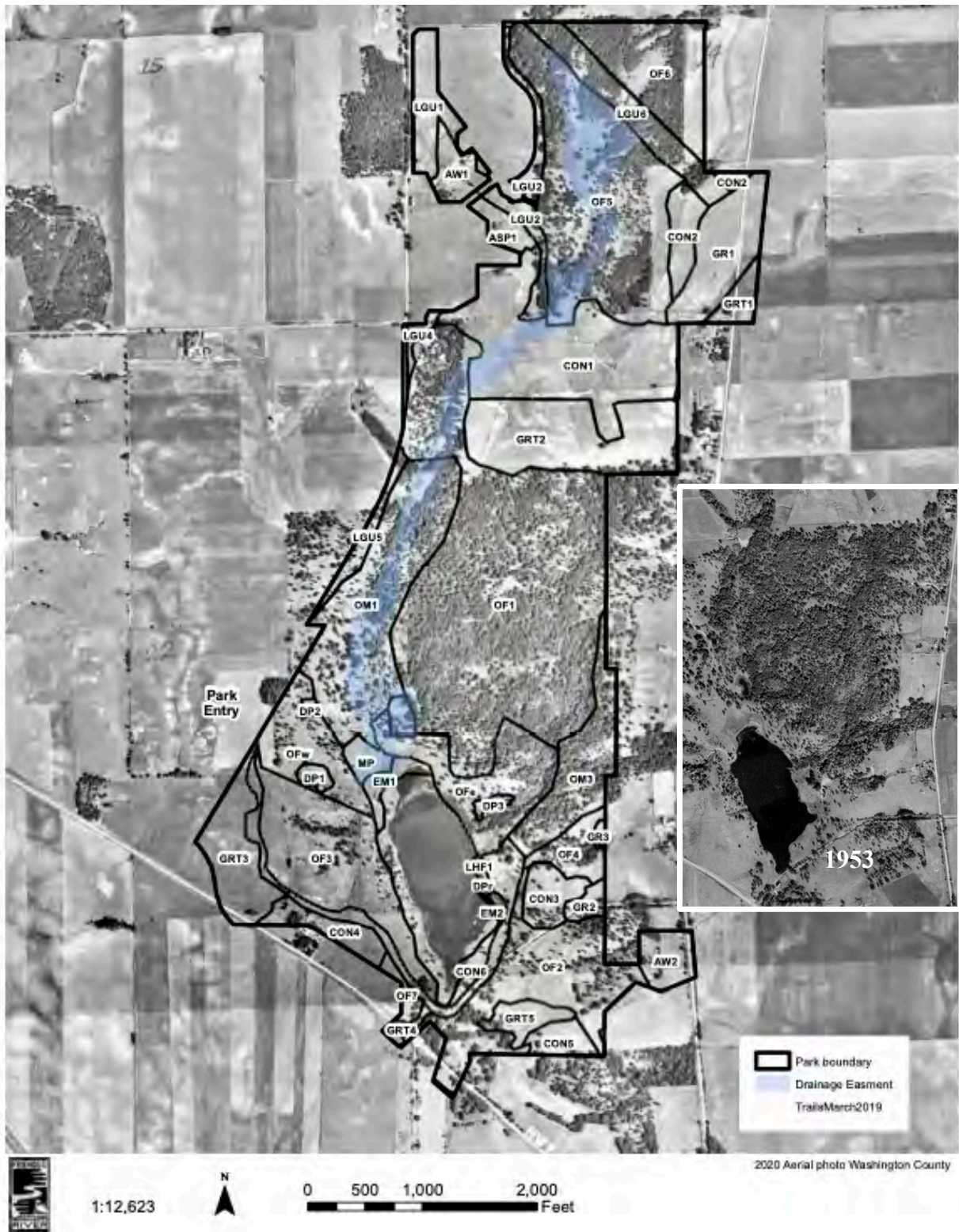
According to the Department of Natural Resources County Biological Survey, less than five percent of high quality, native plant communities remained in Washington County at the time of the 1990 survey. That amount has certainly declined with the rapid urban development that occurred in the past 30 years. This growth continues to expand into farmland and natural areas, making protection and restoration of remnant natural areas increasingly important.

In addition, oak savanna has decreased from 50 percent coverage of the land in the 1850's to less than three percent today. This habitat type is second only to prairie in its importance in the landscape. There are at least 17 species of greatest conservation need (SGCNs) that depend on prairie and savanna habitat in this part of the state.

Although an extensive history of the human activities of the park are beyond the scope of this document, we want to acknowledge the Native Americans who historically occupied this region. Cottage Grove Ravine Park is located on Dakota homelands - the home of hundreds of generations of Mdewakanton Sioux who stewarded this place for thousands of years. Indigenous people are still here, even though the State of Minnesota and the United States government committed genocide, forced them into exile and broke treaties. Despite the ongoing deep injustices of violence and stolen land, the first human caretakers of this place continue to be powerful protectors of these lands and waters.

We cannot restore these lands without honoring Indigenous ancestors and Indigenous presence here, without learning from their stewardship practices and working together. Indigenous communities, these lands and waters hold memories, stories, names and lessons. We look back at that long history with respect, and we know our work must repair and build relationships, must be the transformative restoration of connections between and among land and people.

MAP 9. 1945 AERIAL PHOTOGRAPH



WATER RESOURCES

An inventory of surface water resources and associated issues such as erosion, vegetated buffers, impairment, and groundwater infiltration or recharge are beyond the scope of this document. These issues are well known for this park had have been well-addressed by the County and the Watershed District in recent years.

There are still areas that are subject to erosion and the park should be surveyed annually to detect and address them. At this time, we noted one location on the trail east of LHF2 as it goes up the hill (Photo 1).

As these trails are used for skiing, installing water bars is not an option. As the erosion is not severe it may be enough to install a heavy coir erosion fabric and overseed it with grasses.



Photo 1. Erosion on the south trail at OF2.

WILDLIFE

Comprehensive wildlife surveys were not completed for the park. However, FMR has been conducting annual breeding bird surveys from 2018-2021. The point count method was used, and 8 points were surveyed (Map 10) on two occasions in June between dawn and 9 am. The surveys included some areas prior to restoration activities, but most already had some management done. The survey results (Appendix A) show a marked increase in numbers of birds and species in the 2021 survey. This could be incidental, or it could be a reflection of the habitat changes. A total of 50 species have been recorded during the breeding surveys, with an average of 28 per year. Four species of greatest conservation need have been recorded at the site (eastern towhee, northern rough-winged swallow, yellow-billed cuckoo, and wood thrush), with an average of two recorded most years.

Although there are no conclusions to be made from the surveys, it is helpful to have the baseline information. The units where the survey is set still have a long way to go to have a full complement of native species that belong in the plant community. It would be beneficial to continue the bird surveys periodically, if not annually, to potentially capture those changes over time. It may also be informative to do surveys in the northern part of the park, which has not had as much restoration work, to potentially compare before and after.

MAP 10. BREEDING BIRD POINT COUNT SURVEY



ECOLOGICAL EVALUATION and MANAGEMENT RECOMMENDATIONS

SITE EVALUATION

The 522-acre Cottage Grove Ravine Regional Park was evaluated in 2021 to record the existing plant community, determine a target restoration community, and develop methods to achieve the restoration goals. The Minnesota Land Cover Classification System (MLCCS) (DNR 2005), which defines and classifies all types of land cover, was used as a basis for the site evaluation. Based on field observations, some of the MLCCS landcovers were then modified; some polygons were altered, and a few land cover types were changed to a different cover type. Some cover type names were also abbreviated or modified for clarity and ease of use. The existing land covers are summarized in Table 4 and shown in Map 11.

Information recorded during field surveys included plant species and their percent coverage in each vegetation layer (canopy, subcanopy, shrub, herbaceous) (**Appendix B**), soil type, slopes, animal signs, and ecological concerns, such as erosion, invasive species, and tree age distribution.

To determine target plant communities for restoration (Table 4), we considered the historical conditions, existing conditions, and relative effort versus. benefits. As a guideline for the target plant community goals, we used the *Field Guide to the Native Plant Communities of Minnesota: The Eastern Broadleaf Forest Province* (DNR 2005). This book describes the system developed by the Minnesota Department of Natural Resources for identifying ecological systems and native plant community types in the state, based on multiple ecological features such as major climate zones, origin of glacial deposit, and plant composition. There are four ecological provinces in Minnesota (prairie parkland, eastern broadleaf forest, laurentian mixed forest, and tallgrass aspen parkland), ten sections within the provinces, and 26 subsections. Ravine Park is classified as follows:

Ecological Province: Eastern Broadleaf Forest
Section: Minnesota and Northeast Iowa Morainal
Subsection: St. Paul Baldwin Plains and Moraines

This property was likely dominated historically by southern dry sand-gravel oak savanna, with some combination of other plant communities, especially southern dry sand-gravel prairie on south and west-facing slopes, northern bulrush-spikerush marsh near the lake, and southern dry-mesic oak woodland in the ravines and north-facing slopes. These plant communities are generally still appropriate for the site, but the distribution of each has changed dramatically due to succession. Many areas that had been oak savanna have developed into oak woodland or forest, and in most cases it is no longer be desirable to revert back to savanna.

Each land cover unit is described in more detail in the subsections below, including primary ecological concerns and general management recommendations.

Dry oak forest is currently the largest native plant community at the park, comprising about 260 acres at the park. These units are located on hills that flank the east and west sides of the

lake and main valley that transects the park. Hilltop peaks are mostly 910 feet, nearly the highest elevation in the park, while the low points are at 770 feet, the lowest points in the park and at the lake level.

The terrain of the woodland units varies from fairly level hilltops to very steep ravines and slopes. The primary drainage is toward the lake, but there are multiple shallow side-ravines that orient in different directions. The vegetation corresponds to the terrain, with more densely wooded cover in the ravines and while hilltops have more canopy openings.

The primary ecological issues of concern throughout the park were invasive species, especially common buckthorn, Tatarian honeysuckle, garlic mustard, and earthworms, which were at the highest level of invasion. Invasion by earthworms is a primary factor in altering a native plant community due to changes in soil chemistry and structure as well as native seed ingestion. Garlic mustard and buckthorn are typically the first species to establish following earthworm invasion. The white-tailed deer population was also excessively high. In large numbers, deer can impede the regeneration of native trees, shrubs and herbaceous species, resulting in lower plant diversity and more opportunity for invasive species, which they generally do not consume.

Table 4. Existing Land Cover and Proposed Restoration
The units are color coded according to the target plant community.

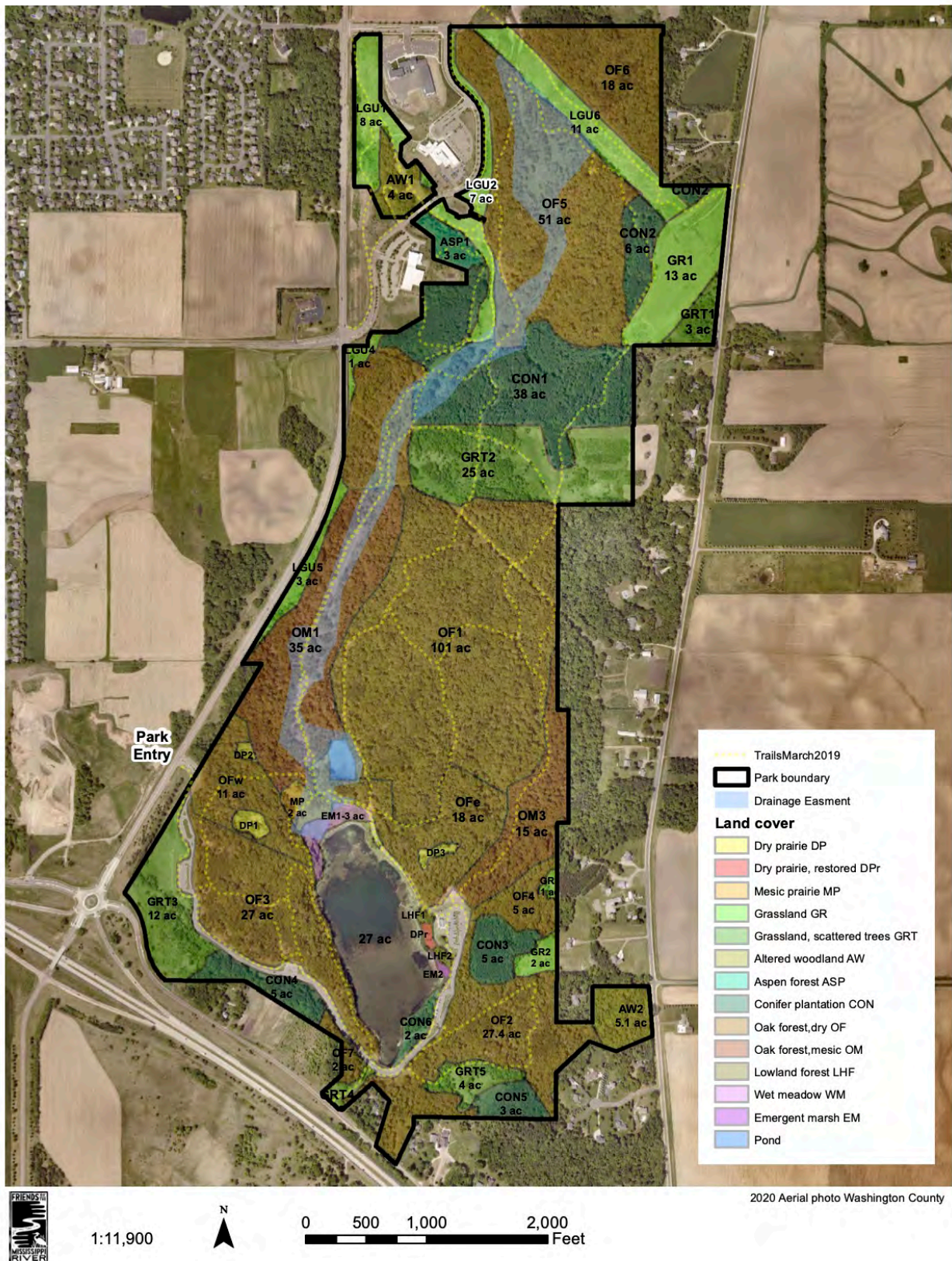
Managed	Unit	Acres	Existing Land cover	Target Plant Community	Target Code	Priority	Primary Soil type
WOODED UNITS							
Y	OF1	100.6	Oak forest,dry	Southern dry-mesic oak woodland	FDs37	High	Mahtomedi loamy sand, Antigo silt loam
N	OF2	27.4	Oak forest,dry	Southern dry savanna	UPs14	Medium/low	Mahtomedi loamy sand
Y	OF3	26.6	Oak forest,dry	Southern dry-mesic oak woodland	FDs37	High	Mahtomedi loamy sand
Y	OF4	5.3	Oak forest,dry	Southern dry-mesic oak woodland	FDs37	High	Mahtomedi loamy sand
N	OF5	50.5	Oak forest,dry	Southern dry savanna	UPs14	High	Mahtomedi loamy sand, Chetek sandy loam
N	OF6	18.3	Oak forest,dry	Southern dry-mesic oak woodland	FDs37	Low	Mahtomedi loamy sand, Lindstrom silt loam
N	OF7	1.7	Oak forest,dry	Southern dry-mesic oak woodland	FDs37	High	Hubbard loamy sand
Y	OFe	17.9	Oak forest,dry	Southern dry-mesic oak woodland	FDs37	High	Mahtomedi loamy sand
Y	OFw	11.5	Oak forest,dry	Southern dry-mesic oak woodland	FDs37	High	Mahtomedi loamy sand
259.8							
Y	OM1	35.3	Oak forest,mesic	Southern dry-mesic oak forest	MHs37	High	Mahtomedi loamy sand, Barronett silt loam
Y	OM3	15	Oak forest,mesic	Southern dry-mesic oak forest	MHs37	High	Mahtomedi loamy sand
50.3							
Y	LHF1	0.3	Lowland forest	Southern wet-mesic hardwood forest	MHs49	High	Mahtomedi loamy sand
Y	LHF2	0.4	Lowland forest	Southern wet-mesic hardwood forest	MHs49	High	Poskin silt loam
0.7							
N	ASP1	3	Aspen forest	Southern dry-mesic oak woodland	FDs37	Low	Mahtomedi loamy sand
N	AW1	4.3	Altered woodland	Southern dry-mesic oak woodland	FDs37	Low	Mahtomedi loamy sand
N	AW2	5.1	Altered woodland	Southern dry-mesic oak woodland	FDs37	Low	Mahtomedi loamy sand
9.4							
N	CON1	37.6	Conifer plantation	Conifer plantation		Low	Mahtomedi loamy sand, Barronett silt loam
N	CON2	5.8	Conifer plantation	Conifer plantation		Low	Chetek sandy loam
N	CON3	5.1	Conifer plantation	Southern dry-mesic oak woodland	FDs37	Low	Mahtomedi loamy sand
N	CON4	5.1	Conifer plantation	Southern dry-mesic oak woodland	FDs37	High	Sparta loamy sand
N	CON5	3.5	Conifer plantation	Conifer plantation		Medium	Mahtomedi loamy sand
N	CON6	2.1	Conifer plantation	Southern dry savanna	UPs14	Medium	Mahtomedi loamy sand
59.2							

Table 4, continued

Managed	Unit	Acres	Existing Land cover	Target Plant Community	Target Code	Priority	Primary Soil type
GRASSLAND UNITS							
Y	DP1	1.2	Dry prairie	Southern dry prairie, sand-gravel subtype	UPs13	High	Mahtomedi loamy sand
Y	DP2	0.4	Dry prairie	Southern dry prairie, sand-gravel subtype	UPs13	High	Mahtomedi loamy sand
Y	DP3	0.8	Dry prairie	Southern dry prairie, sand-gravel subtype	UPs13	High	Mahtomedi loamy sand
Y	DPr	0.5	Dry prairie	Southern dry prairie, sand-gravel subtype	UPs13	High	Mahtomedi loamy sand
2.9							
N	GR1	13.4	Grassland	Southern dry prairie, sand-gravel subtype	UPs13	High	Antigo silt loam
N	GR2	2	Grassland	Southern dry savanna	UPs14	Low	Antigo silt loam
N	GR3	0.6	Grassland	Southern dry savanna	UPs14	Low	Mahtomedi loamy sand
16							
N	GRT1	3	Grassland, scattered trees	Altered woodland & Southern dry prairie, sand-gravel	UPs13	Low	Mahtomedi loamy sand
N	GRT2	24.8	Grassland, scattered trees	Southern dry savanna	UPs14	High/Medium	Mahtomedi loamy sand, Antigo silt loam
N	GRT3	11.9	Grassland, scattered trees	Southern dry savanna	UPs14	Medium	Waukegon silt loam, Hubbard loamy sand
N	GRT4	1.1	Grassland, scattered trees	Southern dry savanna	UPs14	Low	Hubbard loamy sand
N	GRT5	4	Grassland, scattered trees	Southern dry savanna	UPs14	Medium	Mahtomedi loamy sand
44.8							
N	LGU1	7.6	Grassland	Southern dry prairie, sand-gravel subtype	UPs13	High	Antigo silt loam
N	LGU2	7	Grassland	Southern dry prairie, sand-gravel subtype	UPs13	High	Antigo silt loam
N	LGU4	1.3	Grassland	Southern dry prairie, sand-gravel subtype	UPs13	Medium	Antigo silt loam
N	LGU5	3	Grassland	Southern dry savanna	UPs14	Low	Mahtomedi loamy sand
N	LGU6	11.2	Grassland	Southern dry prairie, sand-gravel subtype	UPs13	High	Mahtomedi loamy sand
30.1							
N	MP	2.4	Mesic prairie	Southern mesic prairie	UPs23	Medium	Barronett silt loam
WETLAND UNITS							
N	EM1	2.6	Emergent marsh	Southern Seepage Meadow/Carr	WMs83	Low	Barronett silt loam
N	EM2	0.4	Emergent marsh	Northern mixed cattail marsh	MRn83	Low	Poskin silt loam

3

MAP 11. EXISTING LANDCOVER



Dry Oak Forest

Unit OF1 (managed)

OF1 was the largest oak forest unit, about 100 acres, located north of the visitor building. The canopy was fairly dense and dominated by oaks, especially pin, bur and red. Other species included hackberry, American basswood, big-toothed aspen, quaking aspen, and, rarely, cottonwood. Tree sizes were generally mixed age, but some areas were mostly similar size, small trees, about 8-10 inches diameter at breast height (dbh) (Photo 2), indicating they established at about the same time, possibly when pasture use or other past uses ceased. Throughout the unit were scattered large diameter trees, up to 25 inches dbh (Photo 3), especially bur oaks, some of which had spreading branches (Photo 4). The subcanopy included canopy species as well as boxelder, red cedar, and American elm. The shrub and ground layer have been altered by restoration and management that began in



Photo 2. The east subunit of OF1 had large expanses of sparse ground cover, abundant garlic mustard. Trees were even aged and small diameter in some areas.



Photo 3. Scattered large diameter trees in OF1, no shrub layer.

subunits a, b, and c (Map 12) in 2015, 2016, and 2017, respectively (Appendix C). All were forestry mowed followed by up to four foliar treatments of resprouts and seedlings. Goats were used to control buckthorn and garlic mustard in the east and north. At the time of the 2021 survey, there was virtually no shrub layer at any of the managed subunits.

The ground layer was very sparse in the east subunits (Photo 2), moderate in the north (Photo 4). The west subunit had a dense ground cover over most of it (Photo 5), dominated by native species, especially



Photo 4. Spreading branched bur oak in the north OF1 subunit.

honestwort and white snakeroot. Garlic mustard was very sparse in the west but dominant in the other two subunits. The native grass, white grass, was very abundant along the edges of the OF1 units, where it formed a nearly continuous cover in some areas (Photo 5). This species should be sought when overseeding other units, as a means for suppressing garlic mustard and buckthorn.

The most common species in the east and north subunits included enchanter's nightshade, sweet cicely, and stinging nettle. Other very sparse species included wild geranium, white avens, false lily of the valley, and blue violet. Japanese hedge parsley was found in the east and west, and small amounts of burdock were in all subsections.

Management of these units was proceeding well. Garlic mustard remains a primary issue, along with small buckthorn. Goats can be an effective tool for controlling garlic mustard as long as the timing is right. Garlic mustard is a biennial plant, so if it is cut or browsed when it is flowering and just starting to form seeds then the plant will typically die. If cut too soon, the plant will resprout and go another year. The downside to using goats is that they are not selective and will eat all the native plants along with the mustard, which may kill the native plants and also results in bare soil that invites more weed species.

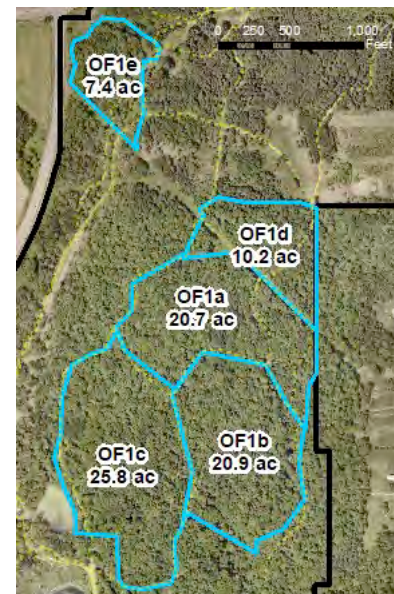


Photo 5. Continuous ground cover over about two thirds of the OF unit included dense whitegrass, especially along the trails.

Although we advocate for minimizing chemical use, it can be a very effective way to treat small areas or scattered patches of garlic mustard with minimal impact to non-target plant species. Timing again is important. Most native plants are dormant in very late fall (e.g., early November) or very early spring while garlic mustard remains green through the winter. Glyphosate can be applied with no collateral damage. However, we do not recommend herbicide use for very large treatment areas or multiple repeated use. All herbicides negatively impact soil organisms and have other unintended consequences.

These units also need to be burned. The county has worked to reduce the fuel load of dead standing and fallen trees so burns will be feasible and they plan to initiate that in 2022. With the amount of pin and red oaks, which retain many of their leaves, a spring burn is likely to be most feasible. We recommend burning no more than a third of the unit in any year, to provide refugia for wildlife. Historically, oak woodlands would have burned approximately every ten years.

MAP 12. UNIT OF1 SUBUNITS



In the early stages of restoration, however, the burns may need to be a little more frequent.

After burning, these units may benefit from supplemental seeding (**Appendix D**) to help restore the native species assemblage and to help deter invasive species. Continued management of this unit is high priority to maintain what has been accomplished.

The other two OF1 subunits, d and e, about 18 acres, would be a high priority for restoration to complete management of the OF1 unit. The methods would follow the typical progression of forestry mow, fall foliar spray, burn, overseed, spot spray.

Unit OF2

Unit OF2 was a 27-acre unit in the southeast part of the park. The canopy was dominated by pin oak up to 32-inch dbh (Photo 6). Bur oak was subdominant, some with spreading branches (Photo 7), indicative of the more open savanna of the past. There were occasional boxelder, hackberry, and American elm as well as red pine, a stand of Scotch pine adjacent to the GRT5 unit and occasional Siberian elm.

Unit OF2, especially along the roadside edges, provided a sense of what the managed OF units looked like prior to restoration, with buckthorn cover over 50% and 1 to 3-inches dbh trunks (Photo 8).



Photo 6. Large diameter pin oak in OF2.



Photo 7. Spreading bur oak tree crowded by younger trees in OF2.

Prickly ash and sapling quaking aspen were also common in the shrub layer, with Tatarian honeysuckle common in openings and edges.

The ground layer was dominated by seedling buckthorn and garlic mustard, but there was also a fairly high diversity of native woody species, representing the canopy tree species plus occasional red-berried elder and gooseberry.

The forb cover overall was relatively high, over 50%. Garlic mustard was dominant, but interesting native species, mostly in very low abundances, included shinleaf, Solomon's seal, false lily-of-the valley, columbine and wild geranium, along with the typical weedy species like Virginia stickseed, motherwort, and hog peanut.

The leg on the south side of this unit was a bit different with more disturbance species. The canopy was open, dominated by boxelder with occasional American elm, and red cedar in the subcanopy. The shrub layer was dense consisting of gray dogwood, buckthorn and honeysuckle. The outflow stream from Ravine Lake flows through this part of the unit.



Photo 8. Buckthorn in OF2 was mostly mature stems, particularly dense along the road.

The target community for OF2 is Southern Dry Savanna. However, due to the excessive cost of accomplishing that, full restoration to savanna would be low priority. We suggest focusing on initial steps of invasive tree and shrub removal, including Scotch pine, and removing small trees from around oaks with spreading branches. After those steps it will become more apparent if additional restoration to savanna would be beneficial. The invasive woody removal would be a medium priority. This unit is not directly adjacent to other restored units, so the management could be delayed until resources are available.

Unit OF3 (managed)

Unit OF3 was 27-acres on the southwest side of the lake. As with the other oak forest units, pin oak was the dominant canopy species. The diameter ranged from about 8 to 24 inches dbh, but scattered giants were found including a 41-inch dbh (Photo 9). Bur oak was subdominant in the canopy, but the trees were typically larger than pin oak, ranging from 10 to 28 inches in diameter with most about 22.



Photo 9. A 41-inch dbh pin oak in OF3 with much smaller trees around points to the historical savanna.

Many of the bur oak trees had a spreading branch form, indicating they matured in a much more open savanna-like setting. With fire suppression since the mid-1800's, the tree canopy filled in and the historical savanna became woodland.

Pin oak seedlings were commonly found, but bur oaks were not regenerating due to the deep shade conditions. They may continue to decrease over time, but there will likely be some regeneration when canopy gaps are created by windfall and disease. Oak wilt is common in the park (Photo 10), and tends to affect red oak species most, potentially creating opportunities for bur oak to regenerate.



Photo 10. Dead canopy trees seen here in OF3 are from oak wilt, which is common throughout the park.

Other canopy tree species included

American basswood, black cherry, quaking aspen, red cedar, hackberry and paper birch.

Boxelder was present along the edges. Subcanopy tree cover was less than 25 percent and included most of the canopy species. There was a fairly good age range of trees in the woods, but saplings are largely missing due in part to the management process. Seedling trees are also heavily browsed by deer, so survival tends to be low.

The shrub layer was sparse because of invasive woody control that began in 2019. However, quaking aspen thickets have sprung up on the south and west sides of the unit, helping to suppress buckthorn.

Each of the managed OF units underwent slightly different restoration methods (Appendix C). Although some units had more years of management than others, we surveyed the vegetation, particularly the ground layer, to assess the condition and compare the results of the different management methods used. The survey results showed that some of the units varied considerably in the ground layer recovery (Appendix B).

Unit OF3 had the best ground layer species richness and abundance, with 49 native species recorded versus 24 in Unit OF1. OF1 had much less seedling buckthorn cover than OF3, but it had four foliar treatments whereas OF3 had had one at the time of the 2021 survey. OF1 also had dramatically more garlic mustard cover. OF3 generally had a dense cover of ground layer vegetation, whereas OF1 had large expanses that were very sparsely vegetated. However, OF1 also had areas, primarily along trail edges, that were densely vegetated. White grass was especially abundant, forming a dense ground cover. If available at native plant nurseries, this species could be a good option for overseeding after woody removal.

Based on these results, we are able to suggest a general sequence of management steps that seemed to provide optimal results. Yr 1: Winter forestry mow (hand-cut large stems and steep slopes), fall foliar. Yr 2: Spring Rx burn, seeding, fall foliar. Yr 3: fall foliar. There are nuances in terms of type of chemical used for foliar treatment and application method as well as the timing. Depending on the amount of mulch, for example, a burn and/or seeding may need to be delayed a year. We recommend using daubers (sponge head) for stump treating and a wicking method (e.g., rollers) when possible for foliar application, to minimize non-target impacts to native species. Species management details are provided in Appendix E.

While unit OF3 had the greatest number and cover of native species in the ground layer and good invasive species control, it will need follow-up management for a few years. Woody plants that are large enough should be cut and stump treated. Small stems can be foliar sprayed or wick-treated in fall. Alternatively, goats can be used for repeat browsing in the same unit and are scheduled for 2022. The goats may reduce the buckthorn cover, but eventually herbicide treatment will be needed for full control.

Garlic mustard was not abundant and should be hand-pulled or spot sprayed in late fall or very early spring (March). A prescribed burn is planned for 2022. Broadcasting additional native seed, including shrubs seed especially hazelnut, would be beneficial. Seed should be local ecotype, within 100 miles, and suitable to the dry-mesic oak woodland community. The south and west edges of this unit are fairly open and could be further opened to create savanna (Map 11). Boxelder, American elm and green ash can be removed from those areas, as well as other small trees, then overseeded with savanna grasses and forbs. Continued management of this unit is high priority to maintain what has been accomplished. The spring burn, garlic mustard control, goat browse and fall foliar buckthorn treatment are scheduled with existing funding (FMR, Outdoor Heritage Fund) for one year (2022).

Unit OF4 (managed)

Located east of the lake, this was a small unit of five acres. The canopy was similar to the other OF units. The invasive woody shrub cover was not as dense as other units, and removal was completed in 2021. Follow-up management will be needed to control seedling buckthorn and occasional honeysuckle. Garlic mustard was not abundant but will also need to be monitored and managed. This unit can be burned in the next few years; overseeding will not likely be needed. On-going management of this unit is high priority at least in terms of continuing buckthorn control. Burning could be delayed.

Unit OF5

The second largest oak woodland unit is OF-5, a 50-acre unit of contiguous forest occupying the central portion of the northern half of the property. This unit was historically a mix of oak savanna and prairie, with pockets of woodland that had a much more open character. Areas of woodland vegetation occurred along the ravines and draws, and areas of more oak savanna-like vegetation occurred on flatter ground.

The unit currently has a relatively uniform vegetative character, dominated by large bur oaks and to a lesser extent, white oaks (Photo 11). Green ash, American elm, hackberry, black cherry, pin oak, and box elder occur as smaller components of the canopy and make up much of the subcanopy. Occasional sugar maple specimens occur as well. That species like green ash and box elder are moving into this unit is a testament to the lack of disturbance over the last half century or more. The unit also contains groves of quaking aspen, which likely started as edge species and have since been enveloped by the spreading woodlands. A number of

dead white oaks were spotted in the southwestern portion of the unit, signaling the likely presence of oak wilt. A detailed survey of trees was conducted in 2018 by the Tree Trust. That data, including dbh measurements, is available online. A number of deer trails traverse the diverse topography, but this unit shows little to no evidence of current human use outside of the mowed trail system.

The shrub layer is largely dominated by very dense buckthorn. Some prickly ash is interspersed throughout, with gooseberry, elderberry, various raspberry species, and occasional black cherry and chokecherry present as well. The understory is both sparse and lacking diversity, due in part to the combination of dense buckthorn and abundant earthworms. Common forest species such as geranium, Jack-in-the-pulpit, false Solomon's seal, violets, white snakeroot, enchanter's nightshade, lady fern, and woodland sedge were found throughout.



Photo 11. A buckthorn-dominated slope in OF5

Woody seedlings included green ash, ironwood and hackberry; few oak seedlings were encountered. Unfortunately, buckthorn seedlings were the most abundant plant in many areas, and other woody invaders including glossy buckthorn and Japanese barberry were present, especially in wetter areas along the southern ravine (Photo 12). Herbaceous invaders were present as well, and included garlic mustard, dame's rocket, burdock, and motherwort. These species were among the most abundant herbaceous species in the entire unit (Appendix B).

Besides invasive species, woody encroachment due to the lack of natural disturbance, primarily fire, was the most prominent issue in this unit (Photo 13). Thinning the subcanopy and canopy would allow a return to savanna-like system. Native understory vegetation, especially grasses, could help prevent erosion and provide dense cover to compete with future invasive species. Other issues include remnants of barbed wire fences and occasional refuse piles.

Overall, the target plant community for this unit is oak savanna. This unit retains much of the character of the historical savanna community and presents an opportunity to think boldly to restore one of the state's most imperiled habitats. Moreover, a return to a savanna system in this unit would improve the transitions between other prairie and



Photo 12. The canopy of OF5 was dominated by bur oaks, while buckthorn dominated the shrub layer.

grassland units and would improve the ability to manage invasive plants in the long run by allowing the use of fire and grazing.

Restoration to savanna would be accomplished by removing invasive species, thinning the canopy and subcanopy, and re-vegetating the unit with an understory of grasses and wildflowers. Another important benefit of savanna restoration will include erosion control, water filtration, and protection of the property from flooding, including from 100 and 500-year flood events. Restoration of this unit would be high priority.



Photo 13. Towering bur oaks line the path on the south end of OF5.

Unit OF6

OF6 is an 18-acre unit and was one of the most degraded oak forest units, with a mix of oak and disturbance tolerant species dominating the canopy and subcanopy layers. Bur and white oak were present in the canopy and their growth forms are indicative of an historically more open savanna environment, but American elm, hackberry, quaking aspen, and black cherry have all become co-dominant as the canopy has closed. The subcanopy had occasional green ash, American elm, and hackberry, while the shrub layer was dominated by mature, dense common buckthorn. The ground layer was fairly depauperate, with generalists such as white avens and Virginia stickseed mixed in with the more abundant garlic mustard and dame's rocket.

Due to the unit's connection with neighboring unrestored properties, long-term successful restoration is less likely than for some of the park's internal units. However, there is the opportunity to thin the canopy, especially on the unit's oak-dominated southwestern diagonal edge, in order to more gradually transition between oak forest and prairie in LGU6. Moreover, invasive shrub removal should occur to eliminate a seed source to other restored units, though this is still lower priority than the other OF units.



Photo 14. Buckthorn dominates under a closed canopy of oak and more generalist tree species.

Unit OF7

OF7 was a 2-acre unit along the south edge of the park. It was most notable for the largest pin oak we located at the park, with a 49-inch dbh (Photo 15). The unit was otherwise similar to other units, but the canopy was more diverse, probably due to the fact that it is an “edge habitat” which tends to accommodate more species. Bur oak, pin oak and quaking aspen dominated with lesser amounts of American elm, black cherry, red pine, cottonwood, hackberry and others.

The shrub layer was fairly dense buckthorn and honeysuckle. Prickly ash and red-berried elder was also common but there were few other native shrubs or tree saplings.

The ground layer was a typical low diversity weedy composition, heavily dominated by buckthorn. Forbs were sparse, but included white snakeroot, lady fern, white avens, Canada mayflower, enchanter’s nightshade as well as garlic mustard and motherwort.



Photo 15. 49-inch dbh pin oak at OF7 was the largest tree we recorded at the park.

Targeted to be southern dry-mesic oak woodland, the primary management need is to remove the invasive plants – buckthorn, honeysuckle, garlic mustard - and to continue the follow-up needed to keep them from taking over. As these species are managed and decrease throughout the park it will become easier to keep them reduced. Also, the giant pin oak, and any other spreading-branched large trees, should be “released” from the competition of small trees that are crowding them. A prescribed burn would also be beneficial. Full management of this unit to woodland is low priority, but managing the invasive species is high priority to prevent propagules from seeding into the adjacent OF3 unit, which has been managed.

Units OFe and OFw (managed)

Unit OFe (18 acres) and OFw (11 acres) were the first sizable areas where ecological management began, with invasive woody removal in winter 2015 by forestry mowing and hand-cutting steep slopes. Both units have had two to three fall foliar treatments and portions of both units were burned.

In 2021, OFe had a lot of small buckthorn whips on the west side (Photo 16), and scattered stems elsewhere, especially the south side. They can be managed by wick-applying herbicide in fall (scheduled for 2022). Similarly, OFw had virtually no buckthorn in the shrub layer, but

it was moderately abundant in the ground layer, which was scheduled for treatment in fall 2021.

The portion of the OFe unit to the south and west of the pond demonstrated the former savanna landscape of the park, with several large bur oaks. Since the unit has been managed and there were with very few invasive species in the understory and ground layer (Photo 17).

The target plant community for most of the two units is dry-mesic oak woodland, but the target for the west edges of both units is savanna. This will require removal of small trees along with most shrubs.



Photo 16. Small dense buckthorn whips cover the western side of OFe.



Photo 17. The far western edge of OFe, south and west of the pond, was in very good condition with very little buckthorn.

Follow-up foliar treatment is needed throughout the two units to address seedling and resprouted buckthorn and honeysuckle. However, care must be taken not to eradicate the ground cover, as erosion of the sandy soil is likely to occur. Both units should be burned then overseeded with savanna species. Restoration tasks, especially burns, should be coordinated with the DP1 and DP3 prairie associated with these units. Continued invasive woody management of these units is high priority to maintain what has been accomplished. The savanna restoration would be a lower priority.

Dry-Mesic Oak Forest

Units OM1, OM3 (managed)

The 35-acre OM1 is north of the lake, where east and west-facing slopes flank the main paved trail and the drainageway. The 15-acre OM3 occupies a ravine to the east of the visitor building. The plant species composition of the mesic oak forest units was similar to the dry-mesic oak woodland units but had a few indicators of the more mesic soil conditions, such as more red oak and basswood in all vegetative layers, and more honeysuckle and white snakeroot in the ground layer.



