

WETLAND FLORA OF THE GRAND CALUMET RIVER IN NORTHWEST INDIANA: POTENTIAL IMPACTS OF SEDIMENT REMOVAL AND RECOMMENDATIONS FOR RESTORATION

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ABSTRACT. Northwestern Indiana supports unusually diverse floras. However, rapid industrialization and urbanization since the late 19th Century have changed much of the natural character of the wetlands along Grand Calumet River. Of more than 1400 species that occurred historically in the northwestern Indiana, 19 species were identified as extirpated species; and only 653 species, including 1 extirpated, 17 endangered, 14 threatened, and 18 rare species were documented during the recent surveys in the Grand Calumet River wetlands. Over 97% the wetlands along the Grand Calumet River were disturbed by fragmentation, infestation by alien species (120 of 653 species were alien), and anthropogenic disruption of ecosystem processes (e.g., fire suppression, draining, filling, and sedimentation). Among the wetlands along the Grand Calumet River, Roxanna Marsh, DuPont Tract, Clark & Pine East Nature Preserve, and Miller Woods were identified as high quality habitats with special needs of conservation. The proposed sediment dredging may cause direct physical damage to wetland floras, shoreline erosion along the stream banks, and "probable" drainage by deepening the riverbed. Restoration of ecosystem structure and function is needed to minimize such negative impacts that would potentially be incurred by the proposed sediment dredging.

Keywords: Wetland, flora, dredging, conservation, restoration

With its 14,000-year geologic history, northwestern Indiana natural areas support unusually diverse biological communities (Reshkin 1990). The diverse flora on the dune-and-swale complex on the southern shore of Lake Michigan has been noted by Cowles' (1899) bench-mark study, followed by Fuller (1935), Olson (1958), and Wilhelm (1990). Many factors caused drastic changes in species of the plant communities along the Grand Calumet River. The geomorphology of this river system has been altered significantly by human activities. The rivers have become straighter and narrower as a result of channelization. In addition, drainage and filling, along with industrial pollution of marshes and ponds adjacent to the river, altered local hydrology (Hiebert et al. 1986; Wilcox et al. 1986; Bowles 1990). This chapter discusses (1) pre-settlement and present-day wetland plant communities, (2) potential impacts of the proposed dredging project on wetland vegetation in the Grand Calumet River basin, and (3) restoration potentials of native wetland flora in conjunction with sediment removal.

NATIVE FLORA OF PRE-SETTLEMENT TIMES

Extirpated species.—Peattie (1930), in his publication *Flora of the Indiana Dunes*, estimated that 1400 plant species inhabited the Indiana Dunes area. Nineteen of these species have not been seen in Indiana since Peattie's sightings, and they have now been classified as extirpated species (species that had not been seen in Indiana for 50 years) by Aldrich et al. (1986). They are *Betula populifolia* (gray birch), *Carex scabrata*, *Corallorrhiza trifida* (coral root), *Gerardia pedicularia ambigens* (clammy false foxglove), *Hemicarpha drummondii*, *Hippuris vulgaris* (mare's tail), *Lechea stricta* (bush pinweed), *Lemna perpusilla* (least duckweed), *Linnaea borealis* (twin flower), *Lonicera canadensis* (American fly honeysuckle), *Oryzopsis pungens* (short-horned rice grass), *Panicum lucidum* (bog panic grass), *Psilocarya nitens* (bald rush), *Pyrola secunda* (one-sided shinleaf), *Scleria reticularis* (netted nut rush), *Shepherdia canadensis* (russet buffaloberry), *Trillium cernuum macranthum* (nodding trillium), and *Utricularia resupinata* (small purple bladderwort).

Historic plant community types.—Bacone et al. (1980) reconstructed the pre-settlement vegetation characteristics of northwestern Indiana by analyzing land survey records that were compiled between 1829 and 1834. The wetland community types recognized by this study are aquatic communities, marshes, swamps, bottomland forests, beach communities, and pannes.

Aquatic communities consist of macrophytes and phytoplankton in standing or running water. The 1829–1834 survey record noted *Polygonum* spp., *Nuphar advena*, and *Nymphaea tuberosa* as typical macrophytes (Bacone et al. 1980). Since European settlement, species composition of this community has been changed significantly by numerous human activities such as loading of nutrients, silts and other pollutants, alteration of local hydrology through channelization, drainage, and filling of the river and its adjacent wetlands.

