Natural Features Inventory and Management Recommendations for Independence Oaks, Lyon Oaks, and Rose Oaks, Oakland County Parks

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For:
Oakland County Parks
2800 Watkins Lake Road
Waterford, MI 48328–1917

March 31, 2006

Report Number 2006–04

Michigan DNR

MICHIGAN STATE UNIVERSITY EXTENSION

Photo credits: All photos by MNFI ecologist Mike Kost unless otherwise indicated.

Cover photo: Buckhorn Road Sedge Meadow in Rose Oaks, Oakland County Parks.
Inset: MNFI Ecologist Adrienne Bozic examines Indian grass (*Sorghastrum nutans*), a deep-rooting native prairie grass, in Rose Oaks Wet-mesic prairie, which lies between Buckhorn Road Sedge Meadow and Esler Lake Woodland.

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Introduction

During the summers of 2004 and 2005, Michigan Natural Features Inventory (MNFI) conducted surveys for exemplary natural communities and rare plants in three Oakland County Parks: Independence Oaks; Lyon Oaks; and Rose Oaks. Management needs were assessed on all natural areas within the parks that were considered to have good potential for supporting high quality natural communities if they were actively managed and restored. This report summarizes the findings of MNFI's surveys and evaluations of the natural areas within these three Oakland County parks.

Landscape Context

Regional landscape ecosystems of Michigan have been classified and mapped based on an integration of climate, physiography (topographic form and geologic parent material), soil, and natural vegetation (Albert 1995). The regional classification describes broad patterns of natural community and species occurrences and natural disturbance regimes across the state; understanding these patterns is useful in integrated resource management and planning, and for biological conservation. The classification is hierarchically structured with three levels in a nested series, from broad landscape regions called sections, down to smaller subsections and sub-subsections.

All three county parks we surveyed occur within the Washtenaw Subsection (VI.1) and Jackson Interlobate Sub-subsection (VI.1.3) of southern Lower Michigan (Figure 1 and Albert 1995). The local landforms within each park are typical of the regional landscape ecosystem in which they occur.

The Jackson Interlobate Sub-subsection (VI.1.3) contains broad expanses of glacial outwash sands that surround sandy and gravelly end moraines and ground moraines (Figure 2 and Albert 1995, Farrand and Bell 1982). The moraine soils are typically well drained or excessively well drained. In the 1800s, these soils supported drought-tolerant, fire-dependent natural communities such as oak barrens, oak savanna, oak forest, woodland prairie, and dry sand prairie. Intermingled with the outwash soils are poorly drained organic deposits that supported a variety of forested and non-forested wetland types.

Significant portions of both Independence Oaks and Lyon Oaks occur on an extensive glacial outwash plain that extends across several counties (Figure 2). At both parks, the outwash plain is bordered by coarse-textured end moraine. Within the Jackson Interlobate, where coarse-textured end moraines meet glacial outwash plains, groundwater typically flows out of the bases of the end moraines and saturates portions of the adjacent outwash plain. Thus, the abundance of groundwater seepages within the outwash plains at both Independence Oaks and Lyon Oaks is likely a result of the juxtaposition of these landforms. The presence of groundwater at or near the surface within the outwash plain has resulted in the formation of numerous wetlands, headwater streams, and lakes.

Rose Oaks occurs almost entirely on a coarse-textured ground moraine, with only a small area in the northwestern corner of the park occurring on medium-textured end moraine (Figure 2). The well-drained soils of the coarse-textured ground moraine support oak-hickory forest in several areas of the park, as the did in 1800. The ground moraine is dissected by narrow outwash channels that are too small to be shown on Figure 2. Numerous wetlands, streams, and lakes occur within the outwash channels. The lakes at Rose Oaks occupy depressions that were likely left by stranded blocks of glacial ice (e.g., ice-block depression lakes). Crooked Lake at Independence Oaks may also have a similar origin.

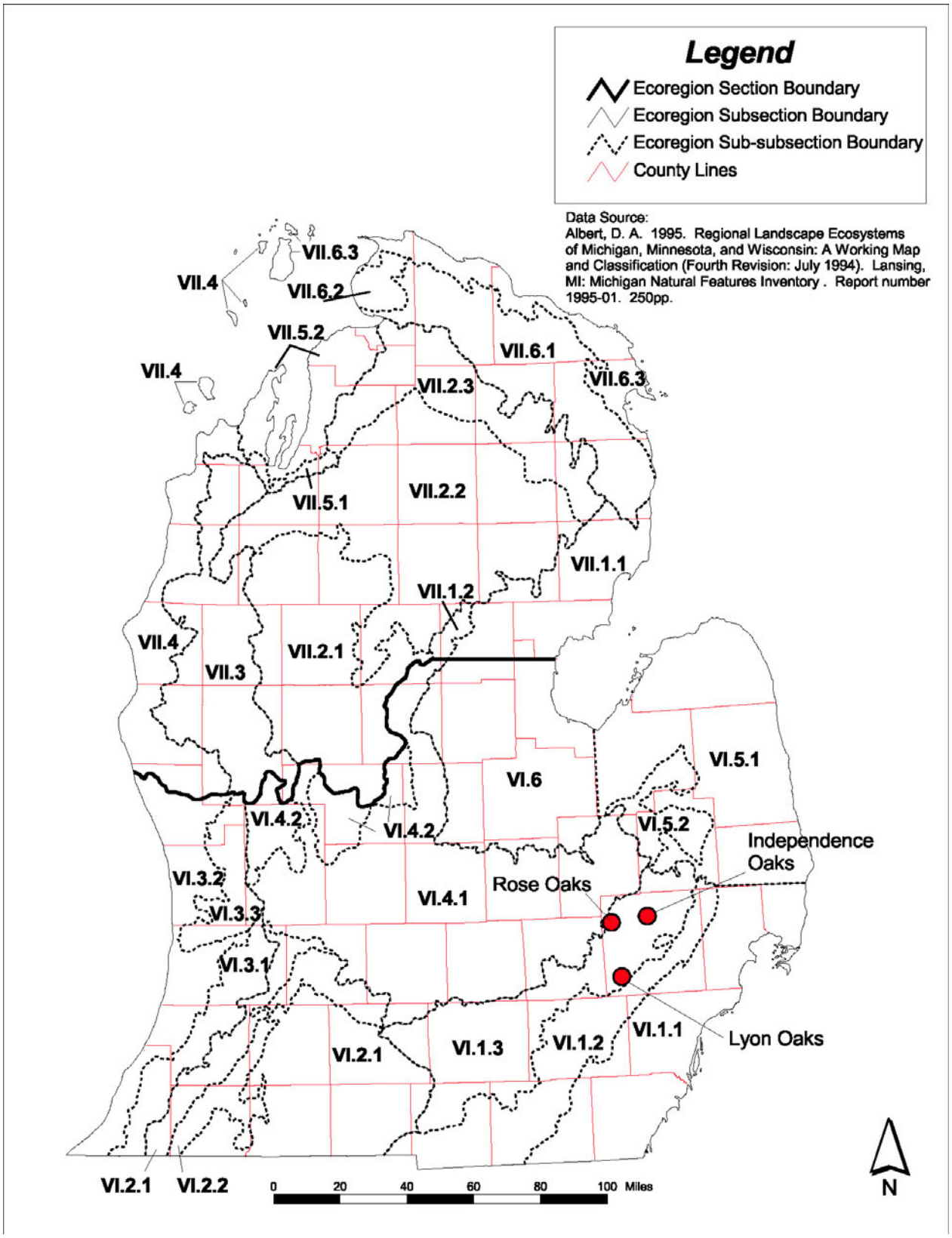

Figure 1. Ecoregions of Lower Michigan.

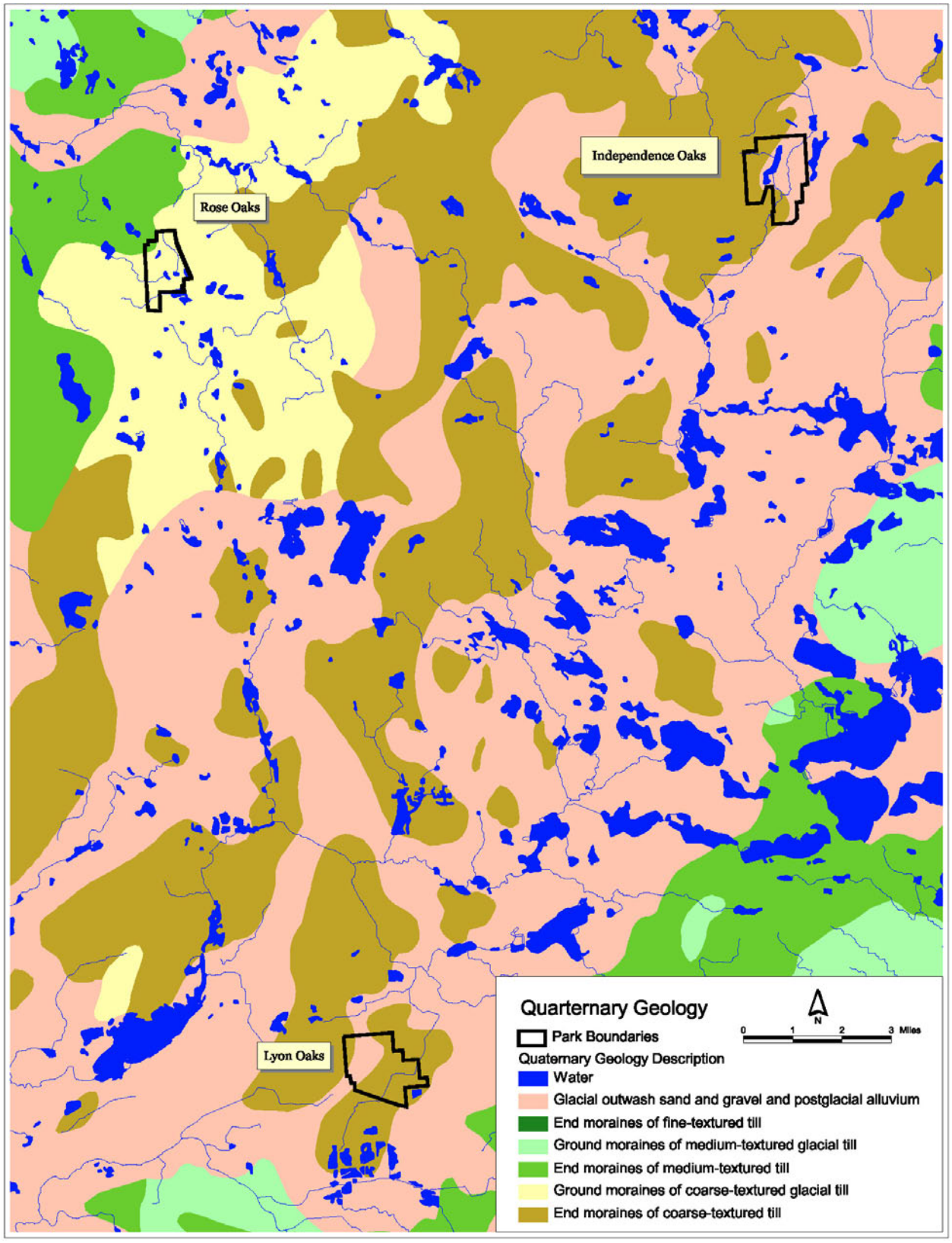

Figure 2. Surface Geology of Oakland County Parks.

Vegetation *circa* 1800

By interpreting the notes of the Michigan General Land Office surveyors (recorded from 1818-1856), MNFI ecologists were able to piece together a relatively accurate picture of the state's vegetation in the early 1800s (Comer et al. 1995). A digital map of vegetation encountered by the land surveyors during this period reveals that large portions of Independence Oaks, Lyon Oaks, and Rose Oaks were occupied by fire-dependent community types such as oak barrens, oak-hickory forest, wet prairie, and emergent marsh (Figure 3). Where fire breaks, such as streams and lakes, impeded the windswept fires, swamp forests and mesic forests occurred. Because the surveyors only recorded information along the section lines and not within the interiors of sections, MNFI ecologists used their understanding of ecological processes, landforms, soils, and species composition within the surrounding landscape to make hypotheses about the community types that occupied the interiors of each section.

The surveyor notes clearly indicate that oak barrens formed the predominant matrix ecosystem within the region that encompasses Independence Oaks, Rose Oaks and Lyon Oaks (Figure 3). At Independence Oaks, it appears that oak barrens nearly surrounded Crooked Lake: Surveyors recorded tree species there including white oak (*Quercus alba*), black oak (*Quercus velutina*), bur oak (*Quercus macrocarpa*), and hickory (*Carya* spp.). The most prevalent species recorded was white oak, which ranged in diameter at breast height (dbh) from 20 to 36 cm (8 to 14 inches). White oak was also noted within the oak barrens that occupied the northwestern corner of Lyon Oaks and southwest portion of Rose Oaks.

In addition to oak barrens, the outwash plain at Independence Oaks also supported mixed conifer swamp, mixed hardwood swamp, and emergent marsh or shrub swamp. Within the mixed conifer swamp along the headwaters of the Clinton River, the surveyors noted the presence of northern white cedar (*Thuja occidentalis*) and tamarack (*Larix laricina*). White pine (*Pinus strobus*) was also noted within the same wetland just north of the park. Mixed hardwood swamp occurred at the southern tip of Crooked Lake, where surveyors recorded both black ash (*Fraxinus nigra*) and American elm (*Ulmus americana*).

At Lyon Oaks, the *circa* 1800 vegetation was a mosaic of forested upland, emergent marsh, and hardwood swamp (Figure 3). The uplands were dominated by dry-mesic southern forest and mesic southern forest. End moraine with moderately-drained rich soils supported mesic southern forest, which was dominated by American beech (*Fagus grandifolia*) and sugar maple (*Acer saccharum*). In addition to the canopy dominants of beech and sugar maple, basswood (*Tilia americana*), red oak, and white oak were common canopy associates. The mean diameter of trees recorded by the surveyors within the mesic southern forest was 43 cm (17 inches) dbh, with observed diameters ranging from 18 to 66 cm (7 to 26 inches). On slightly drier sites, the mesic southern forest graded to dry-mesic southern forest (oak-hickory forest), with increased importance of the oaks, hickories (*Carya* spp.), and aspens (*Populus* spp.). In addition to white oak and red oak, hickories, aspen, and black cherry (*Prunus serotina*) were noted by the original land surveyors as important canopy trees in these dry-mesic southern forests. Average diameter for the oak-hickory forests was 41 cm (16 inches), but diameters ranged widely, from 18 to 91 cm (7 to 36 inches). In the southern portion of the park, the oak-hickory forest and beech-sugar maple forest occurred adjacent to hardwood swamp dominated by ash (*Fraxinus* spp.) and American elm. Recorded diameters for trees within the swamp ranged from 15 to 41 cm (5 to 16 inches), with a mean diameter of 25 cm (10 inches). A large block of emergent marsh occurred in the south-central portion of the park, and a wet prairie was mapped in the northeastern quarter of the park along the Norton Drain. Because the original land surveyors did not differentiate among the many different types of open, grass- and sedge-dominated wetlands, the areas designated as wet prairie on the *circa* 1800 vegetation map could have also supported other types of open, fire-dependent wetlands such as southern wet meadow, wet-mesic prairie, and prairie fen.

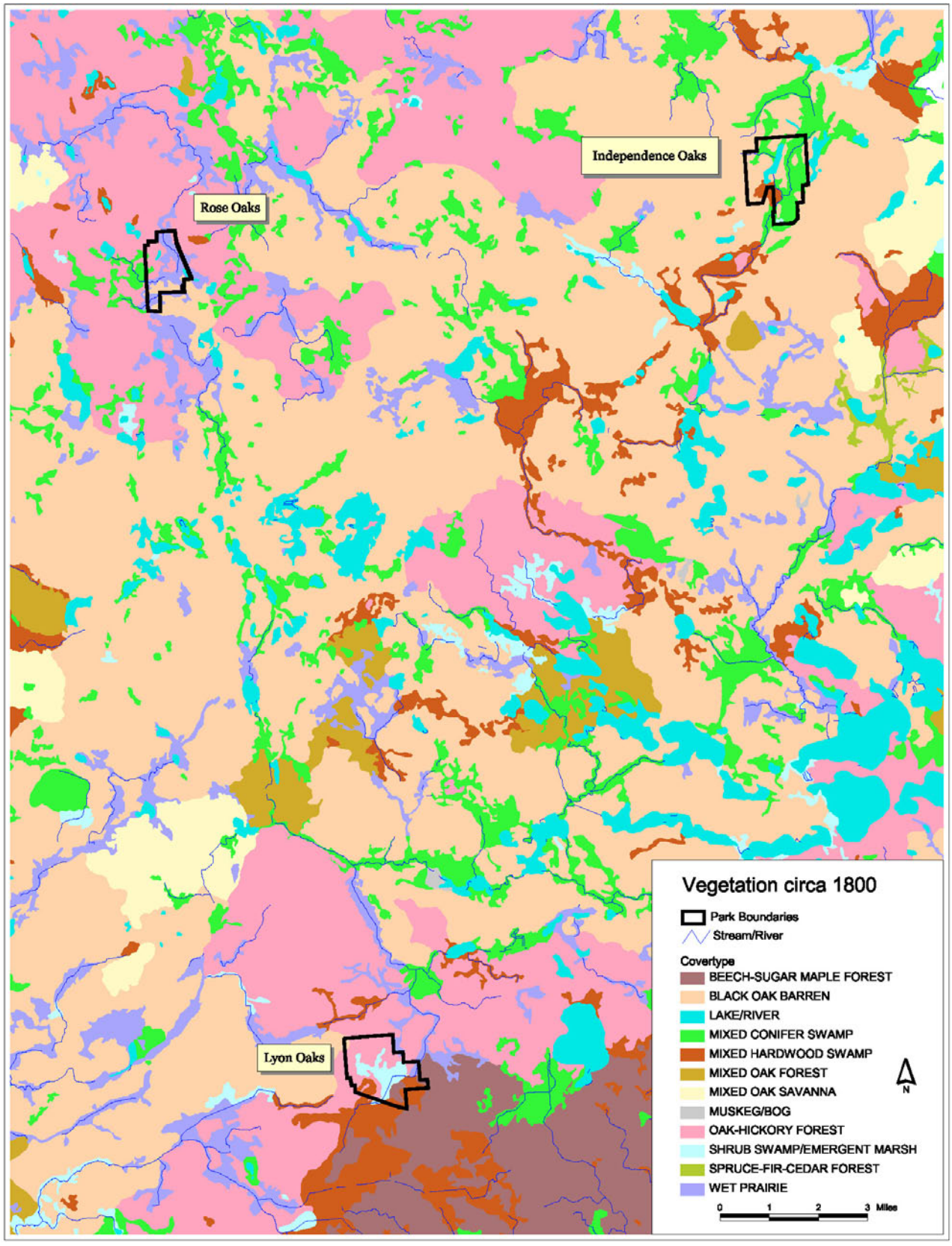

Figure 3. Vegetation *circa* 1800 of Oakland County Parks.

At Rose Oaks, oak barrens occurred in the uplands within the southern portions of the park, while oak-hickory forest occupied the northern, upland areas (Figure 3). The lowlands were predominantly comprised of wet-mesic prairie and associated non-forested wetlands, such as prairie fen, southern wet meadow and emergent marsh. In addition, the presence of tamarack was noted by the surveyor, which indicates that the wetlands also included mixed conifer swamp.

Present Land Cover

The 2000 Land Cover maps (Figures 4–6) were produced by overlaying *circa* 1980 National Wetlands Inventory data over the Southeast Michigan Council of Governments (SEMCOG) 2000 land cover data set. The accuracy of land cover types within each park was further enhanced through interpretation of 1998 aerial photos of each park (Figures 7–9) and ground truthing.

Comparisons between *circa* 1800 vegetation and present land cover reveal dramatic changes across the landscape (Figures 4–9). The most drastic change is the complete loss of oak barrens, which was the most prevalent cover type in the mid-1800s. Nearly all of the oak barrens at these parks (and in the remainder of the Midwest) have been converted to old field (abandoned agricultural fields), recreation areas (golf course, picnic areas, etc.) or have succeeded to closed-canopy oak forest in the absence of natural, periodic fires (Cohen 2001a). The conversion of oak barrens and oak savanna to closed-canopy oak forest was rapid, typically taking place within 30 years following the onset of fire suppression in Wisconsin (Curtis 1959), and likely also in Michigan. The remaining oak-hickory forest is fragmented into many small, isolated areas. Significant blocks of mature oak-hickory forest and beech-sugar maple forest remain in Lyon Oaks, but this forest is now surrounded by old fields, residential and industrial areas, and degraded forest in a largely urban landscape. Exotic species have invaded all structural levels of the upland systems, with the most severe incursions typically occurring in the forest ground layer and understory. Suppression of fire in the fire-dependent wetland systems has resulted in a severe reduction of open wetlands, especially at Rose Oaks, where extensive shrub encroachment has occurred. At Lyon Oaks, the wet prairie, which once occurred in the northeast quarter of the park, has been eliminated. In addition, much of the emergent marsh that remains is dominated by invasive species. The creation of the golf course and highway, which borders the park to the south, has altered drainage conditions within the wetlands, causing increased and sustained flooding. This altered hydrologic regime has resulted in significant tree mortality within the hardwood swamp in the far southern portion of the park.

As the areas surrounding these three Oakland County Parks are being transformed to a semi-urbanized landscape, the parks provide some of the only remaining natural habitats in the region. As development proceeds outside park boundaries, the natural areas within park borders play an increasingly important role in the conservation of regional biodiversity. If development continues at its current rate, Independence Oaks, Lyon Oaks, and Rose Oaks will soon harbor some of the only remaining examples of native ecosystems and species in the vicinity. Protecting and stewarding the remaining natural habitats within these parks is an extremely important component of any long-term strategy for biodiversity conservation in southeast Michigan.

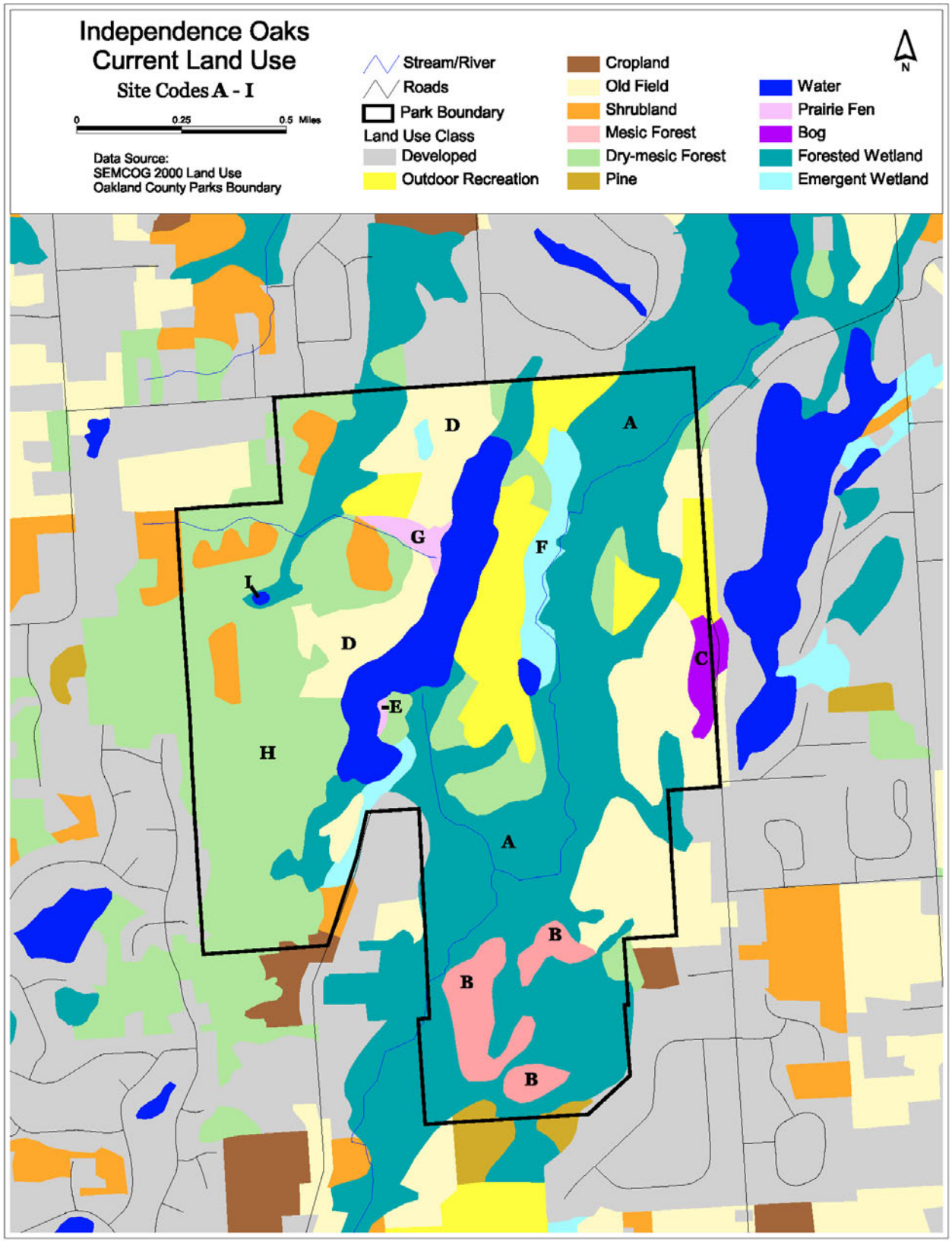

Figure 4. 2000 Land Cover of Independence Oaks.

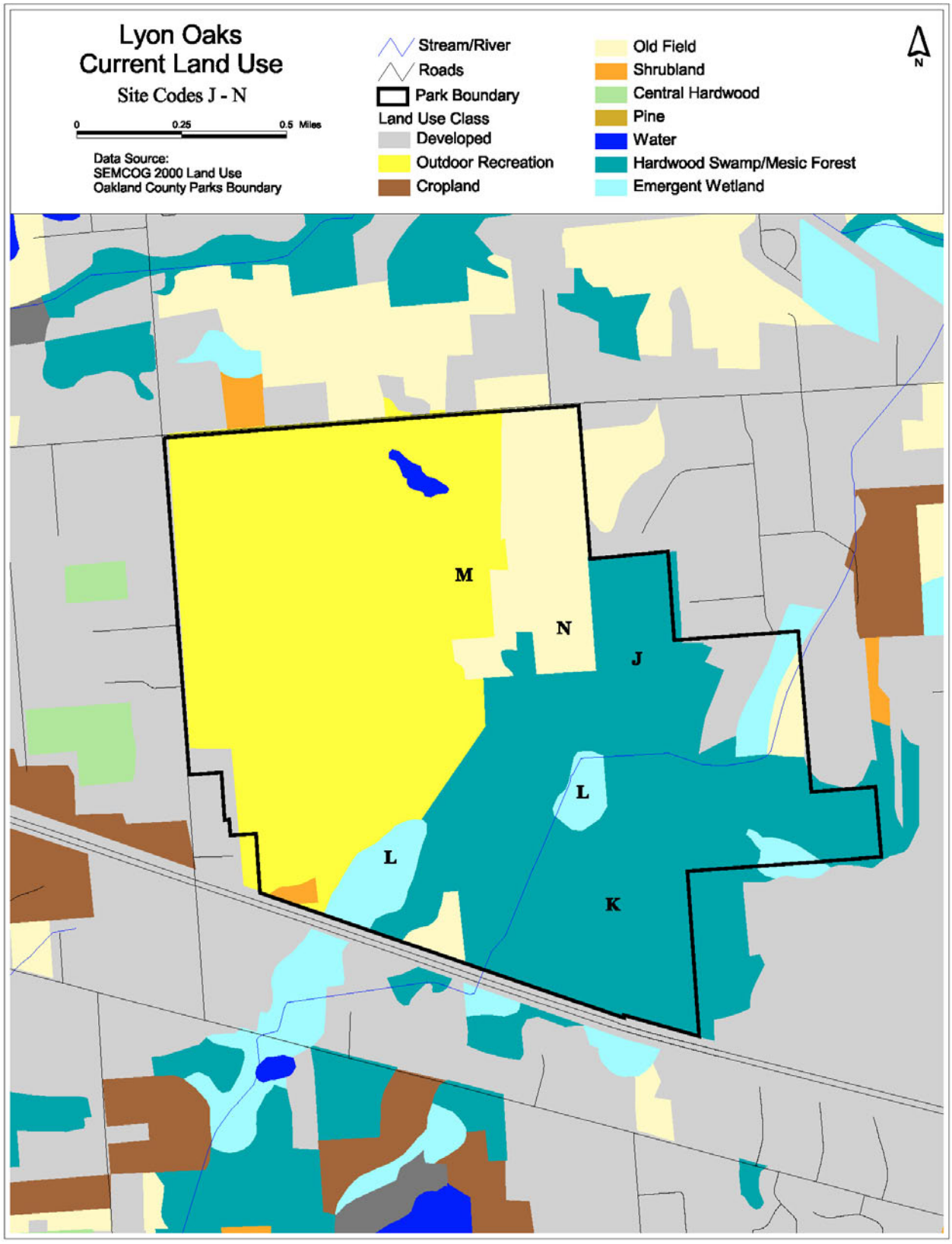

Figure 5. 2000 Land Cover of Lyon Oaks.

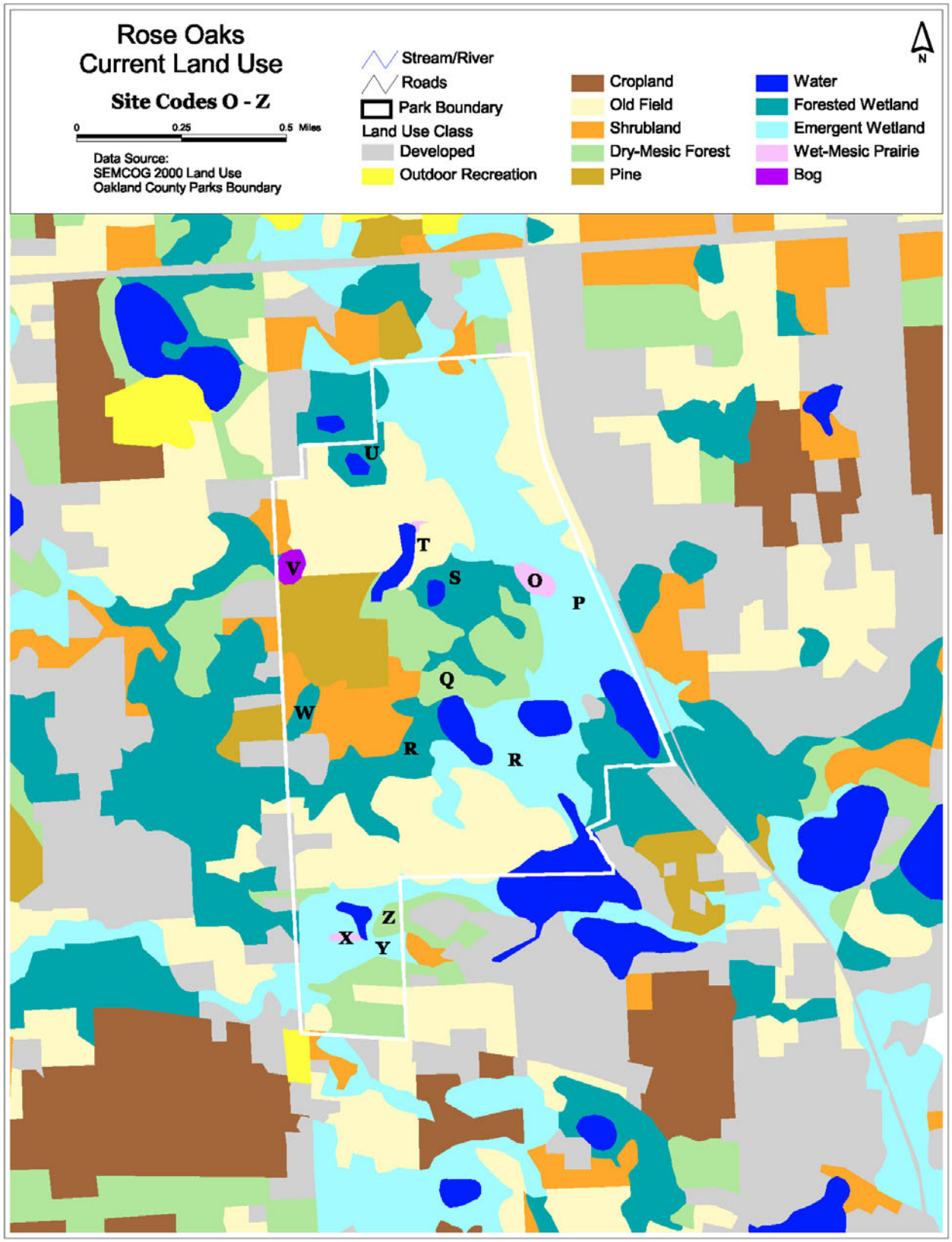

Figure 6. 2000 Land Cover of Rose Oaks.

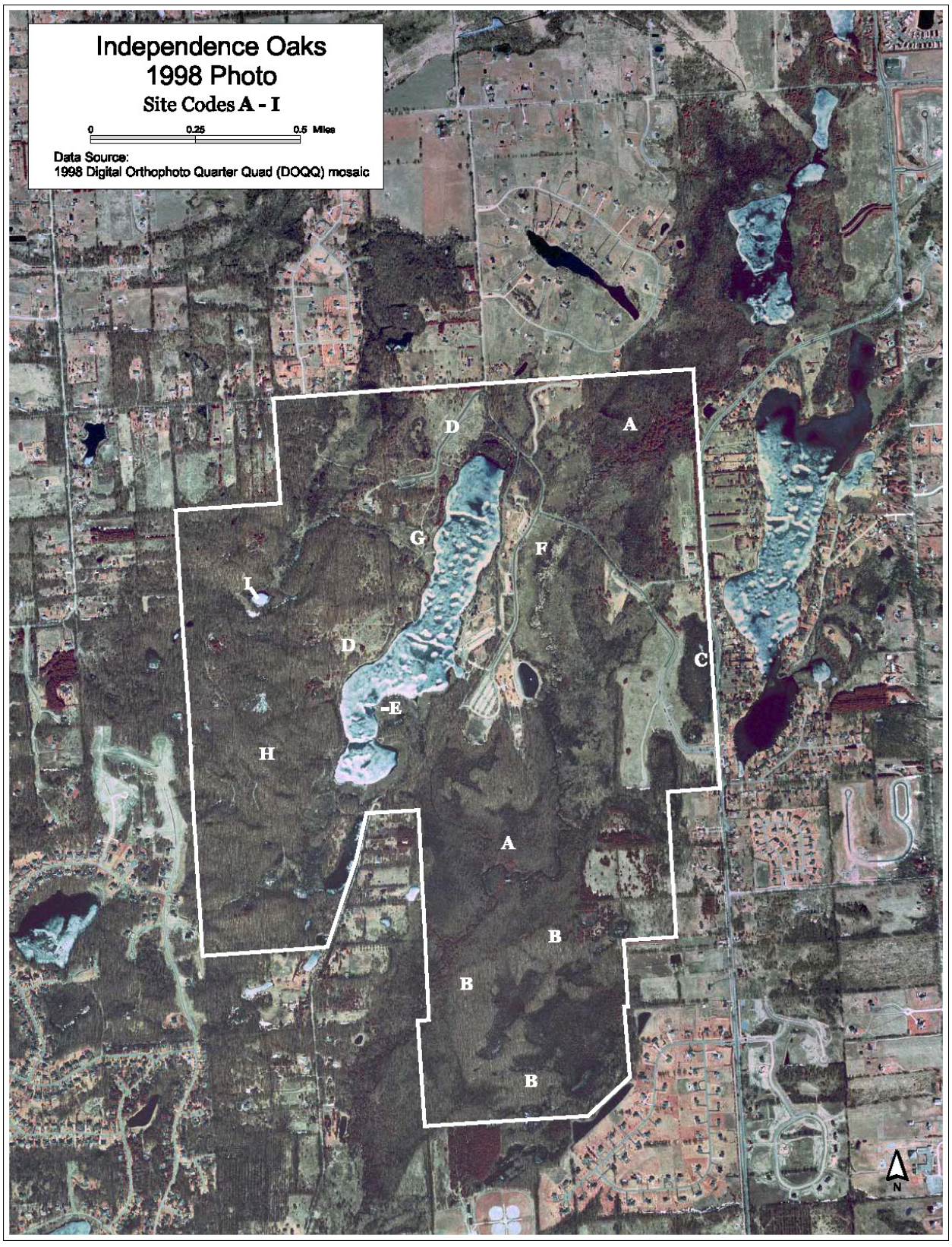

Figure 7. Aerial Photo of Independence Oaks, 1998.

Figure 8. Aerial Photo of Lyon Oaks, 1998.