Photo 18. 4-ft dbh pin oak in OM1.

The canopy was fairly continuous on east-facing slopes and ravines, and more open along edges. The OM1 unit was much more open on the lower, flatter areas along the paved trail. Dominant tree species were red, pin, and bur oak. As with other units, there were widely scattered trees of very large diameter, up to four feet (Photo 18). Black cherry was abundant, with lesser amounts of green ash, hackberry and quaking aspen.

Buckthorn and honeysuckle removal was completed in these units in late winter 2021, followed by foliar treatment in the fall. Most of the stems were hand-cut due to the slopes in OM1 and to the lesser abundance of buckthorn in OM3. The shrub layer was therefore very sparse, although OM3 had somewhat greater cover, and the species diversity was very low, consisting mostly of the canopy tree species. Native shrub species were gooseberry, black raspberry, and prickly ash. One other invasive woody species found in OM3 was a small population of barberry.



Photo 19. A carpet of honewort in OM1 after buckthorn removal.

dense to patchy cover with a fairly low species diversity. Woody cover, primarily buckthorn with canopy tree seedlings, was more abundant than forbs (Photo 20). Garlic mustard was present but not abundant. Pennsylvania sedge was the most abundant herbaceous species, with occasional wild geranium, white avens, false lily of the valley and zigzag goldenrod.

The ecological management goals and methods will be the same as for the dry oak forest units, except that the target plant community for these units will be a little different. As these units are located lower in the landscape and tend to have moister soils, the target

The ground cover was fairly robust in OM1 after invasive woody removal, with nearly continuous cover in low areas. White snakeroot and honewort were the dominant species (Photo 19). Garlic mustard was abundant in the west half and seedling buckthorn seedlings was abundant throughout, forming carpets in some areas. It was treated in fall 2021. Other common species were enchanter's nightshade, sweet-scented bedstraw, lady fern, pilewort, wild geranium, Virginia stickseed, false lily of the valley, false Solomon's seal, and clearweed. Japanese hedge parsley and common burdock were both present though not yet abundant. The ground cover in OM3 unit ranged from



Photo 20. A dense but low diversity ground cover in OM3, dominated by woody plants.

community will be southern dry-mesic oak forest. On-going management is a high priority and will be very similar to methods described for the dry oak forest: annual follow-up foliar spray of woody plant, Rx burn, spot spray (or spot mow prior to seed formation) garlic mustard, hedge parsley and burdock, overseed if needed (OM3). The spring burn and fall foliar buckthorn treatment are scheduled with existing funding (FMR, Outdoor Heritage Fund) for 2022.

Also of note in the OM1 unit is the drainageway easement that parallels the paved hiking trail. This feature is The Central Draw Storage Facility Overflow Project, which was completed by the South Washington Watershed District in 2017 to route overflow runoff from Woodbury and Cottage Grove through Ravine Park to the Mississippi River (<https://www.swwdmn.org/projects/>). Management of the corridor is addressed in a Drainageway Easement section.

Lowland Forest

Units LHF1, LHF2 (managed)

The two LHF units are located on the east side of the lake, south of the fishing dock, in lowland areas that are occasionally flooded. Together they comprise 0.7 acres. Unit LHF2 had a mix of young tree species, dominated by quaking aspen but including basswood, American elm, pin oak, red cedar and one large bur oak (Photo 21). The tree canopy was open with less than 50 percent coverage.

Although buckthorn has been removed or treated at this unit at least three times since 2012, it has reestablished as the dominant shrub, with honeysuckle also abundant. Both are still small plants, less than four feet tall, but dense. There were also a few Amur maple. Saplings of all the tree species were present as well as several native shrubs including gray dogwood, American hazelnut, smooth rose, and nannyberry. The ground layer was dominated by sedges with forbs such as Canada goldenrod, wild grape vine, white snakeroot and a few boneset. The LHF1 unit was dominated by reed canary grass, with a tree canopy of boxelder.



Photo 21. Unit LHF2 with aspen, bur oak, and shrub layer of buckthorn.

The target community for these units is southern wet-mesic hardwood forest. The primary need is to control the invasive woody plants and keep them managed. Follow-up management is a high priority and planned for these units for 2022 (FMR, Outdoor Heritage Fund). The next treatment should be planned for in two to three years.

Aspen Forest

Unit ASP

The three-acre ASP unit is an altered forest unit, though aspen was the dominant canopy species. It is possible that this unit established as an aspen grove in the larger oak savanna landscape and that other woody species have since proliferated with a lack of fire or other management in recent decades. Additional woody species in the canopy and subcanopy included box elder, pin oak, green ash, and hackberry. The shrub layer was dominated by buckthorn, with honeysuckle, chokecherry, and *Rubus* species present as well. Like the other altered units, the ground layer consisted mainly of generalist forest species, and was dominated by garlic mustard and dame's rocket.

If this unit were to be restored, the target would be southern dry-mesic oak woodland. However, in terms of restoration potential, this unit is a low priority. It is separated from other units by roads, buildings, trails, and the CON1 unit, and because of this lacks high quality habitat value. Unlike AW1, however, conversion to grassland is unlikely to be successful, as the woodland is denser and only shares one border with a prairie unit. Instead, this unit can be maintained as forest and enhanced. Woody invasive species removal should be undertaken in order to prevent the unit from becoming a seed source for nearby restored units. Climate adapted trees and shrubs can also be planted into removal areas and canopy gaps in order to diversify the unit, improve climate resiliency, and augment wildlife habitat.

Altered Deciduous Woodland

Unit AW1

The four-acre AW1 unit is more forest-like than woodland, with box elder, cottonwood, and pin oak as the dominant canopy tree species. Black cherry, quaking aspen and green ash make up the rest of the disturbed canopy, while white and red pine - likely planted - were present in groups. Though not confirmed, evidence of EAB was spotted in a number of the ash trees in the unit, including full or partial canopy dieback.

The subcanopy was dominated by box elder, green ash, and American elm - typical of disturbed or altered



Photo 22. Buckthorn dominates the understory of AW1, creating a closed sub-canopy and limiting native species regeneration.

woodlands, and many seedlings and saplings of these species were found in the shrub and understory layers. However, buckthorn and honeysuckle dominated the shrub layer and again highlight the disturbed nature of the unit (Photo 22). Chokecherry was abundant along the small ravine, while the more upland areas contained *Rubus* and *Ribes* species - species indicative of a history of grazing and disturbance. The unit was heavily influenced by human uses and edge habitat, exacerbated in part by the paved trails through the unit. While the understory was quite diverse, with 27 different species present, it was dominated by non-native herbaceous species like garlic mustard and dame's rocket, and most other species were uncommon.

In terms of restoration potential, this unit is a low priority. Because of its small size, isolation from other forested units, and disturbed history, the unit lacks remaining high quality habitat value, and may be more easily maintained as grassland, requiring wholesale conversion. This would come at significant cost, however, which would be better used elsewhere in the park. In lieu of wholesale conversion, woody invasive species removal should still be undertaken in order to prevent AW1 from becoming a seed source for nearby restored units. Climate adapted trees and shrubs can also be planted into removal areas and canopy gaps in order to diversify the unit, improve climate resiliency, and augment wildlife habitat.

Unit AW2

Unit AW2 was a five-acre knob on the east side of the park at the south end. It had been cropland in the past that was allowed to go fallow. Woody plants gradually moved in, with boxelder the primary canopy tree and a dense shrub layer of mature buckthorn and prickly ash (Photo 23). The eastern edge of the unit more closely resembles an oak woodland, with large red oak trees (20-inch dbh), abundant quaking aspen, occasional bur oak, and a dense subcanopy of red cedar.

Due to the highly degraded nature of this unit, full restoration to dry-mesic oak woodland is a low priority. However, buckthorn control is a high priority throughout the park, as mature plants will continue to invade into restored areas as well as adjacent private properties. Buckthorn removal will result in an extremely open canopy, so follow-up management would be needed – seeding heavily with grasses and follow-up spraying of buckthorn. As there are so few native species to be concerned with, treatment can be more aggressive.



Photo 23. The AW2 understory of mature dense buckthorn and prickly ash, with boxelder canopy.

Conifer Plantations

Unit CON1

The 39-acre CON1 was the largest of the conifer plantation units and formed an east-west conifer belt that separates the northern third of the park from the south. The unit was dominated by red pine and white spruce (Photo 24), with red oak occurring as a co-dominant in some areas. The subcanopy was dominated by spruce, but had a larger contingent of deciduous species including American elm, box elder, and patches of quaking aspen. Like the other forest units, the shrub layer was still dominated by common buckthorn. Prickly ash was abundant as well, especially in canopy gaps, and Missouri gooseberry, chokecherry and red-berried elder are common throughout the unit. Honeysuckle was present along the edges and in canopy gas. As is expected under densely-planted conifers, the ground layer was sparse, and consisted mostly of woody seedlings waiting for their chance to escape the dense shade – most notably buckthorn, prickly ash and gooseberry. Virginia creeper and wild grape were common as well. The most common forbs were non-native, and included garlic mustard and dame's rocket. Both species were pervasive throughout the unit, but occurred in patches and did not form continuous stands. Native forbs were dominated by generalist forest species, including enchanter's nightshade, Virginia stickseed, and clearweed.



Photo 24. Red pine and spruce dominate the canopy, with the occasional deciduous species present as well. Buckthorn dominates the shrub layer.

In an ideal world, these man-made stands of conifers might be replaced by vegetation more indicative of the historical plant communities of the site. However, these established stands have transitioned so far from prairie, savanna, or even altered woodland that their removal would be prohibitive. These stands also provide important habitat and food sources for birds and small mammals (Photo 25).



Photo 25. CON1's border with a switchgrass-dominated area of GRT2

The conifer units should still be managed for invasive shrubs and herbaceous species, which grow more slowly in the acidic, low resource environment created by the conifers. On

the other hand, CON1 will always provide a source of unwanted conifer propagules for other prairie and forest units. While these should be relatively easily managed with fire and grazing, it is nonetheless important to plan for. Ultimately, CON1 can be thought of as a vegetative buffer where buckthorn and other species won't easily spread to neighboring units. Occasional management will be necessary, and will likely be largely hand removal or basal barking of invasive shrubs given the tight spacing of the mature canopy trees. This can occur in conjunction with management of neighboring units.

Unit CON2

The six-acre CON2 was a much smaller unit sandwiched between OF1 and two grassland units. There was one main trail that bisects the unit from north to south. The unit was dominated by red pine and white spruce, with occasional box elder, green ash, and cottonwood in the canopy. Like CON1, the subcanopy was made up of spruce and a few deciduous species, including American elm, box elder, and patches of quaking aspen. The shrub layer, though sparser than the other forest units, was still dominated by common buckthorn (Photo 26). Prickly ash was abundant as well, especially in canopy gaps, and red-berried elder was common throughout the unit. The groundlayer was less dense than CON1, but still contained numerous woody seedlings, the most common of which was buckthorn. Garlic mustard and dame's rocket dominated the forb layer. Native forbs were similar to CON1 and included mostly generalist forest species like enchanter's nightshade and Virginia stickseed.

Given CON2's position between prairie and oak forest units, removing the unit makes more sense than does removing CON1. However, this is still a large undertaking, and should only be pursued once other, more high priority restoration goals are met. Like CON1, CON2 does provide habitat, but is problematic due to the propagules it produces and its expansion into neighboring units. In the meantime, wood and herbaceous invasive species removal can be undertaken in conjunction with neighboring units like OF5.



Photo 26. Dense spruce and red pine in CON2.

Unit CON3

CON3 was a 5-acre plantation of dense red pine about 50 feet tall (Photo 27). There were also a few scattered large bur oaks (20-inch dbh) and pin oak (24-inch dbh) (Photo 28), some with wide-spreading branches that point to a more savanna-type land cover in the past. The shrub layer was moderately dense mature buckthorn and abundant prickly ash with occasional amur maple, basswood, boxelder and hackberry. The ground layer was sparse with garlic mustard and motherwort most common.



Photo 27. Mid-size red pine at CON3 with mature buckthorn shrub layer.



Photo 28. Very large diameter scattered oaks in CON3 indicate former savanna.

The target plant community for this unit could ultimately be southern dry-mesic oak woodland. However, such a restoration would be a low priority. As with other CON units, the main priority would be invasive woody removal as well as thinning out around the large oak trees.

Unit CON4



Photo 29. Red pine at CON4 with understory of honeysuckle and buckthorn.

CON4 was a 5-acre unit along the south edge of the park. Planted red pine and Jack pine dominated the unit (Photo 30), but areas of deciduous woodland were intermixed and covered about a third of the unit (Photo 29). Pin oak, boxelder and quaking aspen were the primary deciduous trees, with some black locust and scattered red cedar. The shrub layer was dense and dominated by buckthorn and prickly ash with honeysuckle along the edges and a patch of black locust. The ground layer was primary woody seedlings of buckthorn. Forbs were sparse but included garlic mustard, motherwort and other weedy species.



Photo 30. Mixed deciduous trees occupy about a third of the canopy at CON4.

The target for this unit would be southern dry-mesic oak woodland. While achieving that would be a low priority, this unit is adjacent to the OF3 unit that is being managed, so invasive woody tree and shrub removal is a high priority. Thinning out small trees around large oaks would also be beneficial.

Unit CON5

CON5 was a 3-acre unit of red pine and Scotch pine located at the southeast corner of the park. It also included a one-acre stand of black locust along its north edge (Photo 31). In 2012 the locust stems were 2-inches dbh. By 2021 they were about 4 inches, but very tall, over 40 feet. The shrub layer consisted of moderately dense buckthorn with honeysuckle along edges. Prickly ash, red raspberry and red-berried elder were occasional. The ground cover was fairly sparse overall, as is typical of a dense conifer stand. It was dominated by garlic mustard with some burdock, motherwort and patches of chickweed (Photo 32). Native species were sparse but included clearweed, white snakeroot and sweet cicely.



Photo 31. A one-acre stand of black locust on the north side of CON5.

Although not a native plant community, the plantation does provide wildlife value and other ecological services like carbon storage. Restoring a native plant communities would be very costly and would be considered low priority. At this time, we recommend removing the invasive shrubs throughout the unit, removing the black locust and restoring that area to savanna as part of the GRT5 unit. If the locust tree removal takes place as part of a larger scale tree removal at the park, there maybe be an option for a salvage harvest (e.g., for biofuels). Tree removal work should take place with snow cover to prevent soil compaction.



Photo 32. Carpets of chickweed at CON5.

Unit CON6 (managed)

CON6 was a 2-acre mixed conifer-deciduous stand on the southeast shore of the lake (Photo 33). Scotch pine was the dominant tree, with pin oak, American elm, boxelder, bur oak and white poplar. Tatarian honeysuckle and buckthorn dominated the shrub layer, but they were mostly less than four feet tall as this area has been managed for invasive woody plants several times since 2012. Buckthorn was still dominant in the ground layer along with prickly ash and native forb diversity was low.

The target community for this unit would be dry savanna. This would be a fairly low priority project, but short-term management of invasive woody control (including white poplar) would be high priority, to maintain what has been accomplished and prevent further degradation. Eventually, to restore savanna, the non-oak species would be removed, the unit would be forestry mowed followed by herbicide treatment and seeding savanna species.



Photo 33. CON6 from the south.

Native Prairie, Remnants and Restored

Southern Dry Prairie, Sand-Gravel subtype (UPs13b) (managed)

Units DP1, DP2 and DP3 were dry prairie nodes with a combined area of about 2.5 acres. DP1 was the largest at just over one acre. They were all remnant native sand-gravel prairie

nodes, located in small oak forest openings on south and west-facing slopes. Historically these were probably part of a savanna complex, but now stand out from the woodlands as tiny remnants of that landscape.

All of the units have been managed since 2013, with invasive woody, prescribed burns, and invasive forb control. Each of the prairie nodes had somewhat different species compositions (Appendix B), but all had a few trees on or nearby and a shrub layer of less than 25 percent cover (Photo 34). Most of the shrub layer was small trees, honeysuckle and brambles.



Photo 34. DP3 prairie with abundant small honeysuckle. Hairy puccoon can also be seen.



Photo 35. DP2 prairie with lupine, monarda, and mullein.

All of the units had about 30 forb species, including about 10 non-native species. Most of the non-natives were not invasive species (e.g., dandelion), but seven invasive species were recorded in very low abundances among the sites: hoary alyssum, spotted knapweed, Canada thistle, common St. John's wort, butter and eggs, Japanese hedge parsley, and common mullein. Spotted knapweed was hand-pulled in 2021. Most of the native forbs were not very abundant, but species included yarrow, pussytoes, Canada frostweed, bergamot, large-flowered penstemon, spiderwort, purple prairie clover and whorled milkweed. Notable species included hairy puccoon, a very conservative species, which was abundant at DP3, wild lupine at DP2 (Photo 35), and prairie violet and pinweed at DP1.

Graminoid species varied among the units, with Pennsylvania sedge, Canada wild rye, and little bluestem most common. Poverty oat grass was abundant at DP1 (Photo 36) while June grass was abundant at DP2. Kentucky bluegrass was present at all units, but not abundant, and smooth brome was at DP2 in low abundance.

All of the units have improved since 2011, with more native species. They also had more non-native species, but they were in low amounts. Woody cover, especially non-native species, was greatly reduced.

The target plant community for these units will continue to be southern dry prairie, sand-gravel subtype. Primary ecological concerns at the prairie nodes continue to be encroachment of native and non-native woody species and the non-native, invasive herbaceous species mentioned above. Annual management is needed to control these species by hand-pulling, timed cutting, prescribed burns, and spot-spraying. In addition, the prairie nodes all need to be expanded by removing nearby trees and shrubs, conducting prescribed burns and overseeding with a very select mix of local (Dakota or Washington County) seed. Burning is important but should not be used excessively as it can be detrimental to these dry prairies. Burning should be done as early as possible in the spring (by early April) to minimize damage to native forbs. Burning is also harmful to some native pollinators and other insects so all the prairies should not be burned in the same year.



Photo 36. DP1 prairie, with some knapweed and prickly ash.

Because there is so little native prairie remnant at the park, these small units represent relicts from the past. They are a top priority for management and restoration.

Unit DPr

Unit DPr is a 0.5 acre restored prairie on the east bank of the lake. In 2012 it had a tree cover of amur maple, red cedar, and river birch, and a ground layer of Kentucky bluegrass and fescue with spotted knapweed. Most of the woody plants were removed except a couple cedars, the site was burned and sprayed several times, then seeded to native dry prairie species in fall 2015. It was burned in fall 2018, then additional seed was broadcast. Since then, it has had invasive weed spot-spraying and pulling.

Native plants dominated the site in 2021, especially little bluestem, Canada goldenrod and black raspberry. Native forbs included bergamot, black-eyed Susan, lupine and large-flowered penstemon (Photo 37), but plant species diversity was fairly low, with only about a third of the seeded species detected. The primary non-native species was festuca, with small amounts of amur maple, hoary everlasting, spotted knapweed, birdsfoot trefoil, and honeysuckle. Woody native seedlings included green ash, bur oak and pin oak.

The target plant community for DPr is southern dry prairie, sand-gravel subtype. Ongoing management is a high priority, including spot-treating or pulling non-native invasive herbaceous and woody plants. Canada goldenrod and raspberry also need to be reduced with annual mowing in August for two to three years. A fall spray should be done to target non-native cool season species. It should be burned every three to five years and additional seed broadcast after the burn.



Photo 37. Bergamot and black eyed Susan at the DPr restored prairie.

Long Grasses on Upland Soils

This section includes both the LGU units and the GR units, as both were dominated by non-native grassland species with little or no shrubs and trees.

Unit LGU1

LGU1 was the northwestern-most unit of the current park boundary and was bordered by roads and buildings to the north, east, and west. This edge habitat creates ecological issues for the unit, namely encroaching invasive species and disturbance caused by road and grounds maintenance, but the majority of the unit has high native species abundance and diversity. The unit itself had a mix of distinct prairie areas, with some potential remnant habitat, some obvious restoration areas in good shape, and other areas that were likely failed restoration areas now dominated by invasive species (Photo 38).

The native graminoid community was dominated by little and big bluestem, Indian grass, and switchgrass, while non-native graminoids such as smooth brome and Kentucky bluegrass occurred in similar abundance. Sixty-seven forb species were recorded throughout the unit, with 26 of those being non-native, weedy, or invasive. Three species of milkweeds, large flowered penstemon, hairy puccoon, and dotted blazingstar all provide important floral resources, and were some of the more conservative species in the unit (Photo 39). Generalists such as wild bergamot, Canada and stiff goldenrod, and yellow coneflower were also present. Crown vetch, white and yellow sweet clover, birdsfoot trefoil, leafy spurge, Canada thistle and spotted knapweed were all species that need management efforts in the near future.



Photo 38. The north end of LGU1 illustrates the in-tact prairie areas as well as the non-native-dominated edge habitats



Photo 39. The southern lobe of LGU1 is grass-dominated, with scattered forbs including blazingstars.

Spot herbicide treatment of invasive forbs was warranted, but a full elimination of non-native grasses would likely do more harm than good to the current compliment of native species present in the unit. Rotational prescribed burns would help to knock back woody species while at the same time favoring native fire-adapted forbs and grasses.

Two separate areas were not included in the current unit or park boundary but should be managed with or in the same way as LGU1. These were the small retention pond area on the southwest corner of the Cottage Grove City Hall building, and the southernmost prairie lobe

north of Ravine Pkwy S in front of the Washington County Service Center. We recommend to exploring officially adding these areas to the park through easement or purchase or developing a management agreement with the current landowners.

Unit LGU2

LGU2 was a long, narrow seven-acre unit that was heavily bisected by trails and bordered by Ravine Pkwy S. along most of its length. It also shared a border on its eastern edge with OF5. It was an abrupt transition between the two units, with more evidence of forest species moving into the prairie unit than vice versa. Overall, the unit was quite diverse, though less so than LGU1. The unit boasted 43 forbs species and 11 different grass species, though some of

each were non-native and invasive. Some areas of the prairie – like the central portion - seem to be remnants, with species like Carolina puccoon, large-flowered penstemon, flowering spurge and other dry prairie species present (Photo 40). Other areas had clearly undergone restoration, including the northernmost section, and were dominated by more generalist grasses and forbs (Photo 41).



Photo 41. The central portion of LGU2 retains remnant native plant diversity and is grass-dominated.



Photo 40. The northern end of LGU2 is dominated by Canada goldenrod and other forbs

The biggest issues facing the unit were encroachment by woody species and the presence of invasive forbs and grasses. In particular, spotted knapweed was problematic throughout the unit and necessitates management through either herbicide use or a biocontrol release. In other areas, Canada goldenrod completely dominates the unit and should be mowed in order to remove nitrogen and overall biomass. Lastly, fire is needed to keep woody and forest herbaceous species from encroaching on this narrow unit. By converting OF5 to savanna and softening the transition between it and LGU2, prairie grasses and wildflowers would have more room to expand with less shade to foster the growth of forest species. This would also allow for easier management through rotational prescribed burns.

Unit LGU4 and LGU5

Unit LGU5 was a long, narrow, 3-acre swath on a roadside slope of CR 19, on the far western side of the park and LGU4 was a 1-acre unit just to the north of LGU5. Both were on steep east-facing slopes. These units were dominated by non-native grasses with scattered shrubs and trees. They have persisted as grassland, which is beneficial as the grasses anchor the soil on the steep slopes. Given the location and difficulty of managing it as grassland (burning would be costly and difficult), allowing native trees to gradually fill in would be a suitable goal and they could also be managed as part of the adjacent dry-mesic oak woodland. If the units are kept open for the purpose of the valley view from the road, then no other management is needed other than controlling non-native invasive species.

Unit LGU6

LGU6 was an 11-acre degraded grassland unit underneath the Xcel powerline corridor in the northeast part of the park (Photo 42). Maintained through an easement, the unit was also the only one in the park to contain a snowmobile trail. Currently, very little management is conducted in the unit, other than occasional mowing. As such, the unit has a mix of some generalist native species and many non-native and invasive species. The graminoid layer was dominated by smooth brome and Kentucky bluegrass, but also contained pockets of big bluestem, little bluestem, and switchgrass.

Forb cover was patchy, and was influenced by the narrowness of the unit, with many forest edge species common in all but the centermost portion of the unit. These included woody species like buckthorn, prickly ash, black cherry, and *Rubus* species, and herbaceous species like white snakeroot, white vervain and catnip. Prairie species included non-native species such as white campion, Canada thistle, common mullein, yellow rocket, and spotted knapweed, and patches of native forbs included mountain mint, sweet everlasting, frost aster and common milkweed.



Photo 42. LGU6 looking northeast - smooth brome dominates this degraded unit.

A wet swale runs across the width of the unit towards its eastern end. The swale was dominated by reed canarygrass, and contained stinging nettle, motherwort, and abundant Canada thistle. Some common elderberry was present as well but is not worth protecting if management was undertaken in this unit.

Overall, management in this unit could follow two trajectories, a clean slate-type restoration, or a more focused grazing and interseeding. For the best and quickest results, prepping the unit out and reseeding with native prairie species is recommended. However, to minimize herbicide use or experiment with targeted grazing, a more nuanced approach could be warranted. In either case, a long-term maintenance agreement is needed with Xcel in order to restore the unit to native prairie.

Unit GR1

GR1, a 13-acre open field, was likely historically used for hay and possibly other agricultural uses. The unit was relatively flat, and uniform in vegetative character. The groundlayer was dominated by a thick layer of Kentucky bluegrass and patches of smooth brome (Photo 43).

Very few forbs were present in the unit, and most were non-native or considered invasive. For example, a few small patches of Canada thistle dotted the grassland, while spotted knapweed and common mullein were occasional throughout. Canada goldenrod had formed a few patches but did not yet dominate the unit. Some woody species, including Siberian elm and wild grape were present but infrequent.

Restoration of the grassland to prairie is relatively straightforward. Preparation involves removing the existing vegetation through a combination of several herbicide applications, thatch removal (burning), and seeding with a diverse mix of native prairie grasses and forbs. A few bur oaks have already been planted in the unit, hinting at oak savanna as the target plant community. Their tree tubes should protect them from browsing, but should be noted for contractors that will be conducting burns and establishment mowing.



Photo 43. The bluegrass and brome dominated GR1 with planted oaks visible in the background.

While this restoration is not urgent in terms of protecting remaining native plant communities or eradicating invasive species, it would provide an excellent opportunity to restore habitat for some of the most imperiled animals in the state – grassland birds and pollinators. For that reason, we suggest this as high priority for restoration.

Unit GR2

Unit GR2 was a 2-acre unit located on the north side of OF2. It was heavily dominated by smooth brome. Forbs were sparse but American germander was the most common. Several woody species were common in the ground layer, especially red raspberry and prickly ash (Photo 44). The shrub layer was sparse and included honeysuckle and scotch pine. The canopy was also sparse and included Scotch pine and red cedar. A few small cottonwood trees were found along the grassland/woodland edge.



Photo 44. GR2 grassland with scattered red cedar, honeysuckle and raspberry.

The target plant community would be southern dry savanna, but restoration at this time would be a low priority. This unit should be restored in concert with the OF2 unit. In the short term, removal of invasive woody plants would be the only task warranted.

Unit GR3

This 0.6-acre unit was located east of the lake, along the eastern edge of the park. It was heavily dominated by smooth brome with few other species (Photo 45). Planted red pine on private property flanked the east border. The rest of the unit was surrounded by the oak forest of OF2.

Due to its small size and isolation from other grassland areas, this is a low priority unit for restoration, but the target plant community would southern dry savanna.



Photo 45. The GR3 unit was almost entirely smooth brome.

Pipeline

The east-west pipeline that splits the park into approximately equal north and south areas, occupied a narrow corridor through the park, about 2,500 feet long and 25 to 50 feet wide. The vegetation was mostly herbaceous, dominated by invasive and non-native species. Canada goldenrod was the dominant species overall (Photo 46). Smooth brome and reed canary grass were the primary grasses. Other common plants were birdsfoot trefoil, butter and eggs and red raspberry.

The east half of the corridor included a hiking trail, with a narrow swath of the same type of herbaceous vegetation on either side.



Photo 46. The western half of the pipeline corridor, heavily dominated by Canada goldenrod.

This corridor by itself would be low priority for restoration. But the western portion that is connected to unit GRT2 could be restored with that unit.

Grassland with Sparse Conifer and/or Deciduous Trees

Unit GRT1

This 3-acre unit was among the most degraded on the entire property and was no longer much of a grassland. It consisted of a small, degraded grassland pocket in the southwest corner of the unit (Photo 47), and a very degraded deciduous forest on the rest of the unit.

The grassland pocket can be thought of as an extension of the adjacent GR1 unit and can be restored in much the same manner. It is dominated by a mix of smooth brome and Kentucky bluegrass, and is punctuated by Canada thistle, Canada goldenrod, common mullein and the occasional honeysuckle shrub.

However, the now forested portion of this unit would be difficult to restore to prairie given how far the unit has transitioned to forest cover (Photo 48). The forest was dominated by green ash, with some individuals already showing dieback – likely due to emerald ash borer. The shrub layer was dominated by buckthorn, and contained some honeysuckle, red cedar, prickly ash, and *Rubus* species.

The ground layer was almost exclusively non-native dominated, except for white snakeroot and Canada goldenrod. The most abundant species include garlic mustard, Japanese hedge parsley, burdock, and creeping Charlie. The two restoration options would be to clear this unit altogether and restore the area to prairie, or to manage the unit as an altered woodland. This would involve enhancing the unit using the same methods as the other forest units, but is among the lowest priority areas in the entire park



Photo 47. Small brome dominated grassland pocket in the southwest corner of GRT1.



Photo 48. Degraded forest with green ash in the canopy and invasive plants below.

Unit GRT2

Unit GRT2 was 25 acres located in the central part of the park, just north of the pipeline. The eastern half of GRT2 still fits the description of ‘short grasses and mixed trees’, while the western half of the unit has transitioned to a mix of shrubland and woodland. Throughout both

halves, pockets of planted conifers have proliferated, though the eastern half was planted more recently and is somewhat more uniform in its woody proliferation.

Woody species included rows of planted young conifers and a fallow old field transitioning toward a relatively uniform Siberian elm stand (Photo 49). There was also steady encroachment from the neighboring CON1 unit to the north, including pine, spruce, and what looks to be a windrow of planted blue spruce.

While dominated by non-native grasses, the eastern half of the unit still retained some native diversity, including a field that was at some point seeded to switchgrass. Other pockets of little bluestem, Indiangrass and big bluestem can be found throughout the unit, but smooth brome and Kentucky bluegrass still dominated overall. Penstemon, sweet everlasting, frost aster and other forbs can be found in scattered pockets (Photo 50Photo 52), but native forb diversity and abundance was relatively low. It appears that there may be some slight encroachment of haying by the neighboring property on the eastern edge of the GRT2 unit.



Photo 50. Siberian elm encroaching on a degraded grassland in GRT2 east.



Photo 49. Scattered conifers encroaching on dry sand-gravel prairie in GRT2 east.

In the western half of the unit (Photo 51Photo 51), woody encroachment has progressed to the point where most grasses have been lost except in canopy gaps and where remnant prairie has persisted on south-facing slopes. The few small remnant prairies that persist within the larger shrubland/woodland matrix contain dry prairie species such as puccoon, large-flowered penstemon, whorled milkweed, hoary vervain, and prairie smoke (Photo 52Photo 53). However, they also contain abundant spotted knapweed, mullein and Canada thistle, and disturbed grasses such as hairy cupgrass and Kentucky bluegrass.



Photo 52. Dense shrubland and pockets of trees dominate GRT2 west.



Photo 51. Remnant south-facing dry prairie surrounded by woody vegetation in GRT2 west.

Elsewhere, a mix of shrubs and trees dominated, with pockets of conifers, stands of box elder and pin oak, and areas where Siberian elm was reaching canopy heights. Occasional bur oaks were found scattered throughout the unit, and some pin oaks were present, especially in and around pockets of conifers. In open areas, stands of buckthorn, honeysuckle, sumac, and prickly ash formed continuous shrub canopies, and were too dense to walk through in many areas. Other native shrubs included *Rubus* species, gray dogwood and black cherry.

Other non-native shrubs that require swift management included glossy buckthorn and Amur maple. The ground layer was a mix of prairie and woodland species, with most being generalist or invasive. Species like crown vetch, bouncing bet, and garlic mustard all seem to have proliferated from the pipeline right of way, while Canada goldenrod, white snakeroot, and sulphur cinquefoil were common throughout. St. John's wort was common in this unit, especially along edges, and is encroaching into the remnant prairies.

The target for this unit is southern dry savanna. The fact that the eastern half of the unit (east of the north/south trails) has been more recently encroached upon by woody species presents a simpler restoration trajectory, as there was less woody cover and invasive species to contend with. However, immediate efforts should be made to at least protect and expand the remnant prairie pockets throughout this unit. This would involve woody removal, focused spot spraying, and the use of prescribed burns to reinvigorate native prairie species. Release of knapweed beetles may also be warranted to control the abundant spotted knapweed. Transition back to prairie will be easier on the eastern side of the unit, though this is still the goal for the overall units.

Unit GRT3

The 12-acre GRT3 unit was located in the southwest corner of the park. About half of the unit was level terrain south and west of the first parking lot, and half was steep south and west-facing slopes. The tree cover was about 30 percent. Red cedar was the dominant species and was especially abundant on the south slope. Although it was too dense and needs to be thinned, a good stand of red cedar is desirable habitat for loggerhead shrike, which have been recorded in the vicinity in past years. Jack pine, a native tree but almost certainly planted, was also very abundant at GRT3. It would not need to be eradicated, but reducing it by 30 to 50 percent would be beneficial. There were occasional Scotch pine and boxelder.



Photo 53. GRT3 from north to south, dominated by brome, goldenrod, red cedar and Jack pine.

Smooth sumac was abundant on the south slope. The shrub layer was otherwise sparse but included prickly ash, honeysuckle and Scotch pine.

Grass species were over 50 percent of the ground cover, heavily dominated by smooth brome (Photo 53). Kentucky bluegrass was also abundant. GRT3 had more native grasses than other units, with little bluestem, sideoats grama, and small amounts of Indiangrass, switchgrass, fall witchgrass, and Canada wild rye. GRT3 also had more native forbs, but most were along the east edge that had been seeded after the park remodeling project (Canada milk vetch, early sunflower, bergamot, black-eyed Susan, stiff goldenrod, golden Alexander). The native forb diversity seemed much reduced from the 2011 survey, when numerous native species were found like whorled milkweed, hoary vervain, stiff sunflower, heath aster, and most notably long-bearded hawkweed, a species on the DNR watch list for its relative uncommonness. It is currently found across the highway at the 3M property but was not found at the park.

Non-native invasive species were generally at low abundances and included typical old field species: spotted knapweed, Canada thistle, and birds foot trefoil.

The target plant community is southern dry savanna. Although not a high priority, restoring this savanna would be a great benefit for grassland bird species and pollinators. Native prairie, for example, is used by 20 specialist bird species whereas grassland is used by only 6 (DNR 2006). Recent research has shown that native plants also provide better habitat for native insects (Tallamy) whose populations have plummeted by up to 30 percent in the past 50 years. Many native bees, which play a critical role in pollination, have had more precipitous declines, up to 90 percent in the past 20 years. A 12-acre restoration could provide significant pollinator habitat. And it could also be a showy entry for the park.

However, part of the GRT3 unit is planned as a “destination playground.” Depending on the footprint for that feature, if that plan proceeds, then it may not be worthwhile to invest much in this unit other than invasive woody control.

Unit GRT4 and GRT5

GRT4 was 1-acre unit on the south side of the park at the former entrance. The primary management need would be to remove non-native woody plants – buckthorn, honeysuckle, Siberian elm. The grassland is dominated by smooth brome, but there is no need to restore this small area.

GRT5 was a four-acre unit located south of OF2. The canopy cover was at least 30 percent, dominated by Scotch pine and red cedar (Photo 54). There were also occasional bur oak, pin oak, boxelder, American elm and Siberian elm.

The shrub layer was also about 30 percent, dominated by honeysuckle, smooth sumac and prickly ash. There were lesser amounts of buckthorn, Scotch pine and black locust. Aside from brome, Canada goldenrod was the dominant herbaceous plant and bergamot was also common. Other occasional species included field thistle, sweet everlasting, frost aster, and evening primrose. There were small amounts of knapweed and butter-and-eggs.



Photo 54. GRT5 with brome, cedar, scotch pine and Siberian elm.

The target plant community for this unit is southern dry savanna. The full restoration would be a lower priority, but removal of the invasive non-native and native woody species would be a medium priority that should happen within the next couple years to prevent the woody plants from completely taking over the grassland. A few red cedar should be left as they are a natural part of the plant community,

Mesic Prairie

Unit MP

The MP unit was a small 2-acre area at the north end of the lake (Photo 55). In the 2011 management plan it was shown as fairly overgrown and dominated by non-native species. Although invasive woody plants were later cleared and it was burned, the woody plants have resurged and it was more of a thicket, overgrown with woody plants and difficult to walk through. There was a sparse canopy of red cedar and bur oak with a few quaking aspen, and a

dense shrub layer of honeysuckle with some aspen and sparse buckthorn, sumac, and hazelnut. The ground layer had a low forb diversity. Germander and spotted knapweed were common, Canada goldenrod, yarrow, yellow coneflower, prairie fleabane and bergamot were present but not abundant. The woody ground layer species included those in the canopy and shrub layer, as well as abundant red raspberry, prickly ash, and Virginia creeper. Few grass species were detected but Kentucky bluegrass and switchgrass were noted as well as a few porcupine grass.

The target plant community for this unit is southern mesic prairie (Ups23). Removal of the invasive non-native woody plants occurred in fall 2021, which is the top priority for this unit. Additional woody removal may be needed to open the canopy. The unit should then be burned, in coordination with the adjacent woodland. Invasive forbs also need to be treated. Canada goldenrod is likely to overtake the unit. However, due to its small size and relative isolation, it may not be worthwhile to try to establish a more diverse cover. This unit will be inherently prone to invasion. Keeping the invasive and woody species in check is likely to be the best management strategy.



Photo 55. A small opening in the very overgrown MP unit. Yellow coneflower, bergamot, and spotted knapweed seen among the woody seedlings and shrubs.

Wetlands

Units EM1 and EM2

Unit EM1 was a 2.6-acre unit on the north shore of the lake. There was no tree canopy, and the shrub layer was less than 20 percent, dominated by honeysuckle and buckthorn. Other very sparse shrub layer species included gray dogwood, black ash, bur oak, pussy willow, elderberry and American elm.

Unit EM2 (Photo 56) was a 0.4-acre cattail marsh located on the east side of the lake south of the main parking lot. There were few other species detected in the unit. There is no management needed for this unit.