Marshes are probably the most prominent plant community types along the Grand Calumet River. Marshes are open (non-forested) wetlands that are dominated by sedges and/or grasses communities (Bacone et al. 1980). On the wet end of the moisture gradient, sedge meadow is found directly adjacent to aquatic. At the other extreme, wet prairie overlaps with the borders of mesophytic prairies and savanna complex (Wilhelm 1990). As is indicated by its name, sedge meadow is characterized by abundant sedges (Cyperaceae); wet prairies are dominated by grasses (Poaceae). Typical plant species in this community type include *Aster puniceus firmus*, *Bidens coronata tenuiloba*, *Carex aquatilis altior*, *Decodon verticillatus*, *Polygonum punctatum*, and *Scirpus acutus*. Historically, periodic fires—both natural and man-made—have been a crucial factor in maintaining marshes because fires prohibit the invasion of woody shrubs and trees. Since European settlement, however, most marshes have been heavily disturbed by drainage, by invasion of woody species facilitated by artificial fire suppression and by intentional or accidental introduction of alien species (Labus et al. 1999).

Shrub carr is a transitional wetland from marsh to swamp. Typical woody species include *Alnus* spp. and *Salix* spp. According to the 1829–1834 survey record, woody species (e.g., *Populus tremuloides*, and *Populus gran-*

didentata) were less abundant in pre-settlement than the present times (Bacone et al. 1980). However, significant alterations in the level of the water table, and a long-lasting policy of fire suppression, have resulted in significant invasion of overgrown shrubs into marshes, sedge meadows and wet prairies (Wilcox et al. 1986).

Swamps are forested wetlands where the water level is maintained near the surface of the substrate by ground water or by rain (Wilhelm 1990). In the land survey records, the swamps in northwestern Indiana were classified into three major types. Coniferous swamps occurred only in dune-swale systems, and were dominated by *Pinus banksiana* and *Thuja occidentalis*. Timbered swamps, now classified as green ash (*Fraxinus pennsylvanica subintegerrima*) swamps, are inhabited by *Populus deltoides*, *Platanus occidentalis*, *Fraxinus nigra*, *Acer saccharinum*, and *Ulmus* spp. This type of swamp occurred along the Kankakee River. Extensive draining and logging in this century has destroyed much of this community. The species composition of these two community types is quite similar. Shared species include *Alnus rugosa americana* and *Salix* spp. This type of swamp, like the shrub carrs, has become more common than during pre-settlement times as a result of long-term drainage and fire suppression (Bacone et al. 1980).

Bottomland forests consist of several woody strata underlain by herbaceous cover, and they are located along the stream banks and are characterized by annual deposition of silt during flooding. Major canopy species in these forests include *Acer negundo*, *Acer saccharinum*, *Platanus occidentalis*, *Salix nigra*, *Ulmus americana*, and *Ulmus rubra*. Small, scattered patches of bottomland forest still occur today, although most of these have been heavily disturbed (Bacone et al. 1980; Wilhelm 1990).

Beach communities are narrow specialized strips adjacent to the littoral zone of the lakeshore, and they are dominated by *Ammophila breviligulata* (Cowles 1899; Wilhelm 1990; Poulson 1999). Pannes are moist interdunal depressions in calcareous sands on the lee-side of dune, containing such species as *Aster ptarmicoides* and *Carex* spp. (Hiebert et al. 1986; Wilcox & Simonin 1987; Wilhelm 1990).

Table 1.—Eleven natural plant communities listed by Bowles et al. (1990) in Indiana Dunes National Lakeshore. Wetland types are signified by *italics*.