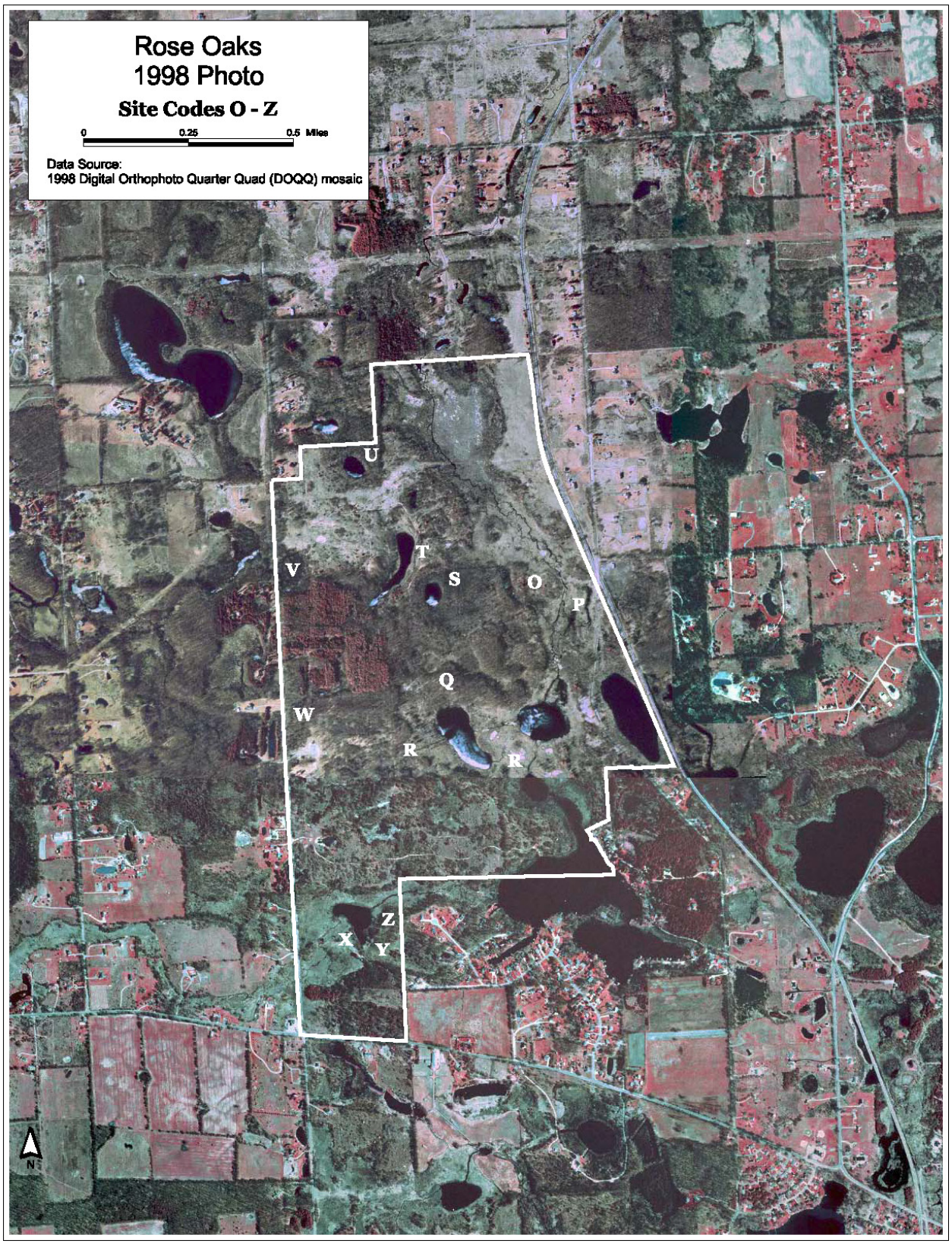

Figure 9. Aerial Photo of Rose Oaks, 1998.

Methods

Natural Communities

Natural community surveys were conducted in conjunction with rare plant surveys. Prior to surveys, aerial photos were interpreted to determine the types of natural communities likely to be present in each of the parks. Field surveys concentrated on identifying high quality natural areas and recording management concerns, such as evidence of excessive deer herbivory, hydrologic manipulation, fire suppression, farming, logging, and invasive species. Species lists were compiled for high quality sites and those deemed to have potential to significantly improve with restoration. Site names and site codes used in the accompanying park maps and photos (Figures 4–9) are listed in Table 1. Partial species lists were recorded for most of the areas visited and are included as appendices for each park (Appendices 1–3). Site summaries were written for all high quality natural communities and for sites thought to have good potential for significant improvement with restoration and management. Species lists for this report were tabulated with the Floristic Quality Assessment Program and species nomenclature follows Herman et al. (2001).

Rare Plant Inventories

Rare plant species were targeted for survey based on the natural communities determined to be present in the park through aerial photo review and known historical and current rare plant distribution patterns within the region. Table 2 lists the rare species, by associated natural community, that were searched for during the surveys. Rare plant inventories were performed by meander survey of appropriate habitat during periods when the plants are most recognizable (usually flowering or fruiting periods).

Table 1. Survey site names and associated site codes for accompanying maps (Figures 4–9).

Park and Site Name	Site Code
Independence Oaks	
Independence Hardwood-Conifer Swamp (HCS)	A
Group Camp Mesic Southern Forest (MSF)	B
Sashabaw Bog (SB)	C
Crooked Lake Barrens (CLB)	D
Crooked Lake Fen (CLF)	E
Clinton River Wet Meadow (CWM)	F
Nature Center Fen (NCF)	G
Oak Ridge Woodland (ORW)	H
Spring Lake Swamp (SLS)	I
Lyon Oaks	
Wixom Woods (WW)	J
Norton Swamp (NS)	K
Lyon Marsh (LM)	L
Pipeline Prairie (PP)	M
Lyon Old Fields (LOF)	N
Rose Oaks	
Rose Oaks Wet-mesic Prairie (ROP)	O
Buckhorn Road Sedge Meadow (BSM)	P
Esler Lake Woodland (EWO)	Q
Esler Lake Wetlands (EWE)	R
Wild Rice Pond (WRP)	S
Richardson Lake East Shore (RES)	T
Golden Pond Swamp (GPS)	U
Fish Lake Road Bog (FLB)	V
Fish Lake Road Tamaracks (FLT)	W
Beaver Dam Wet-Mesic Prairie (BDP)	X
Beaver Pond Wet Meadow (BPM)	Y
White Oak Knoll (WOK)	Z

Table 2. Rare plants sought by associated natural communities. Status abbreviations are as follows: E, state endangered; LT, federally threatened; T, state threatened; SC, state special concern.

Community	Scientific Name	Common Name	State Status
Mesic Southern Forest			
	Castanea dentata	American chestnut	E
	Aristolochia serpentaria	Virginia snakeroot	T
	Carex oligocarpa	Eastern few-fruited sedge	T
	Carex platyphylla	broad-leaved sedge	T
	Dentaria maxima	large toothwort	T
	Galearis spectabilis	showy orchis	T
	Gentianella quinquefolia	stiff gentian	T
	Hybanthus concolor	green violet	T
	Hydrastis canadensis	goldenseal	T
	Panax quinquefolius	ginseng	T
	Polymnia uvedalia	large-flowered leaf-cup	T
	Spiranthes ovalis	lesser ladies'-tresses	T
	Tipularia discolor	cranefly orchid	T
	Trillium recurvatum	prairie trillium	T
	Triphora trianthophora	three-birds orchid	T
	Adlumia fungosa	climbing fumitory	SC
	Jeffersonia diphylla	twinleaf	SC
	Liparis liliifolia	purple twayblade	SC
Southern Swamp			
	Isotria medeoloides	smaller whorled pogonia	E, LT
	Plantago cordata	heart-leaved plantain	E
	Populus heterophylla	swamp cottonwood	E
	Dryopteris celsa	log fern	T
	Eupatorium fistulosum	hollow-stemmed joe-pye-weed	T
	Isotria verticillata	whorled pogonia	T
	Poa paludigena	bog bluegrass	T
	Cuscuta glomerata	rope dodder	SC
	Lysimachia hybrida	swamp candles	SC
Prairie Fen			
	Berula erecta	cut-leaved water-parsnip	T
	Cypripedium candidum	small white lady’s-slipper	T
	Muhlenbergia richardsonis	mat muhly	T
	Phlox maculata	spotted phlox	T
	Polemonium reptans	Jacob’s ladder	T
	Sanguisorba canadensis	Canadian burnet	T
	Valeriana edulis var. *ciliata*	edible valerian	T
	Sporobolus heterolepis	prairie dropseed	SC

Table 2, continued. Rare plants sought by associated natural communities. Status abbreviations are as follows: E, state endangered; LT, federally threatened; T, state threatened; SC, state special concern.

Community	Scientific Name	Common Name	State Status
Dry sand prairie			
	Panicum leibergii	Leiberg's panic-grass	T
	Ruellia humilis	hairy ruellia	T
	Solidago missouriensis	Missouri goldenrod	T
	Trichostema brachiatum	false pennyroyal	T
	Trichostema dichotomum	bastard pennyroyal	T
	Penstemon pallidus	pale beard-tongue	SC
	Tradescantia virginiana	Virginia spiderwort	SC
	Triplasis purpurea	sand grass	SC
Dry-Mesic Southern Forest			
	Eupatorium sessilifolium	upland boneset	T
	Angelica venenosa	hairy angelica	SC
	Celtis tenuifolia	dwarf hackberry	SC
	Quercus shumardii	Shumard's oak	SC

MNFI inventories in Oakland County Parks located two rare plant species: bog bluegrass (*Poa paludigena*), left; and purple twayblade orchid (*Liparis liliifolia*), right. Photos by Sue R. Crispin (bog bluegrass) and Jim Stasz @ USDA-NRCS PLANTS Database (purple twayblade orchid).

Results

The surveys identified four new element occurrences (EOs). (All state and federally listed rare species and high quality natural communities are referred to as elements and their occurrence at a specific location is referred to as an element occurrence or EO.) In addition, the presence of two previously identified element occurrences was reconfirmed.

Two of the new Eos were high quality natural communities. In addition, natural community survey results were used to update information on two previously identified exemplary natural communities (Table 3). Surveys for rare plants resulted in two new element occurrences (Table 4). It is possible that additional rare species may be found in the future, especially with active restoration and management. All new natural community and rare plant occurrences have been entered into the statewide database (Biotics) managed by MNFI, and all previously existing records have been updated.

Natural Community Inventory Results

The natural community surveys resulted in the identification of two new natural community element occurrences, a bog at Independence Oaks (Figures 4 and 7, Site C) and a wet-mesic prairie at Rose Oaks (Figures 6 and 9, Site O). In addition, four natural community element occurrences, first identified at Independence Oaks in 1981, were resurveyed—a hardwood-conifer swamp (Site A), a mesic southern forest (Site B), a prairie fen (Site E), and a landscape complex, a broad category that MNFI formerly used to classify areas with a mix of upland and wetland communities, and under which much of Independence Oaks was classified. At each of the resurveyed sites, the community boundaries were remapped and information was recorded on vegetation composition, tree sizes, soil, and management concerns. As a result of this effort, the prairie fen EO was removed from MNFI Statewide Database because it is no longer considered viable, as it is completely covered by dense shrub-carr, much of which supports primarily glossy buckthorn (*Rhamnus frangula*), an aggressive invasive shrub. The landscape complex EO was removed because no longer tracks landscape complexes.

In addition to the natural community element occurrences, each park possesses multiple natural areas that are important to protect and steward because they provide significant wildlife habitat and harbor critical components of biodiversity. With restoration and management, these natural areas have great potential for becoming high quality natural communities and contributing significantly to regional biodiversity in southeast Michigan. The high quality natural communities and sites with good potential for restoration are listed in Table 4, along with their associated stewardship needs.

Invasive species were noted as a management concern within all sites discussed in this report. A total of 71 invasive species were observed within the three parks. Of these, 23 species are of particular concern because of their ability to quickly colonize new sites, outcompete native plants, and erode biodiversity (Table 5). These are the species on which aggressive management efforts should focus.

Rare Plant Inventories

Rare plant surveys resulted in the location of two new rare plant occurrences at Independence Oaks (Table 4): bog bluegrass (*Poa paludigena*) and purple twayblade (*Liparis liliifolia*). Bog bluegrass was found in a small portion of the extensive hardwood-conifer swamp along the Clinton River headwaters, and a small colony of purple twayblade was discovered in a degraded oak barrens north of the Nature Center. No rare plants were found at Lyon Oaks or Rose Oaks.

Table 3. Natural Community Occurrences.

Community	Site Name (used for report)	First Observed	Last Observed	Park
Hardwood-conifer swamp	Independence Hardwood-Conifer Swamp	1981	2005	Independence Oaks
Mesic southern forest	Group Camp Mesic Southern Forest	1981	2005	Independence Oaks
Bog	Sashabaw Road Bog	2005	2005	Independence Oaks
Wet-mesic prairie	Rose Oaks Wet-mesic Prairie	2005	2005	Rose Oaks

Table 4. Rare Plant Occurrences.

Species	Site Name	Status	First Observed	Last Observed	EO#	Park
Poa paludigena bog bluegrass	Clinton River Hardwood-Conifer Swamp	T	2004	2004	28	Independence Oaks
Liparis liliifolia purple twayblade orchid	Independence Oaks Oak Barrens	SC	2004	2004	19	Independence Oaks

Table 5. Management recommendations for high quality natural communities and sites with good potential for improvement through restoration and management.

Park Site Code/Site Name		Community Type	Management Recommendations
Independence Oaks			
A	Independence Hardwood-Conifer Swamp	Hardwood-conifer swamp	- remove invasive species - reduce deer densities - selectively remove red maple around conifers
B	Group Camp Mesic Southern Forest	Mesic southern forest	- remove invasive species - reduce deer densities
C	Sashabaw Bog	Bog	- remove invasive species - reduce shrub and tree cover - implement prescribed fire program - reduce deer densities
D	Crooked Lake Barrens	Potential oak barrens and woodland prairie restoration site	- remove invasive species - reduce shrub and tree cover - plant native prairie species - implement prescribed fire program - reduce deer densities

Table 5, continued. Management recommendations for high quality natural communities and sites with good potential for improvement through restoration and management.

Park	Site Name	Community Type	Management Recommendations
Independence Oaks			
E	Crooked Lake Fen	Prairie fen	- remove invasive species - reduce shrub and tree cover - implement prescribed fire program - reduce deer densities
F	Clinton River Wet Meadow	Wet-mesic prairie, southern wet meadow, and southern shrub-carr	- remove invasive species - reduce shrub and tree cover - implement prescribed fire program - reduce deer densities
G	Nature Center Fen	Prairie fen	- remove invasive species - reduce shrub and tree cover - implement prescribed fire program - reduce deer densities
H	Oak Ridge Woodland	Dry-mesic southern forest	- remove invasive species - remove red maple - implement prescribed fire program - reduce deer densities
I	Spring Lake Swamp	Relict conifer swamp	- remove invasive species - remove red maple near oaks - reduce deer densities
Lyon Oaks			
J	Wixom Woods	Mesic southern forest, and dry-mesic southern forest	- remove invasive species - reduce deer densities
K	Norton Swamp	Southern swamp, mesic southern forest, and dry-mesic southern forest	- remove invasive species - reduce deer densities
L	Lyon Marsh	Emergent marsh and southern wet meadow	- remove invasive species - reduce deer densities
M	Pipeline Prairie	Wet-mesic prairie	- remove invasive species - implement prescribed fire program - reduce deer densities

Table 5, continued. Management recommendations for high quality natural communities and sites with good potential for improvement through restoration and management.

Park	Site Name	Community Type	Management Recommendations
Rose Oaks			
O	Rose Oaks Wet-mesic Prairie	Wet-mesic prairie	- remove invasive species - reduce shrub and tree cover - implement prescribed fire program - reduce deer densities
P	Buckhorn Road Sedge Meadow	Southern wet meadow	- remove invasive species - reduce shrub and tree cover - implement prescribed fire program - reduce deer densities
Q	Esler Lake Woodland	Dry-mesic southern forest	- remove invasive species - remove red maple - implement prescribed fire program - reduce deer densities
R	Esler Lake Wetlands	Southern wet meadow, southern shrub-carr, and relict conifer swamp	- remove invasive species - reduce shrub and tree cover - implement prescribed fire program - reduce deer densities
S	Wild Rice Pond	Southern swamp	- remove invasive species - selectively remove red maple around conifers - reduce deer densities
T	Richardson Lake East Shore	Wet-mesic prairie and degraded oak barrens	- remove invasive species - reduce shrub and tree cover - plant native prairie species - implement prescribed fire program - reduce deer densities
U	Golden Pond Swamp	Southern swamp	- remove invasive species - reduce deer densities
V	Fish Lake Road Bog	Bog	- remove invasive species - reduce shrub and tree cover - reduce deer densities
W	Fish Lake Road Tamaracks	Relict conifer swamp	- remove invasive species - remove red maple near tamaracks - reduce deer densities
X	Beaver Dam Wet-mesic Prairie	Wet-mesic prairie	- remove invasive species - reduce shrub and tree cover - implement prescribed fire program - reduce deer densities

Table 5, continued. Management recommendations for high quality natural communities and sites with good potential for improvement through restoration and management.

Park	Site Name	Community Type	Management Recommendations
Rose Oaks			
Y	Beaver Pond Wet Meadow	Southern wet meadow	- remove invasive species - reduce shrub and tree cover - implement prescribed fire program - reduce deer densities
Z	White Oak Knoll	Dry-mesic southern forest	- remove invasive species - remove red maple - implement prescribed fire program - reduce deer densities

Table 6. Invasive species with high potential to harm biodiversity, by park.

SCIENTIFIC NAME	COMMON NAME	PHYSIOG-NOMY	Independence Oaks	Lyon Oaks	Rose Oaks
Acer platanoides	Norway maple	Ad Tree	-	x	-
Alliaria petiolata	garlic mustard	Ad B-Forb	-	x	-
Berberis thunbergii	Japanese barberry	Ad Shrub	x	x	x
Celastrus orbiculata	Oriental bittersweet	Ad W-Vine	x	-	x
Centaurea maculosa	spotted bluet	Ad B-Forb	x	-	x
Elaeagnus umbellata	autumn-olive	Ad Shrub	x	x	x
Lonicera maackii	Amur honeysuckle	Ad Shrub	-	x	x
Lonicera morrowii	Morrow honeysuckle	Ad Shrub	-	-	x
Lonicera tatarica	smooth Tartarian honeysuckle	Ad Shrub	-	x	-
Lythrum salicaria	purple loosestrife	Ad P-Forb	x	x	x
Melilotus alba	white sweet-clover	Ad B-Forb	x	x	-
Melilotus officinalis	yellow sweet-clover	Ad B-Forb	-	x	x
Phalaris arundinacea	reed canary grass	Nt P-Grass	x	-	-
Phragmites australis	reed	Nt P-Grass	x	-	-
Polygonum cuspidatum	Japanese knotweed	Ad P-Forb	-	-	x
Rhamnus cathartica	common buckthorn	Ad Tree	x	x	-
Rhamnus frangula	glossy buckthorn	Ad Shrub	x	x	x
Robinia pseudoacacia	black locust	Ad Tree	-	-	x
Rosa multiflora	multiflora rose	Ad Shrub	x	x	x
Typha angustifolia	narrow leaved cat-tail	Ad P-Forb	x	-	-
Viburnum opulus	European highbush-cranberry	Ad Shrub	-	x	x
Vincetoxicum nigrum	black swallow-wort	Ad P-Forb	x	-	-
Vincetoxicum rossicum	white swallow-wort	Ad P-Forb	-	-	x
Total			**13**	**13**	**14**

Site Summaries and Management Recommendations

Independence Oaks County Park

Independence Hardwood-Conifer Swamp (Site Code: A)

A natural community element occurrence of hardwood-conifer swamp occupies an area along a headwater stream of the Clinton River in both the northeastern and southeastern portions of the park. A rare (state threatened) species of grass, bog bluegrass (*Poa paludigena*), was observed growing on moss-covered logs within the swamp. The swamp occurs on organic soils (e.g., sapric peat or muck) within a poorly drained outwash plain, and contains several low-gradient islands of sandy, gravelly soil that support a variety of species that favor mesic sites, including sugar maple (*Acer saccharum*), American beech (*Fagus grandifolia*), red oak (*Quercus rubra*), and tulip tree (*Liriodendron tulipifera*). The overstory of the swamp is characterized by a mixture of hardwood and conifer species. While hardwoods dominate most of the swamp, northern white-cedar (*Thuja occidentalis*) and white pine (*Pinus strobus*) are locally dominant, especially near the headwater stream; and tamarack (*Larix laricina*) was occasionally observed here as well. In the northern portions of the park, northern white-cedar and white pine have reached an impressive size for lowland conifers of this region today, with cedars measuring from 40 to 56 cm (16 to 22 inches) diameter at breast height (dbh), and pines from 43 to 48 cm (17 to 19 inches) dbh. In addition the conifer species mentioned above, the swamp provides habitat for 16 additional hardwood tree species, with dominance primarily assumed by black ash (*Fraxinus nigra*), yellow birch (*Betula alleghaniensis*), and red maple (*Acer rubrum*). A wide variety of wetland shrubs characteristic of conifer swamps were observed, including poison sumac (*Toxicodendron vernix*), smooth highbush blueberry (*Vaccinium corymbosum*), Michigan holly (*Ilex verticillata*), silky dogwood (*Cornus amomum*), gray dogwood (*Cornus foemina*), pussy willow (*Salix discolor*), and spicebush

The Independence Hardwood-Conifer Swamp (Site A) at Independence Oaks supports a population of large-diameter northern white-cedar (*Thuja occidentalis*, front) and white pine (*Pinus strobus*, back). Regeneration of these species and other conifers, such as tamarack (*Larix laricina*), is lacking due to excessive browsing by deer and the abundance of red maple, which creates dense shade and blocks sunlight needed by conifer seedlings and saplings.

(*Lindera benzoin*). The swamp supports a particularly diverse ground flora, rich with native species: 10 species of grass; 11 species of sedges; 15 species of ferns; and over 60 species of forbs. Several species are notable because of their affinity for high quality sites (Appendix 1): bog bluegrass (*Poa paludigena*); rattlesnake grass (*Glyceria canadensis*); spikenard (*Aralia racemosa*); richweed (*Collinsonia canadensis*); bishop's cap (*Mitella diphylla*); naked miterwort (*Mitella nuda*); broad beech fern (*Thelypteris hexagonoptera*); long-awned wood grass (*Brachyelytrum erectum*); wood reedgrass (*Cinna arundinacea*); and small yellow lady's-slipper (*Cypripedium calceolus* var. *parviflorum*).

Many of the northern white-cedar and tamarack trees were overtopped by hardwoods and were shade-pruned or had died as a result of competition for sunlight with the broad-leaved

hardwoods. Tamarack, which is especially intolerant of dense shade, has experienced extensive mortality with very few individuals still alive. While none of these conifers are tolerant of dense shade, both cedar and white pine can remain competitive within the tree canopy for many years, sometimes reaching an age of over 500 years. In many ecosystems, the present canopy cohort of these species established after a large-scale disturbance event that severely reduced canopy coverage, such as a catastrophic fire, windstorm, or ice storm. Today, their regeneration is limited by both competition from hardwoods, especially red maple, and an excessively high deer population. Intense browsing pressure by deer was observed, with a browse line present on northern white-cedar. Many herbaceous species also appeared browsed, and deer scat was frequently observed.

Management for the site should include removing invasive species, reducing local deer densities, and increasing the amount of sunlight available to conifers by selectively girdling red maples that are growing near conifers. Invasive species observed within the site include glossy buckthorn (*Rhamnus frangula*), common buckthorn (*Rhamnus cathartica*), multiflora rose (*Rosa multiflora*), autumn-olive (*Elaeagnus umbellata*), Japanese barberry (*Berberis thunbergii*), and bittersweet nightshade (*Solanum dulcamara*). While all of these threaten to outcompete native vegetation and erode biodiversity, glossy buckthorn has proven to be particularly aggressive in this type of habitat. Therefore, a concerted and sustained effort to eradicate this shrub within this site and throughout the park should be undertaken before it becomes widely established. To prevent resprouting, all cut stems should be treated with an herbicide approved for wetlands. Increasing the amount of sunlight received by the lowland conifers (northern white-cedar, white pine, and tamarack) can be achieved by girdling red maples that are growing near these species. Substantially reducing the local deer population will also help retain the conifers and allow floristic diversity to be maintained.

Group Camp Mesic Southern Forest (Site Code: B)

Toward the southern portion of Independence Hardwood-Conifer Swamp, near the Group Camp, several low uplands rise like islands from the surrounding forested wetlands. These uplands support an old-growth mesic southern forest, which has been entered as a community element occurrence in the MNFI statewide database. Although much of the park was timbered at the time of settlement in the region, this section of the park shows no evidence of having been harvested. Previous research on this site estimated that some of the large trees were between 200 and 300 years old. Red oak (*Quercus rubra*) and white ash (*Fraxinus americana*) dominating the canopy were measured at over 70 cm (28 inches) dbh. Other large overstory tree species include sugar maple (*Acer saccharum*), American beech (*Fagus grandifolia*), basswood (*Tilia americana*), tulip tree (*Liriodendron tulipifera*), and bitternut hickory (*Carya cordiformis*). Understory and sapling trees were rare, but included beech, sugar maple, red maple, and ironwood (*Ostrya virginiana*). Characteristic groundcover species that were observed include trillium (*Trillium grandiflorum*), two-leaved toothwort (*Dentaria diphylla*), dwarf ginseng (*Panax trifolia*), Solomon's-seal (*Polygonatum pubescens*), leatherwood (*Dirca palustris*), maidenhair fern (*Adiantum pedatum*), Christmas fern (*Polystichum acrostichoides*), and broad beech fern (*Thelypteris hexagonoptera*). Although several characteristic herbaceous species are present, the site has a surprisingly low density of groundcover plants, even early in the year when spring wildflowers should be most abundant. Flowering individuals, particularly of trillium, Solomon's-seal, and two-leaved toothwort, were virtually absent with only small, sterile individuals present. The scant cover within the ground layer and lack of flowering plants is likely the result of an unsustainably high deer population, which results in excessive browsing.

Little site-specific management is needed to protect the Group Camp Mesic Southern Forest, other than reducing the high deer population. Although no invasive species were found, this

habitat is especially susceptible to invasive plants, such as garlic mustard (*Allaria petiolata*). Thus, surveys for garlic mustard and other invasive species (e.g., Dame's rocket, *Hesperis matronalis*) should be conducted annually within the mesic forest and surrounding areas, and colonies of invasive species should be removed before they become well established. Annual monitoring and removal of small populations of invasive species requires little time and effort and is thus extremely cost effective, as opposed to implementing control efforts after invasions have become severe and biodiversity has been significantly eroded.

Sashabaw Road Bog (Site Code: C)

A small bog, which qualifies as a natural community element occurrence, occurs near the park entrance in the far eastern portion of the park along Sashabaw Road. The bog borders an old field to the west and south within the park, and a private home and adjacent lawn to the north. The ground layer of the bog is completely dominated by sphagnum mosses, which is characteristic of bog communities. Other ground-layer species of interest include bog rosemary (*Andromeda glaucophylla*), sedge (*Carex trisperma*), three-way sedge (*Dulichium arundinaceum*), round leaved sundew (*Drosera rotundifolia*), tawny cotton grass (*Eriophorum virginicum*), Canadian rush (*Juncus canadensis*), large cranberry (*Vaccinium macrocarpon*), and Virginia chain fern (*Woodwardia virginica*). Large areas of the bog are dominated by a diverse array of shrub species, which include black chokeberry (*Aronia prunifolia*), bog birch (*Betula pumila*), buttonbush (*Cephalanthus occidentalis*), leatherleaf (*Chamaedaphne calyculata*), water willow (*Decodon verticillatus*), Michigan holly (*Ilex verticillata*), swamp rose (*Rosa palustris*), poison sumac (*Toxicodendron vernix*), and smooth highbush blueberry (*Vaccinium corymbosum*). A small lake occurs in the northeastern portion of the bog and is hidden from view by the surrounding conifers, which include black spruce (*Picea mariana*), tamarack (*Larix laricina*), and white pine (*Pinus strobus*). As one approaches the lake, the footing becomes somewhat treacherous, as a semi-stable substrate gives way to a quaking mat of roots and moss overlaying water. Because of its unique species composition and acidic, organic soil, the bog adds significantly to the diversity of habitats found within Independence Oaks. Glossy buckthorn (*Rhamnus frangula*) was the only invasive species observed during the surveys.

Management of Sashabaw Road Bog should include removal of glossy buckthorn, which can quickly colonize large portions of wetlands. Monitoring for additional invasive species and new colonies of glossy buckthorn should be conducted annually. When invasives are found they should be promptly removed before they spread further. Applying herbicides approved for use in wetlands to cut stumps of glossy buckthorn and other woody invasives will be critical to control efforts. Sashabaw Road Bog once occurred within a fire-dependent landscape dominated by oak barrens. Thus, it is very likely that fire occasionally burned across the surface of the bog, significantly reducing shrub and tree cover. Consideration should be given to reintroducing fire to the bog and adjacent uplands, through prescription burning, and restoring the adjacent uplands to oak barrens to improve the bog's landscape setting.

Crooked Lake Barrens (Site Code: D)

A remnant oak barrens occurs within the western portions of the park on a coarse-textured end moraine with well-drained, low-nutrient soils. Small prairie-like openings that support native prairie plants along with large, scattered open-grown oak trees provide a window into the past and the ecosystems that once characterized much of northern Oakland County in the early 1800s. These prairie-like openings occur throughout the area surrounding the Nature Center, along western shores of Crooked Lake, and upon a high end moraine overlooking a small wetland south of Crooked Lake. The presence of large ant mounds within many of the openings is another link to the past, indicating that oak barrens and a prairie flora once thrived here. The overstory canopy is sparse in these openings, and is typically dominated by black oak (*Quercus velutina*). Over the past 50 to 100 years, many of the oak barrens in the park have filled in with young trees and tall shrubs such as American elm (*Ulmus americana*), black cherry (*Prunus serotina*), gray dogwood (*Cornus*

foemina), and hazelnut (*Corylus americana*) as well as invasive shrubs like autumn-olive (*Elaeagnus umbellata*) and multiflora rose (*Rosa multiflora*). In the remaining openings, a strong compliment of native ground flora is mixed with invasive plants of old fields. Some characteristic native prairie species include bush-clovers (*Lespedeza capitata*, *L. hirta*, and *L. virginiana*), goldenrods (*Solidago speciosa* and *S. nemoralis*), asters (*Aster oolentangiensis* and *A. ericoides*), rough blazing star (*Liatris aspera*), and northern dewberry (*Rubus flagellaris*), as well as grasses, such as poverty grass (*Danthonia spicata*), little bluestem (*Andropogon scoparius*), and occasional clumps of big bluestem (*Andropogon gerardii*). Also occurring in the degraded oak barrens north of the Nature Center is a small colony of the purple tway-blade orchid (*Liparis liliifolia*), a species of special concern in Michigan. Unfortunately, much of the remnant oak barrens is degraded by the prevalence of invasive species. Invasive species observed at the site include spotted knapweed (*Centaurea maculosa*), white sweet-clover (*Melilotus alba*), St. John's-wort (*Hypericum perforatum*), sheep sorrel (*Rumex acetosella*), quack grass (*Agropyron repens*), brome grass (*Bromus inermis*), orchard grass (*Dactylis glomerata*), and timothy (*Phleum pratense*).

Management of the remnant oak barrens should focus on removing invasive species and reducing tree and shrub cover. The maintenance and expansion of small openings that support native prairie species should serve as the focal point for initial ecological restoration efforts because these areas harbor species with a direct, genetic link to the past flora of the site. At present, shrubs and small trees are encroaching on these small openings and should be removed. Combining shrub and tree removal with prescribed burning will stimulate native species, and over time, will help reduce the prevalence of exotic grasses and forbs. Some hand-pulling of troublesome invasive plants, such as white sweet-clover, may also be necessary. Initial management efforts should focus on sites with the greatest potential for recovery, such as the large openings adjacent to the Oldfield Trail and the area south of the Nature Center.

Crooked Lake Fen (Site Code: E)

A small prairie fen occurs at the base of several steep-sided, gravelly knolls along the southeastern shore of Crooked Lake. The fen, which is underlain by marl deposits, is just barely elevated above the lake and has likely been inundated for long periods in the past, whenever beaver dams blocked the outflow of Crooked Lake. Thus, the development of a marl substrate, which forms in shallow water, was likely influenced by historical beaver activity. In addition to occasional flooding by beaver, cold calcareous groundwater seeps occur within the fen, further facilitating the formation of marl, and providing habitat for the unique assemblage of plants that characterize the site. Plant species indicative of prairie fen that occur at the site include the following: sedge (*Carex sterilis*), twig rush (*Cladium mariscoides*), spike rush (*Eleocharis rostellata*), bog lobelia (*Lobelia kalmii*), whorled loosestrife (*Lysimachia quadriflora*), beak-rush (*Rhynchospora capillacea*), false asphodel (*Tofieldia glutinosa*), Ohio goldenrod (*Solidago ohioensis*), Riddell's goldenrod (*Solidago riddellii*), shrubby cinquefoil (*Potentilla fruticosa*), hoary willow (*Salix candida*), alder-leaved buckthorn (*Rhamnus alnifolia*), poison sumac (*Toxicodendron vernix*), and tamarack (*Larix laricina*). Unfortunately, in addition to a diverse

From the southernmost boat dock on Crooked Lake, one can view Crooked Lake Fen (Site E), a small marl fen in Independence Oaks that hosts a unique and diverse assemblage of plant and animal species (Spieles et al., 1999).

array of native wetland plants, glossy buckthorn (*Rhamnus frangula*), a pernicious invasive shrub, also occurs within the fen. As fire suppression and removal of beaver have resulted in tree and shrub colonization over much of the wetland, only the wettest portions of the fen remain non-forested today.

Management of the site should focus on removing invasive species, especially glossy buckthorn, from the fen and surrounding forests. In addition to invasive species control, tree and shrub cover should be reduced within the fen to prevent the area from becoming completely forested. In the past, surface fires frequently moved through the adjacent oak forest (historically oak barrens) that occurs on the gravelly knolls adjacent to the fen. These fires likely carried through the fen and, along with beaver flooding, prevented the establishment of a swamp forest at the site. Reintroducing fire to these oak knolls, with the long-term goal of restoring oak barrens, and allowing fire to burn across the fen, will facilitate the long-term maintenance of this biologically rich and unique landscape complex.

Clinton River Wet Meadow (Site Code: F)

A diverse wetland complex occurs within the floodplain of the Clinton River, east of the Water's Edge Picnic Area. The wetland contains several distinct ecological zones, each supporting a different plant community, including wet-mesic prairie (Albert and Kost 1998), southern wet meadow, and southern shrub-carr . A small area of wet-mesic prairie occurs on mineral soil (e.g., sandy loam over clay) along the entrance road within the northern portion of the wetland. This area is dominated by sedges and grasses and contains a diverse array of forbs. Species observed within the wet-mesic prairie-dominated portion of the wetland include many of the same species found within prairie fens, including sedges (*Carex buxbaumii, C. tetanica, C. sartwellii, C. stricta*), cordgrass (*Spartina pectinata*), slender wheat grass (*Agropyron trachycaulum*), big bluestem (*Andropogon gerardii*), fringed brome (*Bromus ciliatus*), grass-of-parnassus (*Parnassia glauca*), swamp-betony (*Pedicularis lanceolata*) small yellow lady's-slipper (*Cypripedium calceolus* var. *parviflorum*), Riddell's goldenrod (*Solidago riddellii*), tall flat-top white aster (*Aster umbellatus*), tall sunflower (*Helianthus giganteus*), pale spiked lobelia (*Lobelia spicata*), and purple gerardia (*Agalinis purpurea*). Large ant mounds are common within the wet-mesic prairie. South of the wet-mesic prairie is a long, narrow stretch of southern wet meadow dominated by tussock sedge (*Carex stricta*). The best developed portion of the southern wet meadow lies under the power lines that cross the wetland. This portion of the wet meadow occurs on organic soil, which is underlain by a layer of clay at a depth of 1.4 meters (55 inches). High water levels and periodic removal of shrubs and trees as part of power line right-of-way maintenance have kept this portion of the wetland from converting to southern shrub-carr. Both the wet-mesic prairie and southern wet meadow are bordered by southern shrub-carr. Abundant shrub species found within the shrub-carr and remainder of the wetland include silky dogwood (*Cornus amomum*), red-osier dogwood (*Cornus stolonifera*), gray dogwood (*Cornus foemina*), nannyberry (*Viburnum lentago*), and ninebark (*Physocarpus opulifolius*).