Unit EM1 was on a slope and could better be described as mesic prairie and wet meadow (upper slope) and emergent marsh (lower slope) (Photo 57). The upper slope included species that were planted along the trail during the reconstruction project, such as lanceleaf coreopsis, Canada milkvetch, showy tick trefoil and stiff goldenrod. The lower level was heavily dominated by reed canary grass but broadleaf cattail was also common and dark green bulrush and woolgrass were also present. There were quite a few native forbs, but all were very sparse except for yellow jewelweed which was abundant. Other species typical of a wet

meadow/emergent marsh included common boneset, broad-leaf arrowhead and swamp milkweed.



Photo 56. EM2 is a cattail dominated emergent marsh on the east side of the lake.



Photo 57. The upper level at EM1 was a planted area with more diversity than the lower area, dominated by reed canary grass and cattail.

Herbaceous species that need to be spot treated include spotted knapweed, birdsfoot trefoil, common St. John's wort, Canada thistle and Japanese hedge parsley. Purple loosestrife was present in the past but was not detected in 2021.

Overall, the unit appeared to have much less diversity than in 2011 and reed canary grass was more abundant. It appeared to be radically different from the 1988 description by the DNR:

“A small emergent marsh on northwest end of lake grades to wet meadow and old field. Dominant cover is graminoid, *Leersia oryzoides* and several species of *Cyperus*. The forb component is diverse with species typical of marsh, wet meadow, and some agricultural weeds. Characteristic native forbs are: *Polygonum lapathifolium*, *P. coccinium*, *Verbena hastata*, *Amaranthus tamaricina*, *Rumex meridimus*, *Mentha arvensis*, etc. *Lythrum salicaria* present in small numbers. Probably grazed in past.”

Given the abundance of reed canary grass around the wetland, there is not much value in trying to restore the native plant community at this unit. The primary management would be to keep the invasive woody plants controlled, and to regularly monitor and control all invasive species.

Stream



Photo 58. From the bridge, the stream leaving Ravine Lake flowing south.



Photo 59. View of the stream from the south edge of the park, with a thicket of honeysuckle, buckthorn, boxelder and gray dogwood.

The stream that drains from Ravine Lake (Photo 58, Photo 59) to the south was not delineated as a separate unit. It occupies a narrow corridor of Unit OF2 as it flows through it. This area had heavier soils, of Barronett silt loam. Smooth brome still dominated, but there were also areas of reed canary grass. Buckthorn dominated the understory and scattered small trees included red cedar and boxelder. This unit would be managed as part of the OF2 restoration and there would be no additional management associated with the stream.

Unit Pond

The 1.6-acre pond was a small open-water wetland north of the lake (Photo 60), classified as a palustrine emergent wetland. It was mostly surrounded by oak forest, which has been managed for buckthorn (Unit OM1 and OFe). With the drainageway construction, the west side had become more of an open savanna, dominated by native grasses and forbs.

Little ecological management of this unit is needed, but eradicating the reed canary grass before it spreads further would be beneficial. Some wetland health evaluations of this pond would be interesting, such as basic water quality measures and surveys of macroinvertebrates and amphibians. Citizen monitors could be recruited for this as well as for the lake.



Photo 60. Unit M is a small open water wetland mostly surrounded by woods.

Drainageway Easement (Unit CDS)

The Central Draw Storage Facility (CDSF) Overflow Project completed by the South Washington Conservation District has resulted in a drainageway corridor through the northern two thirds of the park that warrants its own management. Referred to as the Drainageway unit in this document, it is a long and narrow corridor, about 1.25 miles long, passing through units LGU6 at the north, then OF5, CON1 and OM1 before emptying into the wetland units and eventually the lake at the south end of the park.



Photo 61. The open drainageway basin in OF5. Ground cover is dominated by burdock and reed canary grass.

Due to the tree removal and regrading work, this particular unit is now more open than the surrounding units, and this is especially evident as the unit runs through OF5. The drainageway impact area in OF5 is roughly 5 acres. Of that, about 4 of those acres are mostly upland, and have an overstory indicative of the historical savanna community. As the topography drops toward the true "basin", the soils become wetter, so the target community transitions from a more upland dry savanna to a mesic savanna. However, the one-acre basin currently dominated by reed canarygrass is probably better thought of as a wet meadow within the larger savanna complex

The SWWD seeded the drainageway with a native wet meadow mixture, including sedges, grasses, and some forbs. The results of this seeding are variable, however, and invasive plants have taken hold where native species are sparse. Combined with its more disturbed nature - occasional scouring and standing water – the majority of the drainageway is vulnerable to invasion by a large suite of non-native, invasive species. Burdock and garlic mustard were especially abundant, along with Canada thistle, motherwort, and dame's rocket. Reed canary grass has also taken hold in the wettest areas. One unusual species found was mock strawberry (*Potentilla indica*), a relatively new non-native species to Minnesota. It forms a carpet and is considered invasive. It was treated in 2021 but should be monitored for future occurrences.



Photo 62. Standing water in the narrow, linear portion of the drainageway toward the south end of OF5.



Photo 63. The south half of the drainageway easement was well-vegetated with native prairie species.

The southern half of the easement was in much better condition, with native plants well-established and dominant (Photo 63). Dominant species were Canada goldenrod, white snakeroot and calico aster, with lesser amounts of anise hyssop, early sunflower and yellow coneflower. Other species recorded, typical of wet prairie, included swamp milkweed, goldenglow, and Joe pyeweed. Primary management needs were for a small amount of birdsfoot trefoil, and occasional small honeysuckle and buckthorn.

While the drainageway may carry invasive propagules from upstream properties in future runoff events, creating a more diverse and resilient plant community can help to not only resist such an invasive plant species, but will also make the unit more resilient to large flooding events.

The south half of the drainageway can be managed by annually spot-spraying invasive weeds and woody plants. Managing the north half of the drainageway will require a combination of late-season herbicide use on first-year rosettes (burdock and garlic mustard, in particular), spring control with goats, and additional use of mowing or spot herbicide treatments. If partners have the resources and could spend multiple years dealing with reed canarygrass in the basin, then they should. Repeated sprays and thatch removal for 1-2 years, or even a scrape to remove the affected soils, are both options to eliminate the reed canarygrass. However, cover crop seeding will be necessary to protect bare soil from washing away during any potential large rain event. Once the reed canarygrass is eliminated, the area can then be seeded with a wet meadow mix and maintained through its establishment.

In addition to invasive species management, more native seeding is required. Augmenting graminoid cover and diversity by seeding a grass-dominated seed mix will allow greater cover to compete with non-native forbs, will increase the effectiveness of goat browsing for controlling non-native forbs, and will allow the future use of prescribed fire when burning the neighboring savanna areas. Seeding should focus on generalist grasses that can tolerate both wet and dry conditions, including species like Virginia and Canada wild rye and bottlebrush grass.

Lake

Evaluation of the 25-acre lake was beyond the scope of this management plan. The South Washington Watershed District prepared a comprehensive water quality modeling and management report for the lake in 2013.

ECOLOGICAL MANAGEMENT RECOMMENDATIONS

This section describes more general ecological goals for the site and outlines a specific restoration strategy. Because this property is so large, implementation of restoration projects must occur in phases. A suggestion for the first restoration phase is described in more detail below.

Restoration goals

The primary objective for this site is to improve the composition of the native plant communities throughout the property for structure, diversity, ecological function, and resilience to climate change. Specific functions include

- habitat for a diversity of wildlife species
- nutrient and water cycling
- carbon storage
- moderation of water-table levels
- erosion control
- filtration of nutrients, sediments and pollutants
- development and enrichment of soils
- local temperature moderation

Though degraded by past uses and non-native invasive species, the existing plant cover retains a good variety of native species. The plant community composition and structure is highly altered, but the primary canopy cover provides the basic framework for native plant community restoration. A healthy and diverse plant community can provide much greater wildlife value than a degraded one, and tends to be much more stable, and less susceptible to disease, invasive species, and shifts in climate conditions.

Specific restoration goals identified for the site are to:

- Restore a complement of native species to the site, based on pre-European settlement conditions, according to the target habitats described below.
- Engage the public in the restoration process by hosting volunteer events for woody removal, planting etc.

Additional suggestions that can be considered are to:

- Enhance wildlife habitat by installing wildlife houses targeted for certain species (e.g., species declining due to habitat loss).
- Increase public awareness about native plant communities by creating a demonstration garden or display the entrance.

Specifications that should be applied to all restoration and management are:

- Seek methods that have the least negative impact on the land and its inhabitants.
- Avoid or minimize the use of chemicals as much as possible.
- Only certified professional should apply chemicals.

- When there are multiple options for effective chemicals, use the lowest toxicity and the one with the least soil residual.
- Use aquatic formula chemicals within 50 feet of the lake or pond.
- For planting or seeding, use native plant species whose genetic origin is as close as possible to the site, within 100 miles if possible.

Target Plant Communities

At the time of European settlement, this property included prairie, savanna, woodland, and wetland plant communities. These communities are still appropriate for the site, although the proportions of each will be considerably different than in the past. General recommendations for restoration targets are identified in Table 4. Existing Land Cover and Proposed Restoration and Map 13.

While reverting to a historical condition is often desirable, it is probably unrealistic for much of this park. The historical condition is important but must be balanced by the extent to which succession has altered the vegetation, as well as the costs, both monetary and ecological, of restoring the historical community. Much of the existing oak forest west of the lake, for example, was historically oak savanna. But because it has transitioned so far to oak woodland, converting it back to savanna would be exceedingly costly and probably more detrimental to the land and its inhabitants than keeping it as is. There are, however, portions of that unit along the edges that are still quite open and could be a transitional savanna area.

The proposed plant community species for each restoration type (**Appendix D**) are derived from the *Field Guide to the Native Plant Communities of Minnesota: The Eastern Broadleaf Forest Province* (DNR 2005), which is based on characteristics of intact native plant communities. Target community descriptions for Phase I units are described in the restoration recommendations for those units. Descriptions for plant communities that are not included in Phase I are described below.

Southern Dry-Mesic Oak (Maple) Woodland (FDs37) is described in the *Native Plant Communities of Minnesota* (DNR 2006) as follows: Dry-mesic hardwood forests occurring on undulating sand flats, hummocky moraines, and river bluffs, mostly on fine sand or sand-gravel soils. Historically, fires were common in this community, and many stands are on sites occupied by brushlands 100–150 years ago. The canopy cover is usually interrupted to continuous (50–100%). Bur oak and northern pin oak are the most common species. Northern red oak, white oak, and red maple are occasionally present. The subcanopy cover is patchy to interrupted (25–75%). The most common species are black cherry, red maple, and bur oak. Because of the open canopy, the shrub layer is often very dense with patchy to continuous cover (25–100%). Common species include black cherry, red maple, chokecherry (*Prunus virginiana*), American hazelnut (*Corylus americana*), gray dogwood (*Cornus racemosa*), prickly ash (*Zanthoxylum americanum*), Virginia creeper, (*Parthenocissus* spp.), and poison ivy (*Toxicodendron rydbergii*). The ground-layer cover is patchy to continuous (25–100%). Pointed-leaved tick trefoil (*Desmodium glutinosum*), Clayton’s sweet cicely (*Osmorhiza claytonii*), hog peanut (*Amphicarpaea bracteata*), Canada

mayflower (*Maianthemum canadense*), and wild geranium (*Geranium maculatum*) are commonly present. Pennsylvania sedge (*Carex pensylvanica*) is the most abundant graminoid. Dewey's sedge (*Carex deweyana*) and starry sedge (*Carex rosea*) may also be present.

Southern Dry-Mesic Oak Forest (MHs37) is described in *Native Plant Communities of Minnesota* (DNR 2006) as: Dry-mesic hardwood forest occurring most often on thin, wind-deposited silt on crests and upper slopes of bedrock bluffs. The ground-layer varies from patchy to continuous. Important species include lady fern, pointed-leaved tick trefoil, Clayton's sweet cicely, enchanter's nightshade, wild geranium, hog peanut, and white snakeroot. Shrub layer cover is patchy to interrupted. Common species include red oak, black cherry, chokecherry, American hazelnut, Missouri gooseberry, and pagoda dogwood. Subcanopy species include basswood, black cherry, red oak, white oak and shagbark hickory. The canopy is interrupted to continuous. The most common species are red oak, white oak, and basswood.

Catastrophic disturbances were rare in this plant community. Analysis of Public Land Survey records indicates that the rotation of catastrophic fires was in excess of 1,000 years and the rotation of catastrophic windthrow was about 390 years. Events that resulted in partial loss of trees, especially light surface fires, were much more common, with an estimated rotation of about 20 years. Based on the historical composition and age structure of these forests, there would be two growth stages separated by a long period of transition.

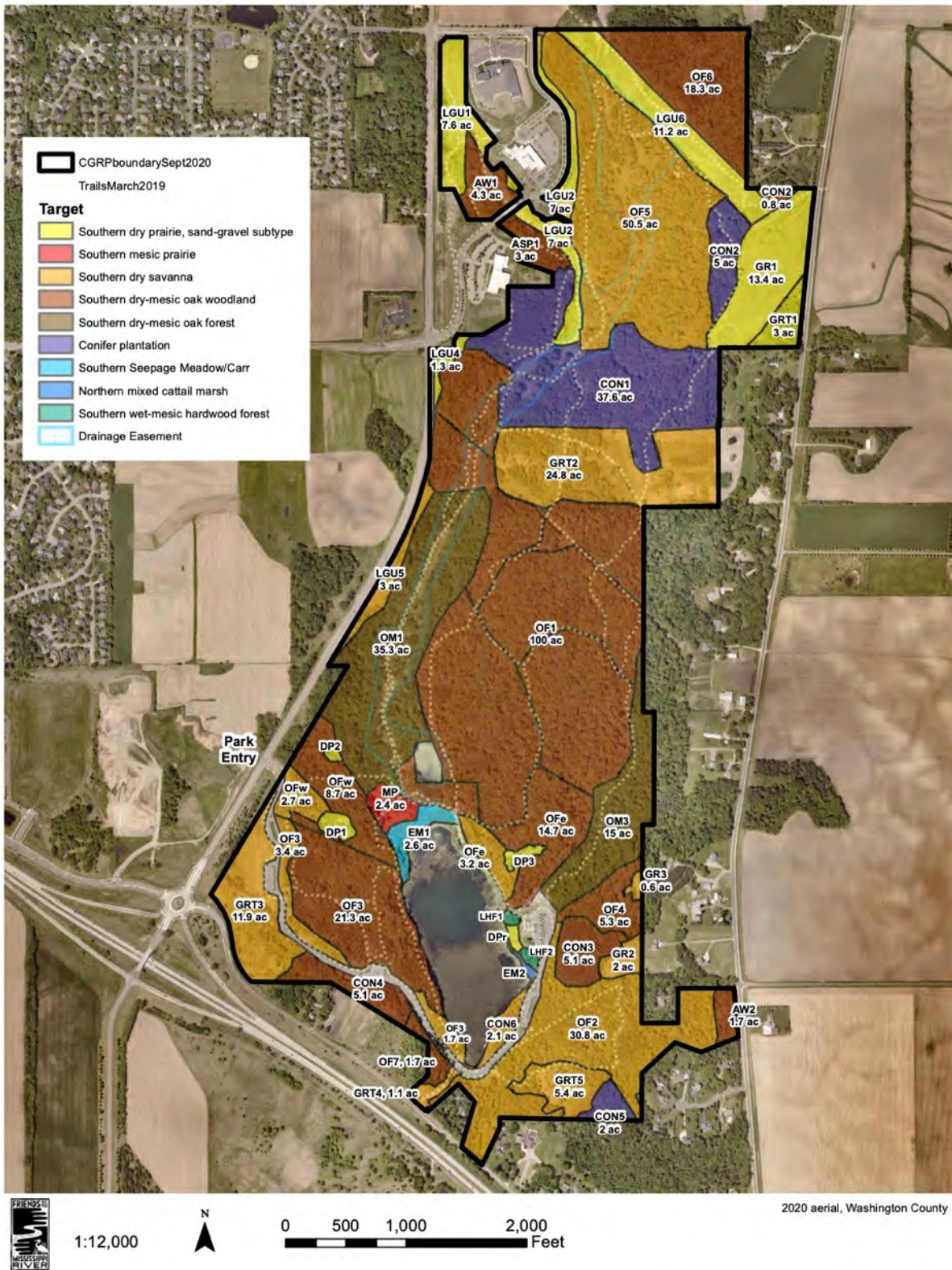
Southern Dry Prairie (UPs13) has the following characteristics: trees are absent, other than an occasional bur oak or red cedar. The shrub layer is sparse, 1 to 5%, and consists of low species such as lead plant, New Jersey Tea, prairie rose, prairie willow and smooth sumac. Graminoid and forbs each have of cover of 5 to 50%, and there may be bare soil visible. Little bluestem is often dominant and other common mid-height species are prairie dropseed, Junegrass, side-oats grama, porcupine grass and Muhly grass. The tallgrasses, e.g., big bluestem, Indiangrass, switchgrass, are present, but less abundant. Common forb species include gray goldenrod, silky aster, dotted blazing star, golden aster, false boneset, flowering spurge, purple prairie clover and stiff sunflower.

Southern Dry Savanna (UPs14) is characterized by a grass-dominated herbaceous cover, sparse trees, mostly oaks, and droughty soils. The topography can be variable, from nearly level plains to steep slopes. One of the most common places UPs14 occurs is on terraces along the Mississippi River. Savannas are commonly associated with prairies in a landscape where features fires would have carried across open flat terrain but would have been halted by steep topography or surface waters, thus providing conditions suitable for savanna species. The plant community is especially adapted to low fertility and drought susceptible soils, conditions that make it more resilient than mesic sites. Fewer species are tolerant of these conditions so there is less competition among species in savannas and more open ground. Where savanna historically covered over 5 million acres in Minnesota, less than 0.1 percent remains today, and it is one of the primary plant communities needed in the Cottage Grove area, according to the DNR (DNR 2005).

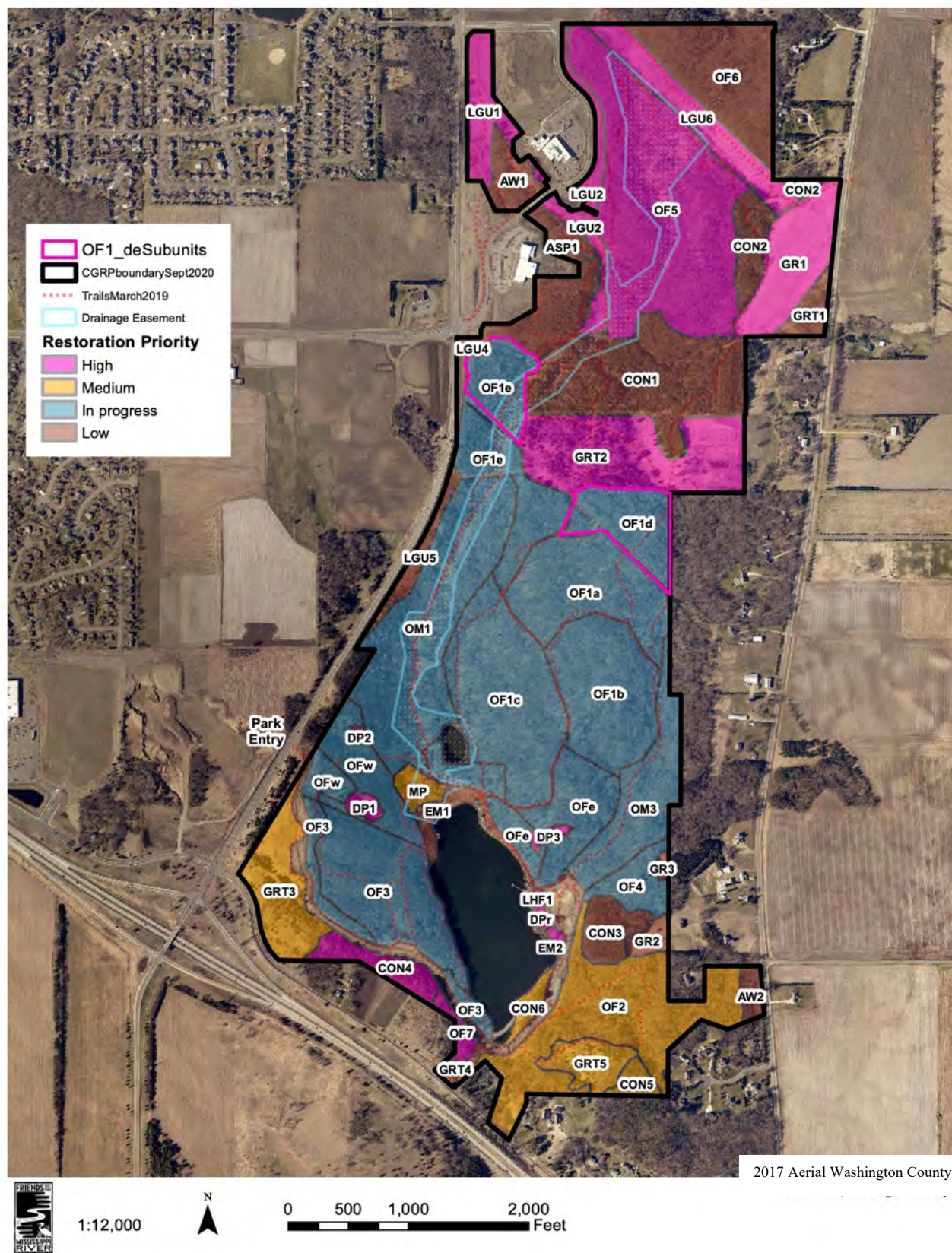
Trees in savannas occur as scattered individuals or clusters, with a total cover of 25-50%. Bur oak is the most common, but pin oak is also present. The shrub layer is patchy with a total cover of 25-50%. Common low shrubs are leadplant, prairie rose, poison ivy, while chokecherry, hazelnut, and smooth sumac are important tall shrubs. The forb cover is about 5-50%. Typical species include western ragweed, Virginia ground cherry, hairy puccoon, gray goldenrod, hoary frostweed, and purple prairie clover. The graminoid cover is 25-100% and dominated by mid-height species such as little bluestem, porcupine grass, and Junegrass. Tall grasses are also important, especially big bluestem and Indiangrass. Purple lovegrass and Muhlenberg's sedge are common short species.

Northern wet meadow-carr (WMn82) occurs in wetland basins associated with streams and drainageways. Water levels are deep enough to prevent trees from growing, but there may be little or no standing water during the growing season. Water levels fluctuate moderately with spring runoff, heavy rains, and summer drawdowns. These wetlands are characterized by dense broad-leaved graminoids (e.g., Canada bluejoint grass, tussock sedge, lake sedge) or tall shrubs (e.g., willows, red-osier dogwood, speckled alder, meadowsweet). Forbs include tufted loosestrife, marsh bellflower, great waterdock, northern bugleweed, northern marsh fern, and others.

MAP 13. TARGET NATIVE PLANT COMMUNITIES



MAP 14. RESTORATION PRIORITIES



Restoration Process

Restoration is a process. It takes time to restore ecosystems to their former functionality and diversity. Sometimes this can only be approximated. It took many decades to degrade the ecosystem and biological communities on site, so it will not be restored overnight. Many steps are typically involved in a successful restoration; even deciding when a restoration is complete/successful can be very difficult. Restoration should be viewed as a process not a state of being. The ultimate goal is to achieve and maintain a diverse natural community at the site, though this will not always proceed in a linear fashion. Using the concept of *adaptive management* will be key to continual progress at the site. Adaptive management is a strategy commonly used by land managers and integrates thought and action into the restoration process. It can be described as a strategy that uses evaluation, reflection, communication, and also incorporates learning into planning and management. It is set up like a feedback loop and looks like this: Assess Problem -> Design -> Implement -> Monitor -> Evaluate -> Adjust -> Assess Problem -> and so forth. Thus, moving forward with restoration, each round of adaptive management refines and hones the process to better fit the conditions of the site. This strategy should be emphasized at the bluffland site.

Given the size and layout of the property, the restoration plan for the site will be difficult. Access to all units is challenging, and the varied topography will necessitate skill and patience. Restoring and maintaining any site takes dedicated time and effort. However, the location of the site away from other natural areas and sources of propagules means that restoration may be less hampered by the cycle of continual reinvasion that plagues many sites. Engaging neighbors (both the city of Newport and private residences) in the importance of restoration on their lands will not only help the restoration on the property be more successful - as it will reduce the potential seed source of invasive plants - but will also increase the size of natural communities being protected and managed in the area.

The restoration of the biological communities at the site will be broken into phases. Each phase will address the restoration of a given target plant community. Restoration tasks will also be prioritized, with the most important resources or vital areas taking precedence. However, restoration will ultimately be conducted based on available funds and resources and may not occur sequentially or as prioritized.

On this site, expansion of the prairie and savanna habitat will be among the highest priorities. As the rarest and most conservative habitat types on the property, intervention to prevent their loss will be important. Removal of woody invasive plants throughout the property is the next highest priority, with a focus on restoration of the forest units. Without this crucial step, forests will continue to lose diversity and prairie and savanna restoration will be consistently plagued by re-invasion. Prioritizing invasive removal will lead to better results in subsequent restoration tasks. All priorities will help to accomplish the main goal of increasing wildlife and pollinator habitat throughout the property.

Restoration Recommendations and Priorities

Because this is a large property, it is not feasible to undertake restoration of the whole park at once. The management units were prioritized (Map 14), based on several factors including past management of the unit (generally given top priority), proximity to other managed units (often ranked high), degree of degradation, ecological importance of the target plant community, planned future uses, and overall restoration potential.

Approximately 220 acres of the park have undergone some level of restoration in recent years, so even if no further restoration is pursued, those units should be managed and maintained. Beyond that, the next priority units were mostly in the north part of the park, where some invasive woody removal has begun (OF5) and the intact canopy of woodlands presents a reasonable outcome for successful restoration (Table 5).

The northern grassland units also were high priority for restoration due to the ecological importance of prairie in the landscape. Savanna and prairie are two of the most imperiled land covers in Minnesota and in this ecological subsection, and opportunities to restore them are few and far between. Units GR1 and LGU6 are 24 acres combined, a moderately large expanse that we identified as high priority for prairie restoration. Adjacent to those units is the 50-acre OF5 unit which would be high priority for savanna restoration (in 10-acre stages). And to the south is the 25-acre GRT2 that would also be high priority for prairie and savanna.

Some units were not identified as high priority for full restoration but would be high priority for invasive woody removal. Unit CON6, for example, is adjacent to the OF3 unit where invasive woody removal has been completed. So removing invasive woody plants from CON6 is a high priority to prevent continued seeding into OF3. Further restoration of CON6 to savanna, however, would be a low priority. Overall, invasive shrub removal is a high priority for most units throughout the property, both to improve their habitat quality and to protect investment made in the restoration of other units.

Table 5. Priority Units

Unit	Acres	Existing Land cover	Target Plant Community	Code	Cost est
IN PROGRESS (HIGHEST PRIORITY)					
CON6	2.1	Conifer plantation	So. dry savanna	UPs14	\$1,800
DP1	1.2	Dry prairie	So. dry prairie, sand-gravel	UPs13	\$4,800
DP2	0.4	Dry prairie	So. dry prairie, sand-gravel	UPs13	\$4,800
DP3	0.8	Dry prairie	So. dry prairie, sand-gravel	UPs13	\$4,800
DPr	0.5	Dry prairie	So. dry prairie, sand-gravel	UPs13	\$4,800
LHF1	0.3	Lowland forest	So. wet-mesic hardwood forest	MHs49	\$315
LHF2	0.4	Lowland forest	So. wet-mesic hardwood forest	MHs49	\$315
OF1	93.6	Oak forest,dry	So. dry-mesic oak woodland	FDs37	\$214,000
OF3	26.6	Oak forest,dry	So. dry-mesic oak woodland	FDs37	\$21,600
OF4	5.3	Oak forest,dry	So. dry-mesic oak woodland	FDs37	\$4,500
OFe	17.9	Oak forest,dry	So. dry-mesic oak woodland	FDs37	\$26,100

OFw	11.5	Oak forest,dry	So. dry-mesic oak woodland	FDs37	\$13,050
OM1	35.3	Oak forest,mesic	So. dry-mesic oak forest	MHs37	\$28,000
OM3	15	Oak forest,mesic	So. dry-mesic oak forest	MHs37	\$12,000

210.9 Highest **\$340,880**

HIGH PRIORITY

OF1 d, e	18	Oak forest,dry	So. dry-mesic oak woodland	FDs37	\$95,600
OF5	10	Oak forest,dry	So. dry savanna	UPs14	\$84,500
OF7	1.7	Oak forest,dry	So. dry-mesic oak woodland	FDs37	\$17,100
CON4	5.1	Conifer plantation	So. dry-mesic oak woodland	FDs37	\$19,000
GR1	13.4	Grassland	So. dry prairie, sand-gravel	UPs13	\$55,250
GRT2	24.8	Grassland, scattered trees	So. dry savanna	UPs14	\$110,000
LGU1	7.6	Grassland	So. dry prairie, sand-gravel	UPs13	\$13,500
LGU2	7	Grassland	So. dry prairie, sand-gravel	UPs13	\$13,500
LGU6	11.2	Grassland	So. dry prairie, sand-gravel	UPs13	\$49,500

98.8 High **\$457,950**

309.7 Highest & high **\$798,830**

MEDIUM PRIORITY

OF2	27.4	Oak forest,dry	So. dry savanna	UPs14	\$234,300
OF5	40	Oak forest,dry	So. dry savanna	UPs14	\$338,000
CON5	3.5	Conifer plantation	Conifer plantation		\$15,000
GRT3	11.9	Grassland, scattered trees	So. dry savanna	UPs14	\$8,500
GRT5	4	Grassland, scattered trees	So. dry savanna	UPs14	\$8,500
MP	2.4	Mesic prairie	Southern mesic prairie	UPs23	\$1,200
LGU4	1.3	Grassland	So. dry prairie, sand-gravel	UPs13	\$2,200

90.5 Medium **\$607,700**

\$1,406,530

LOW PRIORITY

ASP1	3	Aspen forest	So. dry-mesic oak woodland	FDs37	
AW1	4.3	Altered woodland	So. dry-mesic oak woodland	FDs37	
AW2	5.1	Altered woodland	So. dry-mesic oak woodland	FDs37	
CON1	37.6	Conifer plantation	Conifer plantation		\$200,000
CON2	5.8	Conifer plantation	Conifer plantation		\$24,000
CON3	5.1	Conifer plantation	So. dry-mesic oak woodland	FDs37	
EM1	2.6	Emergent marsh	Southern Seepage Meadow/Carr	WMs83	
EM2	0.4	Emergent marsh	Northern mixed cattail marsh	MRn83	
GR2	2	Grassland	So. dry savanna	UPs14	
GR3	0.6	Grassland	So. dry savanna	UPs14	
GRT1	3	Grassland, scattered trees	Altered woodland, So. dry prairie sand-gravel	UPs13	
GRT4	1.1	Grassland, scattered trees	So. dry savanna	UPs14	
LGU5	3	Grassland	So. dry savanna	UPs14	
OF6	18.3	Oak forest,dry	So. dry-mesic oak woodland	FDs37	\$106,200
	91.9	Low			

Long-term maintenance and monitoring

Once the primary restoration tasks are completed and invasive brush is under control, the restoration process will convert to a monitoring and adaptive management phase. Long-term maintenance for the oak woodland and dry oak forest will consist of regular invasive brush management and periodic prescribed burning. Invasive brush should be treated before it is large enough to produce fruit, so a pass through the units every three years to cut and treat plants in fall may be adequate. Prescribed burn rotations may be every 7 to 10 years. The park should be divided into multiple burn units so that no more than 30 percent of any plant community is burned in any year, unless that community type is abundant in adjacent areas. This is especially important for pollinators, many of which overwinter in dead vegetation or just below the soil surface in both woodland edges and grassland.

Management of savanna areas will consist of annual monitoring and spot-mowing or spot treating non-native invasive plant species and burning every 4 to 8 years. Mowing can be used as a substitute for burning periodically, and low-intensity grazing by cattle, bison, or sheep should also be considered in order to restore the functional role that large herbivores historically played. Prairie management will be similar, though the burn frequency may be higher, at about 3 to 5 year intervals.

All managed and restored areas must be regularly monitored to identify ecological issues, such as erosion, invasive species, and disease. Monitoring is also important for detecting human-related issues such as illegal activities (hunting, ATV use, etc). Early detection of concerns enables quick responses to address them before they become significant problems.

Monitoring animal as well as plant communities is also helpful for evaluating the success of the restoration. A comparison of pollinator and breeding bird populations before and after restoration, for example, can be a valuable means for quantifying positive impacts on the land. Such surveys need to be conducted over many years to detect meaningful trends.

Restoration Schedule and Cost Estimates

An approximation of restoration/management tasks, priorities, and costs is provided in Table 5, below. This table is intended for general planning purposes only - project cost estimates are not based on actual contractor bids, but on typical costs for similar projects. Actual project costs could be significantly higher or lower, depending on multiple factors. Costs could potentially be decreased by, for example, reducing the diversity of prairie seed costs, contracting for the entire project with one contractor, or using volunteers or STS (Sentence to Serve) crews for portions of the labor such as hauling brush. Some activities may also be carried out by parks staff. Specific project tasks may also change over time, as more information is learned about the property and as the site conditions change.

Table 6. Restoration Schedule and Cost Estimates

Year 1 is the start of each project, which may not be the same year for all projects

Tasks are for high priority (black font) and medium priority units (gray font). Low priority units are not included. Project management costs are included at the bottom. Blue font = tasks with existing funding. Invasive woody removal at low priority units is not itemized but is important throughout the park.