Community	Characteristics
<i>Beach/Foredune</i>	Wave actions and sandy substrate Annuals and rhizomatous perennial plants
Dune complex	Cycle of sand erosion in steep topography & blow-outs
<i>Sand savanna</i>	Dominant presettlement plant community type on irregular dune topography Open dune conditions with frequent fires
Sand prairie	Flat topography with frequent burns
Upland forest	Protected from intense fires (e.g., dune hollow and ravine slopes) Occasional ground fires
<i>Forested Fen</i>	Calcareous peat soils Relict boreal community Structure affected by fire and water table
<i>Graminoid fen</i>	Calcareous peat soils Boreal and prairie affinities Open conditions with frequent fires and high water table
<i>Forested bog</i>	Acid peat soils Relict boreal community High species diversity in openings and pools
<i>Flatwoods</i>	Wet mineral soils or seepages with high species diversity
<i>Graminoid wetlands</i>	Complex of fen and marsh in interdunal areas High water tables and frequent fires

EXISTING WETLAND PLANT COMMUNITIES

Recent vegetation survey and classification.—Bowles et al. (1990) listed 10 natural communities within the boundary of Indiana Dunes National Lakeshore (INDU). Six of these communities are considered wetland communities (Table 1). These communities include beach, forested fens, graminoid fens, forested bogs, flatwoods, and graminoid wetlands. Wilhelm (1990) also described 11 community types along the gradients of moisture and arborescent development. Among these communities, swamp complex, bog, marsh complex bottomland, and beach are considered as wetland communities. Wilhelm's (1990) list of vascular plants in the Miller Woods area, along with the species list compiled by Peloquin & O'Brien (1990), provides invaluable information on the floristic compositions of wetlands adjacent to the Grand Calumet River.

Natural communities in Lake, LaPorte and Porter Counties, excluding those found at INDU, were surveyed by Kurz et al. (1978). In this inventory, a total of 258 potential natural areas (PNA) was identified. These PNAs

were then placed into three categories. Natural areas are of statewide significance, whereas notable areas are those which do not meet the criteria established for natural areas but do have considerable importance for education, research, and recreation. The third category, eliminated areas, consists of areas that still retain some traces of natural characters but which have been so severely disturbed that it is highly unlikely that they will recover the functions or structure of undisturbed natural areas. Kurz et al. (1978) also listed a total of 49 natural community types, including 26 aquatic and wetland types, that they had observed in the northwestern Indiana (Table 2). In Lake County, a total of 38 wetlands were identified, and seven of them were found adjacent to the Grand Calumet River. These wetlands were located in the DuPont tract, in the Ivanhoe Nature Preserve and in the Clark and Pine Nature Preserve (Fig. 1). Of the seven wetlands, three were placed in the natural area category, one was in the notable category, and three were in the eliminated category. In addition, an environmental assessment report that was submitted by the TAMS Consultants, Inc. (Mierzwa et al. 1991) for the Illinois-In-

diana regional airport project, updated the lists of plant species for the DuPont tract, and for the Clark and Pine nature preserve.

Recent vegetation classification systems.—Concurrent use of different classification systems for the same natural areas (e.g., Kurz et al. 1978; Bowles 1990; Wilhelm 1990) often causes a great deal of confusion because (1) different terms are used to refer to the same community type, (2) similar terms are used for different communities, and/or (3) the borders between community categories are delineated differently. To reduce such confusion, a standardized classification system is proposed, based on the classification scheme of Indiana Department of Natural Resources (Table 3). In this table, for example, Wilhelm's (1990) "marsh complex" is separated into marsh, fen and sedge meadow. The "wet prairie" is a part of "marsh complex" in the Wilhelm's classification, but the proposed classification places it in the category of "prairie." In addition, "hydromesophytic forest" is a part of Wilhelm's "swamp complex," but it is placed the categories of "forest" and "shrub swamp" in the proposed classification system.

Special conservation needs.—Among the riparian wetlands of the Grand Calumet River, Roxanna marsh, DuPont tract, Clark & Pine East Nature Preserve (also known as Bongi Pond), and Grand Calumet Lagoons are especially in need of conservation because they are considered as high quality habitats for endangered, threatened and/or rare animals and plants. After a compilation of the existing plant species records (Wilhelm 1990; Mierzwa et al. 1991; IDNR unpubl.), 653 plant species (533 natives and 120 aliens) were found in DuPont tract, Clark & Pine East, and Miller Woods (Appendix). These species included 1 extirpated species (never found in its historical sites for last 50 years), 17 endangered species (inhabit between 1–5 extant sites), threatened species (inhabit between 6–10 sites), and 18 rare species (inhabit between 11–20 sites) (Aldrich et al. 1986; IDNR unpubl.).