Management of the wetland should include removing invasive species, reducing shrub and tree encroachment within the wet-mesic prairie and southern wet meadow, and prescribed burning. In addition, park maintenance staff should avoid dumping or blowing leaves into the wetland, as the accumulation of thick leaf litter smothers native plants and prevents seed germination and seedling establishment. The following invasive species that were observed within the wetland pose a serious threat to ecological integrity because of their ability to rapidly colonize new areas and outcompete native plants: glossy buckthorn (*Rhamnus frangula*); common buckthorn (*Rhamnus cathartica*); autumn-olive (*Elaeagnus umbellata*); black swallow-wort (*Vincetoxicum nigrum*); reed canary grass (*Phalaris arundinacea*); and reed (*Phragmites australis*). To prevent resprouting of native and invasive woody plants, it will be necessary to apply a wetland-approved herbicide to all cut stumps. Reducing the overall cover of trees and shrubs within the wetland will ensure that habitat remains for plants and animals that require open. unshaded conditions. Because it is bordered by

roads, the Clinton River and a shrub-carr, which can all serve as fire breaks, this wetland is an ideal candidate for the use of prescription burning as a management tool.

Nature Center Fen (Site Code: G)

A small prairie fen occurs along the northwest shore of Crooked Lake and extends inland toward the Nature Center. A trail leading from the Nature Center runs through the eastern portion of the fen. Historically, the uplands surrounding the fen supported oak barrens, a fire-dependent ecosystem, and fires likely burned across the fen on a regular basis. Today, in the absence of frequent fires, the surrounding uplands are now forested and much of the fen supports a thick layer of shrubs and scattered tree canopy. Fire suppression has allowed shrubs and trees to colonize much of the fen, with only the wettest areas remaining open. These open areas frequently support zones of cold, calcareous groundwater seepage (springs). The open portions of the fen harbors a diverse group of plants that are characteristic of fens in this region, including sedges (*Carex sterilis, C. tetanica, C. stricta, C. leptalea*), bog lobelia (*Lobelia kalmii*), shrubby cinquefoil (*Potentilla fruticosa*), slender wheat grass (*Agropyron trachycaulum*), whorled loosestrife (*Lysimachia quadriflora*), rush (*Juncus brachycephalus*), golden-seeded spike-rush (*Eleocharis elliptica*), and Riddell's goldenrod (*Solidago riddellii*). Species common within the tree- and shrub-dominated portions of the fen include tamarack (*Larix laricina*), red-cedar (*Juniperus virginiana*), common juniper (*Juniperus communis*), bog birch (*Betula pumila*), meadowsweet (*Spiraea alba*), poison sumac (*Toxicodendron vernix*), nannyberry (*Viburnum lentago*), prickly-ash (*Zanthoxylum americanum*), red-osier dogwood (*Cornus stolonifera*), gray dogwood (*Cornus foemina*), Bebb's willow (*Salix bebbiana*), and pussy willow (*Salix discolor*).

Management of the Nature Center Fen should focus on reducing overall tree and shrub cover and removing invasive species, which include glossy buckthorn (*Rhamnus frangula*), multiflora rose (*Rosa multiflora*), autumn-olive (*Elaeagnus umbellata*), and purple loosestrife (*Lythrum salicaria*). Because most woody plants that occur in the fen will produce root sprouts when cut, it is critical that the stumps be treated with an herbicide approved for use in wetlands. Fires conducted within the surrounding uplands as part of efforts to restore prairie and oak barrens should be encouraged to carry into the prairie fen. For example, the dry hillside north of the fen supports a variety of native upland prairie species and management of these areas would ideally focus on reducing shrub and tree cover in both the uplands and adjacent lowlands. Prescribed fires should be directed to burn across the ecological gradient from upland prairie and through the prairie fen.

Oak Ridge Woodland (Site Code: H)

A dry-mesic southern forest dominated by large oaks (*Quercus velutina* and *Q. alba*) and hickories (*Carya glabra* and *C. ovata)* occupies a tall, steep-sided end moraine along the southwestern edge of Crooked Lake. Peering through the large oaks that dominate the morainal slopes, one can enjoy a panoramic view of Crooked Lake and the surrounding landscape. While the views currently afforded along these slopes certainly show the natural beauty of the region, the views must have been truly spectacular when open oak barrens occupied the site in the early 1800s. In the absence of frequent surface fires, which once moved across this portion of Michigan annually, the tree canopy has closed, resulting in the elimination of light-demanding prairie species. In addition, the presence of old abandoned fence rows, rock piles, and roads indicate that the woodland was likely used as pasture, which also harmed the former native prairie vegetation.

The forest canopy is dominated by large black oak and white oak that range in size from 33 cm to 76 cm (13 to 30 inches) dbh, and pignut hickory (*Carya glabra*) and occasionally shagbark hickory (*Carya ovata*) ranging from 42 to 51 cm (17 to 20 inches) dbh. The forest also contains a steep, east-facing ravine that supports tree species more commonly found in mesic conditions such as red oak (*Quercus rubra*), basswood (*Tilia americana*), white ash (*Fraxinus americana*), and American beech (*Fagus grandifolia*). The oak-hickory forest contains a diverse understory of huckleberry (*Gaylussacia baccata*), maple-leaved arrow-

wood (*Viburnum acerifolium*), witch-hazel (*Hamamelis virginiana*), common juniper (*Juniperus communis*), flowering dogwood (*Cornus florida*), alternate-leaved dogwood (*Cornus alternifolia*), sassafras (*Sassafras albidum*), and juneberry (*Amelanchier arborea*). Red maple (*Acer rubrum*), a shade-tolerant tree, has colonized the understory of the lower slopes of the oak-hickory forest and east-facing ravine, and threatens to outcompete many of the less shade-tolerant tree and understory species. With the exception of sedge (*Carex pensylvanica*), which dominates local areas, the ground flora is relatively sparse. However, many species of interest were noted, including the following: blue-stemmed goldenrod (*Solidago caesia*); naked tick-trefoil (*Desmodium nudiflorum*); clustered-leaved tick-trefoil (*Desmodium glutinosum*); hairy bush-clover (*Lespedeza hirta*); bracken fern (*Pteridium aquilinum*); poke milkweed (*Asclepias exaltata*); pipsissewa (*Chimaphila umbellata*); poverty grass (*Danthonia spicata*); bottlebrush grass (*Hystrix patula*); pinesap (*Monotropa hypopithys*); doll's-eyes (*Actaea pachypoda*); and hog-peanut (*Amphicarpaea bracteata*). The sparse ground layer is likely the result of high deer densities, low light levels associated with a closed canopy, and past grazing. Reducing deer densities and conducting prescribed fires will help the ground flora to recover. Invasive species observed within the forest include hedge parsley (*Torilis japonica*), common St. John's-wort (*Hypericum perforatum*), Canada bluegrass (*Poa compressa*), Japanese barberry (*Berberis thunbergii*), multiflora rose (*Rosa multiflora*) Oriental bittersweet (*Celastrus orbiculata*), and sheep sorrel (*Rumex acetosella*).

Management for the site should include prescribed burning, controlling invasive species, reducing local deer densities, and removing red maple within the oak-hickory-dominated portions of the forest. While all of the invasive species noted above threaten to erode biodiversity, Oriental bittersweet poses the greatest threat because of its ability to rapidly colonize new areas and dominate all vegetative layers. Management should focus on removing these invasive species, especially Oriental bittersweet, before they spread throughout the site and into adjacent natural communities.

Within the Oak Ridge Woodland at Independence Oaks (Site H), the presence of large-diameter, multi-stem oaks, which likely grew from well established, fire-suppressed oak grubs, indicates that this site was once an open oak barrens. Prescribed fire can help promote oak regeneration and restore the open canopy conditions and plant species characteristic of oak barrens.

Eliminating woody invasives will require cutting followed by the application of herbicide to prevent resprouting. Reintroducing fire to the site in the form of prescription burning will help reduce the prevalence of invasive woody species and, with time, help reduce the cover of understory and overstory vegetation, allowing more light to reach the forest floor and stimulate ground flora.

Spring Lake Swamp (Site Code: I)

Spring Lake Swamp is a small (six-acre) forested wetland surrounded by upland forest. Smaller pockets of shrub-carr and cat-tail-dominated emergent marsh also exist within this community matrix. The swamp surrounds most of Spring Lake, which is a small half-acre pond located west of Crooked Lake and north of the Oldfield Trail. Spring Lake Swamp occupies a narrow outwash channel within a coarse-textured end moraine. Soils within the swamp are saturated sapric peat. The dominant treespecies in the swamp forest is black ash (*Fraxinus nigra*), with lesser dominance by

Due to fire suppression and the absence of beaver, shrubs and small trees are colonizing open areas, such as the Clinton River Wet Meadow (Site F, above) in Independence Oaks and other wetland sites throughout the parks (e.g., Sites E, F, and G at Independence Oaks and Sites O, P, R, X, and Y in Rose Oaks). The woody species gradually shade out sun-loving native plants and eliminate habitat for animals that require open conditions. Prescribed burns can be used to reduce the cover and competitiveness of woody species, and promote the growth and reproduction of native plants.

American elm (*Ulmus americana*) and red maple (*Acer rubrum*). Tamarack (*Larix laricina*) occurs occasionally within the swamp forest and along the periphery of the pond. Numerous fallen tamaracks were also observed, especially west of the pond. The widespread presence of tamarack within this wetland indicates that this species was once a primary component of an earlier relict conifer swamp community that has since become dominated by hardwoods. The transition from conifer to hardwood domination is facilitated by fire suppression within the adjacent uplands, which allowed oak barrens to convert to oak-hickory forest. Without regular fires, thin-barked, fire-intolerant red maples have colonized the understory of the oak forests and spread into adjacent tamarack-dominated wetlands. Because tamarack is not capable of growing under the dense shade of red maple, it eventually senesces and is replaced by hardwoods, especially red and, where they occur, silver maples. Thus, the understory of this swamp is now dominated by red maple, which is predictive of an eventual red maple-dominated canopy.

The shrub layer is best developed west of the pond in a pocket of shrub-carr, and includes nannyberry (*Viburnum lentago*), highbush blueberry (*Vaccinium corymbosum*), bog birch (*Betula pumila*), red-osier dogwood (*Cornus stolonifera*), gray dogwood (*C. foemina*), and poison sumac (*Toxicodendron vernix*). The ground layer is diverse with abundant skunk cabbage (*Symplocarpus foetidus*), sensitive fern (*Onoclea sensibilis*), bishop's cap (*Mitella diphylla*), dwarf raspberry (*Rubus pubescens*), and cinnamon fern (*Osmunda cinnamomea*).

Management for Spring Lake Swamp should include controlling invasive species and reducing local deer densities. Invasive species that occur at this site and should be controlled or eliminated include autumn-olive (*Elaeagnus umbellata*), Japanese barberry (*Berberis thunbergii*), glossy buckthorn (*Rhamnus frangula*), and Oriental bittersweet (*Celastrus orbiculatus*). Invasive plants have specific adaptations that allow them to propagate and spread quickly, so immediate attention would be prudent. As in other areas of the park, deer herbivory is a major concern as indicated by abundant signs of browsing. This wetland complex contributes to the overall biodiversity of the park and is important to many animal species, particularly reptiles and amphibians. Wood frog, green frog and ribbon snake were all observed at this site during our surveys.

Lyon Oaks County Park

Wixom Woods (Site Code: J)

As noted, the forested portions of Lyon Oaks are composed of mesic southern forest intermixed with swamp forest. Slight changes in topography lead to shifts in soil moisture and vegetation, with swamp forest occupying the depressions and mesic southern forest dominating the higher ground. Soils are sandy loams with very slightly acid to neutral pH. Numerous snags are found throughout, and coarse woody debris is abundant. Large trees dominate the canopy, with diameters typically ranging from 30 to 76 cm dbh (12 to 30 inches). Canopy dominance is shared by beech (*Fagus grandifolia*), sugar maple (*Acer saccharum*), and red oak (*Quercus rubra*). Additional canopy associates include basswood (*Tilia americana*), big-toothed aspen (*Populus grandidentata*), white ash (*Fraxinus americana*), shagbark hickory (*Carya ovata*), bur oak (*Quercus macrocarpa*), white oak (*Quercus alba*), and black walnut (*Juglans nigra*). On slightly drier sites, the mesic southern forest grades to dry-mesic southern forest, with increased importance of oaks, shagbark hickory, big-toothed aspen, and sassafras (*Sassafras albidum*). Along the ecotone between the mesic southern forest and the swamp forest, red maple (*Acer rubrum*), American elm (*Ulmus americana*), and basswood become prevalent in the canopy. Species characteristic of the mesic southern forest understory include witch-hazel (*Hamamelis virginiana*), Juneberry (*Amelanchier arborea*), ironwood or hop-hornbeam (*Ostrya virginiana*), flowering dogwood (*Cornus florida*), maple-leaved arrow-wood (*Viburnum acerifolium*), smooth arrow-wood (*Viburnum dentatum*), blue-beech (*Carpinus caroliniana*), wild black currant (*Ribes americanum*), prickly gooseberry (*Ribes cynosbati*), and prickly-ash (*Zanthoxylum americanum*). In the dry-mesic portions of the forest, red maple, a shade-tolerant species, is invading the understory and threatens to outcompete species less tolerant of dense shade, such as white oak and shagbark hickory.

A diversity of species are common within the ground cover, including sedges (*Carex albursina, C. pedunculata*), bottlebrush grass (*Hystrix patula*), doll's-eyes (*Actaea pachypoda*), red baneberry (*Actaea rubra*), soft agrimony (*Agrimonia pubescens*), wild ginger (*Asarum canadense*), blue cohosh (*Caulophyllum thalictroides*), enchanter's-nightshade (*Circaea lutetiana*), clustered-leaved tick-trefoil (*Desmodium glutinosum*), white wild licorice (*Galium circaezans*), wild geranium (*Geranium maculatum*), white avens (*Geum canadense*), round-lobed hepatica (*Hepatica americana*), mayapple (*Podophyllum peltatum*), jumpseed (*Polygonum virginianum*), yellow violet (*Viola pubescens*), maidenhair fern (*Adiantum pedatum)*, hog-peanut (*Amphicarpaea bracteata*), common trillium (*Trillium grandiflorum*), and bellwort (*Uvularia grandiflora*).

Invasive plant species occur in moderate levels in the understory and ground cover of this mesic southern forest. The following invasive exotic shrubs were observed: Japanese barberry (*Berberis thunbergii*), common buckthorn (*Rhamnus cathartica*), glossy buckthorn (*Rhamnus frangula*), autumn-olive (*Elaeagnus umbellata*), smooth Tartarian honeysuckle (*Lonicera tatarica*), and multiflora rose (*Rosa multiflora*). In addition, several patches of garlic mustard (*Alliaria petiolata*) were observed in the mesic forest, with heaviest concentrations in the eastern part of the park.

Stewardship efforts for this site should focus on invasive species removal—especially on eradicating garlic mustard while its distribution is limited. Winter application of herbicide to garlic mustard's basal rosettes has been shown to be an effective control measure (http://tncweeds.ucdavis.edu/). In addition, flowering garlic mustard can be pulled and removed before releasing seed in May and June; it is, however, necessary to remove all pulled plants from the site, as they can produce seed even when fully uprooted. Monitoring of the area every spring should follow any treatment.

Stumps from past logging (right) contrast with the coarse woody debris that remains (left) after natural disturbances—in this case, windthrow—in the beech-sugar maple forest in Wixom Woods, Site J, at Lyon Oaks. The decaying logs that result from windthrow or other forms of mortality, such as infection by emerald ash borer, provide excellent habitat for wildlife and slowly release nutrients back to the soil, which then become available to plants and animals.

Treatment to control invasive woody species should include cutting followed by herbicide treatment to prevent resprouting (Reinartz 1997). Management should also include reduction in the size of the local deer herd. Deer browse, especially of woody species, was noted throughout the site. A concerted management effort to contain these exotics, reduce local deer densities, and limit red maple invasion could restore this mesic forest to a high quality system.

Norton Swamp (Site Code: K)

The forested portions of Lyon Oaks are composed of swamp forest intermixed with mesic southern forest and dry-mesic southern forest. The Norton Swamp is a forested wetland community that is dominated by deciduous tree species and is therefore classified as southern swamp (MNFI 2003). The swamp occurs on an outwash plain with poorly drained soils. The soils, which are composed of muck (e.g., sapric peat) overlying a layer of clay, were saturated with standing water present in many areas at the time of the survey. Construction of the highway and golf course has altered the hydrology of this ecosystem as evidenced by tree mortality adjacent to these anthropogenic disturbances.

Much of the swamp is dominated by mature trees (30 to 76 cm or 12 to 30 inches dbh) but there are also some stands that are immature (15 to 30 cm or 6 to 12 inches dbh). Current canopy dominants include silver maple (*Acer saccharinum*), red maple (*Acer rubrum*), and green ash (*Fraxinus pennsylvanica*). Throughout this site, ash trees are suffering from high levels of mortality, likely due to infestation by the emerald ash borer, an invasive exotic beetle (USDA Forest Service 2004, USDA et al. 2006). Additional canopy components include American elm (*Ulmus americana*), black ash (*Fraxinus nigra*), swamp white oak (*Quercus bicolor*), cottonwood (*Populus deltoides*), bur oak (*Quercus macrocarpa*), black willow (*Salix nigra*), and basswood (*Tilia americana*). Red maple was most common in the ecotone between the hardwood swamp and the adjacent mesic southern forest and on slight rises within the swamp. Diameters of canopy trees typically range from 30 to 76 cm (12 to 30 inches). In the mature portion of the swamp, the understory layer is scattered with spicebush (*Lindera benzoin*), gray dogwood (*Cornus foemina*), musclewood (*Carpinus caroliniana*), Michigan holly (*Ilex verticillata*), buttonbush (*Cephalanthus occidentalis*), nannyberry (*Viburnum lentago*), wild black currant (*Ribes americanum*), prickly gooseberry (*Ribes cynosbati*), bladdernut (*Staphylea trifolia*), and prickly-ash (*Zanthoxylum americanum*).

Younger blocks of swamp forest have denser understory layers, with invasive exotic shrubs such as multiflora rose (*Rosa multiflora*) and glossy buckthorn (*Rhamnus frangula*) forming impenetrable thickets. Vines are an important structural feature in the swamp forests. Prevalent vines in this system include poison ivy (*Toxicodendron radicans*), riverbank grape (*Vitis riparia*), and Virginia creeper (*Parthenocissus quinquefolia*). Common ground cover species include cut grass (*Leersia oryzoides*), side-flowering aster (*Aster lateriflorus*), false nettle (*Boehmeria cylindrica*), enchanter's-nightshade (*Circaea lutetiana*), white avens (*Geum canadense*), wood nettle (*Laportea canadensis*), cardinal flower (*Lobelia cardinalis*), common water horehound (*Lycopus americanus*), northern bugle weed (*Lycopus uniflorus*), native fringed loosestrife (*Lysimachia ciliata)*, jumpseed (*Polygonum virginianum*),

common skullcap (*Scutellaria galericulata*), golden ragwort (*Senecio aureus*), water-parsnip (*Sium suave*), nettle (*Urtica dioica*), sensitive fern (*Onoclea sensibilis*), spotted touch-me-not (*Impatiens capensis*), and clearweed (*Pilea pumila*). Areas with low canopy coverage (<60%) have predominantly graminoid ground cover with species such as reed canary grass (*Phalaris arundinacea*), white grass (*Leersia virginica*), and *Carex lacustris* as dominants. Throughout the swamp, the exotic bittersweet nightshade (*Solanum dulcamara*) occurs infrequently. This exotic species is not considered to pose a serious threat to native vegetation.

Management for the swamp forest should focus on invasive species control with removal of glossy buckthorn and multiflora rose as the main priority. These shrubs should be cut and their stumps treated with a wetland-approved herbicide to prevent resprouting (Reinartz 1997). The highly invasive exotic purple loosestrife (*Lythrum salicaria*) was located along the western edge of the swamp adjacent to the golf course. It is imperative that this population be controlled, or, ideally, eradicated, before it spreads throughout the park's wetlands. Spread of purple loosestrife can be controlled by manually pulling plants and applying herbicide to flowering plants. As noted earlier, some success in controlling purple loosestrife has occurred with the application of *Galerucella* beetles, biological control agents, which are native to purple loosestrife's European habitat (Hight and Drea 1991, Blossey 1992). Efforts to limit the domination of reed canary grass should also be implemented. Control of reed canary grass can be accomplished by applying an herbicide when the species is in flower.

Management should also include reduction in the size of the local deer herd. Deer browse, especially of woody species, was noted throughout the site.

As noted above, many of the ash trees were in a state of decline, which is likely due to infestation by the emerald ash borer. Currently, there are no known means for eliminating this invasive species. The numerous snags and large, coarse woody debris that will eventually result from emerald ash borer infestation should be left in place to provide habitat for wildlife.

Lyon Marsh (Site Code: L)

Pockets of emergent marsh occur throughout Lyon Oaks with the heaviest concentration of open wetlands on the west side of the park near the golf course and the gas pipeline. In addition, two large marshes occur in the park interior, one in the southeast corner, just north of the Interstate 96, and the other at the east end, adjacent to the Ford property, equidistant between the interstate and the Norton Drain. Throughout the growing season, standing water (two to four feet deep) was observed within the open wetlands, which were characterized by mucky organic soils. In many areas, wet meadow and southern shrub-carr grade into the emergent marsh.

The dominant vegetation in the emergent marshes is cat-tail (*Typha latifolia*) and the invasive reed canary grass (*Phalaris arundinacea*). Prevalent herbaceous species include sedge (*Carex lacustris*), cut grass (*Leersia oryzoides*), the invasive reed (*Phragmites australis*), water-plantain (*Alisma plantago-aquatica*), common water horehound (*Lycopus americanus*), water-parsnip (*Sium suave*), trail rush (*Juncus tenuis*), common bur-reed (*Sparganium eurycarpum*), small duckweed (*Lemna minor*), and clearweed (*Pilea pumila*). Throughout the marshes are scattered trees of silver maple (*Acer saccharinum*), cottonwood (*Populus deltoides*), and black willow (*Salix nigra*) with occasional silver maple and black willow snags, likely flood-killed. The perimeters of the open wetlands are ringed by shrubs such as buttonbush (*Cephalanthus occidentalis*) and gray dogwood (*Cornus foemina*).

A population of purple loosestrife (*Lythrum salicaria*) was found within wetlands in the northeastern portion of the park. A stewardship priority for the open wetlands is to control purple loosestrife before it spreads. Spread of purple loosestrife can be controlled by manually pulling plants and applying herbicide to flowering plants. Some success in controlling purple loosestrife has recently occurred with the application of biological control agents, *Galerucella* beetles, which are native to purple loosestrife's European habitat (Hight and Drea 1991, Blossey 1992). Efforts to control the domination of reed canary grass and reed should also be implemented. Control of both species can be accomplished by applying a wetland-

approved herbicide when they are in flower. Note that repeated herbicide applications are often necessary, so monitoring should also be a component of any control efforts.

Pipeline Prairie (Site Code: M)

A small wet-mesic prairie occurs immediately south of the Wood's Edge Picnic Area in an opening maintained for a gas pipeline. This site is quite degraded and it is uncertain if the opening existed prior to the construction of the pipeline. However, given the number of native species we encountered, it is likely that a least a portion of the prairie is of natural origin. The prairie occurs along a small section of the pipeline opening and extends south for approximately 100 yards from the short hill below the picnic area parking lot to a large stand of reed (*Phragmites australis*). The Pipeline Prairie harbors numerous species not found in other locations within the park including mountain-mint (*Pycnanthemum virginianum*), pale-spiked lobelia (*Lobelia spicata*), black-eyed susan (*Rudbeckia hirta*), Culver's root (*Veronicastrum virginicum*), golden alexanders (*Zizia aurea*), thimbleweed (*Anemone cylindrica*), wild indigo (*Baptisia tinctoria*), and an occasional clump of big bluestem (*Andropogon gerardii*). Several non-native grasses were also common within the prairie, including tall fescue (*Festuca arundinacea*) and Kentucky bluegrass (*Poa pratenssis*). Both of these species are common in turf grass seed mixes and were likely planted following construction of the pipeline.

Management priorities at this site include removing autumn-olive and controlling invading reed. A prescribed burn would also greatly benefit the site and help control unwanted cool-season grasses like fescue and bluegrass. However, due to the presence of the gas pipeline, any management, especially involving prescribed burning or digging to remove stumps or create fire breaks, should be done in close consultation with the gas company.

Lyon Old Fields (Site Code: N)

Several large old fields occur in the north-central portion of the park. The largest of these is found immediately south of the Bark Park and is presently under consideration for facilities development. These fields are extremely disturbed and show signs of relatively recent cultivation. They are almost completely dominated by exotic species and the few native species observed were very low in abundance. Dominant species included brome grass (*Bromus inermis*), orchard grass (*Dactylis glomerata*), quack grass (*Agropyron repens*), reed canary grass (*Phalaris arundinacea*), timothy (*Phleum pratense*), musk thistle (*Carduus nutans*), hoary alyssum (*Berteroa incana*) and white sweet-clover (*Melilotus alba*). There is very little potential for restoration from the existing seed bank at this site. If and when new facilities are constructed, a prairie could be established in the remaining area by eliminating old field vegetation with herbicide and planting native prairie grasses and forbs. Alternatively, directing the ecological succession of these fields toward forest will help reduce forest fragmentation and increase the size of current blocks of forest. Reducing forest fragmentation and increasing forest size will improve nesting success for raptors, neotropical migrant songbirds, and ground-nesting species because their nests are less likely to be parasitized and predated in larger blocks of forest (Wilcove et al. 1986).

Open, sedge- and grass-dominated areas, such as that shown in the forest gap, foreground, at Esler Lake Woodlands (Site Q) at Rose Oaks, were once typical of oak woodlands of southeast Michigan, but fire suppression has allowed denser growth by shade-tolerant trees and shrubs, as seen in the background. Prescribed fire will help return these woodlands to a more open state.

Rose Oaks County Park

Rose Oaks Wet-mesic Prairie (Site Code: O)

Rose Oaks Wet-mesic Prairie is an exemplary natural community, so well-preserved that it has been added to the MNFI database of high quality natural communities. It occurs east of Richardson Lake and along the west side of the creek that flows north/south through the park and feeds Big School Lot Lake. This site is part of a wetland complex that dominates the eastern side of the park and is comprised of southern wet meadow (e.g., sedge meadow), emergent marsh, shrub-carr, and southern swamp. Wet-mesic prairie is a groundwater-influenced, fire-dependent community type that is dominated by prairie and wetland species, many of which also occur in prairie fens. The community is considered imperiled, both globally and within Michigan, where only nine other occurrences have been identified statewide.

Mineral soils are an important defining characteristic of wet-mesic prairie and what differentiates this community type from prairie fen, although the two share many species in common. Soils at this site are mapped as Brookston and Colwood loams, which are distinct from surrounding soils and unique within the park. This map unit is defined as being nearly level and having poorly drained soils in broad, flat areas, subject to frequent ponding. Due to the high water table, these soils are not suitable for development or recreation. Soil samples taken by MNFI biologists revealed calcareous, sandy clay loams with a pH in the range of 7.0 to 8.0. Approximately 14 inches of grayish black loam with iron concretions overlies grayish-brown, coarse-textured sand, below which, at 24 inches, occurs gleyed clay with iron concretions.

Rose Oaks Wet-mesic Prairie is dominated by various sedge species, most notably *Carex pellita* and *Carex stricta.* In all, 66 plant species were noted, of which 56 are native. Commonly observed species include shrubby cinquefoil (*Potentilla fruticosa*), stout blue-eyed grass (*Sisyrinchium angustifolium*), side-flowering aster (*Aster lateriflorus*), common mountain mint (*Pycnanthemum virginianum*), Riddell's goldenrod (*Solidago riddellii*), grass-leaved goldenrod (*Euthamia graminifolia*), Dudley's rush (*Juncus dudleyi*), meadowsweet (*Spiraea alba*), and whorled loosestrife (*Lysimachia quadriflora*). While occasional patches of Indian grass (*Sorghastrum nutans*) and broom sedge (*Andropogon virginicus*) were observed, the overall paucity of deep-rooting prairie grasses, which typically dominate wet-mesic prairie communities, indicates that the site was likely plowed in the past. Evidence of channelization of a nearby stream also supports the theory that this site previously supported agriculture.

Rose Oaks Wet-mesic Prairie is a site of statewide significance and should be managed as such. Activities that would benefit the site include aggressive invasive species eradication and the introduction of fire. Prescribed fire will promote the growth and establishment of native grasses and forbs and help reduce encroachment by trees and shrubs. Non-native species noted during our site visits included smooth brome (*Bromus inermis*), autumn-olive (*Elaeagnus umbellata*), and Scotch pine (*Pinus sylvestris*). If left unchecked, these species will likely dominate the site in the future and precipitate a loss of species diversity. Cutting accompanied by application of an herbicide approved for wetlands is the most effective way of controlling woody species. In addition, prescribed fire will be an important component of any long-term management plan for this site. The few Scotch pines growing on the site should be removed; however hawthorns (*Crataegus* spp.) are native and should be left to provide food and cover for wildlife.

Buckhorn Road Sedge Meadow (Site Code: P)

This site is a southern wet meadow, an open, groundwater-influenced, sedge-dominated wetland (Kost 2001b). Water levels fluctuate seasonally, reaching their peak in spring and lows in summer. This community occurs

southwest of the intersection of Buckhorn Road and the railroad tracks, and its hydrology is influenced by the unnamed stream that flows north/south into Big School Lot Lake. The sedge meadow occurs in combination with other wetland communities to form a large wetland complex occupying the eastern third of the park. Many examples of southern wet meadow occur throughout Rose Oaks County Park. This is the highest-quality example, but it is still affected, to some extent, by problems typical of many wetlands in southern Michigan: invasion by non-natives, such as purple loosestrife (*Lythrum salicaria*) and reed canary grass (*Phalaris arundinacea*), or past diking or stream channelization that may still be affecting hydrology.

The dominant species at this site is the sedge *Carex stricta*, with local dominance in places by *Carex lacustris*, sensitive fern (*Onoclea sensibilis*), and cat-tail (*Typha latifolia*). Large hummocks formed from the roots of *Carex stricta* contribute to diverse microtopography and support a diversity of additional species such as spotted touch-me-not (*Impatiens capensis*), water smartweed (*Polygonum amphibium*), blue-joint grass (*Calamagrostis canadensis*), smooth swamp aster (*Aster firmus*), cut grass (*Leersia oryzoides*), Joe-pye-weed (*Eupatorium maculatum*), and nodding bur-marigold (*Bidens cernuus*).

The highest priority management goal for this wet meadow is the eradication of purple loosestrife (*Lythrum salicaria*) before it becomes prevalent throughout wetlands at Rose Oaks. The spread of purple loosestrife can be manually controlled by applying wetland-appropriate herbicides to flowering plants. Some success in controlling purple loosestrife has been achieved with the application of biological control agents, *Galerucella* beetles, which are native to purple loosestrife's European habitat (Hight and Drea 1991, Blossey 1992). Management should also include a reduction in shrub and tree cover, especially along the western edge of this site, through cutting and the application of herbicide. Reducing tree and shrub cover will help maintain the open conditions required by most of the plant and animal species found here.

Evidence from wetland peat cores and presettlement maps indicate that southern wet meadow is a fire-dependent natural community (Curtis 1959, Davis 1979). By reducing leaf litter and allowing light to reach the soil surface and stimulate seed germination, fire can play an important role in maintaining southern wet meadow seed banks (Warners 1997, Kost and De Steven 2000) while also reducing shrub cover. Prescribed fires should be conducted in the sedge meadow and allowed to spread to the adjacent Rose Oaks Wet-mesic Prairie (above) and Esler Lake Woodland (described below) when feasible. Similarly, prescribed fire conducted in the adjacent wet-mesic prairie and oak forest should be allowed to carry east into the sedge meadow. Buckhorn Road can serve as an effective firebreak along the east side of the sedge meadow, and the unnamed stream can be used as a firebreak along the west side. In the absence of fire or flooding, wet meadows typically convert to shrub-carr and then to swamp forest. Shrub-carr is a common, transitional community type that should not be a goal of park management. Rather, the sedge meadow community should be perpetuated through prescribed fire or flooding by beaver, should it occur. Furthermore, protecting the hydrology of this site is imperative for its continued existence.

Esler Lake Woodland (Site Code: Q)

A dry-mesic southern forest occurs north of Esler Lake and continues north to Richardson Lake Swamp. The forest is bisected by an old, abandoned fence, which demarcates a significant change in the quality of the forest and past land use practices. South of the fence line, the forest is dominated by large white oak and appears less disturbed and more mature. North of the fence line, the forestd is dominated by black oak and black cherry and appears younger, denser, and more recently impacted by grazing and other land use practices. The dry-mesic forest occurs on rolling, coarse-textured moraine and borders swamp forest to the north, pine plantation to the west, and transitions into shrub-carr to the east and south. Several small wetlands and vernal pools occur throughout the forest and provide critical habitat and breeding grounds for reptiles and amphibians.

The forest canopy is dominated by oak species, primarily white oak (*Quercus alba*) and

black oak (*Q. velutina*), with lesser amounts of red oak (*Q. rubra*), several hickories (*Carya* spp.) and black cherry (*Prunus serotina*). Red maple (*Acer rubrum*) is prevalent in the understory, a result of fire suppression. Diameters of the overstory trees range from 10 to 76 cm (4 to 30 inches) and support a closed canopy. This likely differs from the historic character of this site, which almost certainly was more open and contained more widely scattered trees than presently occupy the forest. The past open character of the site is also suggested by the presence of savanna and prairie indicator species, such as common juniper (*Juniperus communis*), yellow pimpernel (*Taenidia integerrima*) and poverty oats grass (*Danthonia spicata*). The current well-developed shrub layer includes gray dogwood (*Cornus foemina*), black raspberry (*Rubus occidentalis*), blueberry (*Vaccinium angustifolium*), wild gooseberry (*Ribes cynosbati*), downy arrowwood (*Viburnum rafinesquianum*), and hazelnut (*Corylus americana*).

Due to fire suppression and shading from the closed canopy, the ground flora is relatively sparse. Species observed in the ground layer included the following: poison ivy (*Toxicodendron radicans*), various sedges (*Carex gracillima*, *C. cephalophora*, *C. radiata*), Virginia creeper (*Parthenocissus quinquefolia*), early meadow rue (*Thalictrum dioicum*), riverbank grape (*Vitis riparia*), white avens (*Geum canadense*), enchanter's nightshade (*Circaea lutetiana*), Canada mayflower (*Maianthemum canadense*), and fragrant bedstraw (*Galium triflorum*).

Oak forests are fire-dependent natural communities that degrade in the absence of a regular fire regime. Fire thins the understory and shrub layer, which allows more light to reach the forest floor and stimulate oak seedlings and other savanna species. It can also help reduce competition from thin-barked, shade-tolerant invaders such as red maple, which can colonize the understory of oak forests, and create dense shade. In addition to fire, cutting and/or girdling can also be used to control red maple. Another factor that threatens to erode biodiversity at this site is the presence of invasive species, which include Japanese barberry (*Berberis thunbergii*), autumn-olive (*Elaeagnus umbellata*), black locust (*Robinia pseudoacacia*), multiflora rose (*Rosa multiflora*), and white swallow-wort (*Vincetoxicum rossicum*). Because these woody species have the potential to rapidly spread and outcompete native vegetation, they should be cut and their stems treated with herbicide to prevent resprouting. Conducting prescribed burns at this site will help reduce the prevalence of woody invasives while also increasing nutrient cycling, reducing leaf litter, stimulating the soil seed bank, and bolstering flowering and seed production.

Esler Lake Wetlands (Site Code: R)

Several wetland community types intermingle within the low-lying area that encompasses Esler Lake, its western output channel, and the unnamed pond east of Esler Lake. Southern wet meadow, shrub-carr, and relict conifer swamp all combine to create an assemblage that represents the various stages of succession from open wet meadow to swamp forest. Soils are Houghton-Adrian mucks throughout. Wetland complexes of this nature are common throughout the Midwest, and, when intact, contain a diversity of habitats and flora beneficial to native wildlife.

The most prevalent community type across the site is shrub-carr, which is also abundant throughout the eastern one-third of the park. Shrub-carr is a shrub-dominated community type successionally intermediate between wet meadow and swamp forest, and is characterized by fluctuating water levels and poor drainage conditions. Dominant at this site are red-osier dogwood (*Cornus stolonifera*) and sedge (*Carex stricta*), accompanied by gray dogwood (*Cornus foemina*), silky dogwood (*Cornus amomum*), blue-joint grass (*Calamagrostis canadensis*), poison sumac (*Toxicodendron vernix*), meadowsweet (*Spiraea alba*), swamp milkweed (*Asclepias incarnata*), and Joe-pye-weed (*Eupatorium maculatum*). The warbler, Common Yellowthroat (*Geothlypis trichas*), was observed using this habitat.

Interspersed among the shrub-carr are pockets of southern wet meadow, a sedge- and grass-dominated wetland community. Wet meadow probably dominated this site prior to invasion by shrubs, but small pockets are all that remain of what was once the primary cover type.