Yr	Season	Units	Activity	Ac	Cost/ac	Cost est
UNIT: OF1a, OF1b 42 ac.			High priority. Managed	Target: Oak woodland		
1	Spr	OF1a, OF1b	Rx burn	42	\$350	County managed
1	Spr	OF1a, OF1b	Native seed (stratified is optimal)	42	\$450	" "
1	Spr	OF1a, OF1b	Broadcast seed grass -mostly openings.	42	\$100	" "
1	fall	OF1a, OF1b	Spot spray woody invasive seedlings and re-sprouts	42	\$280	" "
1	late fall	OF1a, OF1b	Spot spray garlic mustard	42	\$250	" "
2	fall	OF1a, OF1b	Spot spray woody invasive seedlings and re-sprouts	42	\$280	" "
2	late fall	OF1a, OF1b	Spot spray garlic mustard	42	\$250	" "
3	fall	OF1a, OF1b	Spot spray woody invasive seedlings and re-sprouts	42	\$280	\$11,760
3	late fall	OF1a, OF1b	Spot spray garlic mustard	42	\$150	\$6,300
				42		\$18,060
UNIT: OF1c 26 ac.			High priority. Managed	Target: Oak woodland		
1	fall	OF1c	Spot spray woody invasive seedlings and re-sprouts	26	\$280	County managed
1	late fall	OF1c	Spot spray garlic mustard	26	\$250	" "
2	Spr	OF1c	Rx burn	26	\$350	" "
2	Spr	OF1c	Native seed (stratified is optimal)	26	\$450	" "
2	Spr	OF1c	Broadcast seed grass -mostly openings.	26	\$100	" "
2	fall	OF1c	Spot spray woody invasive seedlings and re-sprouts	26	\$280	" "
2	late fall	OF1c	Spot spray garlic mustard	26	\$150	" "
3	fall	OF1c	Spot spray woody invasive seedlings and re-sprouts	26	\$280	\$7,280
3	late fall	OF1c	Spot spray garlic mustard	26	\$150	\$3,900
				26		\$11,180
UNIT: OF1d, OF1e 18 ac.			High priority	Target: Oak woodland		
1	Wtr	OF1d, OF1e	Invasive woody removal: cut/treat large stems and slopes, then forestry mow.	18	\$2,600	\$46,800
1	Fall	OF1d, OF1e	Spot spray woody invasive seedlings and re-sprouts (wick apply if possible).	18	\$450	\$8,100

Table 5. Phase I Restoration Schedule and Cost Estimates (*continued*)

Yr	Season	Units	Activity	Ac	Cost/ac	Cost est
2	Spr	OF1d, OF1e	Rx burn	18	\$350	\$6,300
2	Spr	OF1d, OF1e	Native seed (stratified is optimal)	18	\$450	\$8,100
2	Spr	OF1d, OF1e	Broadcast seed grass -mostly openings.	18	\$60	\$1,080
2	Fall	OF1d, OF1e	Spot spray woody invasive seedlings and re-sprouts (wick apply if possible).	18	\$450	\$8,100
2	late fall	OF1d, OF1e	Spot spray garlic mustard	18	\$300	\$5,400
3	Fall	OF1d, OF1e	Spot spray woody invasive seedlings and re-sprouts (wick apply if possible).	18	\$400	\$7,200
				18		\$91,080
UNIT: OF2 27.4 ac.			Medium Priority	Target: Oak woodland		
1	Wtr	OF2	Thin trees from around very large oaks	27.4	\$6,000	\$164,400
1	Wtr	OF2	Invasive removal (shrub layer): cut/treat, stack, mow or burn piles.	27.4	\$2,100	\$57,540
3	Fall	OF2	Spot spray woody invasive seedlings and re-sprouts	27.4	\$450	\$12,330
				27		\$234,270
UNIT: OF3 27 ac.			High priority. Managed	Target: Oak woodland		
1	Spr	OF3	Rx burn (planned by county)	27		\$0
1	Spr	OF3	Pull or spot treat GM. Contracted for 2022	25		funded
1	Smr	OF3	Goat browse. Contracted for 2022	8		funded
1	Fall	OF3	Spot spray woody invasive seedlings and re-sprouts (wick apply if possible). Contracted for 2022	19	\$128	funded
1	Fall	OF3	Broadcast native woodland seed in targeted spots.	5	\$500	\$2,500
2	Fall	OF3	Spot spray woody invasive seedlings and re-sprouts (wick apply if possible). 2023	27	\$400	\$10,800
3	Fall	OF3	Spot spray woody invasive seedlings and re-sprouts (wick apply if possible). 2024	27	\$400	\$10,800
				27		\$21,600
UNIT: OF4 5 ac.			High priority. Managed	Target: Oak woodland		
1	Spr	OF4	Rx burn . Contracted for 2022	5		funded
1	Fall	OF4	Spot spray woody invasives	5		funded
2	Fall	OF4	Spot spray woody invasives	5	\$450	\$2,250
				5		\$2,250

Table 5. Phase I Restoration Schedule and Cost Estimates (*continued*)

Yr	Season	Units	Activity	Ac	Cost/ac	Cost est
UNIT: OF5 51 ac.			High priority	Target: Oak Savanna		
1	Fall/winter	OF5	Understory removal: forestry mow non-native woody brush	10	\$2,250	\$22,500
2	Winter	OF5	Canopy thinning: remove most non-oaks, including all green ash and box elder. Thin elm, hackberry, black cherry, pin oaks, and other species. Girdle aspen clones.	10	\$2,500	\$25,000
2	Fall	OF5	Spot spray woody invasive seedlings and re-sprouts	10	\$450	\$4,500
2	Winter	OF5	Forestry mow a second time to break down chip and allow for seeding.	10	\$1,100	\$11,000
2	Winter	OF5	Seed open areas after removal – broadcast seed with native graminoid mix. If second forestry mow is not done, wait until following year to allow breakdown of woody material.	10	\$300	\$3,000
3	Summer	OF5	Conduct establishment mow on savanna areas.	10	\$250	\$2,500
3	Fall	OF5	Spot spray woody invasive seedlings and re-sprouts	10	\$400	\$4,000
4	Fall	OF5	Spot spray woody invasive seedlings and re-sprouts	10	\$400	\$4,000
5	Early spring	OF5	Conduct savanna/woodland prescribed burn on project area and let run into neighboring units.	10	\$550	\$5,500
5	Spring	OF5	Seed native forbs into burned areas.	10	\$250	\$2,500
				10		\$84,500
UNIT: OF6: 18 ac			Low priority	Target: Oak woodland		
1	Fall/winter	OF6	Understory removal: forestry mow non-native woody brush	18	\$2,250	\$40,500
2	Fall	OF6	Spot spray woody invasive seedlings and re-sprouts	18	\$450	\$8,100
2	Winter	OF6	Forestry mow a second time to break down chip and allow for seeding.	18	\$1,100	\$19,800
2	Winter	OF6	Seed open areas after removal – broadcast seed with native graminoid mix. If second forestry mow is not done, wait until following year to allow breakdown of woody material.	18	\$300	\$5,400
3	Fall	OF6	Spot spray woody invasive seedlings and re-sprouts	18	\$400	\$7,200
4	Fall	OF6	Spot spray woody invasive seedlings and re-sprouts	18	\$400	\$7,200
4	Fall	OF6	Plant and protect bareroot trees and shrubs	18	\$1,000	\$18,000
				18		\$106,200

Yr	Season	Units	Activity	Ac	Cost/ac	Cost est
UNIT: OF7 2 ac.			High priority.	Target: Oak woodland		
1	Wtr	OF7	Thin trees from around very large oaks	2	\$6,000	\$12,000
1	Wtr	OF7	Invasive removal (shrub layer): cut/treat, stack, mow or burn piles.	2	\$2,100	\$4,200
3	Fall	OF7	Spot spray woody invasive seedlings and re-sprouts	2	\$450	\$900
				2		\$17,100
UNIT: OFe, OFw 29 ac.			High priority. Managed	Target: Oak woodland		
1	Smr	OW	Goat browse. Contracted for 2022	3	\$484	funded
1	Fall	OFe, OFw	Spot spray woody -non-goat areas. Contracted for 2022	9	\$429	funded
1	Fall	OFe, OFw	Spot spray woody invasive seedlings and re-sprouts (wick apply if possible).	29	\$450	\$13,050
2	Fall	OFe, OFw	Rx burn (May need to shift year if other burns same year). Burn with DP2 DP3	29	\$350	\$10,150
2	Fall	OFe, OFw	Spot spray woody invasive seedlings and re-sprouts (wick apply if possible).	29	\$400	\$11,600
				29		\$34,800
UNIT: OM1, OM3 50 ac.			High priority. Managed	Target: Oak Forest		
1	Spr	OM1	Rx burn - Contracted for 2022	42	\$322	funded
1	Spr	OM3	Rx burn - Contracted for 2022	16	\$368	funded
1	Fall	OM1	Spot spray woody invasive seedlings and re-sprouts (wick apply if possible). Contracted for 2022	42	\$257	funded
1	Spr	OM3	Spot spray woody invasive seedlings and re-sprouts. Contracted for 2022	16	\$495	funded
1	Summer/fall	OM1, OM3	Cut invasive forbs (GM, JHP, burdock) before seeds form and/or fall spot-spray.	50	\$200	\$10,000
2	Fall	OM1, OM3	Spot spray woody invasive seedlings and re-sprouts (wick apply if possible). 2023	50	\$400	\$20,000
3	Fall	OM1, OM3	Spot spray woody invasive seedlings and re-sprouts (wick apply if possible). 2024	50	\$400	\$20,000
				50		\$40,000
UNIT: LHF1, LHF2 0.7 ac.			High priority. Managed	Target: Oak woodland		
1	Fall	LHF1, LHF2	Spot spray woody invasives. Includes Con 6. Contracted 2022	1.9	\$972	funded
3	Fall	LHF1, LHF2	Spot spray woody invasives 2024	0.7	\$450	\$315
5	Fall	LHF1, LHF2	Spot spray woody invasives 2026	0.7	\$450	\$315
				1		\$630

Table 5. Phase I Restoration Schedule and Cost Estimates (*continued*)

Yr	Season	Units	Activity	Ac	Cost/ac	Cost est
UNIT: CON1, CON2: 44 ac. Medium priority Target: Conifer plantation						
1	Fall/winter	CON1, CON2	Invasive shrub removal: Cut and paint removal of non-native, invasive shrubs	44	\$2,500	\$110,000
2	Spring	CON1, CON2	Spot spray invasive herbaceous species including garlic mustard, dame's rocket, and burdock.	44	\$350	\$15,400
2	Fall	CON1, CON2	Spot spray woody invasive seedlings and re-sprouts	44	\$450	\$19,800
3	Fall	CON1, CON2	Spot spray woody invasive seedlings and re-sprouts	44	\$400	\$17,600
4	Fall	CON1, CON2	Spot spray woody invasive seedlings and re-sprouts	44	\$400	\$17,600
4	Fall	CON1, CON2	Plant and protect bareroot trees and shrubs	44	\$1,000	\$44,000
				44		\$224,400
UNIT: CON4. 5.1 ac. High priority. Target: Oak woodland						
1	Wtr	CON4	Thin trees from around very large oaks	1	\$6,000	\$6,000
1	Wtr	CON4	Invasive removal (shrub layer): cut/treat, stack, mow or burn piles.	5.1	\$2,100	\$10,710
3	Fall	CON4	Spot spray woody invasive seedlings and re-sprouts	5.1	\$450	\$2,295
				5		\$19,005
UNIT: CON5 3.5 ac. Medium priority Target: Conifer plantation						
1	Wtr	CON5	Remove black locust stand. Look for salvage options for wood.	1	\$8,000	\$8,000
1	Wtr	CON5	Invasive woody removal (shrub layer): cut/treat, stack. Mow or burn piles.	2.5	\$2,100	\$5,250
3	Fall	CON5	Spot spray woody invasive seedlings and re-sprouts	3.5	\$450	\$1,575
				4		\$14,825
UNIT: CON6 2 ac. High priority. Managed Target: Oak woodland						
1	Fall	CON6	Spot spray woody invasive seedlings and re-sprouts	2	\$450	\$900
3	Fall	CON6	Spot spray woody invasive seedlings and re-sprouts	2	\$450	\$900
				2		\$1,800
UNIT: DP1, DP2, DP3, DPr 8 ac. High priority. Managed Target: Dry prairie						
1	Mar-Apr	DP3	Rx burn very early spr. Contracted 2022.	1		funded
1	Wtr	All	Woody removal within units and around perimeter. Remove selected trees. Pile and burn in woods.	6	\$400	\$2,400
1	Spr-Fall	All	Invasive weed control: Hand-pull before seeds form (Jap hedge parsley, sp knapweed, hoary allysum, mullein). Spot spray Linaria, others.	4	\$600	\$2,400

Table 5. Phase I Restoration Schedule and Cost Estimates (*continued*)

Yr	Season	Units	Activity	Ac	Cost/ac	Cost est
1	Aug	DPr	Mow goldenrod on east side before seeds form. Mow brambles along lake.	1	\$500	\$500
1	Sept	All	Spot spray woody invasive seedlings and re-sprouts	6	\$350	\$2,100
1	Oct	All	Cool season spot spray of invasive grasses. Glyphosate	6	\$250	\$1,500
2	Fall or Spr	DP2, DP3	Rx burn as part of Ofc and Ofw burns. If spring, burn before April 5.	3		\$0
2	Fall or Spr	DP2, DP3	Post burn, Broadcast native local ecotype seed, from within 50 miles.	3	\$350	\$1,050
2	Spr-Fall	All	Invasive weed control: Hand-pull before seeds form (Jap hedge parsley, sp knapweed, hoary allysum, mullein). Spot spray Linaria, others.	4	\$600	\$2,400
3	Fall or Spr	DP1, DPr	Rx burn. If spring, burn before April 5.	5	\$600	\$3,000
3	Fall or Spr	DP1, DPr	Post burn, Broadcast native local ecotype seed, within 50 miles. If spring seeding, stratified seed is optimal	4	\$350	\$1,400
3	Spr-Fall	All	Invasive weed control: Hand-pull before seeds form (Jap hedge parsley, sp knapweed, hoary allysum, mullein). Spot spray Linaria, others.	4	\$600	\$2,400
				6		\$19,150
UNIT: GR1 13 acres. High priority.				Target: Dry prairie		
1	Fall/winter	GR1	Forestry mow or cut/treat non-native woody brush and trees. Pile and burn.	13	\$100	County managed
2	Spring	GR1	Prep spray for prairie resto	13	\$250	" "
2	Summer	GR1	Prescribed burn to remove thatch. Let burn run into neighboring units.	13	\$250	" "
2	Summer	GR1	Optional drag/harrow to smooth planting surface	13	\$200	" "
2	Summer	GR1	Prep spray for prairie resto	13	\$250	" "
2	Fall	GR1	Prep spray for prairie resto	13	\$250	" "
2	Fall	GR1	Purchase upland mesic prairie mix	13	\$800	" "
2	Fall	GR1	Broadcast seed rye cover crop (include seed cost)	13	\$150	" "
3	Spring	GR1	Prep spray for prairie resto	13	\$250	" "
3	Spring	GR1	Drill seed upland mesic prairie mix	13	\$250	" "
3	Summer	GR1	Mow (2x) establishing prairie	13	\$200	" "
3	Summer	GR1	Spot spray (2x) establishing prairie	13	\$200	" "
4	Summer	GR1	Mow (1x) establishing prairie	13	\$100	" "
4	summer	GR1	Spot spray (1x) establishing prairie	13	\$100	" "
5	Spring	GR1	Prescribed burn	13	\$250	" "
5	Spring	GR1	Purchase supplemental forb seed	13	\$500	" "
5	Spring	GR1	Broadcast seed post-burn	13	\$150	" "
			Subtotal	13		

Table 5. Phase I Restoration Schedule and Cost Estimates (*continued*)

Yr	Season	Units	Activity	Ac	Cost/ac	Cost est
UNIT: GRT2 east 13 acres.			High priority.	Target: Dry Prairie		
1	Fall/winter	GRT2 east	Forestry mow or cut/treat non-native woody brush and trees. Pile and burn.	13	\$2,250	\$29,250
2	Spring	GRT2 east	Prep spray for prairie resto	13	\$250	\$3,250
2	Summer	GRT2 east	Prescribed burn to remove thatch. Let burn run into neighboring units.	13	\$300	\$3,900
2	Summer	GRT2 east	Optional drag/harrow to smooth planting surface	13	\$150	\$1,950
2	Summer	GRT2 east	Prep spray for prairie resto	13	\$250	\$3,250
2	Fall	GRT2 east	Prep spray for prairie resto	13	\$250	\$3,250
2	Fall	GRT2 east	Purchase upland dry prairie mix	13	\$800	\$10,400
2	Fall	GRT2 east	Broadcast seed rye cover crop (include seed cost)	13	\$150	\$1,950
3	Spring	GRT2 east	Prep spray for prairie resto	13	\$250	\$3,250
3	Spring	GRT2 east	Drill seed upland mesic prairie mix	13	\$200	\$2,600
3	Summer	GRT2 east	Mow (2x) establishing prairie	13	\$400	\$5,200
3	Summer	GRT2 east	Spot spray (2x) establishing prairie	13	\$250	\$3,250
4	Summer	GRT2 east	Mow (1x) establishing prairie	13	\$200	\$2,600
4	summer	GRT2 east	Spot spray (1x) establishing prairie	13	\$250	\$3,250
5	Spring	GRT2 east	Prescribed burn	13	\$300	\$3,900
5	Spring	GRT2 east	Purchase supplemental forb seed	13	\$500	\$6,500
5	Spring	GRT2 east	Broadcast seed post-burn	13	\$150	\$1,950
				13		\$89,700
UNIT: GRT2 West 12 acres.			High priority.	Target: Dry Prairie		
1	Fall/ Winter	GRT2 west	Cut and treat non-native woody brush and trees and other undesirable native woody brush within and between prairie remnants. Haul brush to piles outside of the prairie units; burn in winter.	5	\$2,800	\$14,000
2	Spring	GRT2 west	Conduct prescribed burn on removal areas, and if possible into nearby units.	5	\$500	\$2,500
2	Spring	GRT2 west	Broadcast seed removal areas following burn (FMR will provide seed). Evaluate areas for seeding need.	5	\$200	\$1,000
2	Summer	GRT2 west	Release seedhead and root weevils for knapweed biocontrol	5	--	\$100
2	Summer	GRT2 west	Spot treat or hand pull Canada thistle and other invasive forbs (except knapweed)	5	\$250	\$1,250
3	Summer	GRT2 west	Spot treat or hand pull Canada thistle and other invasive forbs (except knapweed)	5	\$250	\$1,250
				5		\$20,100

Table 5. Phase I Restoration Schedule and Cost Estimates (*continued*)

Yr	Season	Units	Activity	Ac	Cost/ac	Cost est
UNIT: GRT3, GRT5, MP 18.4 ac. Medium priority Target: Dry savanna						
1	Wtr	GRT3, GRT5, MP	Invasive woody removal, trees & shrubs. Cut/treat, stack. Mow or burn piles. MP: remove aspen & other small trees.	18.4	\$900	\$16,560
				18		\$16,560
UNIT: LGU1, 2: 15 acres. High priority. Target: Dry Prairie						
1	Spring	LGU1, 2	Late spring burn to set back non-native grasses. Burn only 1/2 of each unit	7.0	\$400	\$2,800
1	May-July	LGU1, 2	Spot-mow patch-forming invasive weeds (e.g. crown vetch, trefoil, burdock) before seeds form. 2x	5.0	\$350	\$1,750
1	July	LGU1, 2	Release seedhead and root weevils for knapweed biocontrol	15.0	--	\$500
1	August	LGU1, 2	Mow dense stands of goldenrod when flowering starts. About 2 ac.	2.0	\$350	\$700
1	Aug-Oct	LGU1, 2	Spot-spray invasive weeds before seeds form (cut knapweed). 2 visits. Milestone	15.0	\$350	\$5,250
1	August	LGU1, 2	Purchase seed mix of milestone-tolerant grasses and forbs (see seed mix).	3.0	\$700	\$2,100
1	Oct	LGU1, 2	Broadcast seed milestone-tolerant species, mostly grasses (see seed mix), where sprayed weeds were in sizable patches.	3.0	\$200	\$600
2	Late May-early June & late Aug-Sep	LGU1, 2	Spot-spray any additional invasive weeds before seeds form. 2 visits. Milestone. Do not spray seeded patches or target knapweed.	15.0	\$350	\$5,250
2	June, Aug	LGU1, 2	Seeded patches: mow 2x when 12"-15" tall. Do not allow weeds to produce seeds.	3.0	\$350	\$1,050
2	August	LGU1, 2	Repeat mow of dense stands of goldenrod in LGU 1 and 2, when flowering starts.	2.0	\$350	\$700
3	Late May-early June & late Aug-Sep	LGU1, 2	Spot-spray any additional invasive weeds, including seeded patches , before seeds form. 2 visits. Milestone.	3.0	\$350	\$1,050
3	May	LGU1, 2	Seeded patches: mow ONCE when 12"-15" tall. Do not allow weeds to produce seeds.	3.0	\$350	\$1,050
4	Late May-early June & late Aug-Sep	LGU1, 2	Spot-spray any additional invasive weeds, including seeded patches , before seeds form. 2 visits. Milestone.	3.0	\$350	\$1,050

Table 5. Phase I Restoration Schedule and Cost Estimates (*continued*)

Yr	Season	Units	Activity	Ac	Cost/ac	Cost est
UNIT: GRT3, GRT5, MP 18.4 ac. Medium priority Target: Dry savanna						
1	Wtr	GRT3, GRT5, MP	Invasive woody removal, trees & shrubs. Cut/treat, stack. Mow or burn piles. MP: remove aspen & other small trees.	18.4	\$900	\$16,560
				18		\$16,560
UNIT: LGU1, 2: 15 acres. High priority. Target: Dry Prairie						
1	Spring	LGU1, 2	Late spring burn to set back non-native grasses. Burn only 1/2 of each unit	7.0	\$400	\$2,800
1	May-July	LGU1, 2	Spot-mow patch-forming invasive weeds (e.g. crown vetch, trefoil, burdock) before seeds form. 2x	5.0	\$350	\$1,750
1	July	LGU1, 2	Release seedhead and root weevils for knapweed biocontrol	15.0	--	\$500
1	August	LGU1, 2	Mow dense stands of goldenrod when flowering starts. About 2 ac.	2.0	\$350	\$700
1	Aug-Oct	LGU1, 2	Spot-spray invasive weeds before seeds form (cut knapweed). 2 visits. Milestone	15.0	\$350	\$5,250
1	August	LGU1, 2	Purchase seed mix of milestone-tolerant grasses & forbs (see seed mix).	3.0	\$700	\$2,100
1	Oct	LGU1, 2	Broadcast seed milestone-tolerant species, mostly grasses (see seed mix), where sprayed weeds were in sizable patches.	3.0	\$200	\$600
2	Late May-early June & late Aug-Sep	LGU1, 2	Spot-spray any additional invasive weeds before seeds form. 2 visits. Milestone. Do not spray seeded patches or target knapweed.	15.0	\$350	\$5,250
2	June, Aug	LGU1, 2	Seeded patches: mow 2x when 12"-15" tall. Do not allow weed seed to form.	3.0	\$350	\$1,050
2	August	LGU1, 2	Repeat mow of dense stands of goldenrod when flowering starts.	2.0	\$350	\$700
3	Late May-early June & late Aug-Sep	LGU1, 2	Spot-spray any additional invasive weeds, including seeded patches , before seeds form. 2 visits. Milestone.	3.0	\$350	\$1,050
3	May	LGU1, 2	Seeded patches: mow ONCE when 12"-15" tall. Do not allow weed seeds.	3.0	\$350	\$1,050
4	Late May-early June & late Aug-Sep	LGU1, 2	Spot-spray any additional invasive weeds, including seeded patches , before seeds form. 2 visits. Milestone.	3.0	\$350	\$1,050
4	Oct	LGU1, 2	Fall burn to promote forbs. Burn only 1/2 of each unit	7.0	\$400	\$2,800
				15		\$26,650

Table 5. Phase I Restoration Schedule and Cost Estimates (*continued*)

Yr	Season	Units	Activity	Ac	Cost/ac	Cost est
UNIT: LGU6: 11 acres.			High priority.	Target: Dry Prairie		
1	Fall/winter	LGU6	Forestry mow or cut & treat non-native woody brush and trees. Pile, burn.	11	\$350	\$3,850
2	Spring	LGU6	Prep herbicide for prairie resto	11	\$250	\$2,750
2	Summer	LGU6	Prescribed burn to remove thatch. Let burn run into neighboring units.	11	\$250	\$2,750
2	Summer	LGU6	Optional harrow	11	\$200	\$2,200
2	Summer	LGU6	Prep herbicide for prairie resto	11	\$250	\$2,750
2	Fall	LGU6	Prep herbicide for prairie resto	11	\$250	\$2,750
2	Fall	LGU6	Purchase upland mesic prairie mix	11	\$800	\$8,800
2	Fall	LGU6	Purchase and seed rye cover crop	11	\$150	\$1,650
3	Spring	LGU6	Prep herbicide for prairie resto	11	\$250	\$2,750
3	Spring	LGU6	Drill seed upland mesic prairie mix	11	\$250	\$2,750
3	Summer	LGU6	Mow (2x) establishing prairie	11	\$200	\$2,200
4	Summer	LGU6	Mow (1x) establishing prairie	11	\$100	\$1,100
4	summer	LGU6	Spot spray (1x) establishing prairie	11	\$100	\$1,100
5	Spring	LGU6	Prescribed burn on newly established upland prairie	11	\$250	\$2,750
5	Spring	LGU6	Purchase supplemental forb seed	11	\$500	\$5,500
5	Spring	LGU6	Broadcast supplemental seed post-burn	11	\$150	\$1,650
				11		\$47,300
			TOTAL	391		\$1,140,530
Additional Annual Activities						
			Breeding bird surveys			\$2,400
			Volunteer stewardship events (e.g. brush haul, shrub planting)			\$2,400
			Supplies, mileage			\$2,000
			Ecological monitoring, project management, adaptive management recommendations			\$8,900
						\$15,700
					3 yr total	\$47,100
TOTAL FUNDING NEEDED				391		\$1,187,630
TOTAL TOP PRIORITY PROJECTS				267		\$592,005
TOTAL needed for 1/1/22 - 6/30/24				144		\$204,350

Priority Habitat/Acres	
Forest	207
Savanna restoration	10
Native Prairie	6
Prairie restoration	44
	267

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South Washington County Watershed District: <http://www.swwdmn.org>

APPENDIX A. BREEDING BIRD SURVEYS 2018-2021

Cottage Grove Ravine Park

Two June dates, 8 points, 50 m radius, 8 min survey

Red bold: Species of conservation need. Highlighted: New species

	Common name	Scientific name	2018	2019	2020	2021
1	American Crow	Corvus brachyrhynchos	5	3	1	9
2	American Goldfinch	Carduelis tristis	3	2	3	3
3	American Robin	Turdus migratorius	5	6	8	10
4	Bald Eagle	Haliaeetus leucocephalus		1		1
5	Baltimore Oriole	Icterus galbula	3	1	2	2
6	Black-capped Chickadee	Parus atricapillus	6	2	4	9
7	Blue Jay	Cyanocitta cristata	4	8	10	9
8	Blue-gray Gnatcatcher	Polioptila caerulea	1		1	1
9	Blue-headed vireo	Vireo solitarius	3		1	
10	Broad-winged Hawk	Buteo platypterus		1		
11	Brown-headed Cowbird	Molothrus ater	3	3	6	4
12	Canada goose	Branta canadensis				7
13	Cedar Waxwing	Bombycilla cedrorum	1		1	2
14	Chipping Sparrow	Spizella passerina	1		1	2
15	Common grackle	Quiscalus quiscula	1	14	6	
16	Common Yellowthroat	Geothlypis trichas		2	1	
17	Downy Woodpecker	Picoides pubescens	1			4
18	Eastern kingbird	Tyrannus tyrannus				1
19	Eastern Towhee	Pipilo erythrophthalmus	5	4	3	5
20	Eastern wood-pewee	Contopus virens	10	8	7	8
21	Gray Catbird	Dumetella carolinensis	5	1	4	3
22	Great Blue Heron	Ardea herodias		1		1
23	Great-crested Flycatcher	Bubo virginianus	3	2	3	1
24	Hairy woodpecker	Myiarchus crinitus	1	1	1	2
25	House Wren	Troglodytes aedon	2	1	5	3
26	Indigo Bunting	Passerina cyanea	3		3	1
27	Mallard	Anas platyrhynchos		9		
28	Marsh wren	Cistothorus palustris		1		1
29	Northern cardinal	Cardinalis cardinalis	6	5	4	1
30	Northern Flicker	Colaptes auratus	1	2		1
31	Northern Rough-winged Swallow	Stelgidopteryx serripennis				1
32	Osprey	Pandion haliaeetus				1
33	Ovenbird	Seiurus aurocapillus	13	14	9	7
34	Pileated woodpecker	Dryocopus pileatus		1	1	2
35	Red-bellied woodpecker	Melanerpes carolinus	4	4	5	7
36	Red-eyed Vireo	Vireo olivaceus	2	3	3	3
37	Red-winged Blackbird	Agelaius phoeniceus	5	5	4	3
38	Rose-breasted Grosbeak	Pheucticus ludovicianus	4	5	5	6
39	Ruby-throated Hummingbird	Archilochus colubris		1	1	1
40	Scarlet tanager	Piranga olivacea	1		1	2
41	Song Sparrow	Melospiza melodia	1	1	3	3
42	Warbling Vireo	Vireo gilvus		1		1
43	White-breasted Nuthatch	Sitta carolinensis	1	2	7	6
44	Wild Turkey	Meleagris gallopavo	1			
45	Wood duck	Aix sponsa				1
46	Wood thrush	Hylocichla mustelina	2	2	1	
47	Yellow Warbler	Dendroica petechia	1	1		
48	Yellow-bellied Sapsucker	Sphyrapicus varius	3	4	5	3
49	Yellow-billed cuckoo	Coccyzus americanus	1			
50	Yellow-throated Vireo	Vireo flavifrons				3
	No. birds		112	122	120	141
	No. Species		27	28	25	33
	No. SGCNs		3	2	2	2

APPENDIX B. PLANT SPECIES RECORDED

The following plant species lists were recorded by Friends of the Mississippi River ecologists in 2021. Relative coverages* of species and vegetation layers in 2021 surveys

DRY OAK FOREST - south half of park

UNITS OF2, OF3, OF7, OFe, OFw. Target: Southern Dry-Mesic Oak Woodland FDs37

No. relative	Scientific Name	Common Name	2012		2021		Managed units				Unmanaged units			
			OF3	OF3	dbh (in)		OFe	OFw	OF1	dbh (in)	OF2	dbh (in)	OF7	dbh (in)
			Acres	27			18	11	101		31		2	
Canopy 30 - 100 ft height			Total cover:	4	4		5	4	4		3		5	
	<i>Acer negundo</i>	boxelder	1								1			
	<i>Acer saccharinum</i>	silver maple											0.5	dead
	<i>Betula papyrifera</i>	paper birch	1	0.5	14		1		0.5					
	<i>Celtis occidentalis</i>	Hackberry	1	0.5				1	1		1	10	1	
	<i>Juniperus virginiana</i>	red cedar	1	1										
	<i>Pinus resinosa</i>	red pine									1		1	
x	<i>Pinus sylvestris</i>	Scotch pine									1			
	<i>Populus deltoides</i>	cottonwood							1	30	0.5	28	1	30
	<i>Populus grandidentata</i>	big-toothed aspen		1					1					
	<i>Populus tremuloides</i>	quaking aspen	1	1	10		1	1	1		2		2	
	<i>Prunus serotina</i>	black cherry	1		26				2	8			1	
	<i>Quercus macrocarpa</i>	bur oak	2	2	10-28		1	1	1	14, 18, 25	2	20	3	14, 18, 22
	<i>Quercus ellipsoidalis</i>	pin oak	3	3	8, 24, 41		3	3	2		2	8, 22, 32	2	49
	<i>Quercus rubra</i>	red oak	1	1			2	2	1				1	14
	<i>Tilia americana</i>	American basswood	1	1	8, 10		1		1	24		12		
	<i>Ulmus americana</i>	American elm	1	1				1			1		1	
Subcanopy 15-30 ft height			Total cover:	1	2		2	2	1		3		0	
	<i>Acer negundo</i>	boxelder	1				0.5		1		1			
	<i>Celtis occidentalis</i>	Hackberry						0.5	1					
	<i>Fraxinus pennsylvanica</i>	Green ash						1	1		0.5			
	<i>Juniperus virginiana</i>	red cedar		2			0.5	1	1		1			
	<i>Ostrya virginiana</i>	ironwood						1						
	<i>Populus tremuloides</i>	quaking aspen		2				1						
	<i>Prunus serotina</i>	black cherry		1					1					
	<i>Quercus ellipsoidalis</i>	pin oak		1										
	<i>Quercus macrocarpa</i>	bur oak						1			2			
	<i>Quercus rubra</i>	red oak		1			1	1	1					
	<i>Tilia americana</i>	American basswood					1							
	<i>Ulmus americana</i>	American elm					1		1		1			
Understory/shrub layer 4-15 ft			Total cover:	4	2		2	1	0.5		4		4	
	<i>Acer negundo</i>	boxelder		1				0.5						
	<i>Cornus racemosa</i>	gray dogwood									2	South leg		
	<i>Juniperus virginiana</i>	red cedar	0.5								1			
x	<i>Lonicera tatarica</i>	Tatarian honeysuckle	2	0.5							1		2	edges
	<i>Populus tremuloides</i>	quaking aspen		2				0.5			2			
	<i>Prunus serotina</i>	black cherry	1					0.5			0.5			
	<i>Prunus virginiana</i>	choke cherry	1					0.5						
x	<i>Robinia pseudoacacia</i>	black locust		0.5										
	<i>Quercus macrocarpa</i>	bur oak									0.5			
x	<i>Rhamnus cathartica</i>	common buckthorn	4	1	1		1	0.5			4		3	0.5-3
	<i>Ribes americana</i>	currant	1											
	<i>Ribes cf cynosbati</i>	gooseberry	1	0.5										
	<i>Sambucus racemosa</i>	red-berried elder							0.5				2	
	<i>Tilia americana</i>	American basswood					0.5							
	<i>Ulmus americana</i>	American elm	1											
	<i>Viburnum lentago</i>	nannyberry									0.5			
	<i>Zanthoxylum americana</i>	prickly ash	3	1			2				2		1	
			No. spp	9	7		3	5	1		9		4	
			No. native shrub spp	7	6		2	4	1		7		2	

OF2, OF3, OF7, OFe, OFw.

GROUND COVER

Total cover:

3 5

5

5

3

4

3

Woody and Vines

		4	3
Acer negundo	boxelder	1	1
Celtis occidentalis	Hackberry		1
Corylus americana	American hazelnut	0.5	
Fraxinus pennsylvanica	Green ash		
Juniperus virginiana	red cedar		
x Lonicera tatarica	Tatarian honeysuckle		1
Ostrya virginiana	ironwood		
Parthenocissus inserta	Virginia creeper	1	3
Populus tremuloides	quaking aspen	0.5	
Prunus serotina	black cherry	1	1
Prunus virginiana	chokecherry		1
Quercus macrocarpa	bur oak		
Quercus ellipsoidalis	pin oak	0.5	0.5
Quercus rubra	red oak		0.5
x Rhamnus cathartica	common buckthorn	3	2
Ribes cf americana	currant	0.5	
Ribes missouriensis	Missouri gooseberry		
Rubus ideaus	red raspberry	1	0.5
Rubus occidentalis	black raspberry		1
Rubus pubescens	dwarf raspberry		0.5
Sambucus racemosa	red-berried elder		
Tilia americana	American basswood	0.5	1
Toxicodendron rydbergii	poison ivy		0.5
Ulmus americana	American elm		
Vitis riparia	wild grape vine	1	1
Zanthoxylum americana	prickly ash	1	1

No. woody spp

12 16

3	4	1	3	3
0.5	0.5	0.5		0.5
	0.5		0.5	
0.5	0.5			
1	1		0.5	1
	0.5			
2	1	0.5	2	
	0.5	0.5	1	
1	1	1		0.5
0.5	0.5		1	0.5
	1		0.5	
1		0.5		0.5
2	1	1	2	3
1	0.5	0.5	1	1
2	2		0.5	1
2	1	0.5		1
			0.5	
		0.5	1	
0.5	0.5			
1	1	1	1	1
1	1		1	0.5

14 18

15

11

Forbs

3 3

Achillea millefolium	common yarrow		
Ageratina altissima	white snakeroot	1	2
Agrimonia gryposepala	tall hairy agrimony		
x Alliaria officinalis	garlic mustard	2	1
Ambrosia artemisiifolia	common ragweed	0.5	
Amphicarpa bracteata	hog peanut		0.5
Anemone quinquefolia	wood anemone		0.5
Aquilegia canadensis	columbine	0.5	0.5
x Arctium minus	common burdock	0.5	0.5
Arisaema trifolium	Jack in the pulpit		0.5
Aster sp	aster	0.5	0.5
Athyrium filix-femina	lady fern		0.5
Botrypus virginianus	rattlesnake fern		0.5
Campanulastrum americanum	tall bellflower		0.5
x Cerastium sp	chickweed		1
Chenopodium album	lamb's quarter		
Circaea leutetiana	enchanter's nightshade	1	1
x Cirsium arvense	Canada thistle		0.5
Cryptotaenia canadensis	honewort		
Desmodium glutinosum	pointed-leaved tick trefoil		
Fragaria virginiana	wild strawberry	0.5	0.5
Galium aparine	cleavers	1	2
Galium boreale	northern bedstraw	0.5	
Galium triflorum	sweet-scented bedstraw		1
Geranium maculatum	wild geranium	1	0.5
Geum canadense	white avens	0.5	0.5
x Glechoma hederacea	creeping charlie		0.5
Hackelia virginiana	Virginia stickseed		1
x Hesperis matronalis	dame's rocket		0.5
Impatiens capensis	Jewelweed		0.5
Lactuca biennis	blue lettuce		0.5
x Leonurus cardiaca	motherwort	0.5	0.5
Maianthemum canadense	false lily of the valley	1	2
x Myosoton aquaticum	giant chickweed		
x Nepeta cataria	catnip		0.5

2	2	2	2	2
1	1	2	1	1
0.5			0.5	
2	0.5	2	2	1
1			1	
		1	0.5	
1			0.5	
1		1	1	
		0.5		
1		0.5		1
1		1	1	1
1		2		
			1	
0.5			1	
2	1	2		1
	0.5	1	1	
1	0.5	0.5	0.5	1
1		0.5	1	
	0.5		0.5	
	0.5	0.5	1	1
1	1	0.5	1	1
		1		
	0.5	0.5		

OF2, OF3, OF7, OFe, OFw.

	<i>Osmorhiza claytonii</i>	sweet cicely		2
	<i>Osmorhiza longistylus</i>	aniseroot		0.5
	<i>Oxalis stricta</i>	wood sorrel		0.5
	<i>Parietaria pensylvanica</i>	Pennsylvania pellitory		0.5
	<i>Phryma leptostachya</i>	lopseed		
x	<i>Plantago major</i>	common plantain		
	<i>Pilea sp</i>	clearweed		
	<i>Polygonatum biflorum</i>	Solomon's seal		0.5
	<i>Polygonatum pubescens</i>	Hairy Solomon's seal		0.5
	<i>Pyrola sp</i>	shinleaf		
	<i>Ranunculus abortivus</i>	little leaf buttercup		0.5
	<i>Scrophularia lanceolata</i>	lance-leaved figwort		0.5
	<i>Smilax cf herbacea</i>	carrion plant	0.5	0.5
x	<i>Solanum dulcamara</i>	bittersweet nightshade		0.5
	<i>Solidago canadensis</i>	Canada goldenrod		
	<i>Solidago flexicaulis</i>	zigzag goldenrod		
	<i>Symphyotrichum cordifolium</i>	heart-leaved aster		
	<i>Symphyotrichum laeve</i>	smooth blue aster		
	<i>Symphyotrichum lateriflorum</i>	calico aster		0.5
x	<i>Taraxacum officinale</i>	dandelion		0.5
	<i>Teucrium canadense</i>	American germander		
x	<i>Torilis arvensis</i>	Japanese hedge parsley		
	<i>Urtica dioica</i>	stinging nettle		0.5
	<i>Uvularia sessilifolia</i>	sessile bellwort	0.5	
x	<i>Verbascum thapsus</i>	common mullein		0.5
	<i>Verbena urticifolia</i>	white vervain		
	<i>Viola sororia</i>	blue violet		0.5
		moss spp	2	

No. Forb spp

17

42

Graminoids		1	1
	<i>Carex blanda</i>	Eastern woodland sedge	
	<i>Carex gracillima</i>	graceful sedge	
	<i>Carex pensylvanica</i>	Pennsylvania sedge	1
	<i>Carex rosea</i>	rosy sedge	1
	<i>Elymus hystrix</i>	bottlebrush grass	1
	<i>Elymus virginicus</i>	Virginia wild rye	1
	<i>Leersia virginica</i>	white grass	

No. Gram spp

1

4

Total ground cover spp

30

62

No. native spp		27	49
Rel cover native spp		24	46.5
No. non-native invasive		2	7
Rel cover non-native invasive		2.5	3.5

1	2	1				
1	0.5	0.5				
0.5		0.5		1		
1		0.5				
	0.5					
		0.5				
				0.5		
				0.5		
				1		
	0.5	0.5			0.5	
0.5	0.5	0.5				
		0.5				
	1					
		0.5				
	0.5					
	0.5					
1		0.5				
1	0.5	1				
0.5	0.5	1				
0.5		0.5				
	0.5					
		0.5			0.5	

25

21

30

22

11

2	2	2	1			
	0.5	0.5	1			
0.5	1					
2	1	0.5	1			
	1					
1	1					
	1	2				

3

5

3

2

0

42

44

33

39

22

24

32

4

3

* Units have been intensively managed since 2018

* Relative Cover Classes for individual species and vegetation layers: 0.5=0-1%, 1=1-5%, 2=5-25%, 3=25-50%, 4=50-75%, 5=75-100%

DRY OAK FOREST - north half of park

UNITS OF5, OF6. Target: OF5: Southern Oak savanna Ups14. OF6: Southern Dry-Mesic Oak Woodland FDs37

Drainage
UNIT: OF5 OF6 Pond
DATE: 8/25/21 8/25/21 5/21/21

Non	Family	Scientific Name	Common Name			
Canopy 30 - 100 ft height			Total cover:	4	4	1
	Sapindaceae	<i>Acer negundo</i>	boxelder	1		0.5
	Sapindaceae	<i>Acer saccharinum</i>	silver maple			
	Betulaceae	<i>Betula papyrifera</i>	paper birch			
	Cannabaceae	<i>Celtis occidentalis</i>	hackberry	2	2	
	Oleaceae	<i>Fraxinus pennsylvanica</i>	green ash			
	Pinaceae	<i>Picea pungens</i>	blue spruce			
	Pinaceae	<i>Pinus resinosa</i>	red pine	1		
	Pinaceae	<i>Pinus strobus</i>	white pine			
	Salicaceae	<i>Populus deltoides</i>	cottonwood			
	Salicaceae	<i>Populus tremuloides</i>	quaking aspen	2	2	
	Rosaceae	<i>Prunus serotina</i>	black cherry	2	1	
	Fagaceae	<i>Quercus alba</i>	white oak	1	2	
	Fagaceae	<i>Quercus ellipsoidalis</i>	pin oak	2		
	Fagaceae	<i>Quercus macrocarpa</i>	bur oak	4	2	
	Fagaceae	<i>Quercus rubra</i>	red oak	1		
	Ulmaceae	<i>Ulmus americana</i>	American elm	2	2	

Subcanopy 15-30 ft height			Total cover:	3	3	1
	Sapindaceae	<i>Acer negundo</i>	boxelder	1		0.5
	Cannabaceae	<i>Celtis occidentalis</i>	hackberry	3	2	
	Oleaceae	<i>Fraxinus pennsylvanica</i>	green ash	0.5	2	
	Cupressaceae	<i>Juniperus virginiana</i>	red cedar	0.5		
	Pinaceae	<i>Picea pungens</i>	blue spruce			
	Salicaceae	<i>Populus tremuloides</i>	quaking aspen			
	Rosaceae	<i>Prunus serotina</i>	black cherry	2		
	Fagaceae	<i>Quercus ellipsoidalis</i>	pin oak	1		
	Fagaceae	<i>Quercus macrocarpa</i>	bur oak	2		
	Fagaceae	<i>Quercus rubra</i>	red oak			
	Ulmaceae	<i>Ulmus americana</i>	American elm	3	2	

Understory/shrub layer 4-15 ft height			Total cover:	4	4	1
	Sapindaceae	<i>Acer negundo</i>	boxelder	1		
	Sapindaceae	<i>Acer saccharinum</i>	silver maple			
	Cannabaceae	<i>Celtis occidentalis</i>	hackberry	3		
	Oleaceae	<i>Fraxinus pennsylvanica</i>	green ash	0.5		
	Cupressaceae	<i>Juniperus virginiana</i>	red cedar			
X	Caprifoliaceae	<i>Lonicera tartarica</i>	Tatarian honeysuckle	1		
X	Moraceae	<i>Morus alba</i>	white mulberry			
	Betulaceae	<i>Ostrya virginiana</i>	ironwood			
	Pinaceae	<i>Picea pungens</i>	blue spruce			
	Salicaceae	<i>Populus tremuloides</i>	quaking aspen	1		
	Rosaceae	<i>Prunus serotina</i>	black cherry	1	1	
	Rosaceae	<i>Prunus virginiana</i>	chokecherry	1		
	Fagaceae	<i>Quercus macrocarpa</i>	bur oak			
	Fagaceae	<i>Quercus rubra</i>	red oak			
X	Rhamnaceae	<i>Rhamnus cathartica</i>	common buckthorn	4	4	
	Grossulariaceae	<i>Ribes missouriense</i>	Missouri gooseberry	2	2	

	Rosaceae	<i>Rubus ideaus</i>	red raspberry	1		
	Rosaceae	<i>Rubus occidentalis</i>	black raspberry	1		
	Adoxaceae	<i>Sambucus sp.</i>	elderberry sp.	2		
X	Rosaceae	<i>Sorbus aucuparia</i>	mountain-ash	0.5		
	Ulmaceae	<i>Ulmus americana</i>	American elm			
	Adoxaceae	<i>Viburnum lentago</i>	nannyberry	0.5		
	Adoxaceae	<i>Viburnum opulus</i>	highbush cranberry	0.5		
	Rutaceae	<i>Zanthoxylum americana</i>	prickly ash	2		

GROUNDCOVER

			Total groundcover:	3	3	4
<i>Vines and woody species</i>			Total cover:	1	1	1
	Sapindaceae	<i>Acer negundo</i>	boxelder	0.5		1
	Sapindaceae	<i>Acer saccharinum</i>	silver maple			
	Rosaceae	<i>Amelanchier interior</i>	inland serviceberry			
	Celastraceae	<i>Celastrus scandens</i>	American bittersweet	0.5		
	Cannabaceae	<i>Celtis occidentalis</i>	hackberry		0.5	
	Rosaceae	<i>Cornus racemosa</i>	gray dogwood			
	Oleaceae	<i>Fraxinus pennsylvanica</i>	green ash		1	
	Cupressaceae	<i>Juniperus virginiana</i>	red cedar	0.5		
X	Caprifoliaceae	<i>Lonicera tartarica</i>	Tatarian honeysuckle			0.5
	Menispermaceae	<i>Menispermum canadense</i>	moonseed			
X	Moraceae	<i>Morus alba</i>	white mulberry			
	Vitaceae	<i>Parthenocissus quinquefolia</i>	Virginia creeper	1	1	1
	Pinaceae	<i>Pinus resinosa</i>	red pine			
	Salicaceae	<i>Populus tremuloides</i>	quaking aspen			
	Rosaceae	<i>Prunus serotina</i>	black cherry			
	Grossulariaceae	<i>Prunus virginiana</i>	chokecherry			
	Fagaceae	<i>Quercus macrocarpa</i>	bur oak	0.5		
	Fagaceae	<i>Quercus rubra</i>	red oak	0.5		
X	Rhamnaceae	<i>Rhamnus cathartica</i>	common buckthorn			
	Anacardiaceae	<i>Rhus glabra</i>	smooth sumac			
	Grossulariaceae	<i>Ribes missouriense</i>	Missouri gooseberry			
	Rosaceae	<i>Rubus occidentalis</i>	black raspberry			
	Adoxaceae	<i>Sambucus racemosa</i>	red-berried elder			
X	Rosaceae	<i>Sorbus aucuparia</i>	mountain-ash			
	Anacardiaceae	<i>Toxicodendron rydbergii</i>	poison ivy			
	Ulmaceae	<i>Ulmus americana</i>	American elm			
	Adoxaceae	<i>Viburnum lentago</i>	nannyberry			
	Vitaceae	<i>Vitis riparia</i>	wild grape	1	0.5	
	Rutaceae	<i>Zanthoxylum americana</i>	prickly ash			

<i>Forbs</i>			Total cover:	3	3	3
	Actaea	<i>Actea rubra</i>	red baneberry			
	Asteraceae	<i>Ageratina altissima</i>	white snakeroot	2		
X	Brassicaceae	<i>Alliaria officinalis</i>	garlic mustard	3	3	
	Ranunculaceae	<i>Anemone quinquefolia</i>	wood anemone			
	Asteraceae	<i>Antennaria parlinii</i>	Parlin's pussytoes			
X	Asteraceae	<i>Arctium minus</i>	common burdock	1		3
	Araceae	<i>Arisaema trifolium</i>	Jack in the pulpit			
	Dryopteridaceae	<i>Athyrium filix-femina</i>	lady fern			
	Amaranthaceae	<i>Chenopodium simplex</i>	maple-leaf goosefoot			
	Onagraceae	<i>Circaea leutetiana</i>	enchanter's nightshade	2	2	
X	Asteraceae	<i>Cirsium arvense</i>	Canada thistle			2
X	Asteraceae	<i>Cirsium vulgare</i>	bull thistle	0.5		
	Apiaceae	<i>Cryptotaenia canadensis</i>	Canadian honewort	1		
	Dryopteridaceae	<i>Dryopteris carthusiana</i>	wood fern			
	Asteraceae	<i>Erigeron philadelphicus</i>	Philadelphia fleabane			

	Rosaceae	<i>Fragaria virginiana</i>	wild strawberry	1		
	Rubiaceae	<i>Galium aparine</i>	sticky-willy	2	1	2
	Rubiaceae	<i>Galium triflorum</i>	fragrant bedstraw	2		
	Rosaceae	<i>Geum canadense</i>	white avens	2	2	
X	Lamiaceae	<i>Glechoma hederacea</i>	creeping Charlie			
	Boraginaceae	<i>Hackelia virginiana</i>	Virginia stickseed	2	1	
X	Brassicaceae	<i>Hesperis matronalis</i>	dame's rocket	3	2	2
	Asteraceae	<i>Lactuca biennis</i>	blue lettuce			
X	Lamiaceae	<i>Leonurus cardiaca</i>	motherwort	1		1
	Ruscaceae	<i>Maianthemum canadense</i>	false Solomon's seal			
	Lamiaceae	<i>Monarda fistulosa</i>	bergamot			
	Apiaceae	<i>Osmorhiza claytonii</i>	sweet cicely	2		
	Oxalidaceae	<i>Oxalis stricta</i>	wood sorrel			
	Urticaceae	<i>Parietaria pensylvanica</i>	Pennsylvania pellitory			
	Phrymaceae	<i>Phryma leptostachya</i>	American lopseed			
	Urticaceae	<i>Pilea pumila</i>	clearweed			
	Ruscaceae	<i>Polygonatum biflorum</i>	smooth Solomon's seal	2	0.5	
	Rosaceae	<i>Potentilla simplex</i>	common cinquefoil			
	Lamiaceae	<i>Prunella vulgaris</i>	heal-all			
	Ranunculaceae	<i>Ranunculus abortivus</i>	little leaf buttercup			
	Apiaceae	<i>Sanicula canadensis</i>	Canadian black snakeroot			
	Apiaceae	<i>Sanicula marilandica</i>	black snakeroot			
	Smilacaceae	<i>Smilax ecirrhata</i>	carrión plant			
X	Solanaceae	<i>Solanum dulcamara</i>	bittersweet nightshade	1		
	Asteraceae	<i>Solidago canadensis</i>	Canada goldenrod	1		
X	Caryophyllaceae	<i>Stellaria media</i>	chickweed			2
	Asteraceae	<i>Taraxacum officinale</i>	common dandelion			
	Lamiaceae	<i>Teucrium canadense</i>	American germander			
X	Apiaceae	<i>Torilis japonica</i>	Japanese hedge parsley	1		
	Urticaceae	<i>Urtica dioica</i>	stinging nettle	1		2
X	Scrophulariaceae	<i>Verbascum thapsus</i>	common mullein	1		
	Plantaginaceae	<i>Veronicastrum virginicum</i>	Culver's root			
	Violaceae	<i>Viola pubescens</i>	downy yellow violet		0.5	
	Violaceae	<i>Viola sororia</i>	blue violet			
			moss spp			

Graminoids			Total cover:	1	0.5	3
	Cyperaceae	<i>Carex blanda</i>	Eastern woodland sedge	1		2
	Cyperaceae	<i>Carex pensylvanica</i>	Pennsylvania sedge		0.5	
	Cyperaceae	<i>Carex rosea</i>	rosy sedge	1		
	Cyperaceae	<i>cf. Carex sprengei</i>	cf. Sprengel's sedge	1		
	Poaceae	<i>Dichanthelium sp.</i>	panic grass			
	Poaceae	<i>Leersia virginica</i>	white cutgrass			
X	Poaceae	<i>Phalaris arundinacea</i>	reed canary grass			3

		<i>Bare soil</i>		2	2	1
		<i>Woody debris</i>		2	3	1
		<i>Leaf litter</i>		2	2	1

MESIC OAK FOREST - south half of park

UNITS OM1, OM3. Target: Southern Dry-Mesic Oak Forest MHs37

Non-native	Scientific Name	Common Name	OM1		OM3	Diam (In)
Canopy 30 - 100 ft height			Total cover:	3	4	
	<i>Celtis occidentalis</i>	Hackberry	0.5			
	<i>Fraxinus pennsylvanica</i>	Green ash	1			
	<i>Populus tremuloides</i>	quaking aspen	1		2	12, 15
	<i>Prunus serotina</i>	black cherry	2	10,12		
	<i>Quercus macrocarpa</i>	bur oak	2	20	2	10, 12
	<i>Quercus ellipsoidalis</i>	pin oak	1		2	12
	<i>Quercus rubra</i>	red oak	2	8-12		
	Snags		1			
Subcanopy 15-30 ft height			Total cover:	2	3	
	<i>Acer negundo</i>	boxelder	1			
	<i>Celtis occidentalis</i>	Hackberry	1			
	<i>Juniperus virginiana</i>	red cedar	0.5			
	<i>Ostrya virginiana</i>	ironwood			3	
	<i>Quercus palustris</i>	pin oak	1			
	<i>Ulmus americana</i>	American elm	1			
	<i>Tilia americana</i>	American basswood	1			
Understory/shrub layer 4-15 ft			Total cover:	1	2	
	<i>Acer negundo</i>	boxelder			0.5	
x	<i>Berberis thunbergii</i>	barberry			0.5	
	<i>Juniperus virginiana</i>	red cedar	1			
x	<i>Lonicera tatarica</i>	Tatarian honeysuckle	1			
	<i>Ostrya virginiana</i>	ironwood			1	
	<i>Prunus serotina</i>	black cherry	1		1	
	<i>Prunus virginiana</i>	choke cherry	0.5			
x	<i>Rhamnus cathartica</i>	common buckthorn	1		1	
	<i>Ribes missouriensis</i>	Missouri gooseberry	0.5			
	<i>Rubus occidentalis</i>	black raspberry	1			
	<i>Tilia americana</i>	American basswood			1	
	<i>Ulmus americana</i>	American elm	0.5			
	<i>Zanthoxylum americana</i>	prickly ash	1		1	
GROUND COVER			Total cover:	4	4	
Woody and Vines			2	3		
	<i>Acer negundo</i>	boxelder	1		0.5	
	<i>Celastrus scandens</i>	bittersweet vine	0.5			
	<i>Celtis occidentalis</i>	Hackberry	1		0.5	
	<i>Corylus americana</i>	American hazelnut	1			
	<i>Fraxinus pennsylvanica</i>	Green ash	0.5		0.5	
x	<i>Lonicera tatarica</i>	Tatarian honeysuckle	1			
	<i>Ostrya virginiana</i>	ironwood			0.5	
	<i>Parthenocissus inserta</i>	Virginia creeper	2		1	
	<i>Populus tremuloides</i>	quaking aspen	0.5			
	<i>Prunus serotina</i>	black cherry	1		1	
	<i>Prunus virginiana</i>	chokecherry			0.5	
	<i>Quercus macrocarpa</i>	bur oak			0.5	
	<i>Quercus rubra</i>	red oak	1		0.5	
x	<i>Rhamnus cathartica</i>	common buckthorn	2		2	
	<i>Ribes missouriensis</i>	Missouri gooseberry	1		1	

	<i>Rubus ideaus</i>	red raspberry		1	
	<i>Rubus occidentalis</i>	black raspberry	1		
	<i>Sambucus racemosa</i>	red-berried elder	0.5		
	<i>Tilia americana</i>	American basswood	0.5	0.5	
	<i>Vitis riparia</i>	wild grape vine	1	1	
	<i>Zanthoxylum americana</i>	prickly ash	1	1	
	Forbs		4	2	
	<i>Ageratina altissima</i>	white snakeroot	3	0.5	
x	<i>Alliaria officinalis</i>	garlic mustard	2	0.5	
	<i>Ambrosia artemisiifolia</i>	common ragweed	1		
x	<i>Arctium minus</i>	common burdock	0.5		
	<i>Arisaema trifolium</i>	Jack in the pulpit	0.5		
	<i>Athyrium filix-femina</i>	lady fern	1	0.5	
	<i>Campanulastrum americanum</i>	tall bellflower	0.5		
	<i>Circaea leutetiana</i>	enchanter's nightshade	2	1	
	<i>Cryptotaenia canadensis</i>	honestwort	2		
	<i>Erechtites hieraciifolius</i>	pilewort	1		
	<i>Fragaria virginiana</i>	wild strawberry	1		
	<i>Galium boreale</i>	northern bedstraw		0.5	
	<i>Galium triflorum</i>	sweet-scented bedstraw	2		
	<i>Geranium maculatum</i>	wild geranium	1	1	
	<i>Geum canadense</i>	white avens	1	1	
	<i>Hackelia virginiana</i>	Virginia stickseed	1		
	<i>Lactuca biennis</i>	blue lettuce	0.5		
x	<i>Leonurus cardiaca</i>	motherwort	1		
	<i>Maianthemum canadense</i>	false lily of the valley	1	1	
	<i>Mianthemum racemosa</i>	false Solomon's seal	1		
	<i>Onoclea sensibilis</i>	sensitive fern	0.5		
	<i>Osmorhiza claytonii</i>	sweet cicely	1		
	<i>Osmorhiza longistylis</i>	aniseroot	0.5		
	<i>Phryma leptostachya</i>	lopseed	0.5		
	<i>Pilea sp</i>	clearweed	1		
	<i>Pyrola sp</i>	shinleaf	0.5	0.5	
	<i>Ranunculus abortivus</i>	little leaf buttercup	0.5		
	<i>Smilax cf herbacea</i>	carion plant	0.5		
	<i>Solidago flexicaulis</i>	zigzag goldenrod		1	
	<i>Symphotrichum lanceolatum</i>	panicled aster	0.5		
	<i>Symphotrichum latiflorum</i>	calico aster	0.5		
x	<i>Taraxacum officinale</i>	dandelion	0.5		
x	<i>Torilis japonica</i>	Japanese hedge parsley	1		
	<i>Triosteum perfoliatum</i>	horse gentian	0.5		
	<i>Urtica dioica</i>	stinging nettle	0.5		
	<i>Viola sororia</i>	blue violet	0.5	1	
	Graminoids		1	2	
	<i>Carex blanda</i>	Eastern woodland sedge	0.5	0.5	
	<i>Carex gracilima</i>	graceful sedge	0.5		
	<i>Carex pensylvanica</i>	Pennsylvania sedge		2	
	<i>Carex rosea</i>	rosy sedge	1		
	<i>Leersia virginica</i>	white grass	1		

* Relative Cover Classes for individual species and vegetation layers: 0.5=0-1%, 1=1-5%, 2=5-25%, 3=25-50%, 4=50-75%, 5=75-100%

LOWLAND HARDWOOD FOREST - south half of park

UNITS LHF1, LHF2. Target: southern wet-mesic hardwood forest (MHs49)

Non-native	Scientific Name	Common Name	LHF	Tree Diam (in), Notes
Canopy & subcanopy 15-50 ft		Total cover:	3	
	<i>Juniperus virginiana</i>	red cedar	1	
	<i>Populus tremuloides</i>	quaking aspen	2	
	<i>Quercus ellipsoidalis</i>	pin oak	1	
	<i>Quercus macrocarpa</i>	bur oak	1	14"
	<i>Tilia americana</i>	American basswood	1	
	<i>Ulmus americana</i>	American elm	1	
Understory/shrub layer 4-15 ft		Total cover:	3	
x	<i>Acer ginnala</i>	amur maple	0.5	
	<i>Cornus racemosa</i>	gray dogwood	0.5	
	<i>Corylus americana</i>	American hazelnut	1	
	<i>Fraxinus pennsylvanica</i>	Green ash	0.5	
x	<i>Lonicera tatarica</i>	Tatarian honeysuckle	2	
	<i>Populus tremuloides</i>	quaking aspen	1	
	<i>Prunus serotina</i>	black cherry	1	
	<i>Quercus rubra</i>	red oak	0.5	
x	<i>Rhamnus cathartica</i>	common buckthorn	2	Short- 4' or less
	<i>Ribes missouriensis</i>	Missouri gooseberry	1	
	<i>Rosa blanda</i>	smooth wild rose	0.5	
	<i>Tilia americana</i>	American basswood	1	
	<i>Viburnum lentago</i>	nannyberry	1	
	<i>Vitis riparia</i>	wild grape vine	1	
	<i>Zanthoxylum americana</i>	prickly ash	0.5	
GROUND COVER		Total cover:	4	
Forbs			2	
	<i>Solidago canadensis</i>	Canada goldenrod	1	
	<i>Symphyotrichum lanceolatum</i>	panicled aster	1	
	<i>Medicago lupulina</i>	black medick	1	
	<i>Eupatorium perfoliatum</i>	common boneset	0.5	
Graminoids			3	
	<i>Carex</i> sp	sedge species	3	
	<i>Phalaris arundinacea</i>	reed canary grass	3	LHF1 only
	<i>Typha</i> sp	cattail	1	LHF1 only

* Relative Cover Classes for individual species and vegetation layers: 0.5=0-1%, 1=1-5%, 2=5-25%, 3=25-50%, 4=50-75%, 5=75-100%

ALTERED FORESTS - north half of park
 CON1: Conifer plantation. CON2: Conifer plantation. AW1: Altered Forest

UNIT: CON1 CON2 AW1
 DATE: 7/30/21 7/30/21 8/7/21

Non	Family	Scientific Name	Common Name			
Canopy 30 - 100 ft height			Total cover:	5	5	3
	Sapindaceae	<i>Acer negundo</i>	boxelder		1	2
	Sapindaceae	<i>Acer saccharinum</i>	silver maple			0.5
	Betulaceae	<i>Betula papyrifera</i>	paper birch			0.5
	Cannabaceae	<i>Celtis occidentalis</i>	hackberry			0.5
	Oleaceae	<i>Fraxinus pennsylvanica</i>	green ash		1	1
	Pinaceae	<i>Picea glauca</i>	white spruce	3	2	1
	Pinaceae	<i>Pinus resinosa</i>	red pine	4	5	1
	Pinaceae	<i>Pinus strobus</i>	white pine			1
	Salicaceae	<i>Populus deltoides</i>	cottonwood	0.5	1	2
	Salicaceae	<i>Populus tremuloides</i>	quaking aspen	1		1
	Rosaceae	<i>Prunus serotina</i>	black cherry			1
	Fagaceae	<i>Quercus ellipsoidalis</i>	pin oak			2
	Fagaceae	<i>Quercus rubra</i>	red oak	2		

Subcanopy 15-30 ft height			Total cover:	2	3	3
	Sapindaceae	<i>Acer negundo</i>	boxelder	1	2	2
	Cannabaceae	<i>Celtis occidentalis</i>	hackberry			1
	Oleaceae	<i>Fraxinus pennsylvanica</i>	green ash			2
	Cupressaceae	<i>Juniperus virginiana</i>	red cedar		1	
	Pinaceae	<i>Picea glauca</i>	white spruce		2	
	Salicaceae	<i>Populus tremuloides</i>	quaking aspen		2	
	Rosaceae	<i>Prunus serotina</i>	black cherry		1	1
	Fagaceae	<i>Quercus ellipsoidalis</i>	pin oak			1
	Fagaceae	<i>Quercus rubra</i>	red oak	1		
	Ulmaceae	<i>Ulmus americana</i>	American elm	1	2	2

Understory/shrub layer 4-15 ft height			Total cover:	4	4	5
	Sapindaceae	<i>Acer negundo</i>	boxelder	1	1	1
	Sapindaceae	<i>Acer saccharinum</i>	silver maple			0.5
	Cannabaceae	<i>Celtis occidentalis</i>	hackberry	1		
	Oleaceae	<i>Fraxinus pennsylvanica</i>	green ash			1
	Cupressaceae	<i>Juniperus virginiana</i>	red cedar		1	
X	Caprifoliaceae	<i>Lonicera tartarica</i>	Tatarian honeysuckle	2	1	2
X	Moraceae	<i>Morus alba</i>	white mulberry	1		
	Betulaceae	<i>Ostrya virginiana</i>	ironwood			0.5
	Pinaceae	<i>Picea glauca</i>	white spruce	0.5		
	Salicaceae	<i>Populus tremuloides</i>	quaking aspen			1
	Rosaceae	<i>Prunus serotina</i>	black cherry	1	1	
	Rosaceae	<i>Prunus virginiana</i>	chokecherry	2		2
	Fagaceae	<i>Quercus macrocarpa</i>	bur oak			0.5
	Fagaceae	<i>Quercus rubra</i>	red oak	1		
X	Rhamnaceae	<i>Rhamnus cathartica</i>	common buckthorn	3	3	5
	Grossulariaceae	<i>Ribes missouriense</i>	Missouri gooseberry	2	1	0.5
	Rosaceae	<i>Rubus occidentalis</i>	black raspberry	1	1	1
	Adoxaceae	<i>Sambucus canadensis</i>	common elderberry			0.5

	Adoxaceae	<i>Sambucus racemosa</i>	red-berried elder	2	2	
	Ulmaceae	<i>Ulmus americana</i>	American elm	1	1	
	Adoxaceae	<i>Viburnum lentago</i>	nannyberry	1		
	Rutaceae	<i>Zanthoxylum americana</i>	prickly ash	3	3	0.5

GROUNDCOVER

				Total groundcover:	3	3	3
				Total cover:	2	2	2
Vines and woody species							
	Sapindaceae	<i>Acer negundo</i>	boxelder	1			0.5
	Sapindaceae	<i>Acer saccharinum</i>	silver maple				0.5
	Rosaceae	<i>Amelanchier interior</i>	inland serviceberry				0.5
	Celastraceae	<i>Celastrus scandens</i>	American bittersweet	0.5			0.5
	Cannabaceae	<i>Celtis occidentalis</i>	hackberry	1	0.5		0.5
	Rosaceae	<i>Cornus racemosa</i>	gray dogwood	0.5			0.5
	Oleaceae	<i>Fraxinus pennsylvanica</i>	green ash	1	1		1
	Cupressaceae	<i>Juniperus virginiana</i>	red cedar	0.5			
X	Caprifoliaceae	<i>Lonicera tartarica</i>	Tatarian honeysuckle	1	1		1
	Menispermaceae	<i>Menispermum canadense</i>	moonseed	0.5			0.5
X	Moraceae	<i>Morus alba</i>	white mulberry	0.5			
	Vitaceae	<i>Parthenocissus quinquefolia</i>	Virginia creeper	2	2		1
	Pinaceae	<i>Pinus resinosa</i>	red pine	0.5			
	Salicaceae	<i>Populus tremuloides</i>	quaking aspen	0.5	1		
	Rosaceae	<i>Prunus serotina</i>	black cherry	1	0.5		0.5
	Grossulariaceae	<i>Prunus virginiana</i>	chokecherry	1			1
	Fagaceae	<i>Quercus macrocarpa</i>	bur oak	0.5			0.5
	Fagaceae	<i>Quercus rubra</i>	red oak	0.5	0.5		0.5
X	Rhamnaceae	<i>Rhamnus cathartica</i>	common buckthorn	2	2		2
	Anacardiaceae	<i>Rhus glabra</i>	smooth sumac				0.5
	Grossulariaceae	<i>Ribes cynosbati</i>	prickly gooseberry	0.5			
	Grossulariaceae	<i>Ribes missouriense</i>	Missouri gooseberry	2	2		1
	Rosaceae	<i>Rubus occidentalis</i>	black raspberry	1	1		1
	Adoxaceae	<i>Sambucus racemosa</i>	red-berried elder	1	1		0.5
X	Rosaceae	<i>Sorbus aucuparia</i>	mountain-ash	0.5			
	Anacardiaceae	<i>Toxicodendron rydbergii</i>	poison ivy	0.5			0.5
	Ulmaceae	<i>Ulmus americana</i>	American elm	0.5	0.5		0.5
	Adoxaceae	<i>Viburnum lentago</i>	nannyberry	0.5			
	Vitaceae	<i>Vitis riparia</i>	wild grape	1	1		1
	Rutaceae	<i>Zanthoxylum americana</i>	prickly ash	2	2		0.5

				Total cover:	2	2	3
Forbs							
	Actaea	<i>Actea rubra</i>	red baneberry	0.5			1
	Asteraceae	<i>Ageratina altissima</i>	white snakeroot	1	1		1
X	Brassicaceae	<i>Alliaria officinalis</i>	garlic mustard	2	2		1
	Ranunculaceae	<i>Anemone quinquefolia</i>	wood anemone				0.5
	Asteraceae	<i>Antennaria parlinii</i>	Parlin's pussytoes	0.5			
X	Asteraceae	<i>Arctium minus</i>	common burdock	0.5	0.5		0.5
	Araceae	<i>Arisaema trifolium</i>	Jack in the pulpit	0.5			
	Dryopteridaceae	<i>Athyrium filix-femina</i>	lady fern	0.5			0.5
	Amaranthaceae	<i>Chenopodium simplex</i>	maple-leaf goosefoot				0.5
	Onagraceae	<i>Circaea leutetiana</i>	enchanter's nightshade	2	1		1
	Apiaceae	<i>Cryptotaenia canadensis</i>	Canadian honewort				1
	Dryopteridaceae	<i>Dryopteris carthusiana</i>	wood fern	2	1		0.5
	Asteraceae	<i>Erigeron philadelphicus</i>	Philadelphia fleabane	0.5	0.5		
	Rosaceae	<i>Fragaria virginiana</i>	wild strawberry	0.5			
	Rubiaceae	<i>Galium triflorum</i>	fragrant bedstraw	1	1		1

	Rosaceae	<i>Geum canadense</i>	white avens	0.5		1
X	Lamiaceae	<i>Glechoma hederacea</i>	creeping Charlie	1	1	0.5
	Boraginaceae	<i>Hackelia virginiana</i>	Virginia stickseed	1	1	0.5
X	Brassicaceae	<i>Hesperis matronalis</i>	dame's rocket	2	2	2
	Asteraceae	<i>Lactuca biennis</i>	blue lettuce	0.5		
X	Lamiaceae	<i>Leonurus cardiaca</i>	motherwort	0.5	1	0.5
	Ruscaceae	<i>Maianthemum canadense</i>	false Solomon's seal			1
	Lamiaceae	<i>Monarda fistulosa</i>	bergamot			0.5
	Apiaceae	<i>Osmorhiza claytonii</i>	sweet cicely	0.5		0.5
	Oxalidaceae	<i>Oxalis stricta</i>	wood sorrel		0.5	0.5
	Urticaceae	<i>Parietaria pensylvanica</i>	Pennsylvania pellitory	0.5	0.5	
	Phrymaceae	<i>Phryma leptostachya</i>	American lopseed			0.5
	Urticaceae	<i>Pilea pumila</i>	clearweed	1	1	
	Rosaceae	<i>Potentilla simplex</i>	common cinquefoil	0.5		
	Lamiaceae	<i>Prunella vulgaris</i>	heal-all	0.5		
	Ranunculaceae	<i>Ranunculus abortivus</i>	little leaf buttercup	0.5	0.5	
	Apiaceae	<i>Sanicula canadensis</i>	Canadian black snakeroot			1
	Apiaceae	<i>Sanicula marilandica</i>	black snakeroot	0.5		
	Smilacaceae	<i>Smilax ecirrhata</i>	carrion plant			0.5
X	Solanaceae	<i>Solanum dulcamara</i>	bittersweet nightshade	0.5	0.5	0.5
	Asteraceae	<i>Solidago canadensis</i>	Canada goldenrod			0.5
X	Caryophyllaceae	<i>Stellaria media</i>	chickweed	0.5	1	
	Asteraceae	<i>Taraxacum officinale</i>	common dandelion	0.5		
	Lamiaceae	<i>Teucrium canadense</i>	American germander	0.5		0.5
X	Apiaceae	<i>Torilis japonica</i>	Japanese hedge parsley	1	0.5	
	Urticaceae	<i>Urtica dioica</i>	stinging nettle	1	0.5	
X	Scrophulariaceae	<i>Verbascum thapsus</i>	common mullein	0.5		
	Plantaginaceae	<i>Veronicastrum virginicum</i>	Culver's root	0.5		
	Violaceae	<i>Viola sororia</i>	blue violet	0.5		0.5
			moss spp	2		

Graminoids			Total cover:	0.5	0.5	1
	Cyperaceae	<i>Carex blanda</i>	Eastern woodland sedge	0.5	0.5	1
	Cyperaceae	<i>Carex pensylvanica</i>	Pennsylvania sedge	0.5		0.5
	Poaceae	<i>Dichanthelium sp.</i>	panic grass	0.5		
	Poaceae	<i>Leersia virginica</i>	white cutgrass		0.5	0.5

		<i>Bare soil</i>		1	0.5	3
		<i>Woody debris</i>		2	2	2
		<i>Leaf litter (includes pine needles)</i>		4	4	2

CONIFER FOREST - south half of park

Targets: CON3, CON4: Southern Dry-Mesic Oak Woodland (FDs37)

CON5: Conifer plantation. CON6: Southern Dry Savanna (UPs14)

Non-native	Scientific Name	Common Name	Con3	DBH (Inch)	Con4	Con5	DBH (Inch)	Con6
Canopy 30 - 100 ft height			Total cover:					
	<i>Acer negundo</i>	boxelder	5		4	5		5
	<i>Quercus ellipsoidalis</i>	pin oak	1	24	1			1
	<i>Quercus macrocarpa</i>	bur oak	1	20				0.5
	<i>Pinus banksiana</i>	Jack pine			3			
	<i>Pinus resinosa</i>	red pine	5	8-10	2	5	8-12	
x	<i>Pinus sylvestris</i>	Scotch pine						5
x	<i>Populus alba</i>	white poplar						1
x	<i>Robinia pseudoacacia</i>	black locust				2	6-8	
	<i>Ulmus americana</i>	American elm						1
Subcanopy 15-30 ft height			Total cover:					
	<i>Acer negundo</i>	boxelder	0.5			2		
	<i>Quercus ellipsoidalis</i>	pin oak				1		
	<i>Juniperus virginiana</i>	red cedar	0.5					
Understory/shrub layer 4-15 ft			Total cover:					
x	<i>Acer ginnala</i>	amur maple	1					
	<i>Acer negundo</i>	boxelder	1					
	<i>Celtis occidentalis</i>	Hackberry	0.5					
	<i>Corlyus americana</i>	American hazelnut						1
	<i>Juniperus virginiana</i>	red cedar			1			
x	<i>Lonicera tartarica</i>	Tartarian honeysuckle			2	1		2
	<i>Populus tremuloides</i>	quaking aspen						
	<i>Prunus serotina</i>	black cherry						
	<i>Prunus virginiana</i>	choke cherry						
	<i>Quercus ellipsoidalis</i>	pin oak						1
x	<i>Rhamnus cathartica</i>	common buckthorn	4	0.5-2	2	3	0.5-2	2
	<i>Ribes americana</i>	currant						
	<i>Ribes cf cynosbati</i>	gooseberry						
	<i>Rhus glabra</i>	smooth sumac			1			
	<i>Rubus ideaus</i>	red raspberry						1
	<i>Tilia americana</i>	American basswood	1					
	<i>Viburnum opulus</i>	highbush cranberry						1
	<i>Zanthoxylum americana</i>	prickly ash	1		2	1		2
Groundcover to 4 ft			Total cover:					
	Woody species and vines		2		2	4		2
	<i>Acer negundo</i>	boxelder			0.5			
	<i>Celtis occidentalis</i>	Hackberry	1					
x	<i>Lonicera tartarica</i>	Tartarian honeysuckle			1	1		
	<i>Parthenocissus inserta</i>	Virginia creeper	1			2		1
	<i>Prunus virginiana</i>	chokecherry	1					1
	<i>Quercus macrocarpa</i>	bur oak			0.5			
	<i>Quercus rubra</i>	red oak				0.5		1
x	<i>Rhamnus cathartica</i>	common buckthorn			2	2		2
	<i>Ribes cynosbati</i>	prickly gooseberry	1		1			
	<i>Rubus ideaus</i>	red raspberry			1	1		
	<i>Sambucus racemosa</i>	red-berried elder				1		
	<i>Zanthoxylum americana</i>	prickly ash	1		1	1		1

CON3, CON4, CON5, CON6

	Forbs & ferns		1		1	3		1
	<i>Ageratina altissima</i>	white snakeroot				1		1
x	<i>Alliaria officinalis</i>	garlic mustard	1		1	3		
x	<i>Arctium minus</i>	burdock				1		
	<i>Athyrium filix-femina</i>	lady fern				1		0.5
x	<i>Cerastium sp</i>	chickweed				2		
	<i>Circaea leutetiana</i>	enchanter's nightshade	0.5					0.5
	<i>Galium triflorum</i>	sweet-scented bedstraw	0.5		1			
	<i>Geum canadense</i>	white avens			1	1		
x	<i>Leonurus cardiaca</i>	motherwort	1		1	1		
	<i>Maianthemum canadense</i>	false lily of the valley	0.5					
	<i>Osmorhiza claytonii</i>	sweet cicely	0.5			1		0.5
	<i>Pilea sp</i>	clearweed				1		
	<i>Smilax herbacea</i>	carrion plant	0.5					
	<i>Urtica dioica</i>	stinging nettle				0.5		
	Graminoids		0					

* Relative Cover Classes for individual species and vegetation layers: 0.5=0-1%, 1=1-5%, 2=5-25%, 3=25-50%, 4=50-75%, 5=75-100%

DRY PRAIRIE - north half of park

Units LGU1, LGU2, LGU6. Target: Southern Dry Sand-Gravel Prairie (UPs13)

UNIT: LGU1 LGU2 LGU6
DATE: 8/9/21 7/30/21 7/30/21

Non	Family	Scientific Name	Common Name			
Canopy 30 - 100 ft height			Total cover:	0		
	Fagaceae	<i>Picea pungens</i>	blue spruce	0.5		
	Salicaceae	<i>Populus tremuloides</i>	quaking aspen	0.5		
	Fagaceae	<i>Quercus macrocarpa</i>	bur oak	0.5		
Subcanopy 15-30 ft height			Total cover:	0		
	Sapindaceae	<i>Acer negundo</i>	boxelder	0.5		
	Sapindaceae	<i>Acer saccharinum</i>	silver maple	0.5		
	Salicaceae	<i>Populus deltoides</i>	cottonwood	1		
	Ulmaceae	<i>Ulmus americana</i>	American elm	0.5		
Understory/shrub layer 4-15 ft height			Total cover:	1	1	1
	Sapindaceae	<i>Acer negundo</i>	boxelder	0.5	0.5	
	Cornaceae	<i>Cornus racemosa</i>	gray dogwood		0.5	
	Cornaceae	<i>Cornus sericea</i>	red-osier dogwood	0.5		
	Betulaceae	<i>Corylus americana</i>	American hazelnut	0.5		
	Oleaceae	<i>Fraxinus pennsylvanica</i>	green ash	0.5		
	Cupressaceae	<i>Juniperus virginiana</i>	red cedar	0.5		
	Pinaceae	<i>Larix laricina</i>	tamarack	0.5		
x	Caprifoliaceae	<i>Lonicera tartarica</i>	Tartarian honeysuckle	0.5	0.5	
	Rosaceae	<i>Malus sp.</i>	apple sp.	0.5		
x	Moraceae	<i>Morus alba</i>	white mulberry	0.5		

	Salicaceae	<i>Populus tremuloides</i>	quaking aspen	1		
	Rosaceae	<i>Prunus serotina</i>	black cherry		0.5	0.5
X	Rhamnaceae	<i>Rhamnus cathartica</i>	common buckthorn	1		0.5
	Anacardiaceae	<i>Rhus glabra</i>	smooth sumac	1	1	
	Grossulariaceae	<i>Ribes missouriense</i>	Missouri gooseberry	0.5		
	Rosaceae	<i>Rubus ideaus</i>	red raspberry	0.5	0.5	0.5
	Rosaceae	<i>Rubus occidentalis</i>	black raspberry	1	1	1
	Salicaceae	<i>Salix interior</i>	sandbar willow	0.5		
	Adoxaceae	<i>Sambucus canadensis</i>	common elderberry	0.5		1
X	Oleaceae	<i>Syringa vulgaris</i>	common lilac	0.5		
	Ulmaceae	<i>Ulmus americana</i>	American elm	0.5	0.5	
X	Ulmaceae	<i>Ulmus pumila</i>	Siberian elm	0.5		
	Rutaceae	<i>Zanthoxylum americana</i>	prickly ash		0.5	0.5