The sedge, *Carex stricta*, is dominant, and interspersed among its hummocks are blue-joint grass (*Calamagrostis canadensis*), Joe-pye-weed (*Eupatorium maculatum*), shrubby cinquefoil (*Potentilla fruticosa*), marsh fern (*Thelypteris palustris*), fowl manna grass (*Glyceria striata*), and sedge (*Carex sartwellii*).

Where tamaracks (*Larix laricina*) have colonized and formed a partially-closed canopy, small areas of a community type known as relict conifer swamp occur. Relict conifer swamp is a minerotrophic (e.g. groundwater-fed), tamarack-dominated, forested wetland that occurs on deep organic soils.

The western lakeshore of Esler Lake is dominated by marsh fern (*Thelypteris palustris*) and sedge (*Carex stricta*), in addition to the other typical lakeshore species, which include swamp loosestrife (*Decodon verticillatus*), pickerel weed (*Pontederia cordata*), arrow-arum (*Peltandra virginica*), swamp betony (*Pedicularis lanceolata*), sweet-scented waterlily (*Nymphaea odorata*), numerous sedges (*Carex vulpinoidea, C. comosa, C. stipata*), coontail (*Ceratophyllum demersum*), jack-in-the-pulpit (*Arisaema triphyllum*), purple meadow rue (*Thalictrum dasycarpum*), buttonbush (*Cephalanthus occidentalis*), common water horehound (*Lycopus americanus*), and golden-seeded spike rush (*Eleocharis elliptica*).

A hiking trail crosses this site east of Esler Lake, between trail reference points two and three, so this wetland complex is frequently visited and highly visible. Thus, it is an excellent site for stewardship and interpretation activities. Stewardship efforts should aim to reduce shrub cover in order to restore the formerly dominant open wetlands. Shrub-carr is a native community and important habitat, but due to fire suppression, it now dominates many formerly open wet meadows and prairie fens across the Midwest. Consequently, these open wetland communities are now rare. Reducing shrub cover will require cutting shrubs and treating the stumps with a wetland-approved herbicide to discourage resprouting. Shrub removal can occur from July through early March; in wet sites such as this, however, cutting can be more easily accomplished in winter when the ground is frozen and leaves are off. Spot herbicide application to regrowth is essential to any removal effort. Prescribed fire is also an effective tool for reducing woody species and restoring the wet meadow. Evidence from wetland peat cores and presettlement maps indicate that southern wet meadow is a fire-dependent natural community (Curtis 1959, Davis 1979). By reducing leaf litter and allowing light to reach the soil surface and stimulate seed germination, fire can play an important role in maintaining southern wet meadow seed banks (Warners 1997, Kost and De Steven 2000).

Wild Rice Pond (Site Code: S)

The Wild Rice Pond is a closed-canopy forested wetland community comprised of the southern swamp community type, surrounding a small pond. According to 1937 and 1978 aerial photographs, it is one of the only terrestrial sites within the park that has remained largely structurally unchanged over time. This site occurs east of Richardson Lake and occupies a depression of approximately 16 acres, situated over coarse-textured glacial till. It is surrounded on the south by upland forest and on the north by sedge meadow, shrub-carr, and emergent marsh, diverse wetlands common throughout the Midwest. Wild Rice Pond supports young, small-diameter (10 to 25 cm, 4 to 10 inch dbh), deciduous tree species dominated by black ash (*Fraxinus nigra*). Yellow birch (*Betula alleghaniensis*) is also abundant throughout the swamp, and large, fallen, decomposing trunks of this species add structural diversity and moist, exposed, nutrient-rich substrates for seedlings of various species. An additional structural component is present in the numerous soft-bottomed, seasonally flooded depressions, which are dominated by red maple (*Acer rubrum*), American elm (*Ulmus americana*), and black ash. These forested vernal pools provide critical breeding habitat for amphibians as well as an insect-rich food resource for migrating songbirds in the spring.

Wild Rice Pond harbors diverse understory and ground floras. Shrubs commonly found here include spicebush (*Lindera benzoin*), highbush blueberry (*Vaccinium corymbosum*), and Michigan holly (*Ilex verticillata*). Common ground-flora species include skunk cabbage

Wild-rice (*Zizania aquatica*), as shown here growing on the edge of Wild Rice Pond (Site S) at Rose Oaks, was an important food source for Native Americans; the Anishinaabe or Ojibwe word for it, "manonin," translates into "good berry." This grass species is sensitive to disturbance—especially damming, dredging, or any other activity that impairs natural hydrologic regimes—and should be protected from overharvesting.

(*Symplocarpus foetidus*), Jack-in-the-pulpit (*Arisaema triphyllum*), side-flowering aster (*Aster lateriflorus*), fowl manna grass (*Glyceria striata*), wood nettle (*Laportea canadensis*), common horsetail (*Equisetum arvense*), sensitive fern (*Onoclea sensibilis*), and marsh fern (*Thelypteris palustris*). Soils throughout the site are black Houghton-Adrian muck, poorly drained, and have a high water table (at or above the surface) from November to May. The soil is sapric peat at the surface, including partially decomposed chunks of wood, with a pH of 7.0. At two feet, gray, calcareous gravelly sand with a pH of 7.5 occurs. This marl layer may indicate that this site was historically an open, grassy, prairie fen that eventually converted to conifers and then hardwoods. A sparse ring of tamarack (*Larix laricina*) still exists around the small, unnamed pond situated in the western portion of the swamp. Between the pond and the tamaracks remains a narrow zone of prairie fen, which atop a quaking mat with a pH of 7.5. Common species observed within the fen include poison sumac (*Toxicodendron vernix*), marsh cinquefoil (*Potentilla palustris*), sedge (*Carex lasiocarpa*), softstem bulrush (*Schoenoplectus tabernaemontani*), wild-rice (*Zizania palustris*), tall swamp marigold (*Bidens coronatus*), smooth highbush blueberry (*Vaccinium corymbosum*), meadowsweet (*Spiraea alba*), and sphagnum moss.

Management of Wild Rice Pond should focus on maintaining the current hydrology and the forest community. This wetland complex is important to many species, particularly reptiles and amphibians, and is important to the overall biodiversity of the park. Wood frogs were plentiful during our survey, and rare species such as Blanding's turtles may also be utilizing this site. Non-native species are present in manageable numbers; their removal should be a high-priority goal before they become well established. Invasive species observed include autumn-olive (*Elaeagnus umbellata*) and Japanese barberry (*Berberis thunbergii*) in the swamp forest northwest of the pond, and Oriental bittersweet (*Celastrus orbiculata*) east of the pond. Oriental bittersweet poses the most imminent threat due to its ability to rapidly colonize new areas and dominate all vegetative strata (e.g. ground layer, shrub layer, and tree canopy). This vine and the invasive woody

shrubs should be cut and their stumps treated with a wetland-approved herbicide to prevent resprouting. If the emerald ash borer should colonize this site, dead ash trees should be left standing and/or fallen to contribute to structural diversity of the forest and provide wildlife habitat.

Richardson Lake East Shore (Site Code: T)

The northeast shore of Richardson Lake supports an assemblage of upland communities situated on Fox sandy loam, a well-drained soil found on side slopes, knolls, and ridges. Southern wet meadow (sedge meadow) occurs in the wetter areas adjacent to the lake, overlying Houghton-Adrian muck, and transitions to a small patch of wet-mesic prairie at a slightly higher elevation. South of this point, between the lake and the hiking trail, is a combination of old field and degraded oak barrens. All of these communities combine to create excellent breeding habitat for turtles that utilize Richardson Lake. For many native turtle species, pregnant females leave open-water ponds or lakes and traverse the sedge meadow or fen wetland edge to lay their eggs in the adjacent, open and semi-open savanna uplands. When the uplands adjacent to the pond succeed from open prairie and savanna communities to closed-canopy forest, turtles must travel greater distances to find suitable nesting sites. The reduction of open habitat creates greater risk of egg predation on the sites that remain and many female turtles are killed attempting to cross roads to reach open, sunny nesting sites. Maintaining a scattered canopy of oaks or prairie habitat along the eastern shore of Richardson Lake, through a combination of prescribed fire and woody plant removal, will facilitate turtle egg-laying and decrease egg predation and mortality rates for adult, female turtles.

While small in size, the area of wet-mesic prairie contains many species commonly associated with high quality wetland communities, including Riddell's goldenrod (*Solidago riddellii*), whorled loosestrife (*Lysimachia quadriflora*), a sedge (*Carex stricta*), Ohio goldenrod (*Solidago ohiensis*), swamp thistle (*Cirsium muticum*), common juniper (*Juniperus communis*), and shrubby cinquefoil (*Potentilla fruticosa*).

Restoration of the wet-mesic prairie and remnant oak barrens should be the goal of management efforts, as these areas harbor species with a direct, genetic link to the past fauna and flora of the site. At present, shrubs and small trees are encroaching upon these small openings and should be removed. Combining shrub and tree removal with prescribed burning will stimulate native species, and over time, help reduce the prevalence of non-native grasses and forbs. Maintaining an open habitat along the eastern shore of Richardson Lake will also benefit turtles inhabiting the lake. Invasive species that should be eradicated include Scotch pine (*Pinus sylvestris*), autumn-olive (*Elaeagnus umbellata*), spotted knapweed (*Centaurea maculosa*), and Oriental bittersweet (*Celastrus orbiculatus*).

Golden Pond Swamp (Site Code: U)

The Golden Pond Swamp is a forested wetland community dominated by deciduous tree species and is therefore classified as southern swamp (MNFI 2003). At its center is a scenic pond. It occurs northwest of Richardson Lake on coarse-textured glacial outwash and is surrounded on all sides by old field. This southern swamp is a mature and dynamic system, which maintains a good representation of tree size-classes, structural diversity, and floral composition, despite being small and poorly buffered. Due to annual and semi-permanent inundation, it likely escaped large-scale logging in the past; 1937 and 1978 photos indicate it was forested at those times. The average diameter of trees within the swamp is 30 to 35 cm (12 to 14 inches), with some individuals attaining diameters greater than 80 cm (31 inches) and one silver maple (*Acer saccharinum*) with a diameter of 92 cm (36 inches). Dominant tree species are red maple (*Acer rubrum*) and green ash (*Fraxinus pennsylvanica*), with lesser numbers of silver maple (*Acer saccharinum*), American elm (*Ulmus americana*), white oak (*Quercus alba*), yellow birch (*Betula alleghaniensis*), basswood (*Tilia americana*), and swamp white oak (*Quercus bicolor*). A well-developed shrub layer includes spicebush (*Lindera benzoin*), blue-beech (*Carpinus caroliniana*), Michigan holly (*Ilex verticillata*), hazelnut (*Corylus americana*)

and serviceberry (*Amelanchier* sp.). An uneven terrain prevails across the forest floor, the product of numerous depressions, pit and mound topography, and grassy, raised hummocks that have formed around the buttressed roots of trees. Floral composition reflects this diverse microtopography and a unique species assemblage occupies each microhabitat. Thus, no clear dominants were present, though richness and diversity are high. Areas that were recently inundated, and which remain so throughout most of the year, were largely barren.

Natural forest dynamics are driving the ecology of this site, and provide structural diversity. Trees that have naturally senesced and fallen create a patchy canopy cover, allowing sunlight to reach gaps on the forest floor and encouraging the growth of a diverse assemblage of species and tree age classes. Fallen logs also benefit wildlife and can serve as important microsites for seedling establishment, especially in wetlands. Soils throughout Golden Pond Southern Swamp are black Houghton-Adrian muck, poorly drained, and have a high water table at or above the surface from approximately November to May. The soil at the surface is sapric peat, with an average pH of 7.0 and contains many pieces of partially decomposed wood.

Management of this site should focus on monitoring for and removing invasive species. A natural buffer of native species should be allowed to develop surrounding this site and invasive species controlled via methods appropriate to each species and the wetland setting. Woody invasive species should be cut and stumps treated with a wetland-approved herbicide.

Fish Lake Road Bog (Site Code: V)

Adjacent to Fish Lake Road and immediately north of the pine plantation is a small (three-acre) bog, a community type defined as an ombrotrophic (fed by precipitation, as opposed to groundwater) peatland characterized by a sedge-*Sphagnum* floating mat (MNFI 2003). Nutrient-poor and acidic, bogs are peat-accumulating wetlands comprised of acidophilic vegetation, particularly *Sphagnum* mosses and Ericaceous shrubs (of the heath family, Ericaceae). Although bogs are water-saturated, they have virtually no inflow or outflow of mineral-bearing water. Isolated from the groundwater table by a build up of peat, their only source of nutrients is precipitation. In addition to low levels of nutrients, the prevalence of sphagnum mosses creates an acidic environment. Only a select group of plants can tolerate the harsh growing conditions of the bog environment. Excess rainwater runs to the edge of the bog's slightly domed *Sphagnum* mat, often creating a "moat" of standing water that encompasses the bog.

Fish Lake Road Bog occurs in a depression in glacial outwash. The soil is comprised of fibric peat, which overlies calcareous glacial drift and developed over thousands of years as plant debris accumulated within continuously saturated conditions. This site is comprised of a floating sphagnum mat surrounded by a moat with 1 to 2 feet of standing water. The moat supports a community type known as inundated shrub swamp or buttonbush depression, which is a shrub-dominated community successionally intermediate between emergent marsh and forested swamp or bog. Due to extremely slow rates of plant decomposition, the current bog will gradually increase in size as dead organic matter accumulates and is engulfed by the sphagnum mat. As the peat layer thickens, the vegetative surface becomes raised above the water table and will eventually encompass the inundated shrub swamp. The inundated shrub swamp is dominated by a nearly impenetrable thicket of buttonbush (*Cephalanthus occidentalis*), Michigan holly (*Ilex verticillata*), willows (*Salix* spp.), dogwoods (*Cornus foemina* and *C. stolonifera*), and meadowsweet (*Spiraea alba*). A stand of invasive reed canary grass (*Phalaris arundinacea*) occurs in the northern portion of the swamp. Numerous, dead, small-diameter elms (*Ulmus americana*) are also present, their mortality likely due to Dutch elm disease. Standing snags (i.e., dead trees) should remain undisturbed as they provide valuable wildlife habitat.

The bog is dominated by *Sphagnum* mosses upon which grows an open-canopy stand of scattered tamarack (*Larix laricina*) and lesser amounts of red maple (*Acer rubrum*); both species have diameters ranging from 10 to 15 cm (4 to 6 inches). Dominant under the

tamaracks is a meadow of *Carex oligosperma* interspersed with shrubs such as leatherleaf (*Chamaedaphne calyculata*), blueberry (*Vaccinium angustifolium*), and small cranberry (*Vaccinium oxycoccos*). Herbs noted during a fall survey include pitcher plant (*Sarracenia purpurea*), wool-grass (*Scirpus cyperinus*), and cinnamon willow-herb (*Epilobium coloratum*).

Stewardship recommendations for this site include removing invasive plants, most notably the reed canary grass invading the northern portion of the inundated shrub swamp, red maple, and Scotch pine (*Pinus sylvestris*). Control of reed canary grass can be accomplished by applying a wetland-approved herbicide when the plant is in flower and monitoring for regrowth throughout the year and in successive years. Red maples should be cut and their stumps treated with a wetland-approved herbicide to prevent it from resprouting. Removing the Scotch pine (*Pinus sylvestris*) planted to the south of the bog will improve the surrounding landscape context of the community.

Fish Lake Road Tamaracks (Site Code: W)

A small tamarack swamp occurs along Fish Lake Road, immediately north of the entrance to the main parking lot. Tamarack swamps, classified as relict conifer swamp communities (Kost 2001), are groundwater-influenced, forested wetland communities dominated by tamarack (*Larix laricina*) and occurring on deep organic soils (peat and muck). Their hydrology is maintained by calcareous groundwater that permeates the muck and peat soils. Historically, tamarack swamps were the most common type of conifer swamp in southern Michigan but they have been reduced to less than 1% of their *circa* 1800 cover. These swamps were frequently drained and logged, and subsequently used for agriculture, mined for peat, or abandoned and converted to wet meadow, shrub-carr, or hardwood conifer swamp (Kost 2001a, b, and c).

Tamaracks at this site form a savanna structure (with an open canopy and low density of trees) interspersed with large clones of gray dogwood (*Cornus foemina*). Sharing the canopy, though in much lesser numbers, is American elm (*Ulmus americana*). Numerous dead standing elm, presumably killed by Dutch elm disease, provide habitat for cavity-nesting birds and numerous insects. The open branching and spire-shaped canopy of tamarack allows a significant amount of light to reach the shrub layer, increasing diversity and richness at this level. The most common shrubs present here are silky dogwood (*Cornus amomum*), poison sumac (*Toxicodendron vernix*), and meadowsweet (*Spiraea alba*). The high amount of sunlight that reaches the forest floor, in addition to various microhabitats created by the buttressed roots of the tamaracks results in a diverse ground flora, which includes the following species: horsetail (*Equisetum arvense*), skunk cabbage (*Symplocarpus foetidus*), sensitive fern (*Onoclea sensibilis*), spotted touch-me-not (*Impatiens capensis*), sedges (*Carex stricta, C. lacustris,* and *C. leptalea*), fowl manna grass (*Glyceria striata*), thistle (*Cirsium muticum*), marsh fern (*Thelypteris palustris*), and side-flowering aster (*Aster lateriflorus*). Numerous ant mounds and characteristic species of fen indicate that this site may have been more open in the past and was likely a prairie fen community that was encroached upon by tamarack and eventually converted to forest as a result of fire suppression in surrounding uplands.

Management for this site should concentrate on removing invasive plants. The invasives noted include glossy buckthorn (*Rhamnus frangula*), reed canary grass (*Phalaris arundinacea*), and reed (*Phragmites australis*). Each of these species can negatively influence species richness and alter community structure, and therefore, should be addressed immediately. Glossy buckthorn, in particular, is the greatest threat to relict conifer swamps because it can completely dominate the shrub and ground layers. Wetland-approved herbicides can be effective against each of these species. Another threat, invasion by red maple (*Acer rubrum*), can cause a relict conifer swamp to shift to hardwood domination. Once red maple reaches the overstory, its broad canopy effectively reduces the amount of light available to the understory and results in a significant reduction in tamarack and shrub-layer cover and species richness, as well as a loss of many shade-intolerant ground-layer species (Kost 2001a).

Indian grass, *Sorghastrum nutans* (left), a deep-rooting tallgrass prairie native, grows in Rose Oaks Wet-mesic prairie, Site O. Due to fire suppression, shrubs and small trees are colonizing formerly open areas, and gradually shading out sun-loving prairie natives. Prescribed burns can be used to reduce the cover and competitiveness of woody species, and promote the growth and reproduction of prairie species. Dividing a large area into smaller burn units that can be burned in alternate years or seasons can protect populations of slow-moving amphibian and reptile species, such as the leopard frog, *Rana pipiens* (right), found nearby.

Significantly reducing red maple cover through selective girdling will help ensure that characteristic natural disturbance events, such as windthrow and insect outbreaks, result in tamarack regeneration.

Beaver Dam Wet-mesic Prairie (Site Code: X)

Beaver Dam Wet-mesic Prairie occurs on a narrow peninsula of land bisecting an emergent marsh located in the southernmost section of the park. Wet-mesic prairie is a groundwater-influenced, fire-dependent community type dominated by prairie and wetland species, many of which also occur in prairie fens. Though small and degraded, this site supports a good diversity of native plants and is worthy of management and protection.

Mineral soil is an important defining characteristic of wet-mesic prairie and is also what differentiates this community type from prairie fen. Peat accumulation and subsequent organic soil formation have not occurred here because the surface is not inundated for long periods. The soils are calcareous, coarse-textured sand and gravel with pH ranging from 7.5 to 8.0. Slight changes in elevation, coupled with close proximity to water, support variation in composition and texture from sand to marl to clay to fibric sedge peat in lower layers. In all, 73 plants (68 native) were noted, including blue-joint grass (*Calamagrostis canadensis*), spike-rush (*Eleocharis rostellata*), side-flowering aster (*Aster lateriflorus*), a bulrush (*Scirpus pendulus*), common mountain mint (*Pycnanthemum virginianum*), Joe pye weed (*Eupatorium maculatum*), grass-leaved goldenrod (*Euthamia graminifolia*), marsh fern (*Thelypteris palustris*), Dudley's rush (*Juncus dudleyi*), fringed brome (*Bromus ciliatus*), big bluestem (*Andropogon gerardii*), thimbleweed (*Anemone virginiana*), and purple meadow rue (*Thalictrum dasycarpum*).

The history of this site as a natural community is somewhat questionable. The presence of gravel below the surface suggests that this area may have been filled in the past to procure access to the "marsh hay" available in the surrounding wetlands.

Management activities that would benefit Beaver Dam Wet-mesic Prairie include aggressive non-native species eradication and the introduction of fire to promote native grasses and forbs and to reduce encroachment of shrubs. Invasive species noted during our site visit were

autumn-olive (*Elaeagnus umbellata*) and glossy buckthorn (*Rhamnus frangula*). If left unchecked, these species will likely dominate the site in the future and precipitate a loss of species diversity. Controlling woody species invasion through cutting followed by the application of a wetland-approved herbicide would be most effective. Additionally, this site, and the adjacent oak upland along Fish Lake Road, should be managed with prescribed fire to stimulate prairie species and further discourage resprouting of invasive shrubs.

Beaver Pond Wet Meadow (Site Code: Y)

A southern wet meadow community occurs southeast of the large, unnamed pond in the southwest corner of the park. It is situated in the low-lying area between two forested uplands, and is similar in composition to the other wet meadows in the park. Southern wet meadow is an open, groundwater-influenced, sedge-dominated wetland. Water levels fluctuate seasonally, reaching their peak in spring and lows in summer (Costello 1936, Curtis 1959, Warners 1997). The sedges *Carex stricta*, *C. lacustris*, and *Carex lasiocarpa* dominate this site. Numerous other forbs and graminoids are present, including common mountain mint (*Pycnanthemum virginianum*), fringed brome (*Bromus ciliatus*), red-osier dogwood (*Cornus stolonifera*), Joe-pye-weed (*Eupatorium maculatum*), marsh fern (*Thelypteris palustris*), bog goldenrod (*Solidago uliginosa*), smooth swamp aster (*Aster firmus*), and blue-joint grass (*Calamagrostis canadensis*). A small stand of tamarack occurs in the eastern section of this site, and hosts a species assemblage similar to that of prairie fen and relict conifer swamp.

Management recommendations for this site include monitoring for and removing invasive species when found, reducing shrub and tree cover, and using prescribed fire to maintain diversity. The small grove of tamaracks and native shrubs near the center of the wetland should be left intact to provide structural diversity and protect the unique species assemblage of this area. Shrub and tree encroachment into the open sedge meadow can be controlled by cutting shrubs and applying a wetland-approved herbicide directly to the cut stumps. Reducing shrub and tree cover will help maintain the open conditions required by most of the plant and animal species found here. Prescribed fire, which will also help maintain open conditions and bolster species diversity, should be used regularly as a management tool in this community. The oak knoll (described below) directly north of the wet meadow will also benefit from prescribed fire and should be burned along with the wet meadow. The only invasive species noted at this site was bittersweet nightshade (*Solanum dulcamara*), a relatively innocuous species that is easily pulled and does not currently pose a serious threat to biodiversity.

White Oak Knoll (Site Code: Z)

An oak-dominated knoll is situated east of the large, unnamed pond in the southwest corner of the park, and rises conspicuously from the surrounding wetlands. The open-grown, spreading habit of the large, old white oaks present here indicates that this site was historically oak barrens. Diameters of the largest trees averaged 76 cm (30 inches). Oak forests with an open canopy typically have a rich ground flora due to the abundance of sunlight reaching the ground. However, the ground flora at this site was conspicuously sparse, with only four species noted, sedges (*Carex pensylvanica* and *C. cephalophora*), May apple (*Podophyllum peltatum*), and poison ivy (*Toxicodendron radicans*). The low floristic diversity is likely related to past land use practices such as grazing and the presence of a closed canopy, which blocks sunlight from reaching the forest floor. In addition, a thick layer of dried leaves covers the ground, which can reduce seed germination and seedling survival. Historically, open-canopy oak barrens experienced frequent surface fires, which perpetuated the conditions that support the community's ecology (Cohen, 2001a). With the advent of fire suppression, oak barrens quickly converted to closed-canopy oak forests that lack many of the attributes of their earlier successional stages. The primary management needed at this site is the introduction of routine prescribed fire to reduce the forest understory and shrub layer, increase nutrient cycling, reduce leaf litter, stimulate the soil seed bank, and bolster flowering and seed production.

South of this site and north of the Beaver Pond Wet Meadow (Site Code Y) is another stand of dry-mesic forest, adjacent to Rose Center Road. This forest is highly degraded and is discussed here primarily because it supports a population of the pernicious invasive species, garlic mustard (*Alliaria petiolata*), which was seldom observed during the surveys. Control efforts should be undertaken to eliminate this species now before it spreads throughout the park. Annual monitoring and removal of small populations of non-native species requires relatively little time and effort and is more cost-effective than managing large, widely dispersed populations after they have become well established. Winter application of herbicide to the basal rosettes of garlic mustard is an effective control measure. By killing seedlings, prescribed fires conducted annually during the spring can also reduce the prevalence of garlic mustard. In addition, flowering garlic mustard plants can be pulled and removed before releasing seed in May and June. Removing the plants from the site after pulling is necessary because of its ability to continue to mature and release seed even after being removed from the ground. Monitoring of the area every spring should follow any treatment.

Southern blue flag (*Iris virginica*) grows in a southern swamp notch (Golden Pond Swamp, Site U) and in the adjacent complex of wetlands, including Rose Oaks Wet-mesic Prairie (Site O), Buckhorn Road Sedge Meadow (Site P), and Esler Lake Wetlands (Site R) at Rose Oaks. Many open wetland communities are fire-dependent, and will succeed to closed-canopy shrub-carr or swamp forest when fire is suppressed.

Discussion

Rare Plants

Bog bluegrass is a state threatened species that occurs in hardwood swamps in southern Michigan. Although previously documented at 28 sites in the state, only 10 of these populations have been observed in the past 40 years and are currently thought to be viable. The total extent of the population at Independence Oaks is currently unknown, but extensive habitat is available. This species is recognizable by its low, weak stature and characteristic fruiting stalks. It is best sought by examining downed, moss-covered logs for the thin, creeping stems in early to mid June. Conservation strategies to protect bog bluegrass include protecting extensive swamp habitats, limiting hydrologic alterations, and monitoring for and removing exotic invasive species.

Purple twayblade is a species of special concern in Michigan. Plants are given the status of special concern when they are thought to be threatened or endangered, but the status of the species—the number and extent of populations—is unknown. A species remains on the special concern list until specialists are able to determine whether the species should be elevated to state threatened or endangered status or is common enough to remain untracked. Of the 17 occurrences known in Michigan prior to this study, most occurred in the southern two tiers of counties. The colony found at Independence Oaks represents only the second known occurrence of this species in Oakland County. Purple twayblade occurs in a variety of disturbed upland habitats, including brushy second-growth thickets, mixed oak woods, and pine plantations. This orchid can be identified by its two broad basal leaves and purple flowers, which bloom in late June through July. The habitat requirements of this orchid are poorly understood, but it likely requires some shade. Conservation strategies to protect this species include restoring areas of degraded habitat by carefully removing invasive species and gradually converting remnant sites back to oak barrens and oak woodlands.

Fire as an Ecological Process

Many of the areas within the parks we surveyed once supported fire-dependent ecosystems such as wet meadow, prairie fen, oak barrens, and oak-hickory forest. In the past, lightning- and human-induced fires frequently spread over large areas of southern Michigan and other Midwestern states, helping to reduce colonization by trees and shrubs and maintaining the open character of the landscape (Curtis 1959, Dorney 1981, Grimm 1984). In the absence of frequent fires, open oak savanna and prairie communities convert to forest types such as oak-hickory forest or mixed oak forest (Cohen 2001a). The reduction of wildfires in Midwestern states following the loss of indigenous cultures in the early 1800s is well documented and resulted in a loss of fire-dependent natural communities through both active conversion for farming and succession from open barrens and prairie to forest (Curtis 1959).

The conversion of open barrens and prairie to forested communities continues today and often results in a loss of species and habitat diversity (Curtis 1959, McCune and Cottam 1985, McClain et al. 1993). This was evident at many of the sites we surveyed. At Independence Oaks and Rose Oaks, the open character of many wetlands and savanna ecosystems has been lost as shrubs and trees have assumed dominance in the absence of a regular fire regime. As shade-tolerant woody species and canopy closure increase, the amount of sunlight that reaches the understory and ground layer is significantly reduced, and, thus, light-demanding species such as prairie forbs, grasses, and oak seedlings and saplings are unable to remain viable. As a result, both species diversity and habitat heterogeneity are reduced.

Some of the biggest changes caused by fire suppression have taken place at Independence Oaks and Rose Oaks, where previously open wetlands such as wet-mesic prairie, southern wet meadow, and prairie fen have been invaded by shrubs and trees and converted to shrub-carr and swamp forest. Additional long-term changes are

occurring within the oak-hickory forests at these parks due to altered fire regimes. At present, oaks and hickories dominate the canopies of dry-mesic forests at Independence Oaks and Rose Oaks; however, oak regeneration within these forests is either absent or restricted to steep slopes and forest edges. As a result of fire suppression within these ecosystems, red maple has colonized the understory and achieved canopy status in some locations. Unlike oaks, red maple is shade-tolerant, creates a dense canopy, and is fire-intolerant due to its thin bark. Thus, the absence of fire has allowed red maple to colonize these forests, further decreasing light levels and the potential for oak regeneration. The proliferation of red maple within oak forests and subsequent reduction of oak regeneration has been well documented in many locations (Abrams 1998). Repeated prescribed burns will eliminate the red maple seedlings and saplings and help control exotic shrub invasion. A sustained fire management regime will allow for increased recruitment of oak seedlings and saplings.

The establishment of red maple within oak-hickory forests also results in significant changes in adjacent wetland communities. For example, at both Independence Oaks and Rose Oaks, fire suppression has enabled red maple to establish withindry-mesic southern forests, and to colonize adjacent wetlands such as prairie fen, bog, southern wet meadow, and relict conifer swamp (tamarack swamp). Species loss following invasion of relict conifer swamp by red maple can be significant. The shift from conifer dominance to hardwood dominance also results in a drastic reduction in shrub cover (Kost 2001a). The reduction of shrub cover that results from red maple invasion can adversely impact a wide range of both animal and plant species. In particular, many bird species rely heavily on the fruit of native wetland shrubs during fall migration and winter. Although fire is not a frequent form of natural disturbance for relict conifer swamp, its absence in the broader landscape has reduced regeneration opportunities for early successional, light-demanding species, such as tamarack. Thus, actively cutting or girdling shade-tolerant hardwoods, particularly red maple, from prairie fens, southern wet meadows, bogs, and relict conifer swamps may be needed if these important natural community types are to be maintained. Like the relict conifer swamp, the hardwood-conifer swamp at Independence Oaks is experiencing similar changes, with many severely shade-pruned and dead northern white cedar and tamarack occurring under the dense shade of red maple. Girdling red maples that are shading native conifer, such as northern white cedar, tamarack, and white pine, will maintain the long-term viability of these species. However, these management efforts should be performed in conjunction with significant reductions in the local population of white-tailed deer, which kill young conifers through repeated browsing.

Plant communities, whether upland or lowland, benefit from prescribed fire in several ways. Depending on the season and intensity of a burn, prescribed fire may be used to decrease the cover of exotic, cool-season grasses and woody species, and increase the cover of native warm-season grasses and forbs (White 1983, Abrams and Hulbert 1987, Tester 1989, Collins and Gibson 1990, Glenn-Lewin et al. 1990, Anderson and Schwegman 1991). Prescribed fire helps reduce litter levels, allowing sunlight to reach the soil surface and stimulate seed germination and enhance seedling establishment (Daubenmire 1968, Hulbert 1969, Knapp 1984, Tester 1989, Anderson and Schwegman 1991, Warners 1997). Important plant nutrients (e.g., N, P, K, Ca, and Mg) are elevated following prescribed fire (Daubenmire 1968, Viro 1974, Reich et al. 1990, Schmalzer and Hinkle 1992). Prescribed fire has been shown to result in increased plant biomass, flowering, and seed production (Abrams et al. 1986, Laubhan 1995, Warners 1997, Kost and De Steven 2000). Prescribed fire can also help express and rejuvenate seed banks, which may be especially important for maintaining species diversity (Leach and Givnish 1996, Kost and De Steven 2000).

Impacts to faunal communities should also be considered when planning a prescribed burn. Dividing a large area into smaller burn units that can be burned in alternate years or seasons can protect populations of many species. This allows unburned units to serve as refugia for immobile invertebrates and slow-moving amphibian and

reptile species. When burning larger areas, it may be desirable to strive for patchy burns by igniting during times of high relative humidity. As mentioned above, the unburned patches may then serve as refugia, which facilitate recolonization of burned patches by fire-sensitive species. Burning under overcast skies and when air temperatures are cool (<55°F) can help protect reptiles, since they are less likely to be found basking above the surface when conditions are cloudy and cool. Lastly, conducting burns during the dormant season (late October through March) may also help minimize impacts to reptiles.

Implications for Forest Management

In the absence of natural fires, the upland oak-hickory forests at Independence Oaks and Rose Oaks are likely to continue to undergo significant changes in structure and species composition as the oaks are replaced by more shade-tolerant tree species, such as red maple. Management of these upland forests should focus on maintaining conditions suitable for oak regeneration, that is, an open canopy with high light levels. As noted, the first management step should be the reintroduction of fire. If a sustained fire management program does not result in an increase in oak and hickory regeneration and the reduction of red maple recruitment and other shade tolerant species, park managers should consider more intrusive measures. Cutting or girdling shade-tolerant species is often effective. By removing competitors and also planting acorns or oak seedlings within large light gaps such as those created by recent tree-falls, park staff can direct the ecological succession of some portions of these forests. Any management for oak recruitment must also include reducing densities of white-tailed deer and protecting seedlings from browsing.

Another important forest management goal in all parks will be to reduce forest fragmentation. At present, a hard edge is maintained along many of the forest stands. Allowing oaks and hickories to establish within the old fields between blocks of forest and then directing the succession of these fields towards oak savanna or forest will enable isolated blocks of forest to be enlarged and connected. The formation of larger blocks of forest will help improve nesting success for raptors, neotropical migrant songbirds, and ground-nesting species because their nests are less likely to be parasitized and predated in larger blocks of forest (Wilcove et al. 1986). In addition, invasive species are less likely to invade larger blocks of contiguous habitat, since the ratio of interior habitat to edge typically increases with size.

For the beech-sugar maple forests and swamp forests at Lyon Oaks and Independence Oaks (Site Codes: A, B, and J, K respectively), reducing forest fragmentation should be a primary management objective. As native forests become increasingly fragmented, their dynamics shift from being primarily internally driven to being externally and anthropogenically driven. The effects of forest fragmentation on native plants and animals and ecosystem processes are profound and alarming (Heilman et al. 2002). The small and insularized nature of forest fragments may make them too small to support the full array of species formerly found in the landscape (Rooney and Dress 1997). Local population extinctions within fragments are accelerated by reduced habitat and small population size. Because of fragment isolation, inter-patch colonization may fail to compensate for local extinctions (Hewitt and Kellman 2004). Within fragmented forests, avian diversity is reduced by nest predation and nest parasitism. Numerous neotropical migrant songbirds are dependent on interior forest habitat and are highly susceptible to nest parasitism and predation (Robinson et al. 1995, Heske et al. 2001, Heilman et al. 2002). Forest succession within fragmented landscapes can be delayed or drastically modified because seed dispersal is greater for early-successional trees than for mid- or late-successional species (McEuen and Curran 2004). Native plant diversity within forested fragments is threatened by low seedling survivorship, infrequent seed dispersal, high levels of herbivory, and a growing prevalence of invasive exotic species and native weeds. Invasive species thrive along the edges of forest fragments and become widely dispersed throughout fragmented landscapes, especially

along roads (Brosofske et al. 2001, Heilman et al. 2002, Hewitt and Kellman 2004).

At Lyon Oaks, in particular, expanding the size of existing forest blocks by allowing adjacent old fields to succeed to forest will help improve nesting success for raptors, neotropical migrant songbirds, and ground-nesting species because their nests are less likely to be parasitized and predated in larger blocks of forest (Wilcove et al. 1986). In addition, impacts of invasions by exotic species are reduced in larger blocks of contiguous habitat, since the ratio of interior habitat to edge typically increases with size.