GROUND COVER

				Total groundcover:	5	5	
Vines and woody species				Total cover:	1	2	1
	Sapindaceae	<i>Acer negundo</i>	boxelder	0.5			
	Fabaceae	<i>Amorpha canescens</i>	leadplant	1			
	Cornaceae	<i>Cornus racemosa</i>	gray dogwood			1	
	Oleaceae	<i>Fraxinus pennsylvanica</i>	green ash				0.5
	Cupressaceae	<i>Juniperus virginiana</i>	red cedar	0.5	0.5		
X	Caprifoliaceae	<i>Lonicera tartarica</i>	Tatarian honeysuckle	0.5	0.5		
	Rosaceae	<i>Malus sp.</i>	apple sp.	0.5	1		
X	Moraceae	<i>Morus alba</i>	white mulberry	0.5			
	Vitaceae	<i>Parthenocissus quinquefolia</i>	Virginia creeper	0.5	2		
	Salicaceae	<i>Populus tremuloides</i>	quaking aspen	0.5	1		
	Rosaceae	<i>Prunus americana</i>	wild plum	0.5			
	Rosaceae	<i>Prunus serotina</i>	black cherry		1		0.5
	Fagaceae	<i>Quercus macrocarpa</i>	bur oak	0.5	1		
	Fagaceae	<i>Quercus rubra</i>	red oak	0.5			
X	Rhamnaceae	<i>Rhamnus cathartica</i>	common buckthorn	0.5	0.5		1
	Anacardiaceae	<i>Rhus glabra</i>	smooth sumac	1	1		
	Grossulariaceae	<i>Ribes sp.</i>	currant?		0.5		
	Rosaceae	<i>Rosa arkansana</i>	prairie rose				
	Rosaceae	<i>Rubus ideaus</i>	red raspberry	1	0.5		0.5
	Rosaceae	<i>Rubus occidentalis</i>	black raspberry	0.5	1		0.5
X	Ulmaceae	<i>Ulmus pumila</i>	Siberian elm	0.5	0.5		
	Vitaceae	<i>Vitis riparia</i>	wild grape	0.5	2		
	Rutaceae	<i>Zanthoxylum americana</i>	prickly ash		0.5		0.5

Forbs				Total cover:	3	4	3
X	Malvaceae	<i>Abutilon theophrasti</i>	velvet leaf	0.5			
	Asteraceae	<i>Achillea millefolium</i>	yarrow	0.5	2		
	Lamiaceae	<i>Agastache foeniculum</i>	anise hyssop	0.5			
	Asteraceae	<i>Ageratina altissima</i>	white snakeroot				1
X	Malvaceae	<i>Alcea rosea</i>	hollyhock	0.5			
	Asteraceae	<i>Ambrosia psilostachya</i>	western ragweed	1	0.5		0.5
	Asteraceae	<i>Ambrosia trifida</i>	giant ragweed	0.5			
	Ranunculaceae	<i>Anemone cylindrica</i>	thimbleweed		1		
	Asteraceae	<i>Antennaria howellii</i>	Howell's pussytoes		0.5		
	Apocynaceae	<i>Apocynum cannabinum</i>	Indian hemp	0.5			
X	Asteraceae	<i>Arctium minus</i>	common burdock	1			
	Asteraceae	<i>Artemisia campestris</i>	field sagewort		1		
	Asteraceae	<i>Artemisia ludoviciana</i>	prairie sage		0.5		
	Asclepiaceae	<i>Asclepias syriaca</i>	common milkweed	1	1		0.5
	Asclepiaceae	<i>Asclepias tuberosa</i>	butterflyweed	0.5			

	Asclepiaceae	<i>Asclepias verticillata</i>	whorled milkweed	0.5	0.5	
X	Asparagaceae	<i>Asparagus officinalis</i>	wild asparagus	0.5		0.5
	Asteraceae	<i>Aster sp.</i>	aster sp.		1	
	Fabaceae	<i>Astragalus canadensis</i>	Canada milkvetch	1	0.5	
X	Brassicaceae	<i>Barbarea vulgaris</i>	yellow rocket	0.5		0.5
X	Brassicaceae	<i>Berteroa incana</i>	hoary Alyssum	0.5	0.5	
X	Asteraceae	<i>Carduus nutans</i>	nodding thistle	0.5		0.5
X	Asteraceae	<i>Centaurea stoebe</i>	spotted knapweed	2	3	2
X	Amaranthaceae	<i>Chenopodium album</i>	lamb's-quarters	0.5		
X	Asteraceae	<i>Cirsium arvense</i>	Canada thistle	1	1	2
	Asteraceae	<i>Cirsium discolor</i>	field thistle	0.5	0.5	0.5
	Asteraceae	<i>Conyza canadensis</i>	Canadian horseweed	1		
	Asteraceae	<i>Coreopsis palmata</i>	prairie coreopsis	0.5		
	Fabaceae	<i>Dalea candida</i>	white prairie clover	1	2	
	Fabaceae	<i>Dalea purpurea</i>	purple prairie clover	2	1	
X	Apiaceae	<i>Daucus carota</i>	queen Anne's lace	0.5		
	Fabaceae	<i>Desmodium canadense</i>	showy tick-trefoil	1		
	Rosaceae	<i>Drymocallis arguta</i>	prairie cinquefoil	1	0.5	
	Asteraceae	<i>Erigeron strigosus</i>	prairie fleabane	0.5	0.5	
	Euphorbiaceae	<i>Euphorbia corollata</i>	flowering spurge	0.5	2	
X	Euphorbiaceae	<i>Euphorbia virgata</i>	leafy spurge	0.5		1
	Asteraceae	<i>Euthamia graminifolia</i>	grass-leaved goldenrod		1	
	Asteraceae	<i>Helianthus maximiliani</i>	Maximilian sunflower	1	2	
	Asteraceae	<i>Heliopsis helianthoides</i>	early sunflower	0.5		
X	Hypericaceae	<i>Hypericum perforatum</i>	common St. Johnswort	2	2	1
	Asteraceae	<i>Lactuca canadensis</i>	wild lettuce		0.5	
X	Asteraceae	<i>Lactuca serriola</i>	prickly lettuce	0.5		
X	Lamiaceae	<i>Leonurus cardiaca</i>	motherwort			0.5
	Fabaceae	<i>Lespedeza capitata</i>	round-headed bushclover	1	0.5	
	Asteraceae	<i>Liatris punctata</i>	dotted blazing star	0.5	0.5	
X	Scrophulariaceae	<i>Linaria vulgaris</i>	butter and eggs	0.5	1	0.5
	Boraginaceae	<i>Lithospermum carolinense</i>	hairy puccoon		0.5	
X	Fabaceae	<i>Lotus corniculatus</i>	birds-foot trefoil	2	1	
	Fabaceae	<i>Lupinus perennis</i>	wild lupine	0.5		
X	Fabaceae	<i>Medicago sativa</i>	alfalfa	1		
X	Fabaceae	<i>Melilotus alba</i>	white sweet clover	0.5	0.5	
X	Fabaceae	<i>Melilotus officinalis</i>	yellow sweet clover	0.5		
	Lamiaceae	<i>Monarda fistulosa</i>	bergamot	2	2	1
	Lamiaceae	<i>Nepeta cataria</i>	Catnip			0.5
	Onagraceae	<i>Oenothera biennis</i>	common evening primrose	0.5	0.5	
	Oxalidaceae	<i>Oxalis sp.</i>	wood sorrel sp.		0.5	
	Plantaginaceae	<i>Penstemon digitalis</i>	foxglove beardtongue		0.5	
	Plantaginaceae	<i>Penstemon grandiflorus</i>	large-flowered penstemon	0.5		
	Solanaceae	<i>Physalis heterophylla</i>	clammy ground cherry	0.5		
X	Rosaceae	<i>Potentilla recta</i>	sulphur cinquefoil	0.5	1	0.5
	Asteraceae	<i>Pseudognaphalium obtusifolium</i>	sweet everlasting			0.5
	Lamiaceae	<i>Pycnanthemum virginianum</i>	mountain mint	0.5		0.5
	Asteraceae	<i>Ratibida pinnata</i>	yellow coneflower	1	2	
	Rosaceae	<i>Rosa blanda</i>	smooth wild rose	0.5		
	Asteraceae	<i>Rudbeckia hirta</i>	black-eyed susan	1	1	
	Asteraceae	<i>Rudbeckia triloba</i>	brown-eyed susan	2		
X	Polygonaceae	<i>Rumex crispus</i>	curly dock	1		
X	Fagaceae	<i>Securigara varia</i>	crown vetch	2		

X	Caryophyllaceae	<i>Silene latifolia</i>	white campion	0.5	0.5	0.5
	Asteraceae	<i>Silphium laciniatum</i>	compass plant	0.5		
X	Brassicaceae	<i>Sinapsis arvensis</i>	field mustard		0.5	
	Asteraceae	<i>Solidago canadensis</i>	Canada goldenrod	2	4	2
	Asteraceae	<i>Solidago nemoralis</i>	gray goldenrod	1		
	Asteraceae	<i>Solidago rigida</i>	stiff goldenrod	1	2	1
	Asteraceae	<i>Solidago speciosa</i>	showy goldenrod	1		
	Caryophyllaceae	<i>cf. Stellaria media</i>	chickweed			0.5
	Asteraceae	<i>cf. Symphyotrichum ericoides</i>	cf. heath aster		1	
	Asteraceae	<i>cf. Symphyotrichum lanceolatum</i>	cf. lance-leaved aster	2		
	Asteraceae	<i>Symphyotrichum oolentangiense</i>	sky-blue aster	1		
	Asteraceae	<i>Symphyotrichum pilosum</i>	frost aster			1
	Asteraceae	<i>Taraxacum officinale</i>	common dandelion	0.5		
X	Fabaceae	<i>Trifolium arvense</i>	rabbit-foot clover			1
	Urticaceae	<i>Urtica dioica</i>	stinging nettle	0.5		0.5
X	Scrophulariaceae	<i>Verbascum thapsus</i>	common mullein	0.5	1	1
	Verbenaceae	<i>Verbena stricta</i>	hoary vervain	0.5	1	
	Verbenaceae	<i>Verbena urticifolia</i>	white vervain			0.5
	Apiaceae	<i>Zizia aurea</i>	golden Alexanders	0.5		

Graminoids			Total cover:	4	4	4
	Poaceae	<i>Andropogon gerardii</i>	big bluestem	2	1	1
	Poaceae	<i>Bouteloua curtipendula</i>	side-oats grama	1	2	
	Poaceae	<i>Bouteloua gracilis</i>	blue grama	0.5	0.5	
X	Poaceae	<i>Bromus inermis</i>	smooth brome	2	0.5	3
	Cyperaceae	<i>Carex brevior</i>	short sedge			1
	Cyperaceae	<i>Cyperus lupulinus</i>	Great Plains flatsedge		1	
	Poaceae	<i>Dichanthelium oligosanthos</i>	Scribners panic grass	0.5	1	
	Poaceae	<i>Elymus canadensis</i>	Canada wild rye	1	1	
X	Poaceae	<i>Eriochloa villosa</i>	Hairy cupgrass			1
	Poaceae	<i>Koeleria macrantha</i>	junegrass	0.5		
	Poaceae	<i>Panicum virgatum</i>	switchgrass	2	2	
X	Poaceae	<i>Phalaris arundinaceae</i>	reed canary grass	0.5		2
X	Poaceae	<i>Poa pratensis</i>	Kentucky bluegrass	2	3	3
	Poaceae	<i>Schizachyrium scoparium</i>	little bluestem	3	3	
	Poaceae	<i>Sorghastrum nutans</i>	Indian grass	2	1	

		<i>Bare soil</i>		1	1	1
		<i>Woody debris</i>				
		<i>Leaf litter</i>				

DRY PRAIRIE - south half of park

Units DP1, DP2, DP3. (Managed) Target: Southern Dry Sand-Gravel Prairie (UPs13)

	Non-Native	Scientific Name	Common Name	DP1	DP2	DP3
Canopy 10-40 ft height				2		
1		<i>Betula papyrifera</i>	paper birch	2		
2		<i>Juniperus virginiana</i>	red cedar	2		
3		<i>Quercus macrocarpa</i>	bur oak			1
4		<i>Quercus palustris</i>	pin oak	2		
Understory/shrub layer 4-10 ft				2	1	2
1	x	<i>Asparagus officinalis</i>	garden asparagus			0.5
2		<i>Juniperus virginiana</i>	red cedar			
3	x	<i>Lonicera tatarica</i>	Tatarian honeysuckle	1		1
4		<i>Ostrya virginiana</i>	ironwood			0.5
5		<i>Populus tremuloides</i>	quaking aspen			2
6		<i>Prunus serotina</i>	black cherry			1
7		<i>Prunus virginiana</i>	chokecherry			1
8		<i>Quercus palustris</i>	pin oak			
9		<i>Quercus rubra</i>	red oak	1		
10	x	<i>Rhamnus cathartica</i>	common buckthorn			1
11		<i>Rhus glabra</i>	sumac	1		
12		<i>Rubus occidentalis</i>	black raspberry			2
13		<i>Zanthoxylum americana</i>	prickly ash	1	1	0.5
Ground layer						
Forbs				2	2	2
1		<i>Achillea millefolium</i>	yarrow	0.5	1	1
2		<i>Ageratina altissima</i>	white snakeroot		1	0.5
3		<i>Ambrosia artemisiifolia</i>	common ragweed	1	1	
4		<i>Ambrosia psilostachya</i>	western ragweed			1
5		<i>Anemone cylindrica</i>	thimbleweed		0.5	
6		<i>Antennaria neglecta</i>	field pussytoes	0.5		
7		<i>Antennaria plantaginifolia</i>	plantain-leaved pussytoes	0.5		
8		<i>Antennaria sp.</i>	pussytoes			
9		<i>Aquilegia canadensis</i>	columbine			0.5
10		<i>Asclepias syriaca</i>	common milkweed	1	0.5	1
11		<i>Asclepias verticillata</i>	whorled milkweed	0.5	0.5	
12	x	<i>Berteroa incana</i>	hoary alyssum	0.5	2	0.5
13		<i>Campanulastrum americanum</i>	tall bellflower		0.5	
14	x	<i>Carduus nutans</i>	musk thistle			0.5
15	x	<i>Centaurea maculosa</i>	spotted knapweed	0.5	.5	0.5
16	x	<i>Chenopodium album</i>	lamb's-quarters		1	
17	x	<i>Cirsium arvense</i>	Canada thistle			0.5
18		<i>Cirsium discolor</i>	field thistle			
19		<i>Conyza canadensis</i>	Canadian horseweed		0.5	
20		<i>Crocanthemum canadense</i>	Canada frostweed	1	0.5	0.5
21		<i>Dalea candida</i>	white prairie clover		0.5	1
22		<i>Dalea purpurea</i>	purple prairie clover			0.5
23		<i>Equisetum arvense</i>	field horsetail	0.5		0.5
24		<i>Erigeron strigosus</i>	prairie fleabane	1	0.5	0.5
25		<i>Fallopia sp.</i>	bindweed		0.5	
26		<i>Fragaria virginiana</i>	wild strawberry	1		
27		<i>Galium triflorum</i>	fragrant bedstraw	0.5	0.5	
28		<i>Geum canadense</i>	white avens	0.5	0.5	
29		<i>Hackelia virginiana</i>	Virginia stickseed	0.5		
30		<i>Heliopsis helianthoides</i>	early sunflower		0.5	
31		<i>Heuchera richardsonii</i>	prairie alumroot		0.5	
32	x	<i>Hypericum perforatum</i>	common St. Johnswort	0.5		
33		<i>Lathyrus venosus</i>	veiny pea			0.5
34		<i>Lechea sp.</i>	pinweed	0.5		
35	x	<i>Leonurus cardiaca</i>	motherwort		0.5	0.5
36		<i>Lespedeza capitata</i>	round-headed bushclover	1	1	
37	x	<i>Linaria vulgaris</i>	butter and eggs	0.5	1	
38		<i>Lithospermum carolinense</i>	hairy puccoon			2

DP1, DP2, DP3

39		<i>Lupinus perennis</i>	wild lupine	0.5		
40		<i>Mirabilis nyctaginea</i>	wild four o'clock			0.5
41		<i>Monarda fistulosa</i>	bergamot	1	2	0.5
42	x	<i>Nepeta cataria</i>	catnip			0.5
43		<i>Oxalis stricta</i>	wood sorrel			0.5
44		<i>Penstemon grandiflorus</i>	large-flowered penstemon		0.5	0.5
45		<i>Physalis heterophylla</i>	clammy ground cherry	0.5	0.5	
46	x	<i>Potentilla recta</i>	sulphur cinquefoil	0.5		0.5
47		<i>Potentilla sp</i>	cinquefoil			
48	x	<i>Rumex acetosella</i>	sheep sorrel		0.5	
49		<i>Selaginella rupestris</i>	rock spike-moss			
50	x	<i>Silene latifolia</i>	white campion		0.5	0.5
51	x	<i>Solanum dulcamara</i>	bittersweet nightshade		0.5	
52		<i>Solidago canadensis</i>	Canada goldenrod	1		2
53		<i>Solidago gigantea</i>	late goldenrod	0.5	0.5	
54		<i>Solidago nemoralis</i>	gray goldenrod	0.5		
55	x	<i>Taraxacum officinale</i>	common dandelion	0.5	0.5	
56		<i>Thalictrum dasycarpum</i>	tall meadow rue	0.5		
57	x	<i>Torilis japonica</i>	Japanese hedge parsley	0.5	0.5	0.5
58		<i>Tradescantia bracteata</i>	spiderwort	0.5	0.5	
59		<i>Urtica dioica</i>	stinging nettle		0.5	
60	x	<i>Verbascum thapsus</i>	common mullein	0.5	1	0.5
61		<i>Viola pedatifida</i>	prairie violet	0.5		
Woody				3	2	3
1		<i>Amorpha canescens</i>	leadplant	0.5		1
2		<i>Celastrus scandens</i>	American bittersweet			1
3		<i>Corylus americana</i>	American hazelnut	0.5		1
4		<i>Juniperus virginiana</i>	red cedar	1		0.5
5	x	<i>Lonicera tatarica</i>	Tatarian honeysuckle	2	1	2
6		<i>Parthenocissus quinquefolia</i>	Virginia creeper	0.5		1
7		<i>Populus tremuloides</i>	quaking aspen	0.5		2
8		<i>Prunus serotina</i>	black cherry	0.5	0.5	0.5
9		<i>Quercus macrocarpa</i>	bur oak			1
10		<i>Quercus palustris</i>	pin oak			
11		<i>Quercus rubra</i>	red oak	1	0.5	2
12	x	<i>Rhamnus cathartica</i>	common buckthorn	0.5	0.5	1
13		<i>Ribes missouriense</i>	Missouri gooseberry			0.5
14		<i>Rosa arkansana</i>	prairie rose			
15		<i>Rubus ideaus</i>	red raspberry	2	1	2
16		<i>Rubus occidentalis</i>	black raspberry	1	1	2
17		<i>Toxicodendron rydbergii</i>	poison ivy	0.5		
18		<i>Ulmus americana</i>	American elm	0.5		
19	x	<i>Ulmus pumila</i>	Siberian elm			0.5
20		<i>Vitis riparia</i>	wild grape	0.5	0.5	1
21		<i>Zanthoxylum americana</i>	prickly ash	2	2	0.5
				15		
Graminoids				3	3	2
1		<i>Andropogon gerardii</i>	big bluestem	0.5		
2		<i>Bouteloua curtipendula</i>	side-oats grama			1
3	x	<i>Bromus inermis</i>	smooth brome		1	
4		<i>Carex cf muhlenbergii</i>	muhly sedge	0.5		2
5		<i>Carex pensylvanica</i>	Pennsylvania sedge	2	1	1
6		<i>Carex sp.</i>	tall sedge sp.			2
7		<i>cf Muhlenbergia richardsonis</i>	muhly grass			
8		<i>Cyperus sp.</i>	flatsedge		0.5	
9		<i>Danthonia spicata</i>	poverty oat-grass	2		
10		<i>Dichanthelium oligosanthos</i>	Scribners panic grass	1		0.5
11		<i>Elymus canadensis</i>	Canada wild rye	1	2	0.5
12		<i>Elymus hystrix</i>	bottlebrush grass		0.5	
13		<i>Eragrostis spectabilis</i>	purple lovegrass			
14		<i>Koeleria macrantha</i>	june grass		2	
15	x	<i>Poa pratensis</i>	Kentucky bluegrass	1	0.5	1
16		<i>Schizachyrium scoparium</i>	little bluestem	1		2
17	x	<i>Setaria viridis</i>	green foxtail			
18		<i>Sorghastrum nutans</i>	indian grass	1		
19		<i>Stipa spartea</i>	porcupine grass	0.5		1

* Relative Cover Classes for individual species and vegetation layers: 0.5=0-1%, 1=1-5%, 2=5-25%, 3=25-50%, 4=50-75%, 5=75-100%

RESTORED PRAIRIE - south half of park

Unit DPR. Target: Southern Dry Sand-Gravel Prairie (UPs13)

Seeded	Non-native		Scientific Name	Common Name	2016	2018	2021
			Graminoids				
x		1	<i>Bouteloua curtipendula</i>	side-oats grama			
x		2	<i>Bouteloua hirsuta</i>	hairy grama			
		3	<i>Carex muhlenbergii</i>	Muhly sedge			1
x		4	<i>Danthonia spicata</i>	poverty grass			
		5	<i>Digitaria cognata</i>	fall witch grass		1	
x		6	<i>Elymus canadensis</i>	nodding wild rye	0.5	0.5	
		7	<i>Eragrostis spectabilis</i>	purple lovegrass		1	
	x	8	<i>Festuca sp</i>	Fescue		1	2
x		9	<i>Koeleria pyramidata</i>	junegrass			1
x		10	<i>Schizachyrium scoparium</i>	little bluestem			2
		11	<i>Sorghastrum nutans</i>	Indiangrass			0.5
x		12	<i>Sporobolus heterolepis</i>	Prairie dropseed			1
x		13	<i>Stipa spartea</i>	Porcupine grass			
			Forbs				
		1	<i>Achillea millefolium</i>	yarrow			0.5
x		2	<i>Agastache foeniculum</i>	blue giant hyssop			
x		3	<i>Allium stellatum</i>	Prairie Wild Onion			
x		4	<i>Amorpha canescens</i>	lead plant			
x		5	<i>Asclepias tuberosa</i>	butterfly milkweed			
x		6	<i>Asclepias verticillata</i>	whorled milkweed			
x		7	<i>Aster azureus</i>	sky blue aster			
x		8	<i>Aster sericeus</i>	silky aster			0.5
x		9	<i>Astragalus crassicaulus</i>	ground plum			
	x	10	<i>Berteroa incana</i>	hoary everlasting	1	0.5	0.5
x		11	<i>Campanula rotundifolia</i>	harebell		0.5	
	x	12	<i>Centaurea stoebe</i>	Knapweed	1	1	1
x		13	<i>Chamaecrista fasciculata</i>	partridge pea	0.5	0.5	
x		14	<i>Coreopsis palmata</i>	bird's foot coreopsis			
x		15	<i>Dalea candida</i>	white prairie clover			
x		16	<i>Dalea purpurea</i>	purple prairie clover			
x		17	<i>Delphinium virescens</i>	Prairie larkspur			
x		18	<i>Fragaria virginiana</i>	wild strawberry			
x		19	<i>Galium boreale</i>	northern bedstraw			
x		20	<i>Geum triflorum</i>	prairie smoke			
x		21	<i>Gnaphalium obtusifolium</i>	sweet everlasting	0.5	0.5	
x		22	<i>Heuchera richardsonii</i>	alumroot			
x		23	<i>Lespedeza capitata</i>	round-headed bush clover			
x		24	<i>Liatris aspera</i>	rough blazing star			
x		25	<i>Liatris punctata</i>	dotted blazing star			
	x	26	<i>Lotus corniculatus</i>	bird's foot trefoil	2	1	1
x		27	<i>Lupinus perennis</i>	Wild lupine		0.5	0.5
x		28	<i>Monarda fistulosa</i>	wild bergamot	0.5	0.5	0.5
x		29	<i>Penstemon grandiflorus</i>	large-flowered beard tongue		0.5	0.5

Unit DPR.

x		30	<i>Phlox pilosa</i>	prairie phlox		0.5	
	x	31	<i>Potentilla recta</i>	sulfur cinquefoil			1
x		32	<i>Pulsatilla patens</i>	pasque flower			
x		33	<i>Rosa arkansana</i>	prairie rose			
x		34	<i>Rudbeckia hirta</i>	black-eyed susan	0.5	0.5	1
x		35	<i>Scropularia lanceolata</i>	lance-leaved figwort		0.5	
x	x	36	<i>Silene latifolia</i>	white campion			0.5
x		37	<i>Sisyrinchium campestre</i>	field blue-eyed grass			
		38	<i>Solidago canadensis</i>	Canada goldenrod			2
x		39	<i>Solidago speciosa</i>	showy goldenrod			
x		40	<i>Tradescantia bracteata</i>	Ohio spiderwort		0.5	
	x	41	<i>Verbascum thasus</i>	common mullein	2	0.5	1
x		42	<i>Verbena stricta</i>	hoary vervain			
			Woody				
	x	1	<i>Acer ginnala</i>	amur maple			0.5
		2	<i>Fraxinus pensylvanica</i>	green ash			
	x	3	<i>Lonicera tartarica</i>	honeysuckle		0.5	1
		4	<i>Quercus macrocarpa</i>	bur oak			
		5	<i>Quercus rubra</i>	red oak			
		6	<i>Ribes missouriensis</i>	gooseberry			
		7	<i>Rubus occidentalis</i>	black raspberry			2

* Relative Cover Classes for individual species and vegetation layers: 0.5=0-1%, 1=1-5%, 2=5-25%, 3=25-50%, 4=50-75%, 5=75-100%

GRASSLAND with Trees - north half of park

Units GR1, GRT1, GRT2. Target: Southern Dry Prairie (UPs13)

UNIT: GR1 GRT1 GRT2
DATE: 8/9/21 7/30/21 7/30/21

Non	Family	Scientific Name	Common Name			
Canopy 30 - 100 ft height			Total cover:	0	3	2
	Sapindaceae	<i>Acer negundo</i>	boxelder		1	1
	Oleaceae	<i>Fraxinus pennsylvanica</i>	green ash		3	2
	Fagaceae	<i>Picea pungens</i>	blue spruce			
	Pinaceae	<i>Picea glauca</i>	white spruce			2
	Pinaceae	<i>Pinus resinosa</i>	red pine			2
	Pinaceae	<i>Pinus strobus</i>	white pine			2
	Salicaceae	<i>Populus tremuloides</i>	quaking aspen			2
	Fagaceae	<i>Quercus ellipsoidalis</i>	pin oak			2
	Fagaceae	<i>Quercus macrocarpa</i>	bur oak			2
	Ulmaceae	<i>Ulmus americana</i>	American elm			2
Subcanopy 15-30 ft height			Total cover:	0	3	2
	Sapindaceae	<i>Acer ginnala</i>	Amur maple			1
	Sapindaceae	<i>Acer negundo</i>	boxelder			2
	Sapindaceae	<i>Acer saccharinum</i>	silver maple			
	Oleaceae	<i>Fraxinus pennsylvanica</i>	green ash		2	
	Cupressaceae	<i>Juniperus virginiana</i>	red cedar		1	2
	Pinaceae	<i>Picea glauca</i>	white spruce			2
	Fagaceae	<i>Picea pungens</i>	blue spruce			2
	Pinaceae	<i>Pinus resinosa</i>	red pine			2
	Pinaceae	<i>Pinus strobus</i>	white pine			2
	Salicaceae	<i>Populus tremuloides</i>	quaking aspen			2
	Fagaceae	<i>Quercus ellipsoidalis</i>	pin oak			1
	Fagaceae	<i>Quercus rubra</i>	red oak			1
	Ulmaceae	<i>Ulmus americana</i>	American elm			1
Understory/shrub layer 4-15 ft height			Total cover:	1	4	4
	Sapindaceae	<i>Acer ginnala</i>	Amur maple			1
	Sapindaceae	<i>Acer negundo</i>	boxelder			
	Cornaceae	<i>Cornus racemosa</i>	gray dogwood			2
	Cornaceae	<i>Cornus sericea</i>	red-osier dogwood			
	Betulaceae	<i>Corylus americana</i>	American hazelnut			
X	Rhamnaceae	<i>Frangula alnus</i>	glossy buckthorn			1
	Oleaceae	<i>Fraxinus pennsylvanica</i>	green ash		1	
	Cupressaceae	<i>Juniperus virginiana</i>	red cedar		1	2
	Pinaceae	<i>Larix laricina</i>	tamarack			
X	Caprifoliaceae	<i>Lonicera tartarica</i>	Tartarian honeysuckle	1	2	2
	Rosaceae	<i>Malus sp.</i>	apple sp.			
X	Moraceae	<i>Morus alba</i>	white mulberry			
	Fagaceae	<i>Picea pungens</i>	blue spruce			1
	Salicaceae	<i>Populus tremuloides</i>	quaking aspen			
	Rosaceae	<i>Prunus serotina</i>	black cherry			1
	Fagaceae	<i>Quercus ellipsoidalis</i>	pin oak			1
X	Rhamnaceae	<i>Rhamnus cathartica</i>	common buckthorn		4	3
	Anacardiaceae	<i>Rhus glabra</i>	smooth sumac			2

	Grossulariaceae	<i>Ribes missouriense</i>	Missouri gooseberry		2	1
	Rosaceae	<i>Rubus ideaus</i>	red raspberry			1
	Rosaceae	<i>Rubus occidentalis</i>	black raspberry		2	2
	Salicaceae	<i>Salix interior</i>	sandbar willow			
	Adoxaceae	<i>Sambucus canadensis</i>	common elderberry			
X	Oleaceae	<i>Syringa vulgaris</i>	common lilac			
	Ulmaceae	<i>Ulmus americana</i>	American elm			1
X	Ulmaceae	<i>Ulmus pumila</i>	Siberian elm	1		3
	Rutaceae	<i>Zanthoxylum americana</i>	prickly ash		2	3

GROUNDCOVER

Vines and woody species

Total groundcover: Total cover:

5
1

3
1

4
3

	Sapindaceae	<i>Acer negundo</i>	boxelder			0.5
	Fabaceae	<i>Amorpha canescens</i>	leadplant			
	Cornaceae	<i>Cornus racemosa</i>	gray dogwood			1
	Oleaceae	<i>Fraxinus pennsylvanica</i>	green ash		1	0.5
	Cupressaceae	<i>Juniperus virginiana</i>	red cedar			1
X	Caprifoliaceae	<i>Lonicera tartarica</i>	Tatarian honeysuckle		1	1
	Rosaceae	<i>Malus sp.</i>	apple sp.			
X	Moraceae	<i>Morus alba</i>	white mulberry			
	Vitaceae	<i>Parthenocissus quinquefolia</i>	Virginia creeper			1
	Salicaceae	<i>Populus tremuloides</i>	quaking aspen			0.5
	Rosaceae	<i>Prunus americana</i>	wild plum			
	Rosaceae	<i>Prunus serotina</i>	black cherry			0.5
	Fagaceae	<i>Quercus macrocarpa</i>	bur oak			0.5
	Fagaceae	<i>Quercus rubra</i>	red oak			0.5
X	Rhamnaceae	<i>Rhamnus cathartica</i>	common buckthorn		2	2
	Anacardiaceae	<i>Rhus glabra</i>	smooth sumac			2
	Grossulariaceae	<i>Ribes sp.</i>	currant?			
	Rosaceae	<i>Rosa arkansana</i>	prairie rose			
	Rosaceae	<i>Rubus ideaus</i>	red raspberry			0.5
	Rosaceae	<i>Rubus occidentalis</i>	black raspberry			1
X	Ulmaceae	<i>Ulmus pumila</i>	Siberian elm	1		2
	Vitaceae	<i>Vitis riparia</i>	wild grape	1	0.5	1
	Rutaceae	<i>Zanthoxylum americana</i>	prickly ash		1	1

Forbs

Total cover:

2

3

3

X	Malvaceae	<i>Abutilon theophrasti</i>	velvet leaf			
	Asteraceae	<i>Achillea millefolium</i>	yarrow			1
	Lamiaceae	<i>Agastache foeniculum</i>	anise hyssop			
	Asteraceae	<i>Ageratina altissima</i>	white snakeroot		2	1
X	Malvaceae	<i>Alcea rosea</i>	hollyhock			
	Brassicaceae	<i>Alliaria petiolata</i>	garlic mustard		2	2
	Asteraceae	<i>Ambrosia psilostachya</i>	western ragweed			1
	Asteraceae	<i>Ambrosia trifida</i>	giant ragweed			
	Ranunculaceae	<i>Anemone cylindrica</i>	thimbleweed			0.5
	Asteraceae	<i>Antennaria howellii</i>	Howell's pussytoes			0.5
	Apocynaceae	<i>Apocynum cannabinum</i>	Indian hemp			
X	Asteraceae	<i>Arctium minus</i>	common burdock		2	1
	Asteraceae	<i>Artemisia campestris</i>	field sagewort			0.5
	Asteraceae	<i>Artemisia ludoviciana</i>	prairie sage			0.5
	Asclepiaceae	<i>Asclepias syriaca</i>	common milkweed			1
	Asclepiaceae	<i>Asclepias tuberosa</i>	butterflyweed			
	Asclepiaceae	<i>Asclepias verticillata</i>	whorled milkweed			1
X	Asparagaceae	<i>Asparagus officinalis</i>	wild asparagus			0.5

	Asteraceae	<i>Aster sp.</i>	aster sp.			
	Fabaceae	<i>Astragalus canadensis</i>	Canada milkvetch			
X	Brassicaceae	<i>Barbarea vulgaris</i>	yellow rocket			
X	Brassicaceae	<i>Berteroa incana</i>	hoary alyssum			
X	Asteraceae	<i>Carduus nutans</i>	nodding thistle			0.5
X	Asteraceae	<i>Centaurea stoebe</i>	spotted knapweed	2		
X	Amaranthaceae	<i>Chenopodium album</i>	lamb's-quarters			
X	Asteraceae	<i>Cirsium arvense</i>	Canada thistle	1	1	1
	Asteraceae	<i>Cirsium discolor</i>	field thistle			
	Asteraceae	<i>Conyza canadensis</i>	Canadian horseweed			
	Asteraceae	<i>Coreopsis palmata</i>	prairie coreopsis			
	Fabaceae	<i>Dalea candida</i>	white prairie clover			
	Fabaceae	<i>Dalea purpurea</i>	purple prairie clover			
X	Apiaceae	<i>Daucus carota</i>	queen Anne's lace			
	Fabaceae	<i>Desmodium canadense</i>	showy tick-trefoil			
	Rosaceae	<i>Drymocallis arguta</i>	prairie cinquefoil			
	Asteraceae	<i>Erigeron strigosus</i>	prairie fleabane			
	Euphorbiaceae	<i>Euphorbia corollata</i>	flowering spurge			
X	Euphorbiaceae	<i>Euphorbia virgata</i>	leafy spurge			
	Asteraceae	<i>Euthamia graminifolia</i>	grass-leaved goldenrod			
	Rosaceae	<i>Geum triflorum</i>	prairie smoke			0.5
X	Lamiaceae	<i>Glechoma hederacea</i>	creeping Charlie		2	
	Asteraceae	<i>Helianthus maximiliani</i>	Maximilian sunflower			
	Asteraceae	<i>Heliopsis helianthoides</i>	early sunflower			
X	Hypericaceae	<i>Hypericum perforatum</i>	common St. Johnswort			2
	Asteraceae	<i>Lactuca canadensis</i>	wild lettuce			
X	Asteraceae	<i>Lactuca serriola</i>	prickly lettuce			
X	Lamiaceae	<i>Leonurus cardiaca</i>	motherwort			
	Fabaceae	<i>Lespedeza capitata</i>	round-headed bushclover			
	Asteraceae	<i>Liatris punctata</i>	dotted blazing star			
X	Scrophulariaceae	<i>Linaria vulgaris</i>	butter and eggs			
	Boraginaceae	<i>Lithospermum caroliniense</i>	hairy puccoon			0.5
X	Fabaceae	<i>Lotus corniculatus</i>	birds-foot trefoil			1
	Fabaceae	<i>Lupinus perennis</i>	wild lupine			
X	Fabaceae	<i>Medicago sativa</i>	alfalfa			
X	Fabaceae	<i>Melilotus alba</i>	white sweet clover			
X	Fabaceae	<i>Melilotus officinalis</i>	yellow sweet clover			
	Lamiaceae	<i>Monarda fistulosa</i>	bergamot			
	Lamiaceae	<i>Nepeta cataria</i>	Catnip			0.5
	Onagraceae	<i>Oenothera biennis</i>	common evening primrose			
	Oxalidaceae	<i>Oxalis sp.</i>	wood sorrel sp.			
	Plantaginaceae	<i>Penstemon digitalis</i>	foxglove beardtongue			
	Plantaginaceae	<i>Penstemon grandiflorus</i>	large-flowered penstemon			0.5
	Solanaceae	<i>Physalis heterophylla</i>	clammy ground cherry			
X	Rosaceae	<i>Potentilla recta</i>	sulphur cinquefoil			1
	Asteraceae	<i>Pseudognaphalium obtusifolium</i>	sweet everlasting			0.5
	Lamiaceae	<i>Pycnanthemum virginianum</i>	mountain mint			
	Asteraceae	<i>Ratibida pinnata</i>	yellow coneflower			
	Rosaceae	<i>Rosa blanda</i>	smooth wild rose			
	Asteraceae	<i>Rudbeckia hirta</i>	black-eyed susan			
	Asteraceae	<i>Rudbeckia triloba</i>	brown-eyed susan			
X	Polygonaceae	<i>Rumex crispus</i>	curly dock		0.5	0.5

X	Caryophyllaceae	<i>Saponaria officinalis</i>	bouncing bet			1
X	Fagaceae	<i>Securigara varia</i>	crown vetch			
X	Caryophyllaceae	<i>Silene latifolia</i>	white campion			
	Asteraceae	<i>Silphium laciniatum</i>	compass plant			
X	Brassicaceae	<i>Sinapsis arvensis</i>	field mustard			
	Asteraceae	<i>Solidago canadensis</i>	Canada goldenrod	2	1	2
	Asteraceae	<i>Solidago nemoralis</i>	gray goldenrod			0.5
	Asteraceae	<i>Solidago rigida</i>	stiff goldenrod			1
	Asteraceae	<i>Solidago speciosa</i>	showy goldenrod			
	Caryophyllaceae	<i>cf. Stellaria media</i>	chickweed			
	Asteraceae	<i>cf. Symphyotrichum ericoides</i>	cf. heath aster			
	Asteraceae	<i>cf. Symphyotrichum lanceolatum</i>	cf. lance-leaved aster			
	Asteraceae	<i>Symphyotrichum oolentangiense</i>	sky-blue aster			
	Asteraceae	<i>Symphyotrichum pilosum</i>	frost aster			1
	Asteraceae	<i>Taraxacum officinale</i>	common dandelion			
X	Fabaceae	<i>Trifolium arvense</i>	rabbit-foot clover			
	Urticaceae	<i>Urtica dioica</i>	stinging nettle		1	0.5
X	Scrophulariaceae	<i>Verbascum thapsus</i>	common mullein	1	1	1
	Verbenaceae	<i>Verbena stricta</i>	hoary vervain			0.5
	Verbenaceae	<i>Verbena urticifolia</i>	white vervain			
	Apiaceae	<i>Zizia aurea</i>	golden Alexanders			