Oak Barrens Restoration

Large areas of both Independence Oaks and Rose Oaks historically supported oak barrens (Figure 3). In particular, the areas surrounding the Nature Center at Independence Oaks and the southern portions of Rose Oaks provide very good opportunities for restoring oak barrens. Native prairie grasses and forbs were scattered throughout the Crooked Lake Barrens (Site Code D) at Independence Oaks, making restoration of oak barrens at this site a high priority because of its likelihood of success and benefits to regional biodiversity. Conducting prescribed burns in these areas will help reduce canopy cover and allow native prairie and savanna species to expand or reestablish. Areas of former savanna and prairie often contain seed banks that are expressed with canopy opening and the re-introduction of fire. Reduction of canopy and shrub coverage can also be accomplished by cutting and/or mowing. In addition, reintroducing native prairie species through sowing seeds or planting plugs will help supplement the soil seed bank, which may no longer contain the full complement of species that likely once grew at these sites.

Invasive Species

Invasive species pose a major threat to species and habitat diversity within the parks. By outcompeting and replacing native species, invasives change species composition, alter vegetation structure, and reduce native species diversity, often causing local or even complete extinction of native species (Harty 1986). Invasive exotic species can also upset delicately balanced ecological processes such as trophic relationships, interspecific competition, nutrient cycling, soil erosion, hydrologic balance, and solar insolation (Bratton 1982). Lastly, exotic invasive species often have no natural predators and spread aggressively through rapid sexual and asexual reproduction.

While numerous invasive species occur within the parks, **garlic mustard**, **glossy buckthorn**, **multiflora rose**, **Oriental bittersweet**, **reed**, and **purple loosestrife** are likely to pose the greatest threats because of their ability to invade and quickly dominate intact natural communities (see Table 6 for additional invasive species with high potential to erode biodiversity). Additionally, three invasive species that are not currently widespread but have great potential to erode biodiversity were observed in the following locations: **black swallow-wort** (*Vincetoxicum nigrum*) was observed at Independence Oaks in the Clinton River Wet Meadow (Site Code: F); **white swallow-wort** (*Vincetoxicum rossicum*) was observed at Rose Oaks in Esler Lake Woodland (Site Code: Q); and **Japanese knotweed** (*Polygonum cuspidatum*), was observed bordering both sides of the northern, gated access road off of Fish Lake Road (GPS coordinates: 42° 45' 24" N, 84° 21' 12" W). These species should be removed now, while they are relatively easily controlled and before they infest additional areas. Invasive species abstracts, which include detailed management guidelines can be obtained at http: //tncweeds.ucdavis.edu/.

Garlic mustard, in particular, is a serious concern even in small numbers. Because it is self-fertile, even a single plant can establish an entire population and quickly result in a large infestation. While it invades all types of forested habitats, it is especially aggressive in mesic and wet-mesic conditions, like those found within the swamp at Lyon Oaks (Meekins and McCarthy 2001). Garlic mustard should be removed prior to seedset wherever it is encountered.

Glossy buckthorn can also severely reduce species diversity, especially in alkaline wetland habitats, such as wet-mesic prairie, prairie fen,

Japanese knotweed (*Polygonum cuspidatum*), is a fast-growing and extremely invasive exotic plant, which grows in clonal clumps that spread by rhizomes and can reach a height of 8 to 10 feet. This population has just begun to invade Rose Oaks. Controlling this species immediately, while the population is still small, should be a very high priority. Japanese knotweed has taken over many acres of floodplains and open, moist areas along the Ohio and Allegheny Rivers and in the Pacific Northwest. Vigorous and immediate management may help prevent its spread in Michigan.

and relict conifer swamp. Left untreated, it can form large, impenetrable, monotypic stands in formerly open, species-diverse wetlands.

Multiflora rose is large shrub with thick, piercing thorns that grows robustly in both uplands and wetlands. This shrub can form dense, impenetrable thickets that pose a significant danger to wildlife (and people!), as they impede movement, and the sharp, tough thorns can ensnare and tear flesh.

Reed is a very tall (>2m) perennial grass with a dense, fibrous root system. Because of its robust stature, reed displaces native wetland vegetation and degrades wildlife habitat. **Narrow-leaved cat-tail** is also very aggressive and is capable of displacing the native broad-leaved cat-tail. Many methods have been used to control both species, but repeated, multi-year applications of wetland-approved herbicide have proven most effective.

Purple loosestrife is another pernicious invader of wetland habitats, which often completely replaces native emergent marsh vegetation. Some success in controlling purple loosestrife has recently been achieved with the application of biological control agents, *Galerucella* beetles, which are native to purple loosestrife's European habitat (Hight and Drea 1991, Blossey 1992).

Several invasive species also threaten upland dry-mesic forests. Among the most problematic of these are **Oriental bittersweet**, **common buckthorn**, and **Eurasian honeysuckles (Amur** and **Morrow)**. By invading the shrub layer of semi-open forest communities, these species severely reduce the amount of light available to the ground layer, causing the elimination of many herbaceous species and preventing the reproduction of overstory dominants. Oriental bittersweet is especially problematic. A twining vine, it can literally strangle large trees by tightly wrapping around the truck and preventing new growth of cambium tissue, effectively girdling the stem.

These species can be effectively controlled by stem removal, but cutting without immediate herbicide application should be strictly avoided, since resprouting typically results in the proliferation of multiple stems, thus making it even more difficult to eliminate these problematic species.

More information on detailed information on all of these invasive species, as well as methods for controlling them, can be found at http: //tncweeds.ucdavis.edu/.

Deer Densities

Many studies have shown that high deer densities adversely impact local ecosystems and vegetation (Alverson et al. 1988, Balgooyen and Waller 1995, Waller and Alverson 1997, Augustine and Frelich 1998, Rooney 2001, Horsely et al. 2003). At high densities, deer can act as keystone herbivores, drastically altering vegetative structure and composition, which can lead to cascading trophic effects (Alverson et al. 1988, Strole and Anderson 1992, Rooney and Dress 1997, Waller and Alverson 1997, Augustine and Frelich 1998, Van Deelen 1999, Rooney 2001, Rooney and Waller 2003). Chronically high deer densities over the last half-century (or more) have limited tree recruitment in Great Lakes forests and drastically altered their floral composition and structure (Whitney 1984, Abrams and Orwig 1996, Rooney and Dress 1997, Alverson and Waller 1997, Woods 2000, Zhang et al. 2000, Abrams 2001). The high intensity of browsing in many locations has prevented the establishment of seedling or sapling banks of palatable species (Peterson and Pickett 1995, Peterson 2000).

In addition to the drastic changes to tree recruitment, deer browsing has had perhaps an even greater impact to forb and shrub diversity. Most herbaceous species and shrubs never outgrow the "molar zone"—the zone of susceptibility to deer browse (Waller and Alverson 1997). With a single bite, deer can remove the leaf area and reproductive structures of long-lived understory forbs, many of which lack the capacity for regrowth after being browsed. Spring perennial herbs may require decades to fully recover from deer browsing. Herbaceous plants constitute 87% of deer's summer diet. Concentrated herbivory can reduce forb reproductive capacity and plant size, and even lead to the local extirpation of sensitive plants (Alverson et al. 1988, Rooney and Dress 1997, Augustine and Frelich 1998, Rooney and Waller 2003). Indirect impacts of deer herbivory can include the reduction of pollinators and seed dispersers of sensitive herbs (Waller and Alverson 1997, Ruhren and Handel 2003). Researchers have documented that nearly one hundred threatened and endangered plants are jeopardized by deer herbivory (Miller et al. 1992). As a result of high deer densities across the Great Lakes, forb species that are less palatable and more tolerant of grazing, such as ferns, graminoids, and club mosses, have increased in frequency in forested systems, leading various authors to argue that deer browse has contributed to a region-wide "homogenization" of forest flora and a reduction of floral genetic diversity (Van Deelen et al. 1996, Rooney and Dress 1997, Augustine and Frelich 1998, Rooney 2001, Rooney and Waller 2003, Kraft et al. 2004).

Excessive deer browse is evident throughout the parks we surveyed. Deer herbivory is likely reducing floristic diversity and limiting regeneration of oaks within the upland forests and northern white-cedar and white pine within the hardwood-conifer swamp at Independence Oaks (Strole and Anderson 1992). Through preferential grazing of native species, high deer densities are also thought to contribute to the spread of invasive, exotic species such as garlic mustard (Victoria Nuzzo pers. comm. 1998). Changes in herbaceous plant size and reproductive rates can be dramatically reversed when deer herbivory is eliminated for only two years (Augustine and Frelich 1998). Recovery of seedling and sapling banks (advanced regeneration) requires a more prolonged period of low deer densities (8 to 10 years with < 4 deer/km) (Whitney 1984, Alverson et al. 1988, Tester et al. 1997, Rooney et al. 2000). Conservation and restoration of forest communities require active long-term management of deer at low densities, which may be realized through increased hunting pressure (Alverson et al. 1988, Augustine and Frelich 1998). In addition, reducing forest fragmentation by allowing old fields, agricultural fields, and

early-successional forest to succeed to mature forest will diminish suitable habitat for deer and reduce deer populations across the landscape. Where resources are available, deer exclosure fences may be erected around concentrations of sensitive herbs and susceptible saplings. It is recommended that the Oakland County Parks work cooperatively with the Michigan Department of Natural Resources to assess park deer densities and reduce deer densities if determined to be higher than recommended by the DNR.

Setting Stewardship Priorities

While invasive species and other threats, such as fire suppression and excessively high deer densities, occur in nearly all natural communities surveyed in this study, management priority should be given to highest quality sites. By concentrating effort on a few high quality sites, limited resources of time, personnel, volunteer effort, and money can be directed to make a significant impact on biodiversity. How should park managers and naturalists determine which sites to manage? That decision is one best made by resource professionals from the Oakland County Parks, but evaluation criteria should include the following:

1) A preference toward high quality sites with minimal infestations of invasive species. Biodiversity is most easily and effectively protected by preventing high quality sites from degrading, and invasives are much easier to eradicate when they are not yet well established.

2) A focus on sites that harbor high levels of native-species diversity or unique elements of biodiversity (e.g., hardwood swamps, floodplain forests, springs, rare species, etc.). Wetlands, in particular, harbor a disproportionate number of rare species and provide critical habitat for many species.

3) Sites that enhance core areas of high quality habitat or act as critical corridors for wildlife. Reducing forest fragmentation at Lyon Oaks will enhance several high quality sites.

4) High profile sites that are viewed by many visitors, such as well used trails or sites with scenic overlooks or picturesque views. Opportunities to educate the public about biodiversity and stewardship are maximized by actively working to restore frequently visited sites. Restoring sites that provide scenic vistas will promote an appreciation of the park's natural resources.

A brief summary of sites with high restoration potential in each park follows below. Detailed site descriptions and management recommendations are included in the Site Summaries and Management section (page 21).

High Priority Sites at Independence Oaks

At Independence Oaks, we identified nine sites with high restoration potential (Table 5). The **Independence Hardwood-Conifer Swamp** (Site Code: A) represents a rare natural community, especially in southern Michigan, and provides habitat for the rare bog bluegrass; thus, this site is a high priority for protection and management. Glossy buckthorn, an invasive shrub, has become established within the site but its population size is currently small enough to control with a concerted management and monitoring effort. The **Group Camp Mesic Southern Forest** (Site Code: B) represents one of the few remaining, intact beech-sugar maple forests with within the area. At present, the site needs little management other than regular monitoring for and removal of invasive species. Note that reducing deer densities is critical for all sites, but especially the Independence Hardwood-Conifer Swamp and Group Camp Mesic Southern Forest. **Sashabaw Bog** adds significantly to the diversity of ecosystems in the park and in the entire region. While bogs are not rare in Michigan, they are uncommon in the southern part of the state, which makes management and monitoring of this site a high priority. Invasive species are not currently abundant within the bog; thus, annual monitoring for glossy buckthorn and other

invasives, followed by prompt removal when any are found, will help maintain the biological integrity of this unique ecosystem. Several open wetlands that all require similar management strategies of removing invasives, reducing shrub and tree cover, and implementing a prescribed burning program are the **Crooked Lake Fen**, **Clinton River Wet Meadow**, and **Nature Center Fen** (Site Codes: E, F, and G, respectively). Both the Clinton River Wet Meadow and Nature Center Fen are highly visible and easily accessible by park managers, naturalists, and volunteer stewards, which makes management and monitoring of these rare natural communities a realistic and worthy goal. The **Crooked Lake Barrens** and **Oak Ridge Woodland** (Site Codes: D and H) provide an excellent opportunity for restoration of rare upland communities. The reintroduction of fire, through prescription burning, will help restore biodiversity and provide naturalists with teaching examples for explaining ecological processes and natural history. In addition, fire will help thin the understory of the Oak Ridge Woodland, which will increase the beauty of the scenic vista overlooking Crooked Lake.

High Priority Sites at Lyon Oaks

Four sites with good potential for restoration were identified at Lyon Oaks (Table 5). **Wixom Woods** and **Norton Swamp** (Site Codes: J and K) represent naturally closed-canopy forest ecosystems. Management efforts for both sites should focus on reducing deer densities and removing invasive species, which are presently at a realistically controllable level of infestation. Hiking trails crisscross these forests and provide park managers, naturalists, and volunteer stewards with easy access for locating, removing, and monitoring invasive species. Maintaining the ecological integrity of these forests will allow them to serve as regional reservoirs of biodiversity and teaching sites for natural history education. Similar management needs occur at the **Lyon Marsh** and **Pipeline Prairie** (Site Codes: L and M). The emergent marshes, southern wet meadows, and wet-mesic prairies at these sites add significantly to the diversity of ecosystems within the park, which facilitates natural history education and wildlife diversity. Removing invasive species from these habitats will help ensure their long-term viability.

High Priority Sites at Rose Oaks

At Rose Oaks, twelve sites were identified with good potential for restoration (Table 5). The **Rose Oaks Wet-mesic Prairie** represents a globally rare natural community type. Management of this site should focus on 1) removing invasive species, 2) reducing shrub and tree cover, and 3) implementing a regular prescribed-fire program. Other non-forested wetlands within the park that require the same management regime include **Buckhorn Road Sedge Meadow**, **Esler Lake Wetlands**, **Richardson Lake East Shore**, **Beaver Dam Wet-mesic Prairie**, and **Beaver Pond Wet Meadow** (Site Codes: P, R, T, X, and Y). Maintaining the open conditions of these wetlands is critical to the plants and animals that depend on these habitats. Several oak woodlands occur within the park at **Esler Lake Woodland** and **White Oak Knoll** (Site Codes: Q and Z). Reintroducing fire, through regular prescription burning, along with invasive species control, will help restore plant and animal diversity to these sites. Both sites possess substantial topographic relief and offer scenic vistas that are worthy of sharing, which increases their importance as targets for restoration and stewardship. Three swamp forests occur at **Wild Rice Pond**, **Golden Pond**, and **Fish Lake Road Tamaracks** (Site Codes: S, U, and W). These sites add significantly to the diversity of habitats and species supported by the park. Maintaining the biological integrity of these wetland forests will require monitoring for invasive species and removing any that are found, especially glossy buckthorn, and girdling red maples where they are competing with tamaracks or other native conifers. Lastly, **Fish Lake Road Bog** (Site Code: V) represents a very unique habitat and species assemblage. Its location near the access road along Fish Lake Road makes it an easy site to access by park managers, naturalists, and volunteer stewards for stewardship and natural history education. Removing invasive species and Scotch pine from the surrounding area will improve the long-term viability of this bog ecosystem.

Conclusion

The Oakland County Parks staff has the considerable responsibility of stewarding populations of rare species and numerous ecologically significant natural communities. As the region becomes more developed, the prominence of natural features harbored by the County Parks is substantially heightened. Both rare and common native species are threatened by the rapid pace of development in southeast Michigan. In addition, changes taking place outside park boundaries are having significant repercussions within park borders. For example, as new roads, subdivisions, shopping centers, and industries are built outside the park, invasive plants used in landscaping quickly find their way into the park and cause severe degradation to natural communities and their associated complement of native species. Historic wildlife corridors are disrupted, and cosmopolitan edge species such as white-tailed deer increasingly seek refuge within the confines of the County Parks. The increased deer density within the parks result in extirpation of numerous plant and animal species, as their effects on ecosystems reverberate at multiple trophic levels (McShea and Rappole 1992, Waller and Alverson 1997). As rare plants and high quality natural communities are lost to development, the regional significance of safeguarding these natural features within the County Parks becomes even more important.

Conservation scientists and practitioners are more aware today than ever before that protecting rare species and ecologically significant natural communities requires far more than simply creating preserves to prevent their outright destruction (Janzen 1986). Because changes occurring outside the park boundaries result in significant impacts within the parks, protection of rare species and natural communities requires active participation by Oakland County Parks staff in stewarding the land for ecological integrity. This formidable task requires that park staff identify significant natural features, develop conservation strategies, and apply their considerable expertise in resource management to the active stewardship of ecological integrity.

Independence Oaks, Lyon Oaks, and Rose Oaks support significant natural features that are threatened by events taking place within the parks as well as outside their boundaries. The parks have lost a considerable amount of their biodiversity as a result of fire suppression, deforestation, forest fragmentation, infestation of pernicious invasive species, and excessively high white-tail deer populations. Restoring the ecological process of fire to the appropriate ecosystems at these parks will profoundly enhance their ecological integrity. At Rose Oaks, in particular, tremendous ecological benefits can also be gained by directing the ecological succession of its old fields towards oak barrens. The loss of biodiversity caused by infestations of invasive plants can be reversed by developing eradication and monitoring programs that are focused on protecting the centers of biodiversity, namely the wet-mesic prairies, prairie fens, southern wet meadows, dry-mesic southern forests, mesic southern forests, southern swamps, and relict conifer swamps. Finally, active management of the local deer herd is likely to result in the recovery of many plants and ground- and shrub-nesting animal species over time.

Acknowledgments

Funding for this project was provided by the Oakland County Parks and Recreation. We gratefully acknowledge the cooperation of Oakland County Parks and Recreation staff members, including Dan Stencil, Executive Officer, Joseph P. Figa, Jr., Chief of Design and Development, and Jon Noyes, Landscape Designer. Lewis Wint and Lyon Oaks Nature Center naturalists, especially Kathleen Dougherty and Tim Nowicki, offered interest and enthusiasm, and shared with us their considerable knowledge of the parks. We express our sincere gratitude to Dr. Tony Reznicek, University of Michigan Herbarium, for providing information on the parks and assisting with identification of rare plants. We sincerely appreciate the contributions of numerous MNFI staff members, who supported the project in many ways. In particular, we wish to acknowledge the following MNFI staff for their contributions: Mike Penskar and Phyllis Higman supplied their invaluable expertise with plant identification and rare plant survey methodologies; Patrick Brown, Lyn Scrimger, Sue Ridge, and Connie Brinson provided helpful administrative support; Rebecca Boehm, Kim Borland, and Brad Slaughter assisted with element occurrence processing; Jacqueline Courteau and Brad Slaughter offered invaluable editorial assistance. In addition, Jacqueline performed report formatting with great care and Brad assisted with field work. We gratefully acknowledge Tommie Carson for her helpful editorial assistance.

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Appendix 1. Plant species observed at Independence Oaks County Park. "X" indicates the species occurred within the site. "-" indicates species was not observed at the site. Capitalized scientific and common names indicate non-native species. Life form acronyms are as follows: Nt, native; P, perennial; Ad, adventive; B, biannual; A, annual. "C" is the Coefficient of Conservation for each species (Herman et al. 2001). ***** Sites are listed in Table 1, p. 13, along with their abbreviations and site codes.

		Site/Site Code*	HCS	MSF	SB	CLB	CLF	CWM	NCF	ORW	SLS
Scientific Name	**Common Name**	**Life Form**	**C**	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**
Acer rubrum	red maple	Nt Tree	1	x	x	-	x	-	-	-	x	x
Acer saccharum	sugar maple	Nt Tree	5	x	x	-	-	-	-	-	-	-
Achillea millefolium	yarrow	Nt P-Forb	1	-	-	-	x	-	x	-	-	-
Actaea pachypoda	doll's-eyes	Nt P-Forb	7	x	x	-	-	-	-	-	x	-
Adiantum pedatum	maidenhair fern	Nt Fern	6	x	x	-	-	-	-	-	-	-
Agalinis purpurea	purple gerardia	Nt A-Forb	7	-	-	-	-	-	x	-	-	-
AGROPYRON REPENS	QUACK GRASS	Ad P-Grass	0	-	-	-	x	-	-	-	-	-
Agropyron trachycaulum	slender wheat grass	Nt P-Grass	8	-	-	-	-	x	x	x	-	-
Alisma plantago-aquatica	water-plantain	Nt P-Forb	1	x	-	-	-	-	-	-	-	-
Amelanchier arborea	juneberry	Nt Tree	4	-	x	-	x	-	-	-	x	-
Amphicarpaea bracteata	hog-peanut	Nt A-Forb	5	x	-	-	-	-	x	-	x	-
Andromeda glaucophylla	bog rosemary	Nt Shrub	10	-	-	x	-	-	-	-	-	-
Andropogon gerardii	big bluestem	Nt P-Grass	5	-	-	-	x	-	x	-	-	-
Andropogon scoparius	little bluestem grass	Nt P-Grass	5	-	-	-	x	-	-	-	-	-
Anemone cylindrica	thimbleweed	Nt P-Forb	6	-	-	-	x	-	-	-	-	-
Apios americana	groundnut	Nt P-Forb	3	x	-	-	-	-	x	x	-	-
Apocynum androsaemifolium	spreading dogbane	Nt P-Forb	3	-	-	-	-	-	-	-	x	-
Apocynum cannabinum	indian hemp	Nt P-Forb	3	-	-	-	-	x	x	x	-	-
Arabis canadensis	sickle-pod	Nt B-Forb	7	-	-	-	-	-	-	-	x	-
Aralia racemosa	spikenard	Nt P-Forb	8	x	-	-	-	-	-	-	-	-
Arisaema triphyllum	jack-in-the-pulpit	Nt P-Forb	5	x	-	-	-	-	-	-	x	x
Aronia prunifolia	black chokeberry	Nt Shrub	5	-	-	x	-	x	-	-	-	x
Asclepias exaltata	poke milkweed	Nt P-Forb	6	-	-	-	-	-	-	-	x	-
Asclepias incarnata	swamp milkweed	Nt P-Forb	6	-	-	-	-	x	x	x	-	-

Appendix 1, continued. Plant species observed at Independence Oaks.

		Site/Site Code*		HCS	MSF	SB	CLB	CLF	CWM	NCF	ORW	SLS
Scientific Name	**Common Name**	**Life Form**	**C**	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**
Asclepias syriaca	common milkweed	Nt P-Forb	1	-	-	-	x	-	-	x	-	-
Asclepias tuberosa	butterfly-weed	Nt P-Forb	5	-	-	-	x	-	-	-	-	-
Asplenium platyneuron	ebony spleenwort	Nt Fern	2	-	-	-	x	-	-	-	-	-
Aster borealis	northern bog aster	Nt P-Forb	9	-	-	-	-	x	x	-	-	-
Aster ericoides	heath aster	Nt P-Forb	3	-	-	-	x	-	-	-	-	-
Aster firmus	smooth swamp aster	Nt P-Forb	4	-	-	-	-	-	x	x	-	-
Aster lateriflorus	side-flowering aster	Nt P-Forb	2	x	-	-	-	x	-	x	-	-
Aster macrophyllus	big-leaved aster	Nt P-Forb	4	-	-	-	-	-	-	-	x	-
Aster novae-angliae	New England aster	Nt P-Forb	3	-	-	-	-	-	x	x	-	-
Aster oolentangiensis	prairie heart-leaved aster	Nt P-Forb	4	-	-	-	x	-	-	-	-	-
Aster puniceus	swamp aster	Nt P-Forb	5	x	-	-	-	-	-	x	-	-
Aster umbellatus	tall flat-top white aster	Nt P-Forb	5	-	-	-	x	x	x	x	-	-
Athyrium filix-femina	lady fern	Nt Fern	4	x	x	-	-	-	-	-	-	x
BERBERIS THUNBERGII	JAPANESE BARBERRY	Ad Shrub	0	x	-	-	x	x	-	-	x	x
Betula alleghaniensis	yellow birch	Nt Tree	7	x	-	-	-	-	-	-	-	-
Betula pumila	bog birch	Nt Shrub	8	-	-	x	-	-	-	x	-	x
Bidens cernuus	nodding bur-marigold	Nt A-Forb	3	x	-	-	-	-	-	-	-	-
Bidens connatus	purple-stemmed tickseed	Nt A-Forb	5	-	-	-	-	-	x	-	-	-
Bidens coronatus	tall swamp marigold	Nt A-Forb	7	-	-	-	-	x	-	-	-	-
Bidens frondosus	common beggar-ticks	Nt A-Forb	1	x	-	-	-	-	-	-	-	-
Boehmeria cylindrica	false nettle	Nt P-Forb	5	x	-	-	-	x	-	x	-	-
Botrychium virginianum	rattlesnake fern	Nt Fern	5	x	-	-	-	-	-	-	-	x
Brachyelytrum erectum	long-awned wood grass	Nt P-Grass	7	x	x	-	-	-	-	-	-	-
Bromus ciliatus	fringed brome	Nt P-Grass	6	-	-	-	-	-	x	x	-	-
BROMUS INERMIS	SMOOTH BROME	Ad P-Grass	0	-	-	-	x	-	-	-	-	-
Bromus pubescens	Canada brome	Nt P-Grass	5	-	-	-	-	-	x	-	-	-
Calamagrostis canadensis	blue-joint grass	Nt P-Grass	3	-	-	-	-	x	x	x	-	-
Caltha palustris	marsh marigold	Nt P-Forb	6	x	-	-	-	-	x	x	-	x

* Listed in Table 1, p.13.

Appendix 1, continued. Plant species observed at Independence Oaks.

		Site/Site Code*	HCS	MSF	SB	CLB	CLF	CWM	NCF	ORW	SLS
Scientific Name	**Common Name**	**Life Form**	**C**	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**
Campanula aparinoides	marsh bellflower	Nt P-Forb	7	-	-	-	-	x	x	x	-	-
Cardamine pratensis	cuckoo flower	Nt P-Forb	10	-	-	-	-	-	-	-	-	x
Carex albursina	sedge	Nt P-Sedge	5	-	x	-	-	-	-	-	-	-
Carex aquatilis	sedge	Nt P-Sedge	7	-	-	-	-	x	-	-	-	x
Carex bebbii	sedge	Nt P-Sedge	4	-	-	-	-	-	x	-	-	-
Carex blanda	sedge	Nt P-Sedge	1	x	-	-	-	-	-	-	-	-
Carex bromoides	sedge	Nt P-Sedge	6	x	-	-	-	-	-	-	-	-
Carex buxbaumii	sedge	Nt P-Sedge	10	-	-	-	-	-	x	-	-	-
Carex comosa	sedge	Nt P-Sedge	5	-	-	x	-	-	-	-	-	-
Carex diandra	sedge	Nt P-Sedge	8	-	-	-	-	x	-	-	-	-
Carex disperma	sedge	Nt P-Sedge	10	-	-	x	-	-	-	-	-	-
Carex flava	sedge	Nt P-Sedge	4	-	-	-	-	x	-	-	-	-
Carex gracillima	sedge	Nt P-Sedge	4	x	-	-	-	x	-	-	-	-
Carex hystericina	sedge	Nt P-Sedge	2	x	-	-	-	-	-	-	-	-
Carex intumescens	sedge	Nt P-Sedge	3	-	x	-	-	-	-	-	-	-
Carex lacustris	sedge	Nt P-Sedge	6	x	-	-	-	x	x	x	-	x
Carex leptalea	sedge	Nt P-Sedge	5	-	-	-	-	x	-	x	-	-
Carex lupulina	sedge	Nt P-Sedge	4	x	-	-	-	-	-	-	-	-
Carex pedunculata	sedge	Nt P-Sedge	5	x	x	-	-	-	-	-	-	-
Carex pellita	sedge	Nt P-Sedge	2	-	-	-	-	x	-	-	-	-
Carex pensylvanica	sedge	Nt P-Sedge	4	x	x	-	x	-	-	-	x	-
Carex pseudo-cyperus	sedge	Nt P-Sedge	5	-	-	x	-	-	-	-	-	-
Carex radiata	straight-styled wood sedge	Nt P-Sedge	2	x	-	-	-	-	x	-	-	-
Carex sartwellii	sedge	Nt P-Sedge	5	-	-	-	-	-	x	-	-	-
Carex sterilis	sedge	Nt P-Sedge	10	-	-	-	-	x	-	x	-	-
Carex stipata	sedge	Nt P-Sedge	1	x	-	-	-	x	-	-	-	-
Carex stricta	sedge	Nt P-Sedge	4	-	-	x	-	x	x	x	-	-
Carex tetanica	sedge	Nt P-Sedge	9	-	-	-	-	-	x	x	-	-
Carex trisperma	sedge	Nt P-Sedge	9	-	-	x	-	-	-	-	-	-

* Listed in Table 1, p.13.

Appendix 1, continued. Plant species observed at Independence Oaks.

		Site/Site Code*	HCS	MSF	SB	CLB	CLF	CWM	NCF	ORW	SLS
Scientific Name	**Common Name**	**Life Form**	**C**	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**
Carpinus caroliniana	blue-beech	Nt Tree	6	x	-	-	-	-	-	-	-	-
Carya cordiformis	bitternut hickory	Nt Tree	5	-	x	-	-	-	-	-	-	-
Carya glabra	pignut hickory	Nt Tree	5	-	-	-	x	-	-	-	x	-
Carya ovata	shagbark hickory	Nt Tree	5	-	-	-	-	-	-	-	x	-
CELASTRUS ORBICULATA	ORIENTAL BITTERSWEET	Ad W-Vine	0	-	-	-	x	-	-	-	x	x
Celtis occidentalis	hackberry	Nt Tree	5	x	-	-	-	-	-	-	-	-
CENTAUREA MACULOSA	SPOTTED KNAPWEED	Ad B-Forb	0	-	-	-	x	-	-	-	-	-
Cephalanthus occidentalis	buttonbush	Nt Shrub	7	-	-	x	-	x	-	-	-	-
CERASTIUM FONTANUM	MOUSE-EAR CHICKWEED	Ad P-Forb	0	-	-	-	-	-	x	-	-	-
Chamaedaphne calyculata	Leatherleaf	Nt Shrub	8	-	-	x	-	-	-	-	-	-
Chelone glabra	turtlehead	Nt P-Forb	7	x	-	-	-	-	-	-	-	-
Chimaphila umbellata	pipsissewa	Nt Shrub	8	-	-	-	-	-	-	-	x	-
CHRYSANTHEMUM LEUCANTHEMUM	OX-EYE DAISY	Ad P-Forb	0	-	-	-	x	-	x	-	-	-
Cicuta bulbifera	water hemlock	Nt P-Forb	5	-	-	-	-	-	-	x	-	-
Cicuta maculata	water hemlock	Nt B-Forb	4	x	-	-	-	x	x	x	-	-
Cinna arundinacea	wood reedgrass	Nt P-Grass	7	x	-	-	-	-	-	-	-	-
Circaea lutetiana	enchanter's-nightshade	Nt P-Forb	2	x	-	-	-	-	-	-	x	x
Cirsium muticum	swamp thistle	Nt B-Forb	6	-	-	-	-	x	x	x	-	x
Cladium mariscoides	twig rush	Nt P-Sedge	10	-	-	-	-	x	-	-	-	-
Collinsonia canadensis	richweed	Nt P-Forb	8	x	-	-	-	-	-	-	-	-
Conopholis americana	squawroot	Nt P-Forb	10	-	x	-	-	-	-	-	-	-
Coptis trifolia	goldthread	Nt P-Forb	5	x	-	-	-	-	-	-	-	-
Cornus alternifolia	alternate-leaved dogwood	Nt Tree	5	-	-	-	-	-	-	-	x	-
Cornus amomum	silky dogwood	Nt Shrub	2	x	-	-	-	-	x	-	-	-
Cornus florida	flowering dogwood	Nt Tree	8	-	-	-	-	-	-	-	x	-
Cornus foemina	gray dogwood	Nt Shrub	1	x	-	-	x	x	x	x	-	x
Cornus stolonifera	red-osier dogwood	Nt Shrub	2	-	-	-	-	x	x	x	-	x

* Listed in Table 1, p.13.

Appendix 1, continued. Plant species observed at Independence Oaks.

		Site/Site Code*	HCS	MSF	SB	CLB	CLF	CWM	NCF	ORW	SLS
Scientific Name	**Common Name**	**Life Form**	**C**	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**
Corylus americana	hazelnut	Nt Shrub	5	x	-	-	x	x	-	x	-	x
Cryptotaenia canadensis	honewort	Nt P-Forb	2	x	-	-	-	-	-	-	-	x
Cypripedium calceolus var. parviflorum	small yellow lady's-slipper	Nt P-Forb	7	x	-	-	-	-	x	-	-	-
Cystopteris bulbifera	bulblet fern	Nt Fern	5	x	-	-	-	-	-	-	-	-
Cystopteris fragilis	fragile fern	Nt Fern	4	x	-	-	-	-	-	-	-	-
DACTYLIS GLOMERATA	ORCHARD GRASS	Ad P-Grass	0	-	-	-	x	-	-	-	-	-
Danthonia spicata	poverty grass; oatgrass	Nt P-Grass	4	-	-	-	x	-	-	-	x	-
DAUCUS CAROTA	QUEEN-ANNE'S-LACE	Ad B-Forb	0	-	-	-	x	-	x	-	-	-
Decodon verticillatus	whorled or swamp loosestrife	Nt Shrub	7	-	-	x	-	x	-	x	-	-
Dentaria diphylla	two-leaved toothwort	Nt P-Forb	5	-	x	-	-	-	-	-	-	-
Desmodium canadense	showy tick-trefoil	Nt P-Forb	3	-	-	-	-	-	x	-	-	-
Desmodium glutinosum	clustered-leaved tick-trefoil	Nt P-Forb	5	-	-	-	-	-	-	-	x	-
Desmodium nudiflorum	naked tick-trefoil	Nt P-Forb	7	-	-	-	-	-	-	-	x	-
Desmodium sessilifolium	sessile-leaved tick-trefoil	Nt P-Forb	8	-	-	-	x	-	-	-	-	-
DIANTHUS ARMERIA	DEPTFORD PINK	Ad A-Forb	0	-	-	-	x	-	-	-	-	-
Dirca palustris	leatherwood	Nt Shrub	8	-	x	-	-	-	-	-	-	-
Drosera rotundifolia	round leaved sundew	Nt P-Forb	6	-	-	x	-	-	-	-	-	-
Dryopteris carthusiana	spinulose woodfern	Nt Fern	5	x	-	-	-	-	-	-	-	-
Dryopteris cristata	crested shield fern	Nt Fern	6	x	-	-	-	x	-	-	-	x
Dryopteris intermedia	evergreen woodfern	Nt Fern	5	x	-	-	-	-	-	-	-	-
Dulichium arundinaceum	three way sedge	Nt P-Sedge	8	-	-	x	-	-	-	-	-	-
ELAEAGNUS UMBELLATA	AUTUMN-OLIVE	Ad Shrub	0	x	-	-	x	x	x	x	-	x
Eleocharis elliptica	golden-seeded spike-rush	Nt P-Sedge	6	x	-	-	-	x	-	x	-	-
Eleocharis erythropoda	spike rush	Nt P-Sedge	4	-	-	-	-	x	-	-	-	-
Eleocharis rostellata	spike rush	Nt P-Sedge	10	-	-	-	-	x	x	-	-	-
Elymus virginicus	Virginia wild rye	Nt P-Grass	4	x	-	-	-	-	-	-	-	-
Epifagus virginiana	beech drops	Nt P-Forb	10	-	x	-	-	-	-	-	-	-
Epilobium leptophyllum	fen willow-herb	Nt P-Forb	6	-	-	-	-	x	-	x	-	-

* Listed in Table 1, p.13.

Appendix 1, continued. Plant species observed at Independence Oaks.