Graminoids			Total cover:	5	2	3
	Poaceae	<i>Andropogon gerardii</i>	big bluestem			
	Poaceae	<i>Bouteloua curtipendula</i>	side-oats grama			
	Poaceae	<i>Bouteloua gracilis</i>	blue grama			
X	Poaceae	<i>Bromus inermis</i>	smooth brome	3	2	2
	Cyperaceae	<i>Carex brevior</i>	short sedge			
	Cyperaceae	<i>Cyperus lupulinus</i>	Great Plains flatsedge			
	Poaceae	<i>Dichanthelium oligosanthos</i>	Scribners panic grass			1
	Poaceae	<i>Elymus canadensis</i>	Canada wild rye			
	Poaceae	<i>Elymus repens</i>	quackgrass			2
X	Poaceae	<i>Eriochloa villosa</i>	Hairy cupgrass			
	Poaceae	<i>Koeleria macrantha</i>	junegrass			
	Poaceae	<i>Panicum virgatum</i>	switchgrass			2
X	Poaceae	<i>Phalaris arundinaceae</i>	reed canary grass			
X	Poaceae	<i>Poa pratensis</i>	Kentucky bluegrass	3	2	3
	Poaceae	<i>Schizachyrium scoparium</i>	little bluestem			2
	Poaceae	<i>Sorghastrum nutans</i>	Indian grass			

		<i>Bare soil</i>		0.5	2	2
		<i>Woody debris</i>			1	1
		<i>Leaf litter</i>			1	2

GRASSLAND with Trees - south half of park

Units GRT3, GRT5, GR2, Drainageway, Pipeline, Roadsides. Target: Southern Dry Savanna (UPs14)

	Non-Native	Scientific Name	Common Name	GRT3	Notes	GRT5	Notes	GR2	Road-sides	Drain-way	Pipe-line
		Canopy 15-40 ft height		2		3					
1		<i>Acer negundo</i>	box elder	1	South slope	1					
2		<i>Juniperus virginiana</i>	red cedar	1		2					
3		<i>Pinus banksiana</i>	jack pine	2	40 ft						
4	x	<i>Pinus sylvestris</i>	Scotch pine	1		2					
5		<i>Quercus macrocarpa</i>	bur oak			1	8" dbh				
6		<i>Quercus rubra</i>	red oak			1					
7		<i>Ulmus americana</i>	American elm		South slope	1					
8	x	<i>Ulmus pumila</i>	Siberian elm	0.5	South slope	1	8" dbh				
		Understory/shrub layer 4-10 ft		2		3					
3		<i>Juniperus virginiana</i>	red cedar	0.5				2			
4	x	<i>Lonicera tatarica</i>	Tatarian honeysuckle	1		2		1			
6	x	<i>Pinus sylvestris</i>	Scotch pine	1		1		1			
12	x	<i>Rhamnus cathartica</i>	common buckthorn			1					
13		<i>Rhus glabra</i>	sumac	2	South slope	2					
14		<i>Robinia pseudoacacia</i>	black locust			1					
16		<i>Zanthoxylum americana</i>	prickly ash	1		2					
		Ground layer		5		5		5			5
		Woody		0.5		1		2			2
1		<i>Acer negundo</i>	boxelder							1	
2	x	<i>Lonicera tatarica</i>	Tatarian honeysuckle			0.5		1	1	1	
3		<i>Parthenocissus quinquefolia</i>	Virginia creeper			0.5		1		1	
4	x	<i>Pinus sylvestris</i>	Scotch pine					1			
5		<i>Populus tremuloides</i>	quaking aspen			0.5		0.5	0.5		
6		<i>Quercus rubra</i>	red oak			0.5					
7	x	<i>Rhamnus cathartica</i>	common buckthorn			0.5				0.5	
8		<i>Rhus glabra</i>	smooth sumac			1					
9		<i>Rosa arkansana</i>	prairie rose	0.5							
10		<i>Rubus ideaus</i>	red raspberry			1		2	1	0.5	2
11		<i>Ulmus pumila</i>	Siberian elm						0.5		
12		<i>Vitis riparia</i>	wild grape vine			0.5		1		0.5	
13		<i>Zanthoxylum americana</i>	prickly ash					2			
		Forbs		3		3		2	3		4
1		<i>Achillea millefolium</i>	yarrow			0.5			1		
2		<i>Agastache foeniculum</i>	anise hyssop						1	1	
3		<i>Ageratina altissima</i>	white snake root							2	
4		<i>Agrimonia sp</i>	agrimony			0.5					
5		<i>Ambrosia artemisiifolia</i>	common ragweed			0.5				1	
6	x	<i>Arctium minus</i>	burdock							1	
7		<i>Asclepias incarnata</i>	swamp milkweed							1	
8		<i>Asclepias syriaca</i>	common milkweed					0.5	0.5		
9		<i>Astragalus canadensis</i>	Canada milk vetch	0.5	seeded				0.5		
10	x	<i>Centaurea maculosa</i>	spotted knapweed	1		1			1		
11	x	<i>Cirsium arvense</i>	Canada thistle	0.5				1			
12		<i>Cirsium discolor</i>	field thistle			1		1			
13		<i>Desmodium canadense</i>	showy tick trefoil						1		
14		<i>Eupatorium maculatum</i>	Joe pyeweed							1	
15		<i>Helianthus pauciflorus</i>	stiff sunflower						1		
16		<i>Heliopsis helianthoides</i>	early sunflower	1	seeded				1	1	

Grasslands

17		<i>Hypericum punctatum</i>	dotted St John's wort	1				0.5		
18		<i>Liatris aspera</i>	rough blazing star	0.5	(not seeded)					
19	x	<i>Linaria vulgaris</i>	butter and eggs			1				2
20	x	<i>Lotus corniculatus</i>	birds foot trefoil	1				2		2
21		<i>Medicago sativa</i>	alfalfa	1				0.5		
22		<i>Melilotus alba</i>	white sweet clover					0.5		
23		<i>Monarda fistulosa</i>	bergamot	1	seeded	2	1			
24		<i>Oenothera biennis</i>	evening primrose			0.5		1		
25		<i>Physalis heterophylla</i>	clammy ground cherry			0.5				
26		<i>Pseudognaphalium obtusifolium</i>	sweet everlasting	1		1				
27		<i>Ratibida pinnata</i>	yellow coneflower					0.5		
28		<i>Rudbeckia hirta</i>	black-eyed Susan	2	seeded			1		
29		<i>Rudbeckia laciniata</i>	goldenglow						1	
30		<i>Silene latifolia</i>	white campion					1		
31		<i>Solidago canadensis</i>	Canada goldenrod	2		2	1	2	2	3
32		<i>Solidago gigantea</i>	late goldenrod					1		
33		<i>Solidago rigida</i>	stiff goldenrod	1	seeded					
34		<i>Symphyotrichum lanceolatum</i>	panicled aster	1	seeded					
35		<i>Symphyotrichum lateriflorum</i>	calico aster					1	2	
36		<i>Symphyotrichum novae-angliae</i>	New England aster						0.5	
37		<i>Symphyotrichum oolentangiensis</i>	sky blue aster						1	
38		<i>Symphyotrichum pilosum</i>	frost aster	1		0.5		1		
39		<i>Teucrium canadense</i>	germander				2			1
40	x	<i>Verbascum thapsus</i>	mullein			1	1	1		
41		<i>Viola sp</i>	violet			0.5				
42		<i>Zizia aurea</i>	Golden Alexander	0.5	seeded					
Graminoids				4		3	3	4		3
1		<i>Andropogon gerardii</i>	big bluestem					1	1	
2		<i>Bouteloua curtipendula</i>	side oats grama	2				0.5		
		<i>Bromus ciliatus</i>	fringed brome						1	
3	x	<i>Bromus inermis</i>	smooth brome	4		3	3			2
4		<i>Carex cf muhlenbergii</i>	muhly sedge			0.5				
5		<i>Digitaria cognatum</i>	fall witchgrass	1						
6		<i>Elymus canadensis</i>	Canada wild rye	1				1		
7		<i>Eragrostis spectabilis</i>	purple lovegrass			1				
8		<i>Panicum virgatum</i>	switchgrass	1				1	2	
9	x	<i>Phalaris arundinacea</i>	reed canary grass					2		2
10	x	<i>Poa pratensis</i>	Kentucky bluegrass	2		1			1	
11		<i>Schizachrium scoparium</i>	little bluestem	2						
12	x	<i>Setaria glauca</i>	yellow foxtail					1		
13		<i>Sorghastrum nutans</i>	Indiangrass	1				1	2	

* Relative Cover Classes for individual species and vegetation layers: 0.5=0-1%, 1=1-5%, 2=5-25%, 3=25-50%, 4=50-75%, 5=75-100%

GRASSLAND - North half of park

Units LGU1, LGU2, LGU6. Target: Southern dry prairie, sand-gravel subtype

		UNIT:	LGU1	LGU2	LGU6	
		DATE:	8/9/21	7/30/21	7/30/21	
Non	Scientific Name	Common Name				Notes
Canopy	30 - 100 ft height	Total cover:	0			
	<i>Picea pungens</i>	blue spruce	0.5			Planted
	<i>Populus tremuloides</i>	quaking aspen	0.5			
	<i>Quercus macrocarpa</i>	bur oak	0.5			
Subcanopy	15-30 ft height	Total cover:	0			
	<i>Acer negundo</i>	boxelder	0.5			
	<i>Acer saccharinum</i>	silver maple	0.5			
	<i>Populus deltoides</i>	cottonwood	1			
	<i>Ulmus americana</i>	American elm	0.5			
Understory/shrub layer	4-15 ft height	Total cover:	1	1	1	
	<i>Acer negundo</i>	boxelder	0.5	0.5		
	<i>Cornus racemosa</i>	gray dogwood		0.5		
	<i>Cornus sericea</i>	red-osier dogwood	0.5			Planted
	<i>Corylus americana</i>	American hazelnut	0.5		0.5	Planted
	<i>Fraxinus pennsylvanica</i>	green ash	0.5			
	<i>Juniperus virginiana</i>	red cedar	0.5			
	<i>Larix laricina</i>	tamarack	0.5			
x	<i>Lonicera tartarica</i>	Tartarian honeysuckle	0.5	0.5		
	<i>Malus sp.</i>	apple sp.	0.5			
x	<i>Morus alba</i>	white mulberry	0.5			
	<i>Populus tremuloides</i>	quaking aspen	1		0.5	
	<i>Prunus serotina</i>	black cherry		0.5	0.5	
x	<i>Rhamnus cathartica</i>	common buckthorn	1		0.5	
	<i>Rhus glabra</i>	smooth sumac	1	1		
	<i>Ribes missouriense</i>	Missouri gooseberry	0.5			
	<i>Rubus ideaus</i>	red raspberry	0.5	0.5	0.5	
	<i>Rubus occidentalis</i>	black raspberry	1	1	1	
	<i>Salix interior</i>	sandbar willow	0.5			
	<i>Sambucus canadensis</i>	common elderberry	0.5		1	
x	<i>Syringa vulgaris</i>	common lilac	0.5			
	<i>Ulmus americana</i>	American elm	0.5	0.5		
x	<i>Ulmus pumila</i>	Siberian elm	0.5			
	<i>Zanthoxylum americana</i>	prickly ash		0.5	0.5	
GROUND COVER		Total groundcover:	5	5		
	Vines and woody species	Total cover:	1	2	1	
	<i>Acer negundo</i>	boxelder	0.5		0.5	
	<i>Amorpha canescens</i>	leadplant	1			
	<i>Cornus racemosa</i>	gray dogwood		1		
	<i>Corylus americana</i>	american hazelnut			0.5	
	<i>Fraxinus pennsylvanica</i>	green ash			0.5	
	<i>Juniperus virginiana</i>	red cedar	0.5	0.5		
x	<i>Lonicera tartarica</i>	Tartarian honeysuckle	0.5	0.5		
	<i>Malus sp.</i>	apple sp.	0.5	1		
x	<i>Morus alba</i>	white mulberry	0.5			
	<i>Parthenocissus quinquefolia</i>	Virginia creeper	0.5	2		
	<i>Populus tremuloides</i>	quaking aspen	0.5	1	1	
	<i>Prunus americana</i>	wild plum	0.5			
	<i>Prunus serotina</i>	black cherry		1	0.5	
	<i>Quercus macrocarpa</i>	bur oak	0.5	1	0.5	
	<i>Quercus rubra</i>	red oak	0.5			
x	<i>Rhamnus cathartica</i>	common buckthorn	0.5	0.5	1	
	<i>Rhus glabra</i>	smooth sumac	1	1	0.5	

LGU1, LGU2, LGU6

	<i>Ribes</i> sp.	currant?		0.5		
	<i>Rosa arkansana</i>	prairie rose				
	<i>Rubus ideaus</i>	red raspberry	1	0.5	0.5	
	<i>Rubus occidentalis</i>	black raspberry	0.5	1	0.5	
x	<i>Ulmus pumila</i>	Siberian elm	0.5	0.5		
	<i>Vitis riparia</i>	wild grape	0.5	2		
	<i>Zanthoxylum americana</i>	prickly ash		0.5	0.5	
	Forbs	Total cover:	3	4	3	
x	<i>Abutilon theophrasti</i>	velvet leaf	0.5			
	<i>Achillea millefolium</i>	yarrow	0.5	2	1	
	<i>Agastache foeniculum</i>	anise hyssop	0.5			
	<i>Ageratina altissima</i>	white snakeroot			1	
x	<i>Alcea rosea</i>	hollyhock	0.5			
	<i>Ambrosia psilostachya</i>	western ragweed	1	0.5	0.5	
	<i>Ambrosia trifida</i>	giant ragweed	0.5			
	<i>Anemone cylindrica</i>	thimbleweed		1		
	<i>Antennaria howellii</i>	Howell's pussytoes		0.5		
	<i>Apocynum cannabinum</i>	Indian hemp	0.5			
x	<i>Arctium minus</i>	common burdock	1		0.5	
x	<i>Artemisia absinthium</i>	absinthe wormwood			0.5	
	<i>Artemisia campestris</i>	field sagewort		1		
	<i>Artemisia ludoviciana</i>	prairie sage		0.5		
	<i>Asclepias syriaca</i>	common milkweed	1	1	0.5	
	<i>Asclepias tuberosa</i>	butterflyweed	0.5			
	<i>Asclepias verticillata</i>	whorled milkweed	0.5	0.5		
x	<i>Asparagus officinalis</i>	wild asparagus	0.5		0.5	
	<i>Aster</i> sp.	aster sp.		1		
	<i>Astragalus canadensis</i>	Canada milkvetch	1	0.5		
x	<i>Barbarea vulgaris</i>	yellow rocket	0.5		0.5	
x	<i>Berteroa incana</i>	hoary alyssum	0.5	0.5		
	<i>Cannabis sativa</i>	hemp			0.5	
x	<i>Carduus nutans</i>	nodding thistle	0.5		0.5	
x	<i>Centaurea stoebe</i>	spotted knapweed	2	3	2	
x	<i>Chenopodium album</i>	lamb's-quarters	0.5			
x	<i>Cirsium arvense</i>	Canada thistle	1	1	2	
	<i>Cirsium discolor</i>	field thistle	0.5	0.5	0.5	
	<i>Conyza canadensis</i>	Canadian horseweed	1		1	
	<i>Coreopsis palmata</i>	prairie coreopsis	0.5			
	<i>Dalea candida</i>	white prairie clover	1	2		
	<i>Dalea purpurea</i>	purple prairie clover	2	1		
x	<i>Daucus carota</i>	queen Anne's lace	0.5			
	<i>Desmodium canadense</i>	showy tick-trefoil	1			
	<i>Drymocallis arguta</i>	prairie cinquefoil	1	0.5		
	<i>Erigeron strigosus</i>	prairie fleabane	0.5	0.5		
	<i>Euphorbia corollata</i>	flowering spurge	0.5	2		
x	<i>Euphorbia virgata</i>	leafy spurge	0.5		1	
	<i>Euthamia graminifolia</i>	grass-leaved goldenrod		1		
	<i>Helianthus maximiliani</i>	Maximilian sunflower	1	2		
	<i>Heliopsis helianthoides</i>	early sunflower	0.5		0.5	
x	<i>Hypericum perforatum</i>	common St. Johnswort	2	2	1	
	<i>Lactuca canadensis</i>	wild lettuce		0.5		
x	<i>Lactuca serriola</i>	prickly lettuce	0.5			
x	<i>Leonurus cardiaca</i>	motherwort			0.5	
	<i>Lespedeza capitata</i>	round-headed bushclover	1	0.5		
	<i>Liatris punctata</i>	dotted blazing star	0.5	0.5		
x	<i>Linaria vulgaris</i>	butter and eggs	0.5	1	0.5	
	<i>Lithospermum carolinense</i>	hairy puccoon		0.5	0.5	
x	<i>Lotus corniculatus</i>	birds-foot trefoil	2	1		
	<i>Lupinus perennis</i>	wild lupine	0.5			
x	<i>Medicago sativa</i>	alfalfa	1			
x	<i>Melilotus alba</i>	white sweet clover	0.5	0.5	0.5	
x	<i>Melilotus officinalis</i>	yellow sweet clover	0.5		1	
	<i>Monarda fistulosa</i>	bergamot	2	2	1	

LGU1, LGU2, LGU6

	<i>Nepeta cataria</i>	Catnip			0.5	
	<i>Oenothera biennis</i>	common evening primrose	0.5	0.5		
	<i>Oxalis</i> sp.	wood sorrel sp.		0.5		
	<i>Penstemon digitalis</i>	foxglove beardtongue		0.5		
	<i>Penstemon grandiflorus</i>	large-flowered penstemon	0.5			
	<i>Physalis heterophylla</i>	clammy ground cherry	0.5			
x	<i>Potentilla recta</i>	sulphur cinquefoil	0.5	1	0.5	
	<i>Pseudognaphalium obtusifolium</i>	sweet everlasting			0.5	
	<i>Pycnanthemum virginianum</i>	mountain mint	0.5		0.5	
	<i>Ratibida pinnata</i>	yellow coneflower	1	2		
	<i>Rosa blanda</i>	smooth wild rose	0.5			
	<i>Rudbeckia hirta</i>	black-eyed susan	1	1	0.5	
	<i>Rudbeckia triloba</i>	brown-eyed susan	2			
x	<i>Rumex crispus</i>	curly dock	1		0.5	
x	<i>Securigara varia</i>	crown vetch	2			
x	<i>Silene latifolia</i>	white campion	0.5	0.5	0.5	
	<i>Silphium laciniatum</i>	compass plant	0.5			
x	<i>Sinapsis arvensis</i>	field mustard		0.5		
	<i>Solidago canadensis</i>	Canada goldenrod	2	4	2	LGU2:
	<i>Solidago nemoralis</i>	gray goldenrod	1		0.5	
	<i>Solidago rigida</i>	stiff goldenrod	1	2	1	
	<i>Solidago speciosa</i>	showy goldenrod	1			
	cf. <i>Stellaria media</i>	chickweed			0.5	
	cf. <i>Symphyotrichum ericoides</i>	cf. heath aster		1		
	cf. <i>Symphyotrichum lanceolatum</i>	cf. lance-leaved aster	2			
	<i>Symphyotrichum oolentangiense</i>	sky-blue aster	1			
	<i>Symphyotrichum pilosum</i>	frost aster			1	County
x	<i>Tanacetum vulgare</i>	common tansy			0.5	
	<i>Taraxacum officinale</i>	common dandelion	0.5			
x	<i>Trifolium arvense</i>	rabbit-foot clover			1	
	<i>Trifolium pretense</i>	red clover			1	
	<i>Urtica dioica</i>	stinging nettle	0.5		0.5	
x	<i>Verbascum thapsus</i>	common mullein	0.5	1	1	
	<i>Verbena hastata</i>	blue vervain			0.5	
	<i>Verbena stricta</i>	hoary vervain	0.5	1		
	<i>Verbena urticifolia</i>	white vervain			0.5	
	<i>Zizia aurea</i>	golden Alexanders	0.5			
	Graminoids	Total cover:	4	4	4	
	<i>Andropogon gerardii</i>	big bluestem	2	1	1	
	<i>Bouteloua curtipendula</i>	side-oats grama	1	2		
	<i>Bouteloua gracilis</i>	blue grama	0.5	0.5		
x	<i>Bromus inermis</i>	smooth brome	2	0.5	3	
	<i>Carex brevior</i>	short sedge			1	
	<i>Cyperus lupulinus</i>	Great Plains flatsedge		1		
	<i>Dichanthelium oligosanthos</i>	Scribners panic grass	0.5	1		
	<i>Elymus canadensis</i>	Canada wild rye	1	1	1	
	<i>Eragrostis spectabilis</i>	purple lovegrass			1	
x	<i>Eriochloa villosa</i>	Hairy cupgrass			1	
	<i>Koeleria macrantha</i>	junegrass	0.5			
	<i>Panicum virgatum</i>	switchgrass	2	2	0.5	
x	<i>Phalaris arundinaceae</i>	reed canary grass	0.5		2	
x	<i>Poa pratensis</i>	Kentucky bluegrass	2	3	3	
	<i>Schizachyrium scoparium</i>	little bluestem	3	3	0.5	
	<i>Setaria pumila</i>	yellow foxtail			1	
	<i>Sorghastrum nutans</i>	Indian grass	2	1	0.5	
	<i>Bare soil</i>		1	1	1	

* Relative Cover Classes for individual species and vegetation layers: 0.5=0-1%, 1=1-5%, 2=5-25%, 3=25-50%, 4=50-75%, 5=75-100%

APPENDIX C. MANAGEMENT DETAILS UNITS OF1, OF3

Ofe, OFw units. 34 acres				
	Treatment	Date (M/D/Y)	Herbicide/detail	Cost/Acre
2015	Forestry mowed most of units. Hand cut/treat the rest	1/1/15	Garlon 4. 33%	\$985
	Foliar sprayed buckthorn	7/21/2015	Tahoe 3a	
2016	Rx burn part of each unit	5/5/16		\$153
	Overseed entire units	5/19/16		
2017	Foliar sprayed buckthorn	10/19/17	Vastlan	\$177
	Cut/treat large stems	12/28/17	Garlon 4 ultra & Relegate	\$66
	Overseed targeted openings in OFe	12/28/17		
2019	Cut/treat large stems (most too small)	12/2/19	Glyphosate	\$294
2021	Cut/treat large stems in OFw	3/26/21	Garlon 4	\$1,824
	Goat browse 2 ac in OFw	9/14/21		
	Foliar sprayed buckthorn in OFw	9/24/21	Garlon 3	\$432
OF1 unit - East subunit (north). 22 acres				
	Treatment	Date (M/Y)	Herbicide/detail	Cost/Acre
2016	Forestry mow (15.5 acres); Hand cut/treat/burn piles, stems >1/2" diameter, 6 acres (steep slopes, S and E)	11/2015 - 2/2016	Garlon-4 Ultra for stumps	\$1,616
	Foliar spray buckthorn	09/2016	Garlon-3A	\$440
2019	Foliar spray buckthorn - sprayed by PRI	09/2019	Garlon-4 ultra with surfactant (Liberate)	\$238
2020	Fuel load reductions (100' adjacent to trail)	11/01/2019 - 2/1/2020		
	Foliar spray buckthorn - sprayed by Washington County Seasonals	09/2020	Garlon-4 ultra 3%, Milestone .25/gal with surfactant (Liberate)	
2021	Goat browse	05/01 - 06/01/2021		\$71 - \$228
	Foliar spray buckthorn - sprayed by Washington County Seasonals	09/2021	Vastlan, 7 oz/gal with Liberate	\$60 in labor
OF1 unit - north subunit. 17 acres				
	Treatment	Date (M/D/Y)	Herbicide/detail	Cost/Acre
2017	Forestry mow and hand cut	09/2016 - 03/2017		\$1,140
	Foliar spray buckthorn	08/2017 - 10/2017	Garlon-3	\$300
2018	Foliar spray buckthorn	08/2018 - 10/2018	Garlon-3	\$275
2020	Foliar spray buckthorn - sprayed by Washington County Seasonals	9/15/20	Garlon-4 ultra 3%, milestone .25/gal, Liberate 1 oz/gal	
2021	Foliar spray buckthorn - to be sprayed by Washington County Seasonals	9/2021	Garlon-4 Ultra 2.75% with Liberate	
	Fuel load reductions	09/2021 - 02/2022		

OF1 unit - west Subunit. 26 acres

	Treatment	Date (M/D/Y)	Herbicide/detail	Cost/Acre
2017	Forestry mow	09/2016 - 03/2017		\$818
	Hand cut, 2.2 acres on steep W and SW facing slopes	09/2016 - 03/2017		\$2,290
	Foliar spray buckthorn	08/2017 - 10/2017	Garlon-4, 2.5 oz/gal	\$440
2018	Foliar spray buckthorn	08/2018 - 10/2018	Garlon-4, 2.5 oz/gal	\$440
2020	Fuel load reductions (100' adjacent to trail)	11/01/2019 - 2/1/2020		
	Plot 2 Goat browse garlic mustard (8.18 Acres)	07/01 - 08/01/2020		\$71 - \$228
	Spot spray buckthorn - sprayed by Washington County Seasonals	09/2020 - 10/2020	Garlon-4 Ultra 3%, Milestone .25/gal, surfactant	
2021	Goat browse, garlic mustard	7/13/05		\$71 - \$228
	Foliar spray buckthorn - to be sprayed by Washington County Seasonals	9/2021	Garlon-4 Ultra 2.75% with Liberate	

OF3 uni 23 acres

	Treatment	Date (M/D/Y)	Herbicide/detail	Cost/Acre
2019	Forestry mow where feasible	1/1/19		\$1,509
	Hand-cut steep slopes and ravines. Stump-treat, stack, burn.	01/2019-04/2019	75% basal oil and 25% Trycera (8% Triclopyr).	\$2,531
	Foliar spray	10/1/19	Garlon 3a 3.4oz/gal & Trycera 4.5 oz/gal. UTV with boom and backpack.	\$340
2020	Rx burn	4/30/20	Carried very well, good coverage	\$343
	Seed and seeding. Mostly grasses. 8 grass spp (50 lbs), 11 forbs (2.5 lb).	6/1/20	Canopy openings, about 7 ac	\$504
2021	Hand pull garlic mustard - 25 vols, contractors	05/2021	About 50 bags	
	Goat browse 8 ac	8/2021	10 days, 42 goats. Start 8/10	\$438
	Foliar sprayed buckthorn	9/24/21	Garlon 3a	\$410

OM1 and OM2. 28 ac

	Treatment	Date (M/D/Y)	Herbicide/detail	Cost/Acre
2021	Hand cut/treat. Chip and blow back. Forestry mowed a small part of OM2 (south end).	01/2021-03/2021	Garlon 4, daubers	\$1,870
	Foliar sprayed buckthorn	10/30/21	Garlon 3a	

APPENDIX D. PLANT SPECIES LISTS FOR RESTORATION

Southern Dry-Mesic Oak (maple) Woodland (FDs37)

The following species lists are based on data collected by the MN DNR of species recorded at native MN plant communities. The lists are not comprehensive, nor will all species listed be needed or available. Other species found at the site may also be suitable additions. Detailed species lists and quantities will need to be developed by an ecologist after site preparation and additional evaluation. All seed and plant material used at the property should be of local origin, ideally from within 100 miles of the site.

In addition to seed, it would be very beneficial to install shrub plants, with fencing to protect from browsing.

Scientific name	Common Name
Forbs, ferns	
<i>Amphicarpaea bracteata</i>	hog-peanut
<i>Anemone quinquefolia</i>	wood anemone
<i>Apocynum androsaemifolium</i>	spreading dogbane
<i>Aquilegia canadensis</i>	columbine
<i>Aralia nudicaulis</i>	wild sarsaparilla
<i>Arisaema trifolium</i>	Jack in the pulpit
<i>Athyrium filix-femina</i>	lady-fern
<i>Circaea lutetiana</i>	enchanter's nightshade
<i>Desmodium glutinosum</i>	pointed-leaved tick-trefoil
<i>Eurybia macrophylla</i>	large-leaved aster
<i>Galium triflorum</i>	three-flowered bedstraw
<i>Geranium maculatum</i>	wild geranium
<i>Maianthemum canadense</i>	Canada mayflower
<i>Mianthemum racemosum</i>	false Solomon's-seal
<i>Osmorhiza claytonii</i>	Clayton's sweet cicely
<i>Osmunda claytoniana</i>	interrupted fern
<i>Phryma leptostachya</i>	lopseed
<i>Polygonatum biflorum</i>	giant Solomon's-seal
<i>Pyrola elliptica</i>	shinleaf
<i>Sanicula marilandica</i>	Mariland black snakeroot
<i>Solidago flexicaulis</i>	zigzag goldenrod
<i>Thalictrum dioicum</i>	early meadow-rue
<i>Uvularia sessilifolia</i>	pale bellwort
<i>Uvularia grandiflora</i>	large-flowered bellwort
Graminoids	
<i>Carex blanda</i>	eastern woodland sedge
<i>Carex pensylvanica</i>	Pennsylvania sedge
<i>Carex rosea</i>	rosy sedge
<i>Elymus canadensis</i>	Canada wild rye
<i>Elymus hystrix</i>	bottlebrush grass
<i>Elymus virginicus</i>	Virginia wild rye
<i>Festuca subverticillata</i>	nodding fescue
<i>Leersia virginica</i>	white grass
<i>Oryzopsis asperifolia</i>	mountain rice grass

Shrubs	
<i>Amelanchier spp</i>	Juneberry
<i>Cornus racemosa</i>	gray dogwood
<i>Cornus rugosa</i>	round-leaved dogwood
<i>Corylus americana</i>	American hazelnut
<i>Corylus cornuta</i>	beaked hazelnut
<i>Diervilla lonicera</i>	bush honeysuckle
<i>Prunus virginiana</i>	chokecherry
<i>Ribes cynosbati</i>	gooseberry
<i>Ribes missouriense</i>	Missouri gooseberry
<i>Sambucus racemosa</i>	red-berried elder
<i>Symphoricarpos</i>	snowberry
<i>Viburnum rafinesquianum</i>	downy arrowwood
<i>Viburnum lentago</i>	nannyberry
Canopy Trees	
<i>Ostrya virginiana</i>	Ironwood
<i>Quercus alba</i>	white oak
<i>Quercus macrocarpa</i>	bur oak

Southern Dry-Mesic Oak Forest MHs37

Genus	Species	Common Name
Forbs, ferns		
<i>Actaea</i>	<i>rubra</i>	Red baneberry
<i>Adiantum</i>	<i>pedatum</i>	Maidenhair fern
<i>Amphicarpaea</i>	<i>bracteata</i>	Hog-peanut
<i>Anemone</i>	<i>americana</i>	Round-lobed hepatica
<i>Apocynum</i>	<i>androsaemifolium</i>	Spreading dogbane
<i>Aquilegia</i>	<i>canadensis</i>	Columbine
<i>Aralia</i>	<i>nudicaulis</i>	Wild sarsaparilla
<i>Aralia</i>	<i>racemosa</i>	American spikenard
<i>Arisaema</i>	<i>triphillum</i>	Jack-in-the-pulpit
<i>Aster</i>	<i>sagittifolius</i>	Tail-leaved aster
<i>Athyrium</i>	<i>fili-femina</i>	Lady-fern
<i>Ageratina</i>	<i>altissimum</i>	white snakeroot
<i>Fragaria</i>	<i>virginiana</i>	wild strawberry
<i>Caulophyllum</i>	<i>thalictroides</i>	Blue cohosh
<i>Circaea</i>	<i>lutetiana</i>	Enchanter's nightshade
<i>Cryptotaenia</i>	<i>canadensis</i>	Honewort
<i>Desmodium</i>	<i>glutinosum</i>	Pointed-leaved tick-trefoil
<i>Dioscorea</i>	<i>villosa</i>	Wild yam
<i>Galium</i>	<i>triflorum</i>	Three-flowered bedstraw
<i>Geranium</i>	<i>maculatum</i>	Wild geranium
<i>Geum</i>	<i>canadense</i>	White avens
<i>Hydrophyllum</i>	<i>virginianum</i>	Virginia waterleaf
<i>Impatiens</i>	<i>spp.</i>	Touch-me-not
<i>Maianthemum</i>	<i>canadense</i>	Canada mayflower
<i>Mitella</i>	<i>diphylla</i>	Two-leaved miterwort
<i>Osmorhiza</i>	<i>claytonii</i>	Clayton's sweet cicely
<i>Osmunda</i>	<i>claytoniana</i>	Interrupted fern
<i>Phryma</i>	<i>leptostachya</i>	Lopseed
<i>Polygonatum</i>	<i>pubescens</i>	Hairy Solomon's-seal
<i>Polygonatum</i>	<i>biflorum</i>	Giant Solomon's-seal
<i>Pteridium</i>	<i>aquilinum</i>	Bracken
<i>Sanguinaria</i>	<i>canadensis</i>	Bloodroot
<i>Sanicula</i>	<i>marilandica</i>	Mariland black snakeroot
<i>Smilacina</i>	<i>racemosa</i>	false Solomon's-seal
<i>Thalictrum</i>	<i>dioicum</i>	Early meadow-rue
<i>Uvularia</i>	<i>grandiflora</i>	Yellow bellwort
<i>Uvularia</i>	<i>sessilifolia</i>	Pale bellwort
<i>Veronicastrum</i>	<i>virginicum</i>	Culver's root
<i>Viola</i>	<i>Viola sp</i>	Violet
Graminoids		
<i>Brachyelytrum</i>	<i>erectum</i>	Bearded shorthusk
<i>Carex</i>	<i>pennsylvanica</i>	Pennsylvania sedge
<i>Carex</i>	<i>blanda</i>	Eastern woodland sedge
<i>Carex</i>	<i>pennsylvanica</i>	Pennsylvania sedge
<i>Carex</i>	<i>radiata</i>	Stellate sedge
<i>Carex</i>	<i>gracillima</i>	Graceful sedge
<i>Carex</i>	<i>pedunculata</i>	Long-stalked sedge
<i>Elymus</i>	<i>hystrix</i>	Bottlebrush grass
<i>Festuca</i>	<i>subverticillata</i>	Nodding fescue
<i>Oryzopsis</i>	<i>asperifolia</i>	Mountain rice-grass
<i>Schizachne</i>	<i>purpurascens</i>	False melic grass

Shrubs		
<i>Cornus</i>	<i>alternifolia</i>	Pagoda dogwood
<i>Cornus</i>	<i>racemosa</i>	Gray dogwood
<i>Corylus</i>	<i>americana</i>	American hazelnut
<i>Corylus</i>	<i>cornuta</i>	Beaked hazelnut
<i>Prunus</i>	<i>virginiana</i>	Chokecherry
<i>Rosa</i>	<i>blanda</i>	Smooth wild rose
<i>Sambucus</i>	<i>racemosa</i>	Red-berried elder
<i>Symphoricarpos</i>	<i>cmx</i>	Snowberry
<i>Viburnum</i>	<i>rafinesquianum</i>	Downy arrowwood
<i>Viburnum</i>	<i>lentago</i>	Nannyberry

Southern Dry Mesic Oak Forest MHs37 (continued)

Genus	Species	Common Name	³ Freq	⁴ Abund	⁵ Index
Shrubs					
<i>Cornus</i>	<i>alternifolia</i>	Pagoda dogwood	100	6	600
<i>Cornus</i>	<i>racemosa</i>	Gray dogwood	20	1	20
<i>Corylus</i>	<i>americana</i>	American hazelnut	40	9	360
<i>Corylus</i>	<i>cornuta</i>	Beaked hazelnut	40	2	80
<i>Prunus</i>	<i>virginiana</i>	Chokecherry	60	4	240
<i>Rosa</i>	<i>blanda</i>	Smooth wild rose	20	1	20
<i>Sambucus</i>	<i>racemosa</i>	Red-berried elder	40	3	120
<i>Symphoricar</i>	<i>cmx</i>	Snowberry	20	3	60
<i>Viburnum</i>	<i>rafinesquianum</i>	Downy arrow-wood	40	3	120
<i>Viburnum</i>	<i>lentago</i>	Nannyberry	20	1	20
Canopy Trees (>10m)					
<i>Acer</i>	<i>rubrum</i>	Red maple	20	88	1760
<i>Acer</i>	<i>saccharum</i>	Sugar maple	40	9	360
<i>Betula</i>	<i>papyrifera</i>	Paper-birch	20	1	20
<i>Carpinus</i>	<i>caroliniana</i>	Blue beech	20	3	60
<i>Carya</i>	<i>cordiformis</i>	Bitternut hickory	40	3	120
<i>Celtis</i>	<i>occidentalis</i>	Hackberry	60	2	120
<i>Ostrya</i>	<i>virginiana</i>	Ironwood	40	9	360
<i>Prunus</i>	<i>serotina</i>	Black cherry	100	9	900
<i>Quercus</i>	<i>rubra</i>	Northern red oak	100	31	3100
<i>Quercus</i>	<i>alba</i>	White oak	60	46	2760
<i>Tilia</i>	<i>americana</i>	Basswood	40	4	160

³Frequency: Number of releve plots in which species occurs divided by total number of releve plots, multiplied by 100

⁴Abundance: Average percent cover of species within the community. It is most appropriate to interpret each value as a cover class similar to those used for original data collection (see text of report for more details)

⁵Index of Commonness: Frequency multiplied by Abundance

Southern Dry Savanna (UPs14)

Species Lists taken from Terrestrial and Palustrine Native Plant Communities in East-central Minnesota (DNR 2005). Restoring a full complement of species for any type of restoration is not feasible. For savanna and prairie, the following guidelines can be used, depending on funding.

Low diversity: 20-30 species (6-8 grasses, 15-20 forbs, 1 low shrub)

Moderate diversity: 35-40 species (9-11 grasses, 25-30 forbs, 2-3 low shrubs)

High diversity: 50-60 species (12-14 grasses, 30-40 forbs, 3-4 low shrubs)

Scientific name	Common name
Forbs	
<i>Allium stellatum</i>	Prairie wild onion
<i>Anemone cylindrica</i>	Thimbleweed
<i>Antennaria sp</i>	Pussytoes
<i>Apocynum androsaemifolium</i>	Spreading dogbane
<i>Aralia nudicaulis</i>	Wild sarsaparilla
<i>Artemisia ludoviciana</i>	White sage
<i>Asclepias syriaca</i>	Common milkweed
<i>Asclepias tuberosa</i>	Butterflyweed
<i>Campanula rotundifolia</i>	Harebell
<i>Chrysopsis villosa</i>	Golden aster
<i>Coreopsis palmata</i>	Coreopsis
<i>Dalea candida</i>	White prairie clover
<i>Dalea purpurea</i>	Purple prairie clover
<i>Euphorbia corollata</i>	Flowering spurge
<i>Fragaria virginiana</i>	Common strawberry
<i>Galium boreale</i>	Northern bedstraw
<i>Geranium maculatum</i>	Wild geranium
<i>Geum triflorum</i>	Prairie smoke
<i>Helianthemum bicknellii</i>	Hoary frostweed
<i>Helianthus pauciflorus</i>	Stiff sunflower
<i>Heuchera richardsonii</i>	Alum-root
<i>Lechea stricta</i>	Prairie pinweed
<i>Lespedeza capitata</i>	Round-headed bush clover
<i>Liatris aspera</i>	Rough blazing star
<i>Lithospermum carolinense</i>	Hairy puccoon
<i>Mirabilis hirsuta</i>	Hairy four-o'clock
<i>Monarda fistulosa</i>	Wild bergamot
<i>Oenothera biennis</i>	Common evening-primrose
<i>Penstemon gracilis</i>	Slender beard-tongue
<i>Penstemon grandiflorus</i>	Large-flowered penstemon
<i>Potentilla arguta</i>	Tall cinquefoil
<i>Prenanthes racemosa</i>	Rattlesnake root
<i>Pysalis virginiana</i>	Virginia ground cherry
<i>Ratibida pinnata</i>	Yellow coneflower
<i>Rudbeckia hirta</i>	Black-eyed Susan
<i>Smilacina stellata</i>	Starry false Solomon's seal
<i>Solidago missouriensis</i>	Missouri goldenrod
<i>Solidago nemoralis</i>	Gray goldenrod
<i>Solidago rigida</i>	Stiff goldenrod
<i>Solidago speciosa</i>	Showy goldenrod
<i>Symphyotricum ericoides</i>	Heath aster
<i>Symphyotricum laeve</i>	Smooth blue aster
<i>Symphyotricum oolentangiense</i>	Sky-blue aster
<i>Symphyotricum sericeum</i>	Silky aster
<i>Thalictrum dasycarpum</i>	Tall meadow-rue
<i>Viola pedatifida</i>	Prairie violet
<i>Zizia aptera</i>	Heart-leaved Alexanders

Graminoids	
<i>Andropogon gerardii</i>	Big bluestem
<i>Bouteloua curtipendula</i>	Sideoats grama
<i>Bouteloua hirsuta</i>	Hairy grama
<i>Calamovilfa longifolia</i>	Sand reedgrass
<i>Carex brevior</i>	Short sedge
<i>Carex muhlenbergii</i>	Muhlenberg's sedge
<i>Carex pensylvanica</i>	Pennsylvania sedge
<i>Carex siccata</i>	Hay sedge
<i>Carex tenera</i>	Marsh-straw sedge
<i>Cyperus lupulinus</i>	Hop-like cyperus
<i>Elymus hystrix</i>	Bottlebrush grass
<i>Eragrostis spectabilis</i>	Purple lovegrass
<i>Koeleria pyramidata</i>	Junegrass
<i>Leptoloma cognatum</i>	Fall witchgrass
<i>Panicum oligosanthos</i>	Scribner's panic grass
<i>Panicum perlongum</i>	Long-leaved panic
<i>Panicum virgatum</i>	Switchgrass
<i>Schizachyrium scoparium</i>	Little bluestem
<i>Sorghastrum nutans</i>	Indian grass
<i>Sporobolus heterolepis</i>	Prairie dropseed
<i>Stipa spartea</i>	Porcupine grass
Shrubs	
<i>Amelanchier humilis</i>	Low juneberry
<i>Amorpha canescens</i>	Lead plant
<i>Cornus racemosa</i>	Gray dogwood
<i>Corylus americana</i>	American hazelnut
<i>Juniperus virginiana</i>	Red cedar
<i>Prunus americana</i>	Wild plum
<i>Prunus virginiana</i>	Chokecherry
<i>Rhus glabra</i>	Smooth sumac
<i>Rosa arkansana</i>	Prairie rose
<i>Symphoricarpos occidentalis</i>	Wolfberry
Trees	
<i>Quercus macrocarpa</i>	Bur oak

Southern Dry Prairie, sand-gravel subtype (UPs13b)

Genus	Common Name		
Forbs			
<i>Allium stellatum</i>	Prairie wild onion	<i>Solidago speciosa</i>	Showy goldenrod
<i>Anemone cylindrica</i>	Long-headed thimbleweed	<i>Symphyotricum ericoides</i>	Heath aster
<i>Anemone patens</i>	Pasque-flower	<i>Symphyotricum laeve</i>	Smooth aster
<i>Antennaria spp</i>	Pussytoes	<i>Symphyotricum oolentangiense</i>	Sky-blue aster
<i>Artemisia campestris</i>	Tall wormwood	<i>Symphyotricum sericeum</i>	Silky aster
<i>Artemisia ludoviciana</i>	Western mugwort	<i>Thalictrum dasycarpum</i>	Tall meadow-rue
<i>Asclepias syriaca</i>	Common milkweed	<i>Tradescantia occidentalis</i>	Western spiderwort
<i>Asclepias tuberosa</i>	Butterfly-weed	<i>Verbena stricta</i>	Hoary vervain
<i>Asclepias verticillata</i>	Whorled milkweed	<i>Veronicastrum virginicum</i>	Culver's root
<i>Asclepias viridiflora</i>	Green milkweed	<i>Viola virginicum</i>	Prairie bird-foot violet
<i>Aster oblongifolium</i>	Aromatic aster	<i>Zizia aptera</i>	Heart-leaved alexanders
<i>Aster prenanthoides</i>	Crooked-stemmed aster		
<i>Astragalus crassicaupus</i>	Buffalo-bean	Grasses, Rushes and Sedges	
<i>Calylophus serrulata</i>	Toothed evening primrose	<i>Andropogon gerardii</i>	Big bluestem
<i>Campanula rotundifolia</i>	Harebell	<i>Aristida</i>	Base-branched three-awn
<i>Chrysopsis villosa</i>	Prairie golden aster	<i>Bouteloua curtipendula</i>	Side-oats grama
<i>Comandra</i>	Bastard toad-flax	<i>Bouteloua hirsuta</i>	Hairy grama
<i>Coreopsis palmata</i>	Stiff tickseed	<i>Bromus</i>	Kalm's brome
<i>Cycloloma</i>	Winged pigweed	<i>Calamovilfa longifolia</i>	Sand reed-grass
<i>Dalea candida</i>	White prairie-clover	<i>Carex muhlenbergii</i>	Muhlenberg's sedge
<i>Dalea purpurea</i>	Purple prairie-clover	<i>Carex pensylvanica</i>	Pennsylvania sedge
<i>Dalea villosa</i>	Silky prairie-clover	<i>Carex tenera</i>	Marsh-straw sedge
<i>Delphinium carolinianum</i>	Prairie larkspur	<i>Cyperus lupulinus</i>	Hop-like cyperus
<i>Desmodium illinoense</i>	Illinois tick-trefoil	<i>Elymus canadensis</i>	Canada wild rye
<i>Euphorbia corollata</i>	Flowering spurge	<i>Elymus trachycaulus</i>	Slender wheatgrass
<i>Helianthemum bicknellii</i>	Hoary frostweed	<i>Eragrostis spectabilis</i>	Purple lovegrass
<i>Helianthus pauciflorus</i>	Stiff sunflower	<i>Koeleria pyramidata</i>	June-grass
<i>Heuchera richardsonii</i>	Alum-root	<i>Muhlenbergia cuspidata</i>	Plains muhly
<i>Kuhnia eupatorioides</i>	False boneset	<i>Panicum oligosanthos</i>	Few-flowered panic grass
<i>Lathyrus venosus</i>	Veiny pea	<i>Panicum perlongum</i>	Long-leaved panic grass
<i>Lespedeza capitata</i>	Round-headed bush-clover	<i>Panicum virgatum</i>	Switchgrass
<i>Liatris aspera</i>	Rough blazing star	<i>Schizachyrium scoparium</i>	Little bluestem
<i>Liatris punctata</i>	Dotted blazing star	<i>Sorghastrum nutans</i>	Indian grass
<i>Linum sulcatum</i>	Grooved yellow flax	<i>Sporobolus cryptandrus</i>	Sand dropseed
<i>Lithospermum carolinense</i>	Hairy puccoon	<i>Sporobolus heterolepis</i>	Prairie dropseed
<i>Lithospermum incisum</i>	Narrow-leaved puccoon	<i>Stipa comata</i>	Needle-and-thread grass
<i>Mirabilis hirsuta</i>	Hairy four-o'clock	<i>Stipa spartea</i>	Porcupine-grass
<i>Monarda fistulosa</i>	Wild bergamot		
<i>Oenothera biennis</i>	Common evening-primrose	Shrubs	
<i>Oenothera clelandii</i>	Cleland's evening-primrose	<i>Amorpha canescens</i>	Lead-plant
<i>Onosmodium molle</i>	False gromwell	<i>Artemisia frigida</i>	Prairie sagewort
<i>Oxalis cmx</i>	Wood-sorrel	<i>Ceanothus americanus</i>	American New Jersey tea
<i>Pedimelum argophyllum</i>	Silvery scurf-pea	<i>Rosa arkansana</i>	Prairie rose
<i>Pedimelum esculentum</i>	Prairie-turnip	<i>Symphoricarpos sp</i>	Snowberry
<i>Penstemon gracilis</i>	Slender beard-tongue		
<i>Penstemon grandiflorus</i>	Large-flowered beard-tongue		
<i>Physalis heterophylla</i>	Clammy ground-cherry		
<i>Physalis virginiana</i>	Ground-cherry		
<i>Potentilla arguta</i>	Tall cinquefoil		
<i>Ratibida pinnata</i>	Gray-headed coneflower		
<i>Rudbeckia hirta</i>	Black-eyed Susan		
<i>Senecio plattensis</i>	Prairie ragwort		
<i>Silene antirrhina</i>	Sleepy catchfly		
<i>Solidago missouriensis</i>	Missouri goldenrod		
<i>Solidago nemoralis</i>	Gray goldenrod		
<i>Solidago ptarmicoides</i>	Upland white aster		
<i>Solidago rigida</i>	Stiff goldenrod		

Southern Mesic Prairie (UPs23)

Scientific name	Common Name	Freq	Scientific name	Common Name	Freq
Forbs			<i>Solidago ptarmicoides</i>	Upland white aster	8
<i>Allium canadense</i>	Wild garlic	8	<i>Solidago rigida</i>	Stiff goldenrod	58
<i>Allium stellatum</i>	Prairie wild onion	8	<i>Solidago speciosa</i>	Showy goldenrod	8
<i>Anemone canadensis</i>	Canada anemone	8	<i>Symphyotricum ericoides</i>	Heath aster	58
<i>Anemone cylindrica</i>	Long-headed thimbleweed	25	<i>Symphyotricum laeve</i>	Smooth aster	8
<i>Anemone virginiana</i>	Virginia thimbleweed	8	<i>Symphyotricum lanceolatum</i>	Panicled aster	17
<i>Antennaria spp</i>	Pussytoes	17	<i>Symphyotricum novae-angliae</i>	New England aster	17
<i>Apocynum androsaemifolium</i>	Spreading dogbane	25	<i>Symphyotricum oolentangiense</i>	Sky-blue aster	67
<i>Artemisia campestris</i>	Tall wormwood	17	<i>Thalictrum dasycarpum</i>	Tall meadow-rue	25
<i>Artemisia frigida</i>	Prairie sagewort	8	<i>Tradescantia bracteata</i>	Bracted spiderwort	8
<i>Artemisia ludoviciana</i>	Western mugwort	42	<i>Vernonia fasciculata</i>	Ironweed	
<i>Asclepias syriaca</i>	Common milkweed	25	<i>Veronicastrum virginicum</i>	Culver's root	58
<i>Asclepias tuberosa</i>	Butterfly-weed	25	<i>Vicia americana</i>	American vetch	8
<i>Astragalus canadensis</i>	Canada milk-vetch	8	<i>Zizia aurea</i>	Golden alexanders	25
<i>Campanula rotundifolia</i>	Harebell	17	Shrubs		
<i>Chrysopsis villosa</i>	Prairie golden aster	8	<i>Amorpha canescens</i>	Lead-plant	58
<i>Comandra umbellata</i>	Bastard toad-flax	58	<i>Amorpha nana</i>	Fragrant false indigo	8
<i>Coreopsis palmata</i>	Stiff tickseed	58	<i>Rosa arkansana</i>	Prairie rose	58
<i>Dalea candida</i>	White prairie-clover	50	<i>Symphoricarpos cmx.</i>	Snowberry	25
<i>Dalea purpurea</i>	Purple prairie-clover	50	Grasses, Rushes and Sedges		
<i>Desmodium canadense</i>	Canadian tick-trefoil	25	<i>Andropogon gerardii</i>	Big bluestem	100
<i>Eryngium yuccifolium</i>	Rattlesnake master		<i>Bromus kalmii</i>	Kalm's brome	25
<i>Euphorbia corollata</i>	Flowering spurge	8	<i>Carex bicknellii</i>	Bicknell's sedge	33
<i>Euthamia graminifolia</i>	Grass-leaved goldenrod	8	<i>Carex muhlenbergii</i>	Muhlenberg's sedge	8
<i>Fragaria virginiana</i>	Common strawberry	33	<i>Carex meadii</i>	Mead's sedge	17
<i>Galium boreale</i>	Northern bedstraw	42	<i>Carex tenera</i>	Marsh-straw sedge	17
<i>Geum triflorum</i>	Prairie smoke	8	<i>Elymus canadensis</i>	Canada wild rye	25
<i>Helenium autumnale</i>	Autumn sneezeweed	8	<i>Elymus trachycaulus</i>	Slender wheatgrass	8
<i>Helianthus maximiliani</i>	Maximilian's sunflower	17	<i>Eragrostis spectabilis</i>	Purple lovegrass	8
<i>Helianthus pauciflorus</i>	Stiff sunflower	58	<i>Muhlenbergia mexicana</i>	Mexican satin-grass	8
<i>Heliopsis helianthoides</i>	Ox-eye	8	<i>Panicum oligosanthos</i>	Few-flowered panic grass	33
<i>Lathyrus venosus</i>	Veiny pea	17	<i>Panicum virgatum</i>	Switchgrass	17
<i>Lespedeza capitata</i>	Round-headed bush-clover	42	<i>Panicum perlongum</i>	Long-leaved panic grass	8
<i>Liatris ligulistylis</i>	Northern plains blazing star	33	<i>Schizachyrium scoparium</i>	Little bluestem	33
<i>Liatris pycnostachya</i>	Gayfeather	25	<i>Sorghastrum nutans</i>	Indian grass	100
<i>Mirabilis hirsuta</i>	Hairy four-o'clock	8	<i>Sporobolus heterolepis</i>	Prairie dropseed	42
<i>Monarda fistulosa</i>	Wild bergamot	50	<i>Stipa spartea</i>	Porcupine-grass	33
<i>Oenothera biennis</i>	Common evening-primrose	25			
<i>Phlox pilosa</i>	Prairie phlox	42			
<i>Potentilla arguta</i>	Tall cinquefoil	17			
<i>Pycnanthemum virginianum</i>	Virginia mountain-mint	50			
<i>Ratibida pinnata</i>	Gray-headed coneflower	33			
<i>Rudbeckia hirta</i>	Black-eyed Susan	25			
<i>Sisyrinchium campestre</i>	Field blue-eyed grass	8			
<i>Smilacina racemosa</i>	False Solomon's-seal	8			
<i>Smilacina stellata</i>	Starry false Solomon's-seal	17			
<i>Solidago missouriensis</i>	Missouri goldenrod	17			
<i>Solidago nemoralis</i>	Gray goldenrod	25			

Northern Wet Meadow-Carr (WMn82)

Genus	Species	Common Name	Freq %
Shrubs			
<i>Alnus</i>	<i>incana</i>	Speckled alder	24
<i>Betula</i>	<i>pumila</i>	Bog-birch	14
<i>Cornus</i>	<i>sericea</i>	Red-osier dogwood	24
<i>Salix</i>	<i>bebbiana</i>	Bebb's willow	20
<i>Salix</i>	<i>discolor</i>	Pussy willow	29
<i>Salix</i>	<i>petiolaris</i>	Slender willow	42
<i>Spiraea</i>	<i>alba</i>	Meadowsweet	23
Forbs, ferns and fern allies			
<i>Acorus</i>	<i>calamus</i>	Sweet flag	11
<i>Asclepias</i>	<i>incarnata</i>	Swamp milkweed	22
<i>Aster</i>	<i>borealis</i>	Bog aster	12
<i>Aster</i>	<i>puniceus</i>	Red-stemmed aster	19
<i>Bidens</i>	<i>spp.</i>	Beggar-ticks	21
<i>Caltha</i>	<i>palustris</i>	Swamp marsh-marigold	17
<i>Campanula</i>	<i>aparinoides</i>	Marsh bellflower	58
<i>Cicuta</i>	<i>bulbifera</i>	Bulb-bearing water-hemlock	46
<i>Dryopteris</i>	<i>crinata</i>	crested fern	24
<i>Epilobium</i>	<i>sp</i>	Willow-herb	44
<i>Eupatorium</i>	<i>maculatum</i>	Spotted Joe-pye weed	34
<i>Eupatorium</i>	<i>perfoliatum</i>	Common boneset	11
<i>Galium</i>	<i>trifidum</i>	Three-cleft bedstraw	46
<i>Impatiens</i>	<i>spp.</i>	Touch-me-not	39
<i>Iris</i>	<i>versicolor</i>	Northern blue Flag	22
<i>Lathyrus</i>	<i>palustris</i>	Marsh vetchling	17
<i>Lycopus</i>	<i>americanus</i>	Cut-leaved bugleweed	17
<i>Lycopus</i>	<i>uniflorus</i>	Northern bugleweed	45
<i>Lysimachia</i>	<i>thyrsiflora</i>	Tufted loosestrife	59
<i>Mentha</i>	<i>arvensis</i>	Common mint*	19
<i>Onoclea</i>	<i>sensibilis</i>	Sensitive fern	20
<i>Polygonum</i>	<i>amphibium</i>	Water smartweed	42
<i>Polygonum</i>	<i>sagittatum</i>	Arrow-leaved tearthumb	28
<i>Potentilla</i>	<i>palustris</i>	Marsh cinquefoil	38
<i>Rubus</i>	<i>pubescens</i>	Dwarf raspberry	11
<i>Rumex</i>	<i>orbiculatus</i>	Great water dock	52
<i>Sagittaria</i>	<i>lateriflora</i>	Broad-leaved arrowhead	22
<i>Scutellaria</i>	<i>galericulata</i>	Marsh skullcap	53
<i>Scutellaria</i>	<i>lateriflora</i>	Mad-dog skullcap	12
<i>Thelypteris</i>	<i>palustris</i>	Northern marsh-fern	40
<i>Triadenum</i>	<i>fraseri</i>	Marsh St. John's wort	23
<i>Viola</i>	<i>sp</i>	Big-leaf violet	12
Grasses, Rushes and Sedges			
<i>Bromus</i>	<i>ciliatus</i>	Fringed brome	
<i>Calamagrostis</i>	<i>canadensis</i>	Bluejoint	80
<i>Carex</i>	<i>aquaticilis</i>	Water sedge	11
<i>Carex</i>	<i>lacustris</i>	Lake-sedge	72
<i>Carex</i>	<i>lasiocarpa</i>	Wire-sedge	29
<i>Carex</i>	<i>stricta</i>	Tusssock-sedge	41
<i>Carex</i>	<i>utriculata</i>	Beaked sedge	33
<i>Scirpus</i>	<i>cyperinus</i>	Wool-grass	22

Shrubs For Replacing Common Buckthorn

Dry-Mesic Upland Areas					
Common Name	Scientific Name	Height [feet]	Light	Wildlife Value	Comments
Allegheny serviceberry	<i>Amelanchier laevis</i>	15 to 25	Sun/part shade	high	
Pagoda dogwood	<i>Cornus alternifolia</i>	15 to 20	Sun/shade		Beautiful growth form.
Round-leaved dogwood	<i>Cornus rugosa</i>	8 to 12	Part sun/shade		Butterflies use flowers; birds eat berries
Eastern wahoo	<i>Euonymus atropurpurea</i>	6 to 20	Sun/shade		Spreads
Common ninebark	<i>Physocarpus opulifolius</i>	8 to 10	Full sun	Bird food	Dense growth habit
American plum	<i>Prunus americana</i>	20 to 35	Sun	high	
Choke cherry	<i>Prunus virginiana</i>	20 to 30	Sun/part shade	Excellent	
Sambucus racemosa	<i>Red-berried elder</i>	10 to 12	Sun/part shade	High value: bird food	Cluster of white flowers; red berries in early summer.
Smooth rose	<i>Rosa blanda</i>	4 to 6	Sun/part shade	high	
Red-berried elder	<i>Sambucus pubens</i>	6 to 12	Shade	Very high	Excellent massing, fast growing.
Bladdernut	<i>Staphylea trifolia</i>	8 to 15	Shade		Tolerates many soil conditions, disease resistant
Arrowwood viburnum	<i>Viburnum rafinesquianum</i>	5 to 8	Part shade, shade	high	Pretty foliage
Highbush cranberry	<i>Viburnum trilobum</i>	6 to 12	Sun to shade	High -Birds eat fruits.	Foliage open form in shade, dense in sun.
Wafer ash	<i>Ptelea trifoliata</i>	10 to 15	Sun to shade	Larval host for swallowtail butterfly	Foliage open form in shade, dense in sun.
Flood Tolerant Species					
Common Name	Scientific Name	Height	Light	Wildlife Value	Comments
American elder	<i>Sambucus canadensis</i>	8 to 10	Full sun	High value: bird food	Very tolerant of soil conditions; blue-black fruit in late summer
False Indigo	<i>Amorpha fruticosa</i>	8 to 10	Sun/part shade	Butterflies	Attractive flower
Black chokeberry	<i>Aronia melanocarpa</i>	5 to 8	Sun/shade	Bird food	
Buttonbush	<i>Cephalanthus occidentalis</i>	6 to 12	Full sun	Birds, butterflies	Round flower head; fragrant
Silky dogwood	<i>Cornus amomum</i>	6 to 12	Full sun	Bird food	Blue fruit; reddish-purple bark
Red twig dogwood	<i>Cornus sericea</i>	6 to 12	Sun/part shade	Bird food	Red twigs, greenish-white fruit
Witch hazel	<i>Hamamelis virginiana</i>	20 to 30	Sun or shade	Late-season pollinators	Unique, spider-shaped yellow flowers that bloom late in the year.
Winterberry	<i>Ilex verticillata</i>	6 to 8	Sun/light shade	Bird food	Showy red fruit in fall.
Black Currant	<i>Ribes americanum</i>	3 to 6	Sun/light shade	High value: birds and mammals	White flowers and black-purple fruit
Pussy willow	<i>Salix discolor</i>	20	Full sun	Soil stabilizer	Showy catkins and ornamental

Red willow	<i>Salix sericea</i>	6 to 8	Full sun	Bird food	Upright, rounded form; and reddish-brown twigs
Meadowsweet	<i>Spirea alba</i>	3 to 6	Full sun	Bird food	Of wet meadows. Erect branching; white flower spikes in July
Nannyberry	<i>Viburnum lentago</i>	16 to 20	Sun/part shade	high	Dense foliage
Highbush cranberry	<i>Viburnum trilobum</i>	6 to 12	Sun/part shade	High value: bird food	White flat-topped flower clusters: red fruit persists until spring; red color to foliage in autumn

APPENDIX E. METHODS FOR CONTROLLING INVASIVE, INVASIVE PLANT SPECIES

TREES AND SHRUBS

Common buckthorn (*Rhamnus cathartica*), Tatarian honeysuckle (*Lonicera tatarica*), Siberian elm (*Ulmus pumila*), and black locust (*Robinia pseudoacacia*) are some of the most common woody species likely to invade native woodlands or prairies in Minnesota. All are prolific seeders, lack natural disease and predators, and can out-compete native species. Invasions result in dense, impenetrable thickets or nearly monotypic stands that reduces native species diversity.

Chemical Control

The most efficient way to remove woody plants that are 1/2 inch or more in diameter is to cut the stems close to the ground and treat the cut stumps with herbicide immediately after they are cut, when the stumps are fresh, and the chemicals are most readily absorbed. Failure to treat the stumps will result in resprouting, creating much greater removal difficulty. Herbicide should be applied to cut stumps with a **dauber** or sponge type applicator, to minimize effects to non-target species.

In non-freezing temperatures, a triclopyr (e.g., Garlon 3a) or glyphosate (e.g Roundup) herbicide is typically used. Adding a marker dye can help to make treated stumps more visible. In winter months, Garlon 4 is typically used, and it must be mixed with a penetrating oil, such as diluent blue. Do not use diesel fuel, as it is much more toxic in the environment and for humans. For plants in the pea family, such as black locust, an herbicide with the active ingredient clopyralid is used. Common brand names for are Transline, Stinger, and Reclaim.

Brush removal work can be done at any time of year except during spring sapflow, but late fall is often ideal because buckthorn retains its leaves longer than other species and is more readily distinguished from other species. Cutting can be accomplished with brush cutters and chainsaws, used only by properly trained professionals.

Basal bark herbicide treatment is another effective control method for invasive woody plants, especially moderately large stems. A triclopyr herbicide such as 10% Garlon 4, mixed with a penetrating oil, is applied all around the base of the tree or shrub, taking care so that it does not run off. If the herbicide runs off it can kill other plants nearby. More herbicide is needed for effective treatment of plants that are four inches or more in diameter. Herbicide should be applied with daubers to avoid non-target impacts.

Mechanical Control

The most common method of mechanical control of woody plants is forestry mowing. Forestry mowing should be done on frozen ground. It is best done with little or no snow cover. The critical factor is that the mower must get down to the soil surface as much as possible, even scuffing the soil slightly, so that the mower is chewing up the root collar of the invasive woody plants. It requires going back and forth over an area, leaving no punji sticks, and cut debris should be well mulched.

Hand removal of plants by hand-pulling small plants or using weed wrenches may be suitable for very small, targeted areas or a home setting, but is generally not suitable for a large-scale project.

Undesirable trees and shrubs can also be destroyed by girdling. This method is most suitable for small numbers of large trees. Bark is removed in a band around the tree, just to the cambium. If girdled too deeply, the tree will respond by resprouting from the roots. Girdled trees die slowly over the course of one to two years. Girdling should be done in late spring to mid-summer when sap is flowing and the

bark easily peels away from the sapwood. Herbicide can also be used in combination with girdling for a more effective treatment.

Repeated cutting of woody plants (by hand or with a brush cutter) at critical stages in its growth cycle is another method to reduce smaller stems. Stems are cut in mid-spring (late May) to intercept the flow of nutrients from the roots to the leaves and cut again in fall (about late-September) to intercept the flow of nutrients from the leaves to the roots. If repeated for two years or more, this method will reduce small stems, especially if they are in deep shade. But it will also take out some other native woody and herbaceous plants and it ends up being quite costly, so it is generally not used on large sites.

Goats can also be used for mechanical control by browsing. The optimal timing late summer and/or late spring. As with cutting, it can help reduce buckthorn with repeated use over many years and is most successful where there is a dense tree canopy. It is best used in combination with other methods.

Stems, Seedlings and Resprouts

In the year following initial cutting, there will be a flush of new seedlings as well as resprouting from some of the cut plants. A good first step to deal with seedlings is fire. It also restores an important natural process to fire-dependant natural communities (e.g., oak forests). Burning can only be accomplished if adequate fuel (leaf litter) is present and can be done in late fall or early spring, depending on site conditions. Disadvantages to burning are that fire coverage is inconsistent over the site and there will be areas that are missed. Fires are typically “cool” in order to be conducted safely, so that even very small stems sometimes survive and resprout.

When burning is not feasible or not totally effective, herbicide can be applied to the foliage of the plants. Early to mid-fall is the best time to do this, when desirable native plants are mostly dormant and when the target plant is pulling resources from the leaves down into the roots. Garlon (triclopyr) is the most commonly used herbicides for foliar application. As with any herbicide, caution should be used with Garlon, because the surfactants added that allow it to penetrate bark also seep into the soil and may affect other plants within a radius of the treated plant. Herbicides are also known to be detrimental to soil microorganisms, which are vital for plant growth. For this reason, a wick application may be a better method than broadcast spraying, depending on what the groundcover composition is. Krenite (active ingredient – fosamine ammonium) is another herbicide that prevents bud formation, so the plants do not grow in the spring. This herbicide can be effective, but results are highly variable.

Disposal

If removing stems using some form of cut-and-paint removal, the easiest and most cost-effective method to handle large amounts of brush is usually to stack and burn it in winter. In areas where brush is not dense, it can be cut up into smaller pieces and left on the ground where it will decompose in one to three years. This method is especially useful on slopes to reduce erosion potential. Small brush piles can also be left in the woods as wildlife habitat piles. Where there is an abundance of larger trees, cut trees may be hauled and chipped and used for mulch or as a biofuel. Alternatively, the wood can be cut and used for firewood, if a recipient can be found.

FORBS

Birdsfoot trefoil (*Lotus corniculatus*) forms dense mats that choke out most other vegetation. It is especially problematic in prairies and disturbed open areas. Prescribed burns increase seed germination making it difficult to manage in native prairies. It can best be controlled with a combination of mowing or burning and chemical application. An effective broadleaf herbicide for

legumes is aminopyralid (e.g., Milestone). Note that aminopyralid herbicides also affects species in the sunflower family.

Spotted knapweed (*Centaurea maculosa*) is a very aggressive invasive species that is difficult to control. It is a biennial or short-lived perennial plant with very prolific seed production and allelopathic compounds in the roots that prevent other species from growing nearby. Hand-pulling individuals or small groups of individuals can be effective for small infestations and is often a good volunteer group task. However, knapweed has a fairly large tap root and can be difficult to pull. Pulling is typically most feasible in sandy soil or in heavier soil after a rain. All flowering plants must be pulled every year for about five years until the seedbank is exhausted.

If knapweed populations are large, a biocontrol is recommended. A combination of knapweed root weevils (*Cyphocleonus achates*) and seedhead weevils (*Larinus minutus/obtus*) is best. Results from biological control typically take 4-6 years to see. The knapweed will not be eradicated, but will be reduced so that native species diversity is not impeded. Weevils can be purchased online and are released during the summer. Knapweed populations should be monitored each year to keep a record of the effectiveness of the biocontrol.

For immediate control of small populations, spot treatment with a systemic herbicide such as glyphosate, milestone or transline may be needed. Picloram herbicides are also effective, but they have a long soil residual, and we recommend avoiding them. A 2-5% glyphosate solution applied to basal rosettes is very effective. The optimal season is late fall when plants are moving resources to the roots and most natives are dormant. The fall spray can be preceded by a late June mowing, to reduce flowering and seeding of second-year plants. Herbicide can also be used on basal rosettes after a spring burn. However, solid stands of knapweed do not carry a fire very well and the dead vegetation may not get burned off. Knapweed itself cannot be controlled with burning—like sweet clover it actually increases with fire.

Canada thistle (*Cirsium arvense*) While native thistles are not problematic, invasives such as Canada thistle are clone-forming perennials that can greatly reduce species diversity in old fields and restoration areas. A combination of chemical and mechanical control methods may be needed. The two-step process is to cut or mow the stems when they are flowering in June/July, then apply herbicide to the basal rosettes in fall. Chemical control is most effective when the plants are in the rosette stage and least effective when the plants are flowering. A clopyralid herbicide such as Transline is very effective. An aminopyralid (e.g., Milestone) can be applied at bud stage. Aminopyralid has longer residual activity than some other chemicals, so should avoid using in areas of higher diversity.

Mechanical control, involving several cuttings per year for three or four years, can reduce an infestation if timed correctly. The best time to cut is when the plants are just beginning to bud because their food reserves are at their lowest. If plants are cut after flowers have opened, the cut plants should be removed because viable seed may form. Plants should be cut at least three times throughout the season. Late spring burns can also discourage this species, but early spring burns can encourage it. Burning may be more effective in an established prairie, where competition from other species is strong, rather than in an old field, where competition is likely to be weaker.

Garlic mustard (*Alliaria petiolata*) is a nonnative biennial forb of woodlands and woodland edges that is very invasive. It tends to most readily invade disturbed soils, especially following earthworm invasions that leave the ground devoid of vegetation. It is recommended to monitor and remove it as soon as it is detected (early detection and rapid response). Garlic mustard also produces a flavonoid (root exudate) that suppresses mycorrhizal inoculation. Thus, species that are mycorrhizae dependent,

like oaks, will become stunted and easily outcompeted by garlic mustard. The flavinoid persists in the soil years after garlic mustard plants are removed.

Hand-pulling should occur before siliques (seed pods) form. Once flowers form, removed plants should be bagged and transported from the site, since the plant may have enough energy in the stem and root to make viable seeds. When pulling the plants, the entire root must be removed or they may re-sprout. This can be difficult, since roots are “S-shaped” and tend to break off at ground level.

Chemical control can be effective for expansive infestations where hand-pulling is not feasible. Glyphosate is non-specific and very effective but will also kill non-target plants. The key thing is to apply treatment very late in the fall or very early in the spring. Garlic mustard stays green through the winter so when there is no snow cover it can be virtually the only green plant. Another option is to use a water-soluble broadleaf herbicide, like triclopyr (Garlon), which will not kill grasses or sedges.

Garlic mustard can also be controlled by goats. Goats would be brought in at the specific time when the plants are flowering but not producing mature seed. Goats would be removed as soon as grazing is complete and would be used in subsequent years as needed. Seeding after garlic mustard removal will help to suppress it.

GRASSES

Reed canary grass (*Phalaris arundinacea*) is extremely difficult to eradicate and requires repeated treatment over a period of one to three years. A combination of burning, chemical treatment and mowing can be used, in accessible areas, or chemical treatment alone in inaccessible areas. The combination method starts by burning in late spring to remove dead vegetation and to stimulate new growth. When new sprouts have reached a height of 4 to 6 inches, the site can be sprayed with a 5% solution of a glyphosate herbicide appropriate for wetland habitat (e.g., Rodeo). The site is then mowed in late summer, followed by chemical application after re-growth. This treatment will stimulate new growth and germination to deplete the seed bank. The sequence of chemical treatment and mowing are repeated for at least a second season, and possibly a third until the grass is completely eradicated. Then native grass and forb seed can be broadcast or drilled. Reed canary areas should continue to be monitored mapped and treated.

Smooth brome (*Bromus inermis*), Kentucky bluegrass, and creeping fescue are some of the most common non-native, invasive grasses. All are cool season species - active early in the growing season (April-June) and semi-dormant July-September. Many of them reproduce by means of underground stems (stolons and rhizomes) called “tillers”. The most effective treatments are timed to occur at the same time as “tillering” - mid to late May. A late spring burn can set back the non-native grasses, while warming the ground and giving native grasses a boost just when they are ready to emerge from the ground. Within a few weeks, summer conditions will be most favorable for the native warm-season grasses, and further detrimental to cool season grasses. Burning two years in a row followed by seeding has been shown to be effective in controlling smooth brome. Consider that this timing may be a week or two earlier on steep south-facing slopes or in very sandy or sand-gravel soils. Late spring burns, however, are hard on native forbs so that should be a careful consideration. After burning, seeding with native local ecotype seed is important for restoring native. Evaluation can occur each year, and especially after two years.

Another option, especially if there are a lot of desirable native forbs, is a cool-season overspray with a broad-spectrum herbicide (e.g., glyphosate) or a grass-specific herbicide either in the spring (April) or in the fall (October).

All herbicides should be applied by licensed applicators and should not be applied on windy days.

APPENDIX F. GENERAL RESTORATION STRATEGIES FOR OAK SAVANNA IN THE MIDWEST

The first step for regenerating an oak savanna when using the structural manipulation approach is removal of invasive native and non-native trees and shrubs to create a structure that more closely resembles a natural system. For example, the tree canopy can be reduced to 50% cover and all non-oak woody stems that are larger than 150 cm in size would be removed. Treatments should be carried out during the winter months when the soil is frozen to reduce negative impacts such as rutting, erosion, and disturbance to the roots of remaining oak trees. There are several ways of removing trees and shrubs, including chain saw, brush cutter, forestry mower, or large-scale harvesting using machinery. Herbicide treatment will be needed for cut stumps.

After woody removal seeding will be necessary to re-establish the graminoid cover necessary to carry fire. Some herbaceous invasive control may also be necessary, especially where dense patches may prevent seeding take. Seeding with a graminoid-dominated seed mix will help create rapid groundlayer cover that can compete for resources like space, light, and nutrients, and limit re-invasion by both herbaceous and woody species. The seeds can be applied by broadcasting or with a native seed drill. A good time for seeding is fall, which allows seed to get natural stratification over the winter. The winter freeze-thaw cycle also works the seed into the ground. If seeded in spring it should be drilled. Seed mixes should be modeled after nearby remnant sites when available. Seed should be obtained from local ecotype sources. Once a prescribed fire regime has been established, forb diversity can be embellished to help add diversity and resources for pollinators and other wildlife.

Once native graminoids have established, fire can then be re-introduced to prevent woody encroachment by non-oak species and maintain the more open nature of the savanna system. Because of their thick bark and ability to resprout after top-kill, most oak species are naturally adapted to fire and fires have been an essential disturbance that keep savannas from developing into woodland. Another effect of fire in degraded savannas is the reduction of invasive grasses and woody species and to sustain higher levels of habitat and species diversity. But fires don't always yield the expected result as different plant species respond differently to fire. Depending on the timing of fire, some non-native grasses like Kentucky bluegrass and yellow foxtail, respond with increased growth. Quack grass and smooth brome have decreased growth after fire. So, it is important understand the response of individual species to fire.

Knowledge about fire frequency and intensity is also essential. Taking natural fire regimes in a savanna as a reference, the historical frequency of low-intensity fires was every 4 or 8 years for bur oak or white oak dominated savannas respectively. So even oak trees need fire-free periods for seedlings and saplings to successfully develop. Extreme fires, on the other hand, occurred much less frequently, only around every 35-100 years.

There is a range of recommendations concerning the use of prescribed fires in the literature. Generally, fire frequencies that are either too high or too low can shift resource availability and alter species dominance. Some sources say that low-intensity prescribed fires should be used annually or at least every other year (Maloney 1997, Apfelbaum *et al.* 1991). Others say that high-intensity fires should be used, because low-intensity fires are not likely to result in the mortality of large overstory stems. Additionally, frequent low-intensity fires have the potential to destroy seedbanks and endangered savanna species (Nielsen *et al.* 2003, Packard 1997), increase the likelihood of invasive species infestation, change resource availability, and prevent the growth of oak seedlings large enough to survive future fires (Wolf 2006).

At Cottage Grove Ravine Park, more frequent fire may be necessary early on in the restoration process in order to control woody seedlings and establish dense grass cover. However, the frequency of

prescribed fires can lessen as the restoration progresses, the understory establishes, and interseeding adds forb diversity. The low end of a four to eight year rotation may be needed to maintain the system given the woody encroachment pressure from neighboring units.

Oak savanna is the target plant community for several units at Cottage Grove Ravine Park. Most of the units are currently grassland, which is a much easier starting point than forest or woodland. At Unit for example, restoring the entirety of the unit all at once will likely be prohibitively expensive. There are a number of different restoration scenarios or potential trajectories based on available funding. For example, restoration could begin with invasive shrub removal from the entirety of the unit. This not only sets the unit up for next steps but prevents the unit from becoming a seed-source to neighboring restored units or subunits where savanna restoration will proceed. Then, subsequent tree thinning could occur throughout the entire unit – likely only if large-scale tree harvest could be arranged – or could proceed in priority areas such as the western edge that borders LGU2, the northeastern edge bordering LGU6, or the southern edge of the unit. Alternatively, if invasive removal throughout the entire unit is daunting, restoration could target a specific acreage – say 10 acres – and proceed through the entirety of the restoration process on those acres before moving on to another 10-acre section. If this latter scenario is pursued, restoration should begin in the priority areas mentioned above.