		Site/Site Code*	HCS	MSF	SB	CLB	CLF	CWM	NCF	ORW	SLS
Scientific Name	**Common Name**	**Life Form**	**C**	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**
EPIPACTIS HELLEBORINE	HELLEBORINE	Ad P-Forb	0	x	-	-	-	-	-	-	-	-
Equisetum fluviatile	water horsetail	Nt Fern Ally	7	-	-	-	-	x	-	-	-	-
Equisetum palustre	marsh horsetail	Nt Fern Ally	10	-	-	-	-	-	x	-	-	-
Eragrostis spectabilis	purple love grass	Nt P-Grass	3	-	-	-	x	-	-	-	-	-
Erigeron pulchellus	Robin's plantain	Nt P-Forb	5	x	-	-	-	-	x	-	-	-
Erigeron strigosus	daisy fleabane	Nt P-Forb	4	-	-	-	x	-	-	-	x	-
Eriophorum virginicum	tawny cotton grass	Nt P-Sedge	8	-	-	x	-	-	-	-	-	-
Eupatorium maculatum	joe-pye-weed	Nt P-Forb	4	-	-	-	-	x	x	x	-	-
Eupatorium perfoliatum	common boneset	Nt P-Forb	4	x	-	-	-	x	x	x	-	-
Euphorbia corollata	flowering spurge	Nt P-Forb	4	-	-	-	x	-	-	-	-	-
Euthamia graminifolia	grass-leaved goldenrod	Nt P-Forb	3	-	-	-	-	x	x	-	-	-
Fagus grandifolia	American beech	Nt Tree	6	x	x	-	-	-	-	-	x	x
Fragaria virginiana	wild strawberry	Nt P-Forb	2	x	-	-	-	-	x	-	-	x
Fraxinus americana	white ash	Nt Tree	5	-	x	-	x	-	-	-	x	-
Fraxinus nigra	black ash	Nt Tree	6	x	-	-	-	-	-	-	-	x
Fraxinus pennsylvanica	red ash	Nt Tree	2	x	-	-	-	x	x	-	-	-
Galium aparine	annual bedstraw	Nt A-Forb	0	x	-	-	-	-	-	-	-	-
Galium asprellum	rough bedstraw	Nt P-Forb	5	-	-	-	-	x	x	x	-	-
Galium boreale	northern bedstraw	Nt P-Forb	3	-	-	-	-	-	x	-	-	-
Galium circaezans	white wild licorice	Nt P-Forb	4	-	-	-	-	-	-	-	x	-
Galium pilosum	hairy bedstraw	Nt P-Forb	6	-	-	-	x	-	-	-	-	-
Galium triflorum	fragrant bedstraw	Nt P-Forb	4	x	-	-	-	-	-	-	-	x
Gaylussacia baccata	huckleberry	Nt Shrub	7	-	-	-	-	-	-	-	x	-
Geranium maculatum	wild geranium	Nt P-Forb	4	x	-	-	-	-	-	-	x	-
Geum canadense	white avens	Nt P-Forb	1	x	-	-	-	-	-	-	x	x
Glyceria canadensis	rattlesnake grass	Nt P-Grass	8	x	-	-	-	-	-	-	-	-
Glyceria striata	fowl manna grass	Nt P-Grass	4	x	-	-	-	-	x	x	-	-
Hamamelis virginiana	witch-hazel	Nt Shrub	5	-	-	-	-	-	-	-	x	-

* Listed in Table 1, p.13.

Appendix 1, continued. Plant species observed at Independence Oaks.

		Site/Site Code*	HCS	MSF	SB	CLB	CLF	CWM	NCF	ORW	SLS
Scientific Name	**Common Name**	**Life Form**	**C**	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**
Helianthus giganteus	tall sunflower	Nt P-Forb	5	-	-	-	-	**x**	**x**	**x**	-	-
Hepatica americana	round-lobed hepatica	Nt P-Forb	6	**x**	**x**	-	-	-	-	-	-	-
HIERACIUM AURANTIACUM	ORANGE HAWKWEED	Ad P-Forb	0	-	-	-	**x**	-	-	-	-	-
HYPERICUM PERFORATUM	COMMON ST. JOHN'S-WORT	Ad P-Forb	0	-	-	-	**x**	-	-	-	**x**	-
Hystrix patula	bottlebrush grass	Nt P-Grass	5	**x**	-	-	-	-	-	-	**x**	-
Ilex verticillata	Michigan holly	Nt Shrub	5	**x**	-	**x**	-	**x**	-	-	-	-
Impatiens capensis	spotted touch-me-not	Nt A-Forb	2	**x**	-	-	-	-	**x**	**x**	-	**x**
Iris virginica	southern blue flag	Nt P-Forb	5	-	-	-	-	**x**	**x**	**x**	-	-
Juglans cinerea	butternut	Nt Tree	5	**x**	-	-	-	-	-	-	-	-
Juncus brachycephalus	rush	Nt P-Forb	7	-	-	-	-	**x**	-	**x**	-	-
Juncus canadensis	Canadian rush	Nt P-Forb	6	-	-	**x**	-	-	-	-	-	-
Juncus dudleyi	Dudley's rush	Nt P-Forb	1	-	-	-	-	-	**x**	-	-	-
Juncus effusus	soft stemmed rush	Nt P-Forb	3	-	-	**x**	-	-	-	-	-	-
Juniperus communis	common or ground juniper	Nt Shrub	4	-	-	-	**x**	-	**x**	**x**	**x**	-
Juniperus virginiana	red-cedar	Nt Tree	3	-	-	-	-	-	-	**x**	-	-
Laportea canadensis	wood nettle	Nt P-Forb	4	**x**	-	-	-	-	-	-	-	-
Larix laricina	tamarack	Nt Tree	5	**x**	-	**x**	-	**x**	**x**	**x**	-	**x**
Lathyrus palustris	marsh pea	Nt P-Forb	7	-	-	-	-	-	**x**	**x**	-	-
Lechea villosa	hairy pinweed	Nt P-Forb	5	-	-	-	**x**	-	-	-	-	-
Leersia oryzoides	cut grass	Nt P-Grass	3	**x**	-	-	-	-	-	-	-	-
Leersia virginica	white grass	Nt P-Grass	5	**x**	-	-	-	-	-	-	-	-
Lemna minor	small duckweed	Nt A-Forb	5	-	-	-	-	-	-	**x**	-	-
Lespedeza capitata	round-headed bush-clover	Nt P-Forb	5	-	-	-	**x**	-	-	-	-	-
Lespedeza hirta	hairy bush-clover	Nt P-Forb	7	-	-	-	**x**	-	-	-	**x**	-
Lespedeza virginica	slender bush-clover	Nt P-Forb	7	-	-	-	**x**	-	-	-	-	-
Liatris aspera	rough blazing star	Nt P-Forb	4	-	-	-	**x**	-	-	-	-	-
Lilium michiganense	Michigan lily	Nt P-Forb	5	**x**	-	-	-	-	-	-	-	-

* Listed in Table 1, p.13.

Appendix 1, continued. Plant species observed at Independence Oaks.

		Site/Site Code*	HCS	MSF	SB	CLB	CLF	CWM	NCF	ORW	SLS
Scientific Name	**Common Name**	**Life Form**	**C**	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**
Lindera benzoin	spicebush	Nt Shrub	7	x	-	-	-	-	-	-	-	-
Liparis liliifolia	lily-leaved twayblade	Nt P-Forb	8	-	-	-	x	-	-	-	-	-
Liriodendron tulipifera	tulip tree	Nt Tree	9	x	x	-	-	-	-	-	-	-
Lobelia kalmii	bog lobelia	Nt P-Forb	10	-	-	-	-	x	-	x	-	-
Lobelia siphilitica	great blue lobelia	Nt P-Forb	4	x	-	-	-	-	-	-	-	-
Lobelia spicata	pale spiked lobelia	Nt P-Forb	4	-	-	-	-	-	x	-	-	-
Lycopus americanus	common water horehound	Nt P-Forb	2	-	-	-	-	-	x	-	-	-
Lycopus uniflorus	northern bugle weed	Nt P-Forb	2	x	-	-	-	x	x	x	-	x
Lysimachia ciliata	fringed loosestrife	Nt P-Forb	4	x	-	-	-	-	x	-	-	-
Lysimachia quadriflora	whorled loosestrife	Nt P-Forb	10	-	-	-	-	x	-	x	-	-
Lysimachia thyrsiflora	tufted loosestrife	Nt P-Forb	6	-	-	-	-	x	x	-	-	-
LYTHRUM SALICARIA	PURPLE LOOSESTRIFE	Ad P-Forb	0	-	-	-	-	-	-	x	-	-
Maianthemum canadense	Canada mayflower	Nt P-Forb	4	x	-	-	-	-	-	-	-	x
MALUS PUMILA	APPLE	Ad Tree	0	-	-	-	x	-	-	-	-	-
MELILOTUS ALBA	WHITE SWEET-CLOVER	Ad B-Forb	0	-	-	-	x	-	-	-	-	-
Mentha arvensis	wild mint	Nt P-Forb	3	-	-	-	-	-	x	x	-	-
MENTHA PIPERITA	PEPPERMINT	Ad P-Forb	0	-	-	-	-	-	-	-	-	x
Mitchella repens	partridge berry	Nt P-Forb	5	x	x	-	-	-	-	-	-	-
Mitella diphylla	bishop's cap	Nt P-Forb	8	x	-	-	-	-	-	-	-	x
Mitella nuda	naked miterwort	Nt P-Forb	8	x	-	-	-	-	-	-	-	-
Monarda fistulosa	wild bergamot	Nt P-Forb	2	-	-	-	x	-	-	-	-	-
Monotropa hypopithys	pinesap	Nt P-Forb	6	-	-	-	-	-	-	-	x	-
Monotropa uniflora	indian pipe	Nt P-Forb	5	-	x	-	-	-	-	-	-	-
Muhlenbergia glomerata	marsh wild-timothy	Nt P-Grass	10	-	-	-	-	x	-	x	-	-
Muhlenbergia mexicana	leafy satin grass	Nt P-Grass	3	-	-	-	-	-	-	x	-	-
Myrica gale	sweet gale	Nt Shrub	6	-	-	-	-	-	-	-	-	x
NASTURTIUM OFFICINALE	WATERCRESS	Ad P-Grass	0	-	-	-	-	-	-	x	-	-
Nuphar advena	yellow pond lily	Nt P-Forb	8	-	-	-	-	-	-	-	-	x
Nymphaea odorata	sweet-scented waterlily	Nt P-Forb	6	-	-	-	-	x	-	-	-	-
Onoclea sensibilis	sensitive fern	Nt Fern	2	x	-	-	-	x	x	x	-	x

* Listed in Table 1, p.13.

Appendix 1, continued. Plant species observed at Independence Oaks.

		Site/Site Code*	HCS	MSF	SB	CLB	CLF	CWM	NCF	ORW	SLS
Scientific Name	**Common Name**	**Life Form**	**C**	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**
Oryzopsis asperifolia	rough-leaved rice-grass	Nt P-Grass	6	-	x	-	x	-	-	-	-	-
Oryzopsis racemosa	rice-grass	Nt P-Grass	8	-	x	-	-	-	-	-	-	-
Osmorhiza claytonii	hairy sweet-cicely	Nt P-Forb	4	x	-	-	-	-	-	-	-	-
Osmunda cinnamomea	cinnamon fern	Nt Fern	5	x	-	-	-	x	-	-	-	x
Osmunda regalis	royal fern	Nt Fern	5	x	-	x	-	x	x	-	-	x
Ostrya virginiana	ironwood; hop-hornbeam	Nt Tree	5	-	x	-	-	-	-	-	-	-
Oxalis stricta	common yellow wood-sorrel	Nt P-Forb	0	x	-	-	x	-	-	-	-	-
Panax trifolius	dwarf ginseng	Nt P-Forb	8	-	x	-	-	-	-	-	-	-
Panicum clandestinum	panic grass	Nt P-Grass	3	-	-	-	-	-	-	-	x	-
Panicum implicatum	panic grass	Nt P-Grass	3	-	-	-	x	-	x	-	-	-
Panicum oligosanthes	panic grass	Nt P-Grass	5	-	-	-	x	-	-	-	-	-
Parnassia glauca	grass-of-parnassus	Nt P-Forb	8	-	-	-	-	-	x	-	-	-
Parthenocissus quinquefolia	Virginia creeper	Nt W-Vine	5	x	-	-	-	-	x	-	x	x
Pedicularis canadensis	wood-betony	Nt P-Forb	10	-	x	-	-	-	-	-	-	-
Pedicularis lanceolata	swamp-betony	Nt P-Forb	8	-	-	-	-	x	x	-	-	-
Phalaris arundinacea	reed canary grass	Nt P-Grass	0	x	-	-	-	x	x	-	-	-
PHLEUM PRATENSE	TIMOTHY	Ad P-Grass	0	-	-	-	x	-	-	-	-	-
Phragmites australis	reed	Nt P-Grass	0	-	-	-	-	-	x	-	-	-
Physocarpus opulifolius	ninebark	Nt Shrub	4	-	-	-	-	-	x	-	-	-
Picea mariana	black spruce	Nt Tree	6	-	-	x	-	-	-	-	-	-
Pilea pumila	clearweed	Nt A-Forb	5	x	-	-	-	-	-	-	-	-
Pinus resinosa	red pine	Nt Tree	6	-	-	-	x	-	-	-	x	-
Pinus strobus	white pine	Nt Tree	3	x	-	x	-	-	-	-	-	-
PINUS SYLVESTRIS	SCOTCH PINE	Ad Tree	0	-	-	-	x	-	-	-	-	-
POA COMPRESSA	CANADA BLUEGRASS	Ad P-Grass	0	-	-	-	x	-	-	-	x	-
Poa paludigena	bog bluegrass	Nt P-Grass	10	x	-	-	-	-	-	-	-	-
POA PRATENSIS	KENTUCKY BLUEGRASS	Ad P-Grass	0	-	-	-	x	-	-	-	-	-
Podophyllum peltatum	may-apple	Nt P-Forb	3	x	x	-	-	-	-	-	x	-
Polygonatum pubescens	downy solomon-seal	Nt P-Forb	5	x	x	-	-	-	-	-	-	x
Polygonum amphibium	water smartweed	Nt P-Forb	6	-	-	-	-	x	x	x	-	-

* Listed in Table 1, p.13.

Appendix 1, continued. Plant species observed at Independence Oaks.

		Site/Site Code*	HCS	MSF	SB	CLB	CLF	CWM	NCF	ORW	SLS
Scientific Name	**Common Name**	**Life Form**	**C**	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**
Polygonum hydropiper	water-pepper	Nt A-Forb	1	x	-	-	-	-	-	x	-	-
Polystichum acrostichoides	christmas fern	Nt Fern	6	-	x	-	-	-	-	-	-	-
Populus deltoides	cottonwood	Nt Tree	1	x	-	-	-	-	-	-	-	x
Populus grandidentata	big-toothed aspen	Nt Tree	4	-	-	-	x	-	-	-	-	-
Populus tremuloides	quaking aspen	Nt Tree	1	-	-	-	-	x	x	x	-	x
Potentilla fruticosa	shrubby cinquefoil	Nt Shrub	10	-	-	-	-	x	x	x	-	-
Potentilla palustris	marsh cinquefoil	Nt P-Forb	7	-	-	-	-	-	-	-	-	x
Prenanthes alba	white lettuce	Nt P-Forb	5	x	x	-	-	-	-	-	-	-
Prunella vulgaris	lawn prunella	Nt P-Forb	0	x	-	-	-	-	-	-	-	-
Prunus serotina	wild black cherry	Nt Tree	2	x	-	-	x	-	-	-	x	-
Prunus virginiana	choke cherry	Nt Shrub	2	x	-	-	-	-	-	-	-	-
Pteridium aquilinum	bracken fern	Nt Fern	0	x	-	-	-	-	-	-	x	-
Pycnanthemum virginianum	common mountain mint	Nt P-Forb	5	-	-	-	-	x	x	x	-	-
Quercus alba	white oak	Nt Tree	5	x	-	-	x	-	-	-	x	-
Quercus bicolor	swamp white oak	Nt Tree	8	-	-	-	-	-	x	-	-	-
Quercus macrocarpa	bur oak	Nt Tree	5	-	-	-	-	-	x	-	-	x
Quercus rubra	red oak	Nt Tree	5	x	x	-	-	-	-	x	x	x
Quercus velutina	black oak	Nt Tree	6	-	-	-	x	-	-	-	x	-
Ranunculus abortivus	small flowered buttercup	Nt A-Forb	0	-	-	-	-	-	-	-	-	x
Ranunculus recurvatus	hooked crowfoot	Nt A-Forb	5	x	-	-	-	-	-	-	-	x
Rhamnus alnifolia	alder-leaved buckthorn	Nt Shrub	8	-	-	-	-	x	x	-	-	-
RHAMNUS CATHARTICA	COMMON BUCKTHORN	Ad Tree	0	x	-	-	-	-	x	-	-	x
RHAMNUS FRANGULA	GLOSSY BUCKTHORN	Ad Shrub	0	x	-	x	x	x	x	x	-	x
Rhynchospora alba	beak-rush	Nt P-Sedge	6	-	-	-	-	x	-	-	-	-
Rhynchospora capillacea	beak-rush	Nt P-Sedge	10	-	-	-	-	x	-	-	-	-
Ribes cynosbati	prickly or wild gooseberry	Nt Shrub	4	x	x	-	-	-	-	-	-	-
Ribes hirtellum	swamp gooseberry	Nt Shrub	6	-	-	-	-	-	x	-	-	x
ROSA MULTIFLORA	MULTIFLORA ROSE	Ad Shrub	0	x	-	-	x	-	-	x	x	-
Rosa palustris	swamp rose	Nt Shrub	5	-	-	x	-	x	x	-	-	-
Rubus flagellaris	northern dewberry	Nt Shrub	1	-	-	-	x	-	-	-	-	-

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Appendix 1, continued. Plant species observed at Independence Oaks.

		Site/Site Code*	HCS	MSF	SB	CLB	CLF	CWM	NCF	ORW	SLS
Scientific Name	**Common Name**	**Life Form**	**C**	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**
Rubus hispidus	swamp dewberry	Nt Shrub	4	-	-	-	-	-	-	-	-	x
Rubus pubescens	dwarf raspberry	Nt P-Forb	4	x	-	-	-	-	-	x	-	x
Rubus strigosus	wild red raspberry	Nt Shrub	2	-	-	-	-	-	-	x	-	-
Rudbeckia hirta	black-eyed susan	Nt P-Forb	1	-	-	-	x	-	x	x	-	-
RUMEX ACETOSELLA	SHEEP SORREL	Ad P-Forb	0	-	-	-	x	-	-	-	x	-
Rumex orbiculatus	great water dock	Nt P-Forb	9	-	-	-	-	-	x	x	-	-
Sagittaria latifolia	common arrowhead	Nt P-Forb	1	x	-	-	-	-	-	x	-	-
Salix amygdaloides	peach-leaved willow	Nt Tree	3	-	-	-	-	-	x	-	-	-
Salix bebbiana	Bebb's willow	Nt Shrub	1	-	-	-	-	x	-	x	-	-
Salix candida	hoary willow	Nt Shrub	9	-	-	-	-	x	-	-	-	-
Salix discolor	pussy willow	Nt Shrub	1	x	-	-	-	x	-	x	-	-
Salix petiolaris	slender willow	Nt Shrub	1	-	-	-	-	x	-	x	-	-
Sambucus canadensis	elderberry	Nt Shrub	3	x	-	-	-	-	x	-	-	-
Sanicula marilandica	black snakeroot	Nt P-Forb	4	x	-	-	-	-	x	-	-	-
Sarracenia purpurea	pitcher plant	Nt P-Forb	10	-	-	-	-	-	-	-	-	x
Sassafras albidum	sassafras	Nt Tree	5	-	-	-	-	-	-	-	x	-
Schizachne purpurascens	false melic	Nt P-Grass	5	x	-	-	-	-	-	-	-	-
Schoenoplectus acutus	hardstem bulrush	Nt P-Sedge	5	-	-	-	-	x	x	x	-	-
Schoenoplectus tabernaemontani	softstem bulrush	Nt P-Sedge	4	-	-	-	-	-	-	x	-	-
Scirpus atrovirens	bulrush	Nt P-Sedge	3	-	-	-	-	-	x	-	-	-
Scirpus cyperinus	wool-grass	Nt P-Sedge	5	-	-	x	-	-	x	-	-	-
Scirpus pendulus	bulrush	Nt P-Sedge	3	-	-	-	-	-	x	-	-	-
Scutellaria galericulata	common skullcap	Nt P-Forb	5	-	-	-	-	x	x	x	-	-
Scutellaria lateriflora	mad-dog skullcap	Nt P-Forb	5	x	-	-	-	-	-	-	-	-
Selaginella selaginoides	spikemoss	Nt Fern Ally	10	-	-	-	-	-	x	-	-	-
Senecio aureus	golden ragwort	Nt P-Forb	5	x	-	-	-	-	-	-	-	x
Smilacina racemosa	false spikenard	Nt P-Forb	5	-	x	-	-	-	-	-	x	-
SOLANUM DULCAMARA	BITTERSWEET NIGHTSHADE	Ad P-Forb	0	x	-	-	-	-	x	-	-	-
Solidago altissima	tall goldenrod	Nt P-Forb	1	-	-	-	-	x	x	x	-	-
Solidago caesia	blue-stemmed goldenrod	Nt P-Forb	7	-	x	-	-	-	-	-	x	-

* Listed in Table 1, p.13.

Appendix 1, continued. Plant species observed at Independence Oaks.

		Site/Site Code*	HCS	MSF	SB	CLB	CLF	CWM	NCF	ORW	SLS
Scientific Name	**Common Name**	**Life Form**	**C**	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**
Solidago canadensis	Canada goldenrod	Nt P-Forb	1	-	-	-	-	-	x	-	-	-
Solidago gigantea	late goldenrod	Nt P-Forb	3	-	-	-	-	-	x	x	-	-
Solidago nemoralis	old field goldenrod	Nt P-Forb	2	-	-	-	x	-	-	-	-	-
Solidago ohioensis	Ohio goldenrod	Nt P-Forb	8	-	-	-	-	x	-	-	-	-
Solidago patula	swamp goldenrod	Nt P-Forb	6	x	-	-	-	x	-	x	-	-
Solidago riddellii	Riddell's goldenrod	Nt P-Forb	6	-	-	-	-	x	x	x	-	-
Solidago rugosa	rough goldenrod	Nt P-Forb	3	x	-	x	-	x	x	x	-	-
Solidago speciosa	showy goldenrod	Nt P-Forb	5	-	-	-	x	-	-	-	-	-
Solidago uliginosa	bog goldenrod	Nt P-Forb	4	-	-	-	-	x	-	x	-	-
SONCHUS ARVENSIS	PERENNIAL SOW THISTLE	Ad P-Forb	0	-	-	-	-	-	x	-	-	-
Sparganium eurycarpum	common bur-reed	Nt P-Forb	5	x	-	-	-	-	-	-	-	-
Spartina pectinata	cordgrass	Nt P-Grass	5	-	-	-	-	x	x	x	-	-
Spiraea alba	meadowsweet	Nt Shrub	4	-	-	-	-	x	x	x	-	-
Symplocarpus foetidus	skunk-cabbage	Nt P-Forb	6	x	-	-	-	x	x	-	-	x
TARAXACUM OFFICINALE	COMMON DANDELION	Ad P-Forb	0	-	-	-	-	-	-	-	-	x
Thalictrum dasycarpum	purple meadow-rue	Nt P-Forb	3	x	-	-	-	-	x	x	-	-
Thalictrum dioicum	early meadow-rue	Nt P-Forb	6	-	x	-	-	-	-	-	x	-
Thelypteris hexagonoptera	broad beech fern	Nt Fern	8	x	-	-	-	-	-	-	-	-
Thelypteris noveboracensis	New York fern	Nt Fern	5	-	x	-	-	-	-	-	-	-
Thelypteris palustris	marsh fern	Nt Fern	2	-	-	x	-	x	x	x	-	-
Thelypteris phegopteris	northern beech fern	Nt Fern	5	-	x	-	-	-	-	-	-	-
Thuja occidentalis	northern white-cedar	Nt Tree	4	x	-	-	-	-	-	-	-	-
Tilia americana	basswood	Nt Tree	5	x	x	-	-	x	x	-	x	-
Tofieldia glutinosa	false asphodel	Nt P-Forb	10	-	-	-	-	x	-	-	-	-
TORILIS JAPONICA	HEDGE PARSLEY	Ad A-Forb	0	-	-	-	-	-	-	-	x	-
Toxicodendron radicans	poison ivy	Nt W-Vine	2	x	-	-	-	-	-	-	-	-
Toxicodendron vernix	poison sumac	Nt Shrub	6	x	-	x	-	x	x	x	-	x
TRAGOPOGON DUBIUS	GOAT'S BEARD	Ad B-Forb	0	-	-	-	x	-	-	-	-	-
Triadenum fraseri	marsh St. John's-wort	Nt P-Forb	6	-	-	-	-	x	-	-	-	-
Trientalis borealis	starflower	Nt P-Forb	5	x	-	-	-	-	-	-	-	-

* Listed in Table 1, p.13.

Appendix 1, continued. Plant species observed at Independence Oaks.

		Site/Site Code*	HCS	MSF	SB	CLB	CLF	CWM	NCF	ORW	SLS
Scientific Name	**Common Name**	**Life Form**	**C**	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**
TRIFOLIUM PRATENSE	RED CLOVER	Ad P-Forb	0	-	-	-	x	-	-	-	-	-
Trillium grandiflorum	common trillium	Nt P-Forb	5	x	x	-	-	-	-	-	-	-
TYPHA ANGUSTIFOLIA	NARROW-LEAVED CAT-TAIL	Ad P-Forb	0	-	-	-	-	x	-	x	-	-
Typha latifolia	broad leaved cat-tail	Nt P-Forb	1	x	-	x	-	-	x	x	-	x
Ulmus americana	American elm	Nt Tree	1	x	-	-	-	x	x	x	x	x
Urtica dioica	nettle	Nt P-Forb	1	x	-	-	-	-	-	-	-	x
Utricularia intermedia	flat-leaved bladderwort	Nt P-Forb	10	-	-	-	-	x	-	-	-	-
Uvularia grandiflora	bellwort	Nt P-Forb	5	x	-	-	-	-	-	-	-	-
Vaccinium angustifolium	blueberry	Nt Shrub	4	x	-	-	-	-	-	-	-	-
Vaccinium corymbosum	smooth highbush blueberry	Nt Shrub	6	x	-	x	-	-	-	-	-	x
Vaccinium macrocarpon	large cranberry	Nt Shrub	8	-	-	x	-	-	-	-	-	-
VERBASCUM THAPSUS	COMMON MULLEIN	Ad B-Forb	0	-	-	-	x	-	-	-	-	-
Viburnum acerifolium	maple-leaved arrow-wood	Nt Shrub	6	-	x	-	x	-	-	-	x	x
Viburnum lentago	nannyberry	Nt Shrub	4	-	-	-	-	x	x	x	-	x
VINCETOXICUM NIGRUM	BLACK SWALLOW-WORT	Ad P-Forb	0	-	-	-	x	-	x	-	-	-
Viola blanda	white violet	Nt P-Forb	5	-	-	-	-	-	-	-	-	x
Viola conspersa	dog violet	Nt P-Forb	3	-	-	-	-	-	-	-	-	x
Viola cucullata	marsh violet	Nt P-Forb	5	-	-	-	-	-	-	-	-	x
Viola sororia	common blue violet	Nt P-Forb	1	-	x	-	-	-	-	-	-	-
Vitis riparia	riverbank grape	Nt W-Vine	3	x	-	-	x	x	x	-	-	-
Woodwardia virginica	Virginia chain fern	Nt Fern	10	-	-	x	-	-	-	-	-	-
Zanthoxylum americanum	prickly-ash	Nt Shrub	3	x	-	-	x	x	x	x	-	x
Total number of species observed in survey site				**138**	**42**	**31**	**72**	**93**	**111**	**88**	**54**	**65**
Total number of species observed in Independence Oaks:			**363**									

* Listed in Table 1, p. 13.

Appendix 2. Plant species observed at Lyon Oaks County Park. "X" indicates the species occurred within the site. "-" indicates species was not observed at the site. Capitalized scientific and common names indicate non-native species. Life form acronyms are as follows: Nt, native; P, perennial; Ad, adventive; B, biannual; A, annual. "C" is the Coefficient of Conservation for each species (Herman et al. 2001). * Sites are listed in Table 1, p. 13, along with their abbreviations and site codes.

		Site/Site Code*		Wixom Woods	Norton Swamp	Lyon Marsh	Pipeline Prairie	Lyon Old Fields
Scientific Name	**Common Name**	**Life Form**	**C**	**J**	**K**	**L**	**M**	**N**
Acer nigrum	black maple	Nt Tree	4	-	x	-	-	-
ACER PLATANOIDES	NORWAY MAPLE	Ad Tree	0	x	-	-	-	-
Acer rubrum	red maple	Nt Tree	1	x	x	-	-	-
Acer saccharinum	silver maple	Nt Tree	2	-	x	x	-	-
Acer saccharum	sugar maple	Nt Tree	5	x	-	-	-	-
Achillea millefolium	yarrow	Nt P-Forb	1	-	-	-	-	x
Actaea pachypoda	doll's-eyes	Nt P-Forb	7	x	x	-	-	-
Actaea rubra	red baneberry	Nt P-Forb	7	x	-	-	-	-
Adiantum pedatum	maidenhair fern	Nt Fern	6	x	-	-	-	-
Agrimonia gryposepala	tall agrimony	Nt P-Forb	2	x	-	-	-	-
AGROPYRON REPENS	QUACK GRASS	Ad P-Grass	0	-	-	-	-	x
Alisma plantago-aquatica	water-plantain	Nt P-Forb	1	-	x	x	-	-
ALLIARIA PETIOLATA	GARLIC MUSTARD	Ad B-Forb	0	x	x	-	-	-
Ambrosia artemisiifolia	common ragweed	Nt A-Forb	0	-	-	-	-	x
Amelanchier arborea	juneberry	Nt Tree	4	x	-	-	-	-
Amphicarpaea bracteata	hog-peanut	Nt A-Forb	5	x	x	-	-	-
Andropogon gerardii	big bluestem	Nt P-Grass	5	-	-	-	x	-
Anemone cylindrica	thimbleweed	Nt P-Forb	6	-	-	-	x	-
Anemonella thalictroides	rue anemone	Nt P-Forb	8	x	-	-	-	-
Apocynum androsaemifolium	spreading dogbane	Nt P-Forb	3	-	x	-	-	-
Apocynum cannabinum	Indian hemp	Nt P-Forb	3	-	x	-	x	x
Aralia racemosa	spikenard	Nt P-Forb	8	-	x	-	-	-
ARCTIUM MINUS	COMMON BURDOCK	Ad B-Forb	0	x	x	-	-	-
Arisaema triphyllum	jack-in-the-pulpit	Nt P-Forb	5	x	x	-	-	-
Asarum canadense	wild ginger	Nt P-Forb	5	x	-	-	-	-
Asclepias exaltata	poke milkweed	Nt P-Forb	6	x	-	-	-	-
Asclepias incarnata	swamp milkweed	Nt P-Forb	6	-	x	-	-	x

Appendix 2, continued. Plant species observed at Lyon Oaks.

			Site/Site Code*	Wixom Woods	Norton Swamp	Lyon Marsh	Pipeline Prairie	Lyon Old Fields
Scientific Name	**Common Name**	**Life Form**	**C**	**J**	**K**	**L**	**M**	**N**
Asclepias syriaca	common milkweed	Nt P-Forb	1	-	-	-	-	**x**
Aster lateriflorus	side-flowering aster	Nt P-Forb	2	**x**	**x**	-	-	**x**
Athyrium filix-femina	lady fern	Nt Fern	4	**x**	**x**	-	-	-
Baptisia tinctoria	wild indigo	Nt P-Forb	10	-	-	-	**x**	-
BERBERIS THUNBERGII	JAPANESE BARBERRY	Ad Shrub	0	**x**	-	-	-	-
BERTEROA INCANA	HOARY ALYSSUM	Ad A-Forb	0	-	-	-	-	**x**
Bidens frondosus	common beggar-ticks	Nt A-Forb	1	-	**x**	-	-	-
Boehmeria cylindrica	false nettle	Nt P-Forb	5	**x**	**x**	**x**	-	-
BROMUS INERMIS	SMOOTH BROME	Ad P-Grass	0	-	-	-	-	**x**
Bromus pubescens	Canada brome	Nt P-Grass	5	-	**x**	-	-	-
CARDUUS NUTANS	MUSK THISTLE	Ad B-Forb	0	-	-	-	-	**x**
Carex albursina	sedge	Nt P-Sedge	5	**x**	**x**	-	-	-
Carex gracillima	sedge	Nt P-Sedge	4	**x**	-	-	**x**	-
Carex granularis	sedge	Nt P-Sedge	2	-	-	-	-	**x**
Carex hirtifolia	sedge	Nt P-Sedge	5	**x**	-	-	-	-
Carex intumescens	sedge	Nt P-Sedge	3	**x**	**x**	-	-	-
Carex lacustris	sedge	Nt P-Sedge	6	-	**x**	**x**	**x**	-
Carex leptonervia	sedge	Nt P-Sedge	3	-	**x**	-	-	-
Carex lupulina	sedge	Nt P-Sedge	4	-	**x**	-	-	-
Carex muskingumensis	sedge	Nt P-Sedge	6	-	**x**	-	-	-
Carex pedunculata	sedge	Nt P-Sedge	5	**x**	-	-	-	-
Carex radiata	straight-styled wood sedge	Nt P-Sedge	2	-	**x**	-	-	-
Carex retrorsa	sedge	Nt P-Sedge	3	-	**x**	-	-	-
Carex stipata	sedge	Nt P-Sedge	1	-	**x**	-	-	-
Carex stricta	sedge	Nt P-Sedge	4	-	-	-	**x**	-
Carex vulpinoidea	sedge	Nt P-Sedge	1	-	**x**	-	-	-
Carpinus caroliniana	blue-beech	Nt Tree	6	**x**	**x**	-	-	-
Carya cordiformis	bitternut hickory	Nt Tree	5	-	**x**	-	-	-
Carya ovata	shagbark hickory	Nt Tree	5	**x**	-	-	-	**x**
Caulophyllum thalictroides	blue cohosh	Nt P-Forb	5	**x**	**x**	-	-	-
Celastrus scandens	American bittersweet	Nt W-Vine	3	**x**	-	-	-	-
Cephalanthus occidentalis	buttonbush	Nt Shrub	7	-	**x**	**x**	-	-
Chelone glabra	turtlehead	Nt P-Forb	7	-	**x**	-	-	-

* Listed in Table 1, p.13.

Appendix 2, continued. Plant species observed at Lyon Oaks.

		Site/Site Code*		Wixom Woods	Norton Swamp	Lyon Marsh	Pipeline Prairie	Lyon Old Fields
Scientific Name	**Common Name**	**Life Form**	**C**	**J**	**K**	**L**	**M**	**N**
CHRYSANTHEMUM LEUCANTHEMUM	OX-EYE DAISY	Ad P-Forb	0	-	-	-	**x**	**x**
Cicuta maculata	water hemlock	Nt B-Forb	4	-	**x**	-	**x**	-
Circaea lutetiana	enchanter's-nightshade	Nt P-Forb	2	**x**	**x**	-	-	-
CIRSIUM ARVENSE	CANADIAN THISTLE	Ad P-Forb	0	-	**x**	-	-	**x**
CIRSIUM VULGARE	BULL THISTLE	Ad B-Forb	0	-	-	-	-	**x**
Clematis virginiana	virgin's bower	Nt W-Vine	4	-	**x**	-	-	-
Collinsonia canadensis	richweed	Nt P-Forb	8	**x**	-	-	-	-
Conopholis americana	squawroot	Nt P-Forb	10	**x**	-	-	-	-
Conyza canadensis	horseweed	Nt A-Forb	0	-	-	-	-	**x**
Cornus florida	flowering dogwood	Nt Tree	8	**x**	-	-	-	-
Cornus foemina	gray dogwood	Nt Shrub	1	**x**	**x**	**x**	-	-
Cornus stolonifera	red-osier dogwood	Nt Shrub	2	-	-	-	**x**	-
Corylus americana	hazelnut	Nt Shrub	5	**x**	**x**	-	-	-
Crateagus sp.	hawthorn	Nt Tree		**x**	**x**	-	-	-
Cryptotaenia canadensis	honewort	Nt P-Forb	2	-	**x**	-	-	-
DACTYLIS GLOMERATA	ORCHARD GRASS	Ad P-Grass	0	**x**	**x**	-	-	**x**
DAUCUS CAROTA	QUEEN-ANNE'S-LACE	Ad B-Forb	0	-	-	-	**x**	**x**
Desmodium glutinosum	clustered-leaved tick-trefoil	Nt P-Forb	5	**x**	**x**	-	-	-
DIANTHUS ARMERIA	DEPTFORD PINK	Ad A-Forb	0	-	-	-	-	**x**
Dryopteris carthusiana	spinulose woodfern	Nt Fern	5	**x**	**x**	-	-	-
Echinocystis lobata	wild cucumber	Nt A-Forb	2	**x**	**x**	-	-	-
ELAEAGNUS UMBELLATA	AUTUMN-OLIVE	Ad Shrub	0	**x**	-	-	**x**	**x**
Elymus villosus	silky wild-rye	Nt P-Grass	5	-	**x**	-	-	-
Elymus virginicus	Virginia wild-rye	Nt P-Grass	4	-	**x**	-	-	-
EPIPACTIS HELLEBORINE	HELLEBORINE	Ad P-Forb	0	-	**x**	-	-	-
Equisetum fluviatile	water horsetail	Nt Fern Ally	7	-	**x**	-	-	-
Erigeron strigosus	daisy fleabane	Nt P-Forb	4	-	-	-	-	**x**
EUONYMUS ALATA	WINGED WAHOO	Ad Shrub	0	**x**	**x**	-	-	-
Euonymus obovata	running strawberry-bush	Nt Shrub	5	**x**	-	-	-	-
Eupatorium maculatum	joe-pye-weed	Nt P-Forb	4	-	-	**x**	-	-
Euphorbia corollata	flowering spurge	Nt P-Forb	4	-	-	-	**x**	-
Euthamia graminifolia	grass-leaved goldenrod	Nt P-Forb	3	-	-	-	-	**x**
Fagus grandifolia	American beech	Nt Tree	6	**x**	-	-	-	-

* Listed in Table 1, p.13.

Appendix 2, continued. Plant species observed at Lyon Oaks.

			Site/Site Code*	Wixom Woods	Norton Swamp	Lyon Marsh	Pipeline Prairie	Lyon Old Fields
Scientific Name	**Common Name**	**Life Form**	**C**	**J**	**K**	**L**	**M**	**N**
FESTUCA ARUNDINACEA	TALL FESCUE	Ad P-Grass	0	-	-	-	x	-
Fragaria virginiana	wild strawberry	Nt P-Forb	2	-	x	-	-	-
Fraxinus americana	white ash	Nt Tree	5	x	-	-	x	x
Fraxinus nigra	black ash	Nt Tree	6	-	x	-	-	-
Fraxinus pennsylvanica	red ash	Nt Tree	2	-	x	-	-	-
Galium aparine	annual bedstraw	Nt A-Forb	0	x	-	-	-	-
Galium asprellum	rough bedstraw	Nt P-Forb	5	-	x	-	-	-
Galium circaezans	white wild licorice	Nt P-Forb	4	x	-	-	-	-
Geranium maculatum	wild geranium	Nt P-Forb	4	x	-	-	-	-
Geum canadense	white avens	Nt P-Forb	1	x	x	-	-	-
Glyceria striata	fowl manna grass	Nt P-Grass	4	x	x	-	-	-
Gnaphalium obtusifolium	old-field balsam	Nt A-Forb	2	-	-	-	-	x
Hackelia virginiana	beggar's-lice	Nt P-Forb	1	x	x	-	-	-
Hamamelis virginiana	witch-hazel	Nt Shrub	5	x	-	-	-	-
Helianthus divaricatus	woodland sunflower	Nt P-Forb	5	x	x	-	-	-
Hepatica americana	round-lobed hepatica	Nt P-Forb	6	x	-	-	-	-
HYPERICUM PERFORATUM	COMMON ST. JOHN'S-WORT	Ad P-Forb	0	-	-	-	-	x
Hystrix patula	bottlebrush grass	Nt P-Grass	5	x	x	-	-	-
Ilex verticillata	Michigan holly	Nt Shrub	5	-	x	-	-	-
Impatiens capensis	spotted touch-me-not	Nt A-Forb	2	x	x	-	x	-
Impatiens pallida	pale touch-me-not	Nt A-Forb	6	-	x	-	-	-
Iris virginica	southern blue flag	Nt P-Forb	5	-	x	-	-	-
Juglans nigra	black walnut	Nt Tree	5	x	-	-	-	-
Juncus dudleyi	Dudley's rush	Nt P-Forb	1	-	-	-	x	-
Juncus tenuis	path rush	Nt P-Forb	1	-	-	x	-	-
Juniperus virginiana	red-cedar	Nt Tree	3	-	-	-	-	x
Laportea canadensis	wood nettle	Nt P-Forb	4	x	x	-	-	-
Leersia oryzoides	cut grass	Nt P-Grass	3	-	x	x	-	-
Leersia virginica	white grass	Nt P-Grass	5	x	x	-	-	-
Lemna minor	small duckweed	Nt A-Forb	5	-	x	x	-	-
Lilium michiganense	Michigan lily	Nt P-Forb	5	x	-	-	-	-
LINARIA VULGARIS	BUTTER-AND-EGGS	Ad P-Forb	0	-	-	-	-	x
Lindera benzoin	spicebush	Nt Shrub	7	-	x	-	-	-
Lobelia cardinalis	cardinal flower	Nt P-Forb	7	-	x	-	-	-

* Listed in Table 1, p.13.

Appendix 2, continued. Plant species observed at Lyon Oaks.

			Site/Site Code*	Wixom Woods	Norton Swamp	Lyon Marsh	Pipeline Prairie	Lyon Old Fields
Scientific Name	**Common Name**	**Life Form**	**C**	**J**	**K**	**L**	**M**	**N**
Lobelia siphilitica	great blue lobelia	Nt P-Forb	4	x	x	-	-	-
Lobelia spicata	pale spiked lobelia	Nt P-Forb	4	-	-	-	x	-
LONICERA MAACKII	AMUR HONEYSUCKLE	Ad Shrub	0	-	-	-	-	x
LONICERA TATARICA	SMOOTH TARTARIAN HONEYSUCKLE	Ad Shrub	0	x	-	-	-	-
Lycopus americanus	common water horehound	Nt P-Forb	2	-	x	x	-	-
Lycopus uniflorus	northern bugle weed	Nt P-Forb	2	-	x	-	-	-
Lysimachia ciliata	fringed loosestrife	Nt P-Forb	4	-	x	-	-	-
LYTHRUM SALICARIA	PURPLE LOOSESTRIFE	Ad P-Forb	0	-	x	x	-	-
MEDICAGO SATIVA	ALFALFA	Ad P-Forb	0	-	-	-	-	x
MELILOTUS ALBA	WHITE SWEET-CLOVER	Ad B-Forb	0	-	-	-	-	x
MELILOTUS OFFICINALIS	YELLOW SWEET-CLOVER	Ad B-Forb	0	-	-	-	x	x
Menispermum canadense	moonseed	Nt W-Vine	5	-	x	-	-	-
Mentha arvensis	wild mint	Nt P-Forb	3	-	-	-	-	x
Monarda fistulosa	wild bergamot	Nt P-Forb	2	-	-	-	x	-
MORUS ALBA	WHITE MULBERRY	Ad Tree	0	x	-	-	-	-
Onoclea sensibilis	sensitive fern	Nt Fern	2	x	x	-	x	-
Osmorhiza claytonii	hairy sweet-cicely	Nt P-Forb	4	-	x	-	-	-
Osmunda cinnamomea	cinnamon fern	Nt Fern	5	x	-	-	-	-
Ostrya virginiana	ironwood; hop-hornbeam	Nt Tree	5	x	-	-	-	-
Oxalis stricta	common yellow wood-sorrel	Nt P-Forb	0	-	x	-	-	-
Panicum implicatum	panic grass	Nt P-Grass	3	-	-	-	x	-
Parthenocissus quinquefolia	Virginia creeper	Nt W-Vine	5	x	x	-	-	-
Phalaris arundinacea	reed canary grass	Nt P-Grass	0	x	x	x	x	x
PHLEUM PRATENSE	TIMOTHY	Ad P-Grass	0	-	-	-	-	x
Phlox divaricata	woodland phlox	Nt P-Forb	5	x	-	-	-	-
Phragmites australis	reed	Nt P-Grass	0	-	-	x	x	-
Phryma leptostachya	lopseed	Nt P-Forb	4	x	x	-	-	-
Phytolacca americana	pokeweed	Nt P-Forb	2	x	x	-	-	-
Pilea pumila	clearweed	Nt A-Forb	5	-	x	x	-	-
Pinus strobus	white pine	Nt Tree	3	x	-	-	-	-
PLANTAGO LANCEOLATA	ENGLISH PLANTAIN	Ad P-Forb	0	-	-	-	-	x
Plantago rugelii	red-stalked plantain	Nt A-Forb	0	-	-	-	-	x
POA COMPRESSA	CANADA BLUEGRASS	Ad P-Grass	0	-	-	-	x	-

* Listed in Table 1, p.13.

Appendix 2, continued. Plant species observed at Lyon Oaks.

			Site/Site Code*	Wixom Woods	Norton Swamp	Lyon Marsh	Pipeline Prairie	Lyon Old Fields
Scientific Name	**Common Name**	**Life Form**	**C**	**J**	**K**	**L**	**M**	**N**
POA PRATENSIS	KENTUCKY BLUEGRASS	Ad P-Grass	0	-	-	-	x	x
Podophyllum peltatum	may-apple	Nt P-Forb	3	x	x	-	-	-
Polygonatum pubescens	downy solomon-seal	Nt P-Forb	5	x	-	-	-	-
Polygonum amphibium	water smartweed	Nt P-Forb	6	-	-	-	-	x
Polygonum virginianum	jumpseed	Nt P-Forb	4	x	x	-	-	-
Pontederia cordata	pickerel weed	Nt P-Forb	8	-	x	-	-	-
Populus deltoides	cottonwood	Nt Tree	1	-	x	x	-	-
Populus grandidentata	big-toothed aspen	Nt Tree	4	x	-	-	-	-
Populus tremuloides	quaking aspen	Nt Tree	1	x	-	-	x	-
POTENTILLA RECTA	ROUGH-FRUITED CINQUEFOIL	Ad P-Forb	0	-	-	-	-	x
Potentilla simplex	old-field cinquefoil	Nt P-Forb	2	-	-	-	-	x
Prenanthes alba	white lettuce	Nt P-Forb	5	x	-	-	-	-
PRUNELLA VULGARIS	lawn prunella	Nt P-Forb	0	-	-	-	x	x
Prunus serotina	wild black cherry	Nt Tree	2	x	x	-	-	-
Prunus virginiana	choke cherry	Nt Shrub	2	x	x	-	-	-
Pteridium aquilinum	bracken fern	Nt Fern	0	x	-	-	-	-
Pycnanthemum virginianum	common mountain mint	Nt P-Forb	5	-	-	-	x	-
Quercus alba	white oak	Nt Tree	5	x	-	-	-	-
Quercus bicolor	swamp white oak	Nt Tree	8	-	x	-	-	-
Quercus macrocarpa	bur oak	Nt Tree	5	x	x	-	-	-
Quercus rubra	red oak	Nt Tree	5	x	x	-	-	-
Ranunculus abortivus	small-flowered buttercup	Nt A-Forb	0	-	x	-	-	-
Ranunculus recurvatus	hooked crowfoot	Nt A-Forb	5	x	x	-	-	-
RHAMNUS CATHARTICA	COMMON BUCKTHORN	Ad Tree	0	x	x	-	-	-
RHAMNUS FRANGULA	GLOSSY BUCKTHORN	Ad Shrub	0	x	x	-	-	-
Ribes americanum	wild black currant	Nt Shrub	6	x	x	-	-	-
Ribes cynosbati	prickly gooseberry	Nt Shrub	4	x	x	-	-	-
ROSA MULTIFLORA	MULTIFLORA ROSE	Ad Shrub	0	x	x	x	-	x
Rubus allegheniensis	common blackberry	Nt Shrub	1	x	x	-	-	-
Rubus flagellaris	northern dewberry	Nt Shrub	1	-	-	-	-	x
Rubus occidentalis	black raspberry	Nt Shrub	1	x	x	-	-	-
Rubus pubescens	dwarf raspberry	Nt P-Forb	4	-	x	-	-	-
Rudbeckia hirta	black-eyed susan	Nt P-Forb	1	-	-	-	x	-
Rudbeckia laciniata	cut-leaved coneflower	Nt P-Forb	6	-	x	-	-	-

* Listed in Table 1, p.13.

Appendix 2, continued. Plant species observed at Lyon Oaks.

		Site/Site Code*		Wixom Woods	Norton Swamp	Lyon Marsh	Pipeline Prairie	Lyon Old Fields
Scientific Name	**Common Name**	**Life Form**	**C**	**J**	**K**	**L**	**M**	**N**
RUMEX CRISPUS	CURLY DOCK	Ad P-Forb	0	-	-	-	-	**x**
Salix bebbiana	Bebb's willow	Nt Shrub	1	-	-	-	-	**x**
Salix discolor	pussy willow	Nt Shrub	1	-	-	-	-	**x**
Salix exigua	sandbar willow	Nt Shrub	1	-	-	-	-	**x**
Salix nigra	black willow	Nt Tree	5	-	**x**	**x**	-	-
Sambucus canadensis	elderberry	Nt Shrub	3	-	**x**	-	-	-
Sambucus racemosa	red-berried elder	Nt Shrub	3	**x**	-	-	-	-
Sanicula gregaria	black snakeroot	Nt P-Forb	2	-	**x**	-	-	-
Sassafras albidum	sassafras	Nt Tree	5	**x**	-	-	-	-
Scirpus atrovirens	bulrush	Nt P-Sedge	3	-	-	-	**x**	-
Scirpus pendulus	bulrush	Nt P-Sedge	3	-	-	-	**x**	-
Scutellaria galericulata	common skullcap	Nt P-Forb	5	-	**x**	-	-	-
Senecio aureus	golden ragwort	Nt P-Forb	5	-	**x**	-	-	-
SILENE PRATENSIS	WHITE CATCHFLY	Ad A-Forb	0	-	-	-	-	**x**
Sium suave	water-parsnip	Nt P-Forb	5	-	**x**	**x**	-	-
Smilacina racemosa	false spikenard	Nt P-Forb	5	**x**	**x**	-	-	-
Smilacina stellata	starry false solomon-seal	Nt P-Forb	5	**x**	**x**	-	-	-
Smilax tamnoides	bristly green-brier	Nt W-Vine	5	-	**x**	-	-	-
SOLANUM DULCAMARA	BITTERSWEET NIGHTSHADE	Ad P-Forb	0	**x**	**x**	**x**	-	-
Solidago altissima	tall goldenrod	Nt P-Forb	1	-	-	-	-	**x**
Solidago canadensis	Canada goldenrod	Nt P-Forb	1	-	**x**	-	**x**	**x**
Solidago gigantea	late goldenrod	Nt P-Forb	3	-	-	-	-	**x**
Sparganium eurycarpum	common bur-reed	Nt P-Forb	5	-	**x**	**x**	-	-
Spiraea alba	meadowsweet	Nt Shrub	4	-	**x**	**x**	-	-
Staphylea trifolia	bladdernut	Nt Shrub	9	-	**x**	-	-	-
Thalictrum dasycarpum	purple meadow-rue	Nt P-Forb	3	-	**x**	-	-	-
Thalictrum dioicum	early meadow-rue	Nt P-Forb	6	**x**	-	-	-	-
Thelypteris palustris	marsh fern	Nt Fern	2	-	**x**	-	**x**	-
Tilia americana	basswood	Nt Tree	5	**x**	**x**	-	-	-
Toxicodendron radicans	poison ivy	Nt W-Vine	2	**x**	**x**	-	-	**x**
TRAGOPOGON DUBIUS	GOAT'S BEARD	Ad B-Forb	0	-	-	-	-	**x**
TRIFOLIUM PRATENSE	RED CLOVER	Ad P-Forb	0	-	-	-	-	**x**
Trillium grandiflorum	common trillium	Nt P-Forb	5	**x**	**x**	-	-	-
Typha latifolia	broad-leaved cat-tail	Nt P-Forb	1	-	**x**	**x**	-	-

* Listed in Table 1, p.13.

Appendix 2, continued. Plant species observed at Lyon Oaks.

			Site/Site Code*	Wixom Woods	Norton Swamp	Lyon Marsh	Pipeline Prairie	Lyon Old Fields
Scientific Name	**Common Name**	**Life Form**	**C**	**J**	**K**	**L**	**M**	**N**
Ulmus americana	American elm	Nt Tree	1	**x**	**x**	-	-	-
Urtica dioica	nettle	Nt P-Forb	1	-	**x**	**x**	-	-
Uvularia grandiflora	bellwort	Nt P-Forb	5	**x**	-	-	-	-
VERBASCUM BLATTARIA	MOTH MULLEIN	Ad B-Forb	0	-	-	-	-	**x**
VERBASCUM THAPSUS	COMMON MULLEIN	Ad B-Forb	0	**x**	-	-	-	**x**
Verbena stricta	hoary vervain	Nt P-Forb	4	-	-	-	-	**x**
Veronicastrum virginicum	culver's root	Nt P-Forb	8	-	-	-	**x**	-
Viburnum acerifolium	maple-leaved arrow-wood	Nt Shrub	6	**x**	-	-	-	-
Viburnum dentatum	smooth arrow-wood	Nt Shrub	6	**x**	-	-	-	-
Viburnum lentago	nannyberry	Nt Shrub	4	-	**x**	-	-	-
VIBURNUM OPULUS	EUROPEAN HIGHBUSH-CRANBERRY	Ad Shrub	0	-	**x**	-	-	-
Viola pubescens	yellow violet	Nt P-Forb	4	**x**	-	-	-	-
Vitis riparia	riverbank grape	Nt W-Vine	3	**x**	**x**	-	**x**	**x**
Zanthoxylum americanum	prickly-ash	Nt Shrub	3	**x**	**x**	-	-	-
Zizia aurea	golden alexanders	Nt P-Forb	6	-	-	-	**x**	-
Total number of species observed in survey site				**108**	**129**	**24**	**37**	**58**
Total number of species observed in Lyon Oaks County Park:			**243**					

* Listed in Table 1, p.13.

Appendix 3. Plant species observed at Rose Oaks County Park. "X" indicates the species occurred within the site. "-" indicates species was not observed at the site. Capitalized scientific and common names indicate non-native species. Life form acronyms are as follows: Nt, native; P, perennial; Ad, adventive; B, biannual; A, annual. "C" is the Coefficient of Conservation for each species (Herman et al. 2001). * Sites are listed in Table 1, p. 13, along with their abbreviations and site codes.

Note: Species listed under "old fields†" were not associated with a specific site, but were found in wide-ranging surveys of all areas characterized as old fields in the 2000 land cover map (Figure 6, p. 10), which show up as light gray areas on the aerial photo (Figure 9, p. 13).

		Site/Site Code*		ROP	BSM	EWO	EWE	WRP	RES	GPS	FLB	FLT	BDP	BPM	WOK	Old
Scientific Name	**Common Name**	**Life Form**	**C**	**O**	**P**	**Q**	**R**	**S**	**T**	**U**	**V**	**W**	**X**	**Y**	**Z**	**Fields†**
Acer nigrum	black maple	Nt Tree	**4**	-	-	-	-	x	-	-	-	-	-	-	-	-
Acer rubrum	red maple	Nt Tree	**1**	-	-	x	-	x	x	x	-	x	-	-	-	-
Acer saccharinum	silver maple	Nt Tree	**2**	-	-	-	-	-	-	x	-	-	-	-	-	-
Acer saccharum	sugar maple	Nt Tree	**5**	-	-	-	-	-	-	x	-	-	-	-	x	-
Achillea millefolium	yarrow	Nt P-Forb	**1**	-	-	x	-	-	-	-	-	-	-	-	-	x
Actaea pachypoda	doll's eyes	Nt P-Forb	**7**	-	-	x	-	-	-	-	-	-	-	-	-	-
Agalinis purpurea	purple gerardia	Nt A-Forb	**7**	-	-	-	-	x	-	-	-	-	x	-	-	-
Agrimonia gryposepala	tall agrimony	Nt P-Forb	**2**	-	-	x	-	-	-	-	-	-	-	-	-	-
AGROSTIS GIGANTEA	REDTOP	Ad P-Grass	**0**	-	-	-	-	-	x	-	-	-	-	-	-	-
Alisma plantago-aquatica	water plantain	Nt P-Forb	**1**	-	-	-	-	-	-	-	-	x	-	-	-	-
Alnus rugosa	tag alder	Nt Shrub	**5**	-	-	-	-	x	-	-	x	x	-	-	-	-
Amelanchier arborea	juneberry	Nt Tree	**4**	-	-	x	-	-	-	x	-	-	-	-	x	-
Amphicarpaea bracteata	hog peanut	Nt A-Forb	**5**	-	-	x	-	x	-	x	-	x	-	-	-	-
Andropogon gerardii	big bluestem	Nt P-Grass	**5**	-	-	-	-	-	-	-	-	-	x	-	-	x
Andropogon virginicus	broom sedge	Nt P-Grass	**4**	x	-	-	-	-	-	-	-	-	-	-	-	-
Anemone cylindrica	thimbleweed	Nt P-Forb	**6**	x	-	-	-	-	-	-	-	-	-	-	-	x
Anemone virginiana	thimbleweed	Nt P-Forb	**3**	-	-	-	-	-	x	-	-	-	x	-	-	-
Anemonella thalictroides	rue anemone	Nt P-Forb	**8**	-	-	x	-	-	-	-	-	-	-	-	-	-
Antennaria howellii	small pussytoes	Nt P-Forb	**2**	-	-	-	-	-	-	-	-	-	x	-	-	-
Antennaria parlinii	smooth pussytoes	Nt P-Forb	**2**	-	-	x	-	-	-	-	-	-	-	-	-	-
Apios americana	groundnut	Nt P-Forb	**3**	-	x	-	x	-	-	-	-	-	x	-	-	-
Apocynum androsaemifolium	spreading dogbane	Nt P-Forb	**3**	-	-	x	-	-	-	-	-	-	-	-	-	-
Apocynum cannabinum	Indian hemp	Nt P-Forb	**3**	x	-	x	x	-	x	-	-	-	-	-	-	x

* Listed in Table 1, p.13.

Appendix 3, continued. Plant species observed at Rose Oaks.

		Site/Site Code*		ROP	BSM	EWO	EWE	WRP	RES	GPS	FLB	FLT	BDP	BPM	WOK	Old
Scientific Name	**Common Name**	**Life Form**	**C**	**O**	**P**	**Q**	**R**	**S**	**T**	**U**	**V**	**W**	**X**	**Y**	**Z**	**Fields†**
Aralia nudicaulis	wild sarsaparilla	Nt P-Forb	**5**	-	-	-	-	x	-	-	-	-	-	-	-	-
Aralia racemosa	spikenard	Nt P-Forb	**8**	-	-	-	-	-	-	x	-	-	-	-	-	-
ARCTIUM MINUS	COMMON BURDOCK	Ad B-Forb	**0**	-	-	x	-	-	-	-	-	-	-	-	-	-
Arisaema triphyllum	jack-in-the-pulpit	Nt P-Forb	**5**	-	-	x	x	x	-	x	-	-	-	-	-	-
Asclepias incarnata	swamp milkweed	Nt P-Forb	**6**	x	x	-	x	x	-	-	x	-	-	x	-	-
Asclepias syriaca	common milkweed	Nt P-Forb	**1**	-	-	-	-	-	-	-	-	-	x	-	-	x
Asclepias tuberosa	butterfly weed	Nt P-Forb	**5**	x	-	-	-	-	-	-	-	-	-	-	-	x
Asplenium platyneuron	ebony spleenwort	Nt Fern	**2**	-	-	x	-	-	-	-	-	-	-	-	-	-
Aster borealis	northern bog aster	Nt P-Forb	**9**	-	-	-	-	x	-	-	-	-	x	x	-	-
Aster cordifolius	heart-leaved aster	Nt P-Forb	**4**	-	-	x	-	-	-	-	-	-	-	-	-	-
Aster firmus	smooth swamp aster	Nt P-Forb	**4**	-	x	-	x	x	x	-	-	x	-	x	-	-
Aster laevis	smooth aster	Nt P-Forb	**5**	x	-	-	-	-	-	-	-	-	-	-	-	-
Aster lateriflorus	side-flowering aster	Nt P-Forb	**2**	x	-	-	x	x	x	-	x	x	x	-	-	-
Aster macrophyllus	big-leaved aster	Nt P-Forb	**4**	-	-	x	-	-	-	-	-	-	-	-	-	-
Aster novae-angliae	New England aster	Nt P-Forb	**3**	x	-	-	-	-	x	-	-	-	x	-	-	-
Aster pilosus	hairy aster	Nt P-Forb	**1**	-	-	-	-	-	x	-	-	-	-	-	-	x
Aster puniceus	swamp aster	Nt P-Forb	**5**	-	-	-	-	x	-	-	-	-	-	x	-	-
Aster sagittifolius	arrow-leaved aster	Nt P-Forb	**2**	x	-	x	x	-	x	-	-	-	x	-	-	x
Aster umbellatus	tall flat-top white aster	Nt P-Forb	**5**	-	-	-	-	x	-	-	-	x	-	-	-	x
Athyrium filix-femina	lady fern	Nt Fern	**4**	-	-	-	-	x	-	-	-	-	-	-	-	-
BERBERIS THUNBERGII	JAPANESE BARBERRY	Ad Shrub	**0**	-	-	x	-	x	-	-	-	x	-	-	-	-
BERTEROA INCANA	HOARY ALYSSUM	Ad A-Forb	**0**	-	-	-	-	-	-	-	-	-	-	-	-	x
Betula alleghaniensis	yellow birch	Nt Tree	**7**	-	-	-	-	x	-	x	x	x	-	-	-	-
Betula pumila	bog birch	Nt Shrub	**8**	-	-	-	-	-	-	-	-	x	-	-	-	-
Bidens cernuus	nodding bur marigold	Nt A-Forb	**3**	-	x	-	x	x	-	-	-	x	-	-	-	-
Bidens coronatus	tall swamp marigold	Nt A-Forb	**7**	x	x	-	-	x	-	-	-	-	x	x	-	-
Boehmeria cylindrica	false nettle	Nt P-Forb	**5**	-	-	-	-	x	-	x	-	x	-	x	-	-
Botrychium virginianum	rattlesnake fern	Nt Fern	**5**	-	-	-	-	x	-	-	-	-	-	-	-	-
Bromus ciliatus	fringed brome	Nt P-Grass	**6**	-	-	-	-	-	-	-	-	x	x	x	-	-
BROMUS INERMIS	SMOOTH BROME	Ad P-Grass	**0**	x	-	-	-	-	-	-	-	-	-	-	-	x

* Listed in Table 1, p.13.

Appendix 3, continued. Plant species observed at Rose Oaks.

		Site/Site Code*	ROP	BSM	EWO	EWE	WRP	RES	GPS	FLB	FLT	BDP	BPM	WOK	Old
Scientific Name	**Common Name**	**Life Form**	**C**	**O**	**P**	**Q**	**R**	**S**	**T**	**U**	**V**	**W**	**X**	**Y**	**Z**	**Fields†**
Bromus pubescens	Canada brome	Nt P-Grass	**5**	-	-	x	-	-	-	-	-	-	-	-	-	-
Calamagrostis canadensis	blue-joint grass	Nt P-Grass	**3**	-	x	-	x	x	-	-	x	x	x	x	-	-
Caltha palustris	marsh marigold	Nt P-Forb	**6**	-	-	-	x	x	-	x	-	-	-	-	-	-
Calystegia sepium	hedge bindweed	Nt P-Forb	**2**	-	-	-	x	-	-	-	-	-	x	-	-	-
Campanula aparinoides	marsh bellflower	Nt P-Forb	**7**	-	-	-	-	x	-	-	-	-	-	x	-	-
Cardamine pratensis	cuckoo flower	Nt P-Forb	**10**	-	-	-	-	-	x	x	-	-	-	-	-	-
Carex aurea	sedge	Nt P-Sedge	**3**	-	-	-	-	-	-	-	-	-	-	-	-	x
Carex bebbii	sedge	Nt P-Sedge	**4**	x	-	x	-	-	-	-	-	-	-	-	-	-
Carex blanda	sedge	Nt P-Sedge	**1**	-	-	x	-	-	-	x	-	-	-	-	-	-
Carex bromoides	sedge	Nt P-Sedge	**6**	-	-	-	-	x	-	x	-	-	-	-	-	-
Carex buxbaumii	sedge	Nt P-Sedge	**10**	x	-	-	-	-	-	-	-	-	x	-	-	-
Carex cephalophora	sedge	Nt P-Sedge	**3**	-	-	x	-	-	-	-	-	-	-	-	x	-
Carex comosa	sedge	Nt P-Sedge	**5**	-	-	-	x	x	-	x	-	-	-	x	-	-
Carex crawei	sedge	Nt P-Sedge	**10**	-	-	-	-	-	-	-	-	-	x	-	-	-
Carex crinita	sedge	Nt P-Sedge	**4**	-	-	-	-	-	-	-	x	-	-	-	-	-
Carex cristatella	sedge	Nt P-Sedge	**3**	x	-	-	x	-	-	-	-	-	-	-	-	-
Carex diandra	sedge	Nt P-Sedge	**8**	-	-	-	x	-	-	-	-	-	-	-	-	-
Carex gracillima	sedge	Nt P-Sedge	**4**	-	-	x	-	x	-	x	-	-	-	-	-	-
Carex granularis	sedge	Nt P-Sedge	**2**	-	-	-	-	-	-	-	-	-	x	-	-	x
Carex hystericina	sedge	Nt P-Sedge	**2**	-	-	-	-	-	-	-	x	-	-	-	-	-
Carex lacustris	sedge	Nt P-Sedge	**6**	-	x	-	x	x	-	x	-	x	-	x	-	-
Carex lasiocarpa	sedge	Nt P-Sedge	**8**	-	-	-	x	x	-	-	-	-	-	x	-	-
Carex leptalea	sedge	Nt P-Sedge	**5**	-	-	-	-	x	-	-	-	x	-	-	-	-
Carex lupulina	sedge	Nt P-Sedge	**4**	-	-	x	-	x	-	x	x	-	-	-	-	-
Carex oligosperma	sedge	Nt P-Sedge	**10**	-	-	-	-	-	-	-	x	-	-	-	-	-
Carex pellita	sedge	Nt P-Sedge	**2**	x	-	-	x	x	-	-	-	-	x	-	-	-
Carex pensylvanica	sedge	Nt P-Sedge	**4**	-	-	x	-	-	-	-	-	-	-	-	x	-
Carex prairea	sedge	Nt P-Sedge	**10**	x	-	-	x	-	-	-	-	-	-	-	-	-
Carex pseudo-cyperus	sedge	Nt P-Sedge	**5**	-	-	-	x	x	-	-	-	-	-	-	-	-
Carex radiata	straight-styled wood sedge	Nt P-Sedge	**2**	-	-	x	-	-	-	-	-	-	-	-	-	-
Carex retroflexa	sedge	Nt P-Sedge	**1**	-	-	-	-	-	-	-	-	-	-	-	-	x

* Listed in Table 1, p.13.

Appendix 3, continued. Plant species observed at Rose Oaks.

		Site/Site Code*	ROP	BSM	EWO	EWE	WRP	RES	GPS	FLB	FLT	BDP	BPM	WOK	Old
Scientific Name	**Common Name**	**Life Form**	**C**	**O**	**P**	**Q**	**R**	**S**	**T**	**U**	**V**	**W**	**X**	**Y**	**Z**	**Fields†**
Carex rosea	curly-styled wood sedge	Nt P-Sedge	**2**	-	-	-	-	-	-	x	-	-	-	-	-	-
Carex sartwellii	sedge	Nt P-Sedge	**5**	x	-	-	x	-	-	-	-	-	x	-	-	-
Carex sparganioides	sedge	Nt P-Sedge	**5**	-	-	-	-	-	x	-	-	-	-	-	-	-
Carex sterilis	sedge	Nt P-Sedge	**10**	-	-	-	-	-	-	-	-	-	x	-	-	-
Carex stipata	sedge	Nt P-Sedge	**1**	-	-	-	x	x	-	x	-	x	-	-	-	-
Carex stricta	sedge	Nt P-Sedge	**4**	x	-	-	x	x	x	-	-	x	-	x	-	-
Carex tetanica	sedge	Nt P-Sedge	**9**	x	-	-	-	-	-	-	-	-	x	-	-	-
Carex tribuloides	sedge	Nt P-Sedge	**3**	-	-	-	-	-	-	-	x	-	-	-	-	-
Carex vulpinoidea	sedge	Nt P-Sedge	**1**	-	-	-	x	x	-	-	-	-	-	-	-	-
Carpinus caroliniana	blue-beech	Nt Tree	**6**	-	-	x	-	x	-	x	-	x	-	-	-	-
Carya cordiformis	bitternut hickory	Nt Tree	**5**	-	-	x	-	-	-	-	-	-	-	-	-	-
Carya glabra	pignut hickory	Nt Tree	**5**	-	-	x	-	-	-	-	-	-	-	-	-	-
Carya ovata	shagbark hickory	Nt Tree	**5**	-	-	x	-	-	-	x	-	-	-	-	x	-
CELASTRUS ORBICULATA	ORIENTAL BITTERSWEET	Ad W-Vine	**0**	-	-	x	-	x	-	-	x	-	-	-	-	-
CENTAUREA MACULOSA	SPOTTED BLUET	Ad B-Forb	**0**	-	-	-	-	-	-	-	-	-	-	-	-	x
Cephalanthus occidentalis	buttonbush	Nt Shrub	**7**	-	-	-	x	-	-	-	x	-	-	-	-	-
CERASTIUM FONTANUM	MOUSE-EAR CHICKWEED	Ad P-Forb	**0**	-	-	-	-	-	-	-	-	-	-	-	-	x
Ceratophyllum demersum	coontail	Nt P-Forb	**1**	-	-	-	x	-	-	-	-	-	-	-	-	-
Cercis canadensis	redbud	Nt Tree	**8**	-	-	x	-	-	-	-	-	-	-	-	-	-
Chamaedaphne calyculata	leatherleaf	Nt Shrub	**8**	-	-	-	-	-	-	-	x	-	-	-	-	-
Chelone glabra	turtlehead	Nt P-Forb	**7**	-	x	-	-	x	x	-	-	x	-	x	-	-
CHRYSANTHEMUM LEUCANTHEMUM	OX-EYE DAISY	Ad P-Forb	**0**	x	-	x	-	-	-	-	-	-	-	-	-	x
Cicuta bulbifera	water hemlock	Nt P-Forb	**5**	-	x	-	-	-	-	-	-	x	-	x	-	-
Cicuta maculata	water hemlock	Nt B-Forb	**4**	x	-	-	-	x	x	x	-	-	-	-	-	-
Cinna arundinacea	wood reedgrass	Nt P-Grass	**7**	-	-	-	-	x	-	-	-	-	-	-	-	-
Circaea lutetiana	enchanter's nightshade	Nt P-Forb	**2**	-	-	x	-	x	-	x	-	-	-	-	-	-
CIRSIUM ARVENSE	CANADIAN THISTLE	Ad P-Forb	**0**	-	-	-	x	-	-	-	-	-	-	-	-	-
Cirsium muticum	swamp thistle	Nt B-Forb	**6**	x	-	-	-	x	x	-	-	x	x	-	-	-
Clematis virginiana	virgin's bower	Nt W-Vine	**4**	-	-	-	-	x	-	-	-	-	-	-	-	-

* Listed in Table 1, p.13.

Appendix 3, continued. Plant species observed at Rose Oaks.

		Site/Site Code*		ROP	BSM	EWO	EWE	WRP	RES	GPS	FLB	FLT	BDP	BPM	WOK	Old
Scientific Name	**Common Name**	**Life Form**	**C**	**O**	**P**	**Q**	**R**	**S**	**T**	**U**	**V**	**W**	**X**	**Y**	**Z**	**Fields†**
Collinsonia canadensis	richweed	Nt P-Forb	**8**	-	-	-	-	x	-	x	-	-	-	-	-	-
CONVALLARIA MAJALIS	LILY-OF-THE-VALLEY	Ad P-Forb	**0**	-	-	x	-	-	-	-	-	-	-	-	-	-
Coptis trifolia	goldthread	Nt P-Forb	**5**	-	-	-	-	-	-	x	-	-	-	-	-	-
Cornus alternifolia	alternate-leaved dogwood	Nt Tree	**5**	-	-	x	-	-	-	-	-	-	-	-	-	-
Cornus amomum	silky dogwood	Nt Shrub	**2**	-	-	-	x	x	-	-	-	x	-	x	-	-
Cornus foemina	gray dogwood	Nt Shrub	**1**	x	x	x	x	x	x	-	x	x	x	-	-	x
Cornus stolonifera	red-osier dogwood	Nt Shrub	**2**	-	-	-	x	-	-	-	x	x	-	x	-	-
Corylus americana	hazelnut	Nt Shrub	**5**	-	-	x	-	x	-	x	-	x	-	-	-	-
Cypripedium calceolus var. parviflorum	small yellow lady's-slipper	Nt P-Forb	**7**	-	-	-	-	x	-	-	-	-	-	-	-	-
Cypripedium reginae	showy or queen's lady's-slipper	Nt P-Forb	**9**	-	-	-	-	x	-	-	-	-	-	-	-	-
DACTYLIS GLOMERATA	ORCHARD GRASS	Ad P-Grass	**0**	-	-	x	-	-	-	-	-	-	-	-	-	x
Danthonia spicata	poverty grass; oatgrass	Nt P-Grass	**4**	-	-	x	-	-	-	-	-	-	-	-	-	-
DAUCUS CAROTA	QUEEN-ANNE'S-LACE	Ad B-Forb	**0**	x	-	-	-	-	x	-	-	-	-	-	-	x
Decodon verticillatus	whorled or swamp loosestrife	Nt Shrub	**7**	-	-	-	x	-	-	-	-	x	-	-	-	-
Desmodium canadense	showy tick-trefoil	Nt P-Forb	**3**	-	-	-	-	-	-	-	-	-	x	-	-	-
Desmodium glutinosum	clustered-leaved tick-trefoil	Nt P-Forb	**5**	-	-	x	-	-	-	-	-	-	-	-	-	-
Desmodium marilandicum	small-leaved tick-trefoil	Nt P-Forb	**7**	-	-	-	-	-	-	-	-	-	x	-	-	-
DIANTHUS ARMERIA	DEPTFORD PINK	Ad A-Forb	**0**	-	-	-	-	-	-	-	-	-	-	-	-	x
Dioscorea villosa	wild yam	Nt P-Forb	**4**	-	-	-	-	x	-	x	-	-	-	-	-	-
Dryopteris carthusiana	spinulose woodfern	Nt Fern	**5**	-	-	-	-	-	-	x	-	-	-	-	-	-
Dryopteris intermedia	evergreen woodfern	Nt Fern	**5**	-	-	-	-	x	-	-	-	-	-	-	-	-
ELAEAGNUS UMBELLATA	AUTUMN-OLIVE	Ad Shrub	**0**	x	-	x	-	x	-	-	-	-	x	-	-	x
Eleocharis elliptica	golden-seeded spike rush	Nt P-Sedge	**6**	x	-	-	x	-	-	-	-	-	x	-	-	-
Eleocharis rostellata	spike rush	Nt P-Sedge	**10**	-	-	-	-	-	-	-	-	-	x	-	-	-
Elymus virginicus	Virginia wild rye	Nt P-Grass	**4**	-	-	-	x	-	-	-	-	-	-	-	-	-
Epilobium coloratum	cinnamon willow-herb	Nt P-Forb	**3**	-	x	-	-	-	-	-	x	x	-	-	-	-
Epilobium leptophyllum	fen willow-herb	Nt P-Forb	**6**	-	-	-	-	-	-	-	-	-	-	x	-	-

* Listed in Table 1, p.13.

Appendix 3, continued. Plant species observed at Rose Oaks.

		Site/Site Code*	ROP	BSM	EWO	EWE	WRP	RES	GPS	FLB	FLT	BDP	BPM	WOK	Old
Scientific Name	**Common Name**	**Life Form**	**C**	**O**	**P**	**Q**	**R**	**S**	**T**	**U**	**V**	**W**	**X**	**Y**	**Z**	**Fields†**
Equisetum arvense	common horsetail	Nt Fern Ally	**0**	-	-	**x**	-	**x**	-	-	-	**x**	-	-	-	**x**
Equisetum fluviatile	water horsetail	Nt Fern Ally	**7**	-	-	-	**x**	**x**	-	-	-	-	-	-	-	-
Erigeron philadelphicus	marsh fleabane	Nt P-Forb	**2**	-	-	-	-	-	-	-	-	**x**	-	-	-	-
Eupatorium maculatum	Joe-Pye weed	Nt P-Forb	**4**	**x**	**x**	-	**x**	**x**	-	-	-	**x**	**x**	**x**	-	-
Eupatorium perfoliatum	common boneset	Nt P-Forb	**4**	**x**	**x**	-	**x**	**x**	-	-	-	**x**	**x**	**x**	-	-
Eupatorium rugosum	white snakeroot	Nt P-Forb	**4**	-	-	-	-	-	-	-	-	**x**	-	-	-	-
Euphorbia corollata	flowering spurge	Nt P-Forb	**4**	-	-	-	-	-	-	-	-	-	-	-	-	**x**
Euthamia graminifolia	grass-leaved goldenrod	Nt P-Forb	**3**	**x**	-	-	**x**	-	-	-	-	-	**x**	-	-	**x**
FESTUCA ARUNDINACEA	TALL FESCUE	Ad P-Grass	**0**	-	-	-	-	-	-	-	-	-	-	-	-	**x**
Festuca subverticillata	nodding fescue	Nt P-Grass	**5**	-	-	**x**	-	-	-	-	-	-	-	-	-	-
Fragaria vesca	woodland strawberry	Nt P-Forb	**2**	-	-	**x**	-	-	-	-	-	-	-	-	-	-
Fragaria virginiana	wild strawberry	Nt P-Forb	**2**	**x**	-	-	-	-	**x**	-	-	-	-	-	-	-
Fraxinus americana	white ash	Nt Tree	**5**	-	-	**x**	-	**x**	**x**	**x**	-	-	-	-	-	-
Fraxinus nigra	black ash	Nt Tree	**6**	-	**x**	**x**	-	**x**	-	-	**x**	**x**	-	-	-	-
Fraxinus pennsylvanica	red ash	Nt Tree	**2**	-	-	-	-	-	-	**x**	-	-	-	-	-	-
Galium aparine	annual bedstraw	Nt A-Forb	**0**	-	-	**x**	-	-	-	-	-	-	-	-	-	-
Galium asprellum	rough bedstraw	Nt P-Forb	**5**	-	-	-	**x**	-	-	**x**	-	**x**	-	-	-	-
Galium boreale	northern bedstraw	Nt P-Forb	**3**	-	-	**x**	-	**x**	-	-	-	-	-	-	-	-
Galium circaezans	white wild licorice	Nt P-Forb	**4**	-	-	**x**	-	-	-	-	-	-	-	-	-	-
Galium palustre	marsh bedstraw	Nt P-Forb	**3**	-	-	-	-	-	-	-	-	-	**x**	**x**	-	-
Galium triflorum	fragrant bedstraw	Nt P-Forb	**4**	-	-	**x**	-	**x**	-	-	-	**x**	-	-	-	-
Gaylussacia baccata	huckleberry	Nt Shrub	**7**	-	-	-	-	-	-	-	**x**	-	-	-	-	-
Gentianopsis procera	small fringed gentian	Nt A-Forb	**8**	-	-	-	-	-	-	-	-	-	**x**	-	-	-
Geranium maculatum	wild geranium	Nt P-Forb	**4**	-	-	**x**	-	**x**	-	**x**	-	-	-	-	-	-
Geum canadense	white avens	Nt P-Forb	**1**	-	-	**x**	-	-	-	-	-	-	-	-	-	-
Glyceria striata	fowl manna grass	Nt P-Grass	**4**	-	-	**x**	**x**	**x**	-	**x**	-	**x**	-	-	-	-
Hamamelis virginiana	witch-hazel	Nt Shrub	**5**	-	-	**x**	-	-	-	-	-	-	-	-	-	-
Helianthus giganteus	tall sunflower	Nt P-Forb	**5**	-	-	-	-	-	-	-	-	**x**	**x**	-	-	-
Hepatica americana	round-lobed hepatica	Nt P-Forb	**6**	-	-	**x**	-	-	-	**x**	-	-	-	-	-	-

* Listed in Table 1, p.13.

Appendix 3, continued. Plant species observed at Rose Oaks.

		Site/Site Code*		ROP	BSM	EWO	EWE	WRP	RES	GPS	FLB	FLT	BDP	BPM	WOK	Old
Scientific Name	**Common Name**	**Life Form**	**C**	**O**	**P**	**Q**	**R**	**S**	**T**	**U**	**V**	**W**	**X**	**Y**	**Z**	**Fields†**
HIERACIUM AURANTIACUM	ORANGE HAWKWEED	Ad P-Forb	**0**	-	-	**x**	-	-	-	-	-	-	-	-	-	**x**
HIERACIUM PILOSELLOIDES	GLAUCOUS KING-DEVIL	Ad P-Forb	**0**	**x**	-	**x**	-	-	-	-	-	-	**x**	-	-	-
HYPERICUM PERFORATUM	COMMON ST. JOHN'S-WORT	Ad P-Forb	**0**	-	-	-	-	-	-	-	-	-	-	-	-	**x**
Hypericum punctatum	spotted St. John's-wort	Nt P-Forb	**4**	-	-	-	-	**x**	-	-	-	-	-	-	-	-
Hypoxis hirsuta	star grass	Nt P-Forb	**10**	-	-	-	-	-	-	-	-	-	**x**	-	-	-
Ilex verticillata	Michigan holly	Nt Shrub	**5**	-	**x**	**x**	-	**x**	-	**x**	**x**	**x**	-	**x**	-	**x**
Impatiens capensis	spotted touch-me-not	Nt A-Forb	**2**	-	**x**	-	-	**x**	-	-	-	**x**	-	-	-	-
Iris virginica	southern blue flag	Nt P-Forb	**5**	**x**	-	-	-	**x**	-	-	-	-	-	-	-	-
Juglans nigra	black walnut	Nt Tree	**5**	-	-	**x**	-	-	-	-	-	-	-	-	-	-
Juncus brachycephalus	rush	Nt P-Forb	**7**	-	-	-	-	-	-	-	-	-	**x**	-	-	-
Juncus dudleyi	Dudley's rush	Nt P-Forb	**1**	**x**	-	-	-	-	-	-	-	-	**x**	-	-	-
Juncus nodosus	joint rush	Nt P-Forb	**5**	-	-	-	-	-	-	-	-	-	**x**	-	-	-
Juniperus communis	common or ground juniper	Nt Shrub	**4**	**x**	-	**x**	-	**x**	**x**	-	**x**	-	**x**	-	-	-
Laportea canadensis	wood nettle	Nt P-Forb	**4**	-	-	-	-	**x**	-	-	-	-	-	-	-	-
Larix laricina	tamarack	Nt Tree	**5**	**x**	-	-	**x**	**x**	**x**	-	**x**	**x**	**x**	-	-	-
Lathyrus palustris	marsh pea	Nt P-Forb	**7**	**x**	-	-	**x**	**x**	-	-	-	-	**x**	**x**	-	-
Leersia oryzoides	cut grass	Nt P-Grass	**3**	-	**x**	-	-	-	-	-	-	**x**	-	-	-	-
Lemna minor	small duckweed	Nt A-Forb	**5**	-	-	-	-	-	-	-	**x**	**x**	-	-	-	-
Lespedeza capitata	round-headed bush clover	Nt P-Forb	**5**	-	-	-	-	-	-	-	-	-	-	-	-	**x**
Lilium michiganense	Michigan lily	Nt P-Forb	**5**	-	-	-	-	**x**	-	-	-	-	-	-	-	-
LINARIA VULGARIS	BUTTER-AND-EGGS	Ad P-Forb	**0**	-	-	-	-	-	-	-	-	-	-	-	-	**x**
Lindera benzoin	spicebush	Nt Shrub	**7**	-	-	-	-	**x**	-	**x**	-	**x**	-	-	-	-
Lobelia kalmii	bog lobelia	Nt P-Forb	**10**	-	-	-	-	-	-	-	-	-	**x**	-	-	-
Lobelia siphilitica	great blue lobelia	Nt P-Forb	**4**	-	-	-	-	-	**x**	-	-	-	-	-	-	-
Lobelia spicata	pale spiked lobelia	Nt P-Forb	**4**	**x**	-	-	-	-	-	-	-	-	-	-	-	-
LONICERA MAACKII	AMUR HONEYSUCKLE	Ad Shrub	**0**	-	-	**x**	-	-	-	-	-	-	-	-	-	-
LONICERA MORROWII	MORROW HONEYSUCKLE	Ad Shrub	**0**	-	-	-	-	-	**x**	-	-	-	-	-	-	-
Luzula multiflora	common wood rush	Nt P-Forb	**5**	-	-	**x**	-	-	-	-	-	-	-	-	-	-
Lycopus americanus	common water horehound	Nt P-Forb	**2**	**x**	-	-	**x**	**x**	-	-	-	-	**x**	-	-	-

* Listed in Table 1, p.13.

Appendix 3, continued. Plant species observed at Rose Oaks.

		Site/Site Code*		ROP	BSM	EWO	EWE	WRP	RES	GPS	FLB	FLT	BDP	BPM	WOK	Old
Scientific Name	**Common Name**	**Life Form**	**C**	**O**	**P**	**Q**	**R**	**S**	**T**	**U**	**V**	**W**	**X**	**Y**	**Z**	**Fields†**
Lycopus sp.	water horehound	Nt Forb	**0**	-	-	-	-	-	-	-	**x**	-	-	-	-	-
Lycopus uniflorus	northern bugle weed	Nt P-Forb	**2**	-	-	-	-	**x**	-	-	-	**x**	-	**x**	-	-
Lysimachia ciliata	fringed loosestrife	Nt P-Forb	**4**	-	-	-	-	**x**	**x**	-	-	-	-	-	-	-
Lysimachia quadriflora	whorled loosestrife	Nt P-Forb	**10**	**x**	-	-	-	-	**x**	-	-	-	**x**	-	-	-
LYTHRUM SALICARIA	purple loosestrife	Ad P-Forb	**0**	-	**x**	-	**x**	-	-	-	-	-	-	-	-	-
Maianthemum canadense	canada mayflower	Nt P-Forb	**4**	-	-	**x**	-	**x**	-	**x**	-	-	-	-	-	-
MEDICAGO LUPULINA	BLACK MEDICK	Ad A-Forb	**0**	**x**	-	-	-	-	-	-	-	-	-	-	-	**x**
MEDICAGO SATIVA	ALFALFA	Ad P-Forb	**0**	-	-	-	-	-	-	-	-	-	-	-	-	**x**
MELILOTUS OFFICINALIS	YELLOW SWEET-CLOVER	Ad B-Forb	**0**	-	-	-	-	-	-	-	-	-	-	-	-	**x**
Mentha arvensis	wild mint	Nt P-Forb	**3**	-	-	-	**x**	-	-	-	-	-	-	-	-	-
MENTHA PIPERITA	PEPPERMINT	Ad P-Forb	**0**	-	-	-	-	**x**	-	-	-	-	-	-	-	-
Mitella diphylla	bishop's cap	Nt P-Forb	**8**	-	-	**x**	-	**x**	-	**x**	-	-	-	-	-	-
Mitella nuda	naked miterwort	Nt P-Forb	**8**	-	-	-	-	**x**	-	-	-	-	-	-	-	-
Monarda fistulosa	wild bergamot	Nt P-Forb	**2**	**x**	-	-	-	-	**x**	-	-	-	**x**	-	-	**x**
MORUS ALBA	WHITE MULBERRY	Ad Tree	**0**	-	-	-	-	-	-	**x**	-	-	-	-	-	-
Muhlenbergia glomerata	marsh wild-timothy	Nt P-Grass	**10**	-	-	-	-	**x**	-	-	-	-	**x**	-	-	-
Muhlenbergia mexicana	leafy satin grass	Nt P-Grass	**3**	-	-	-	-	-	-	-	-	-	-	**x**	-	-
Myriophyllum sp.	water-milfoil	Forb	**0**	-	-	-	**x**	-	-	-	-	-	-	-	-	-
Nymphaea odorata	sweet scented waterlily	Nt P-Forb	**6**	-	-	-	**x**	-	-	-	-	-	-	-	-	-
Onoclea sensibilis	sensitive fern	Nt Fern	**2**	-	**x**	**x**	**x**	**x**	**x**	**x**	**x**	**x**	-	-	-	-
Osmunda cinnamomea	cinnamon fern	Nt Fern	**5**	-	-	-	-	**x**	-	**x**	-	-	-	-	-	-
Osmunda claytoniana	interrupted fern	Nt Fern	**6**	-	-	-	-	**x**	-	-	-	-	-	-	-	-
Osmunda regalis	royal fern	Nt Fern	**5**	-	-	**x**	-	**x**	-	**x**	**x**	-	-	-	-	-
Ostrya virginiana	ironwood; hop hornbeam	Nt Tree	**5**	-	-	**x**	-	-	-	-	-	-	-	-	-	-
Panicum oligosanthes	panic grass	Nt P-Grass	**5**	-	-	-	-	-	-	-	-	-	-	-	-	**x**
Parnassia glauca	grass-of-parnassus	Nt P-Forb	**8**	-	-	-	-	-	-	-	-	-	**x**	-	-	-
Parthenocissus quinquefolia	Virginia creeper	Nt W-Vine	**5**	-	-	**x**	-	**x**	**x**	**x**	-	**x**	-	-	-	-
Pedicularis lanceolata	swamp betony	Nt P-Forb	**8**	-	-	-	**x**	-	-	-	-	-	**x**	-	-	-
Peltandra virginica	arrow-arum	Nt P-Forb	**6**	-	-	-	**x**	-	-	-	-	-	-	-	-	-
Phalaris arundinacea	reed canary grass	Nt P-Grass	**0**	-	**x**	-	-	-	-	-	**x**	**x**	-	-	-	-

* Listed in Table 1, p.13.

Appendix 3, continued. Plant species observed at Rose Oaks.

		Site/Site Code*	ROP	BSM	EWO	EWE	WRP	RES	GPS	FLB	FLT	BDP	BPM	WOK	Old
Scientific Name	**Common Name**	**Life Form**	**C**	**O**	**P**	**Q**	**R**	**S**	**T**	**U**	**V**	**W**	**X**	**Y**	**Z**	**Fields†**
PHLEUM PRATENSE	TIMOTHY	Ad P-Grass	**0**	x	-	x	-	-	-	-	-	-	x	-	-	x
Phragmites australis	reed	Nt P-Grass	**0**	-	-	-	-	-	-	-	-	x	-	-	-	-
Pinus strobus	white pine	Nt Tree	**3**	-	-	-	-	-	-	-	-	x	-	-	-	-
PINUS SYLVESTRIS	SCOTCH PINE	Ad Tree	**0**	x	-	-	-	-	x	-	-	-	-	-	x	-
PLANTAGO LANCEOLATA	ENGLISH PLANTAIN	Ad P-Forb	**0**	-	-	-	-	-	-	-	-	-	-	-	-	x
POA COMPRESSA	CANADA BLUEGRASS	Ad P-Grass	**0**	-	-	x	-	-	-	x	-	-	-	-	-	x
POA PRATENSIS	KENTUCKY BLUEGRASS	Ad P-Grass	**0**	x	-	x	x	-	-	-	-	-	x	-	-	-
Podophyllum peltatum	May apple	Nt P-Forb	**3**	-	-	x	-	x	-	x	-	-	-	-	x	-
Polygala polygama	racemed milkwort	Nt B-Forb	**9**	-	-	-	-	-	-	-	-	-	x	-	-	-
Polygonatum pubescens	downy Solomon-seal	Nt P-Forb	**5**	-	-	x	-	x	-	x	-	-	-	-	-	-
Polygonum amphibium	water smartweed	Nt P-Forb	**6**	-	x	-	-	-	-	-	-	-	-	x	-	-
Polygonum cuspidatum	Japanese knotweed	Ad P-Forb	**0**	-	-	-	-	-	-	-	-	-	-	-	-	x
Polygonum hydropiperoides	water pepper	Nt P-Forb	**5**	-	-	-	-	-	-	-	-	-	-	x	-	-
Polygonum sagittatum	arrow-leaved tear-thumb	Nt A-Forb	**5**	-	-	-	-	-	-	-	-	x	-	-	-	-
Pontederia cordata	pickerel weed	Nt P-Forb	**8**	-	-	-	x	-	-	x	-	-	-	-	-	-
Populus deltoides	cottonwood	Nt Tree	**1**	-	-	x	x	x	-	-	-	-	-	-	-	-
Populus tremuloides	quaking aspen	Nt Tree	**1**	-	-	-	-	-	-	-	-	x	x	-	-	-
Potentilla fruticosa	shrubby cinquefoil	Nt Shrub	**10**	x	-	-	x	-	x	-	-	-	x	x	-	-
Potentilla palustris	marsh cinquefoil	Nt P-Forb	**7**	-	-	-	x	x	-	-	-	-	-	-	-	-
POTENTILLA RECTA	ROUGH-FRUITED CINQUEFOIL	Ad P-Forb	**0**	-	-	-	-	-	-	-	-	-	-	-	-	x
Potentilla simplex	old-field cinquefoil	Nt P-Forb	**2**	x	-	x	-	-	-	-	-	-	-	-	-	-
Prenanthes altissima	tall white lettuce	Nt P-Forb	**5**	-	-	-	-	-	-	-	-	x	-	-	-	-
PRUNELLA VULGARIS	LAWN PRUNELLA	Nt P-Forb	**0**	x	-	x	-	x	x	-	-	x	-	-	-	-
Prunus serotina	wild black cherry	Nt Tree	**2**	-	-	x	-	x	-	x	-	-	-	-	x	-
Pteridium aquilinum	bracken fern	Nt Fern	**0**	-	-	x	-	-	-	-	-	-	-	-	-	-
Pycnanthemum virginianum	common mountain mint	Nt P-Forb	**5**	x	-	-	-	-	x	-	-	x	x	x	-	-
Pyrola elliptica	large-leaved shinleaf	Nt P-Forb	**6**	-	-	x	-	-	-	-	-	-	-	-	-	-
Quercus alba	white oak	Nt Tree	**5**	-	-	x	-	x	-	x	-	-	-	-	x	-

* Listed in Table 1, p.13.

Appendix 3, continued. Plant species observed at Rose Oaks.

		Site/Site Code*	ROP	BSM	EWO	EWE	WRP	RES	GPS	FLB	FLT	BDP	BPM	WOK	Old
Scientific Name	**Common Name**	**Life Form**	**C**	**O**	**P**	**Q**	**R**	**S**	**T**	**U**	**V**	**W**	**X**	**Y**	**Z**	**Fields†**
Quercus bicolor	swamp white oak	Nt Tree	**8**	x	-	-	-	x	-	x	-	-	-	-	-	-
Quercus ellipsoidalis	Hill's oak	Nt Tree	**4**	-	-	x	-	-	-	x	-	-	-	-	-	-
Quercus macrocarpa	bur oak	Nt Tree	**5**	-	-	-	x	-	-	-	-	-	-	-	-	-
Quercus rubra	red oak	Nt Tree	**5**	-	-	x	-	x	-	-	-	-	-	-	-	-
Quercus velutina	black oak	Nt Tree	**6**	-	-	x	-	-	-	-	-	-	-	-	-	-
Ranunculus abortivus	small-flowered buttercup	Nt A-Forb	**0**	-	-	x	-	-	-	-	-	-	-	-	-	-
Ranunculus hispidus	swamp buttercup	Nt P-Forb	**5**	-	-	-	-	x	-	-	-	-	-	-	-	-
Ranunculus recurvatus	hooked crowfoot	Nt A-Forb	**5**	-	-	x	-	x	x	-	-	-	-	-	-	-
RHAMNUS FRANGULA	GLOSSY BUCKTHORN	Ad Shrub	**0**	-	-	-	x	-	-	-	-	x	x	-	-	-
Ribes americanum	wild black currant	Nt Shrub	**6**	-	x	-	-	-	-	-	-	-	-	-	-	-
Ribes cynosbati	prickly or wild gooseberry	Nt Shrub	**4**	-	-	x	-	-	-	x	-	-	-	-	-	-
ROBINIA PSEUDOACACIA	BLACK LOCUST	Ad Tree	**0**	-	-	x	-	-	-	-	-	-	-	-	-	x
Rosa carolina	pasture rose	Nt Shrub	**4**	-	-	x	-	-	-	-	-	-	-	-	-	-
ROSA MULTIFLORA	MULTIFLORA ROSE	Ad Shrub	**0**	-	-	x	-	-	-	-	-	-	-	-	-	-
Rosa palustris	swamp rose	Nt Shrub	**5**	-	x	-	x	x	-	x	x	-	-	-	-	-
Rubus allegheniensis	common blackberry	Nt Shrub	**1**	-	-	x	-	-	-	-	-	-	-	-	-	-
Rubus flagellaris	northern dewberry	Nt Shrub	**1**	-	-	-	-	-	-	x	-	-	-	-	-	-
Rubus hispidus	swamp dewberry	Nt Shrub	**4**	-	-	-	-	x	-	-	-	-	-	-	-	x
Rubus occidentalis	black raspberry	Nt Shrub	**1**	-	-	x	x	-	-	-	-	x	-	-	-	-
Rubus pensylvanicus	dewberry	Nt Shrub	**2**	-	-	-	-	-	-	-	x	-	-	-	-	-
Rubus pubescens	dwarf raspberry	Nt P-Forb	**4**	-	-	-	-	-	x	-	-	-	-	-	-	-
Rubus strigosus	wild red raspberry	Nt Shrub	**2**	-	-	-	-	-	-	-	-	x	-	-	-	-
Rudbeckia hirta	black-eyed susan	Nt P-Forb	**1**	x	-	-	-	-	x	-	-	-	x	-	-	-
RUMEX ACETOSELLA	SHEEP SORREL	Ad P-Forb	**0**	-	-	-	-	-	-	-	-	-	-	-	-	x
Rumex orbiculatus	great water dock	Nt P-Forb	**9**	-	x	-	x	-	-	-	x	x	-	x	-	-
Sagittaria latifolia	common arrowhead	Nt P-Forb	**1**	-	x	-	x	x	-	-	-	x	-	x	-	-
Salix bebbiana	Bebb's willow	Nt Shrub	**1**	x	-	-	-	-	-	-	-	x	x	-	-	-
Salix candida	hoary willow	Nt Shrub	**9**	-	-	-	-	x	-	-	-	-	-	x	-	-
Salix discolor	pussy willow	Nt Shrub	**1**	x	-	-	x	-	-	-	x	x	-	-	-	-
Salix serissima	autumn willow	Nt Shrub	**8**	-	-	-	-	x	-	-	-	-	-	-	-	-

* Listed in Table 1, p.13.

Appendix 3, continued. Plant species observed at Rose Oaks.

		Site/Site Code*		ROP	BSM	EWO	EWE	WRP	RES	GPS	FLB	FLT	BDP	BPM	WOK	Old
Scientific Name	**Common Name**	**Life Form**	**C**	**O**	**P**	**Q**	**R**	**S**	**T**	**U**	**V**	**W**	**X**	**Y**	**Z**	**Fields†**
Sambucus canadensis	elderberry	Nt Shrub	**3**	-	-	-	-	x	x	-	-	-	-	-	-	-
Sanicula gregaria	black snakeroot	Nt P-Forb	**2**	-	-	-	-	x	-	-	-	-	x	-	-	-
SAPONARIA OFFICINALIS	BOUNCING BET	Ad P-Forb	**0**	-	-	-	-	-	-	-	-	-	-	-	-	x
Sarracenia purpurea	pitcher plant	Nt P-Forb	**10**	-	-	-	-	-	-	-	x	-	-	-	-	-
Sassafras albidum	sassafras	Nt Tree	**5**	-	-	x	-	-	-	-	-	-	-	-	-	-
Schoenoplectus tabernaemontani	softstem bulrush	Nt P-Sedge	**4**	-	-	-	-	x	-	-	-	-	-	-	-	-
Scirpus atrovirens	bulrush	Nt P-Sedge	**3**	x	-	-	x	-	-	-	-	x	x	-	-	-
Scirpus cyperinus	wool grass	Nt P-Sedge	**5**	-	-	-	-	-	-	-	x	x	-	-	-	-
Scirpus pendulus	bulrush	Nt P-Sedge	**3**	x	-	-	-	-	-	-	-	-	x	-	-	-
Scutellaria galericulata	common skullcap	Nt P-Forb	**5**	x	-	-	x	-	-	-	-	-	-	-	-	-
Scutellaria lateriflora	mad dog skullcap	Nt P-Forb	**5**	-	-	-	-	x	-	-	-	-	-	-	-	-
Sisyrinchium albidum	common blue-eyed grass	Nt P-Forb	**7**	-	-	-	-	-	-	-	-	-	x	-	-	-
Sisyrinchium angustifolium	stout blue-eyed grass	Nt P-Forb	**4**	x	-	-	-	-	-	-	-	-	-	-	-	-
Smilacina racemosa	false spikenard	Nt P-Forb	**5**	-	-	x	-	-	-	-	-	-	-	-	-	-
Smilacina stellata	starry false Solomon-seal	Nt P-Forb	**5**	-	-	-	-	x	-	-	-	-	-	-	-	-
Smilacina trifolia	false mayflower	Nt P-Forb	**10**	-	-	-	-	x	-	-	-	-	-	-	-	-
Smilax tamnoides	bristly green-brier	Nt W-Vine	**5**	-	-	x	-	-	-	-	-	-	-	-	-	-
SOLANUM DULCAMARA	BITTERSWEET NIGHTSHADE	Ad P-Forb	**0**	-	-	-	-	-	-	x	-	-	-	x	-	-
Solidago altissima	tall goldenrod	Nt P-Forb	**1**	-	-	-	-	-	-	-	-	-	x	-	-	x
Solidago canadensis	Canada goldenrod	Nt P-Forb	**1**	x	-	-	-	-	-	-	-	x	-	-	-	x
Solidago gigantea	late goldenrod	Nt P-Forb	**3**	-	x	-	-	-	-	-	-	x	-	-	-	-
Solidago juncea	early goldenrod	Nt P-Forb	**3**	x	-	-	-	-	-	-	-	-	-	-	-	-
Solidago nemoralis	old field goldenrod	Nt P-Forb	**2**	x	-	x	-	-	-	-	-	-	x	-	-	x
Solidago ohioensis	Ohio goldenrod	Nt P-Forb	**8**	-	-	-	-	-	x	-	-	-	x	-	-	-
Solidago patula	swamp goldenrod	Nt P-Forb	**6**	-	-	-	-	x	-	-	-	x	-	-	-	-
Solidago riddellii	Riddell's goldenrod	Nt P-Forb	**6**	x	-	-	-	-	x	-	-	-	x	x	-	-
Solidago rugosa	rough goldenrod	Nt P-Forb	**3**	x	-	x	-	x	x	-	-	-	x	-	-	-
Solidago speciosa	showy goldenrod	Nt P-Forb	**5**	-	-	-	-	-	x	-	-	-	-	-	-	-

* Listed in Table 1, p.13.

Appendix 3, continued. Plant species observed at Rose Oaks.

		Site/Site Code*		ROP	BSM	EWO	EWE	WRP	RES	GPS	FLB	FLT	BDP	BPM	WOK	Old
Scientific Name	**Common Name**	**Life Form**	**C**	**O**	**P**	**Q**	**R**	**S**	**T**	**U**	**V**	**W**	**X**	**Y**	**Z**	**Fields†**
Solidago uliginosa	bog goldenrod	Nt P-Forb	**4**	-	-	-	-	-	-	-	-	-	**x**	**x**	-	-
Sorghastrum nutans	Indian grass	Nt P-Grass	**6**	**x**	-	-	-	-	**x**	-	-	-	**x**	-	-	-
Sparganium chlorocarpum	green-fruited bur-reed	Nt P-Forb	**6**	-	-	-	-	-	-	-	-	**x**	-	-	-	-
Sparganium sp.	bur-reed	Nt P-Forb	**0**	-	-	-	**x**	-	-	-	-	-	-	-	-	-
Spartina pectinata	cordgrass	Nt P-Grass	**5**	-	-	-	**x**	-	-	-	-	-	-	-	-	-
Sphenopholis intermedia	slender wedgegrass	Nt P-Grass	**4**	-	-	-	**x**	-	-	-	-	-	-	-	-	-
Spiraea alba	meadowsweet	Nt Shrub	**4**	**x**	**x**	**x**	**x**	**x**	-	-	**x**	**x**	-	-	-	-
Spiranthes cernua	nodding ladies'-tresses	Nt P-Forb	**4**	**x**	-	-	-	-	-	-	-	-	**x**	-	-	-
Spirodela polyrhiza	great duckweed	Nt A-Forb	**6**	-	-	-	-	-	-	-	-	**x**	-	-	-	-
STELLARIA MEDIA	COMMON CHICKWEED	Ad A-Forb	**0**	-	-	**x**	-	-	-	-	-	-	-	-	-	-
Symplocarpus foetidus	skunk cabbage	Nt P-Forb	**6**	-	-	-	**x**	**x**	-	**x**	-	**x**	-	-	-	-
Taenidia integerrima	yellow pimpernel	Nt P-Forb	**8**	-	-	**x**	-	-	-	-	-	-	-	-	-	-
TARAXACUM OFFICINALE	COMMON DANDELION	Ad P-Forb	**0**	-	-	**x**	-	**x**	**x**	-	-	-	-	-	-	-
Thalictrum dasycarpum	purple meadow-rue	Nt P-Forb	**3**	-	-	-	**x**	**x**	-	-	-	-	**x**	-	-	-
Thalictrum dioicum	early meadow-rue	Nt P-Forb	**6**	-	-	**x**	-	-	-	-	-	-	-	-	-	-
Thelypteris palustris	marsh fern	Nt Fern	**2**	-	-	-	**x**	**x**	-	-	**x**	**x**	**x**	**x**	-	-
THLASPI ARVENSE	PENNY CRESS	Ad A-Forb	**0**	-	-	-	-	-	-	-	-	-	-	-	-	**x**
Tilia americana	basswood	Nt Tree	**5**	-	-	**x**	-	**x**	-	**x**	-	-	-	-	-	-
Toxicodendron radicans	poison-ivy	Nt W-Vine	**2**	-	-	**x**	**x**	**x**	-	**x**	-	**x**	-	-	**x**	**x**
Toxicodendron vernix	poison sumac	Nt Shrub	**6**	-	-	-	**x**	**x**	-	**x**	-	**x**	-	**x**	-	-
Trientalis borealis	starflower	Nt P-Forb	**5**	-	-	-	-	-	-	**x**	-	-	-	-	-	-
TRIFOLIUM PRATENSE	RED CLOVER	Ad P-Forb	**0**	**x**	-	-	-	-	-	-	-	-	-	-	-	**x**
TRIFOLIUM REPENS	WHITE CLOVER	Ad P-Forb	**0**	-	-	-	-	-	-	-	-	-	-	-	-	**x**
Trillium grandiflorum	common trillium	Nt P-Forb	**5**	-	-	**x**	-	-	-	-	-	-	-	-	-	-
Typha latifolia	broad-leaved cat-tail	Nt P-Forb	**1**	-	**x**	-	**x**	-	-	-	-	**x**	-	**x**	-	-
Ulmus americana	American elm	Nt Tree	**1**	**x**	**x**	-	**x**	**x**	-	**x**	-	**x**	-	**x**	-	-
Vaccinium angustifolium	blueberry	Nt Shrub	**4**	-	-	**x**	-	-	-	-	**x**	-	-	-	-	-
Vaccinium corymbosum	smooth highbush blueberry	Nt Shrub	**6**	-	-	-	-	**x**	-	-	-	-	-	-	-	-
Vaccinium macrocarpon	large cranberry	Nt Shrub	**8**	-	-	-	-	**x**	-	-	-	-	-	-	-	-

* Listed in Table 1, p.13.

Appendix 3, continued. Plant species observed at Rose Oaks.

		Site/Site Code*		ROP	BSM	EWO	EWE	WRP	RES	GPS	FLB	FLT	BDP	BPM	WOK	Old
Scientific Name	**Common Name**	**Life Form**	**C**	**O**	**P**	**Q**	**R**	**S**	**T**	**U**	**V**	**W**	**X**	**Y**	**Z**	**Fields†**
Vaccinium oxycoccos	small cranberry	Nt Shrub	**8**	-	-	-	-	-	-	-	x	-	-	-	-	-
Vaccinium pallidum	blueberry	Nt Shrub	**7**	-	-	x	-	-	-	-	-	-	-	-	-	-
VERBASCUM THAPSUS	COMMON MULLEIN	Ad B-Forb	**0**	-	-	-	-	-	-	-	-	-	-	-	-	x
Verbena urticifolia	white vervain	Nt P-Forb	**4**	-	-	-	-	-	-	-	-	x	-	-	-	-
Viburnum acerifolium	maple-leaved arrow-wood	Nt Shrub	**6**	-	-	-	-	-	x	-	-	-	-	-	-	-
Viburnum lentago	nannyberry	Nt Shrub	**4**	-	-	x	x	x	x	-	-	x	-	-	-	-
VIBURNUM OPULUS	EUROPEAN HIGHBUSH CRANBERRY	Ad Shrub	**0**	-	-	-	-	-	-	-	-	x	-	-	-	-
Viburnum opulus var. americanum	highbush cranberry	Nt Shrub	**5**	-	-	-	-	-	-	-	-	-	-	x	-	-
Viburnum rafinesquianum	downy arrow-wood	Nt Shrub	**5**	-	-	x	-	-	-	-	-	-	-	-	-	-
Vicia caroliniana	pale or wood vetch	Nt P-Forb	**8**	-	-	x	-	-	-	-	-	-	-	-	-	-
VINCETOXICUM ROSSICUM	WHITE SWALLOW-WORT	Ad P-Forb	**0**	-	-	x	-	-	-	-	-	-	-	-	-	x
Viola conspersa	dog violet	Nt P-Forb	**3**	-	-	-	-	x	-	-	-	-	-	-	-	-
Viola cucullata	marsh violet	Nt P-Forb	**5**	-	-	-	-	x	-	-	-	-	-	-	-	-
Vitis riparia	riverbank grape	Nt W-Vine	**3**	-	x	x	x	x	x	x	-	x	-	-	-	x
Zanthoxylum americanum	prickly-ash	Nt Shrub	**3**	-	-	x	-	x	-	-	-	-	-	-	-	-
Zizania palustris	wild-rice	Nt A-Grass	**9**	-	-	-	-	x	-	-	-	-	-	-	-	-
Zizia aurea	golden alexanders	Nt P-Forb	**6**	-	-	-	-	x	x	-	-	-	x	-	-	-
Total number of species observed in survey site:				**66**	**30**	**112**	**75**	**127**	**45**	**62**	**36**	**80**	**74**	**40**	**10**	**55**
Total number of species observed in Rose Oaks:		**360**														

* Listed in Table 1, p.13.