Roxanna marsh is a severely degraded riparian wetland that is located where the Grand Calumet River intersects Route 41 in Hammond (Fig. 1). There has been no systematic survey for plant species or community types in this area. According to the author's visual

Table 2.—Forty-nine plant community types of Indiana coastal zone listed by Kurz et al. (1978). Wetland types are signified by *italics*.

Community type
Forest
Dry-mesic upland forest
Mesic upland forest
Wet-mesic upland forest
Dry dune forest
Dry-mesic dune forest
Mesic floodplain forest
<i>Wet-mesic floodplain forest</i>
<i>Wet floodplain forest</i>
<i>Flatwoods</i>
Prairie
Dry-mesic prairie
Mesic prairie
<i>Wet-mesic prairie</i>
<i>Wet prairie</i>
Dry sand prairie
Dry-mesic sand prairie
Mesic sand prairie
<i>Wet-mesic sand prairie</i>
<i>Wet sand prairie</i>
Glacial drift hill prairie
Gravel hill prairie
Sand hill (dune) prairie
Shrub prairie
Savanna
Dry-mesic savanna
Mesic savanna
Dry sand savanna
Dry-mesic sand savanna
Mesic sand savanna
Aquatic
<i>Perennial stream</i>
<i>Lake</i>
<i>Pond</i>
<i>Marsh</i>
<i>Shrub swamp</i>
<i>Graminoid bog</i>
<i>Low shrub bog</i>
<i>Tall shrub bog</i>
<i>Forested bog</i>
<i>Calcareous floating mat</i>
<i>Graminoid fen</i>
<i>Low shrub fen</i>
<i>Tall shrub fen</i>
<i>Forested fen</i>
<i>Sedge meadow</i>
<i>Panne</i>
<i>Seep</i>
<i>Calcareous seep</i>
<i>Sand seep</i>
<i>Spring</i>
Primary
<i>Beach</i>
<i>Foredune/Blowout</i>

Table 3.—Synthesized wetland plant community types under the classification scheme of the Indiana Department of Natural Resources. * = Wetland communities classified by Wilhelm (1990). ** = Wetland Communities classified by Bowles et al. (1990).

Communities by Kurz et al. (1978)	Communities by Bowles et al. (1990) and Wilhelm (1990)
Wet-mesic floodplain forest	Bottomland forest*
Wet floodplain forest	Hydromesophytic forest in the Swamp Complex*
Flatwoods	Flatwoods in the Swamp Complex* Flatwoods**
Wet-mesic prairie	Mesophytic prairie*
Wet prairie	Wet prairie of in the Marsh Complex*
Wet-mesic sand prairie	Graminoid wetlands**
Wet sand prairie	
Perennial stream	Aquatic*
Lake	
Pond	
Marsh	Marsh in the Marsh Complex* Graminoid wetlands**
Shrub swamp	Hydromesophytic forest and conifer swamp in the Swamp Complex*
Graminoid bog	Bog*
Low shrub bog	Forested bog**
Tall shrub bog	Graminoid wetlands**
Forested bog	
Calcareous floating mat	
Graminoid fen	Fen in the Marsh Complex*
Low shrub fen	Forested fen**
Tall shrub fen	Graminoid fen**
Forested fen	
Sedge meadow	Sedge meadow in the Marsh Complex* Graminoid wetlands**
Panne	Panne*
Seep	Flatwoods**
Calcareous seep	
Sand seep	
Spring	

inspection, the entire area was infested by undesirable species (alien, invasive, or both) such as *Lythrum salicaria*, *Phragmites communis*, *Typha angustifolia*, and *T. latifolia*. Several woody species (e.g., *Acer negundo*, *Populus deltoides*, and *Salix* spp.) have also invaded the wetland from adjacent riverbanks or woodlands. All of these species have very little or no value as elements of natural communities (Wilhelm 1990), and thus restoration of native vegetation is urgent in this area. Marsh, sedge meadow, and wet prairie are beneficial models for restoration because these

were probably the most common wetland community types in the region's pre-settlement landscape. Their abundance has since been decreased significantly. The introduction of several species has been suggested for restoring marsh, sedge meadow, and wet prairie (Table 4; Wilhelm 1990).

After restoration of any of the above wetlands, periodic fires would be necessary to discourage the invasion of shrubs and trees (Henderson & Long 1984). Wet flood plain forest is very commonly found in the riparian community in the flood plains of streams and riv-

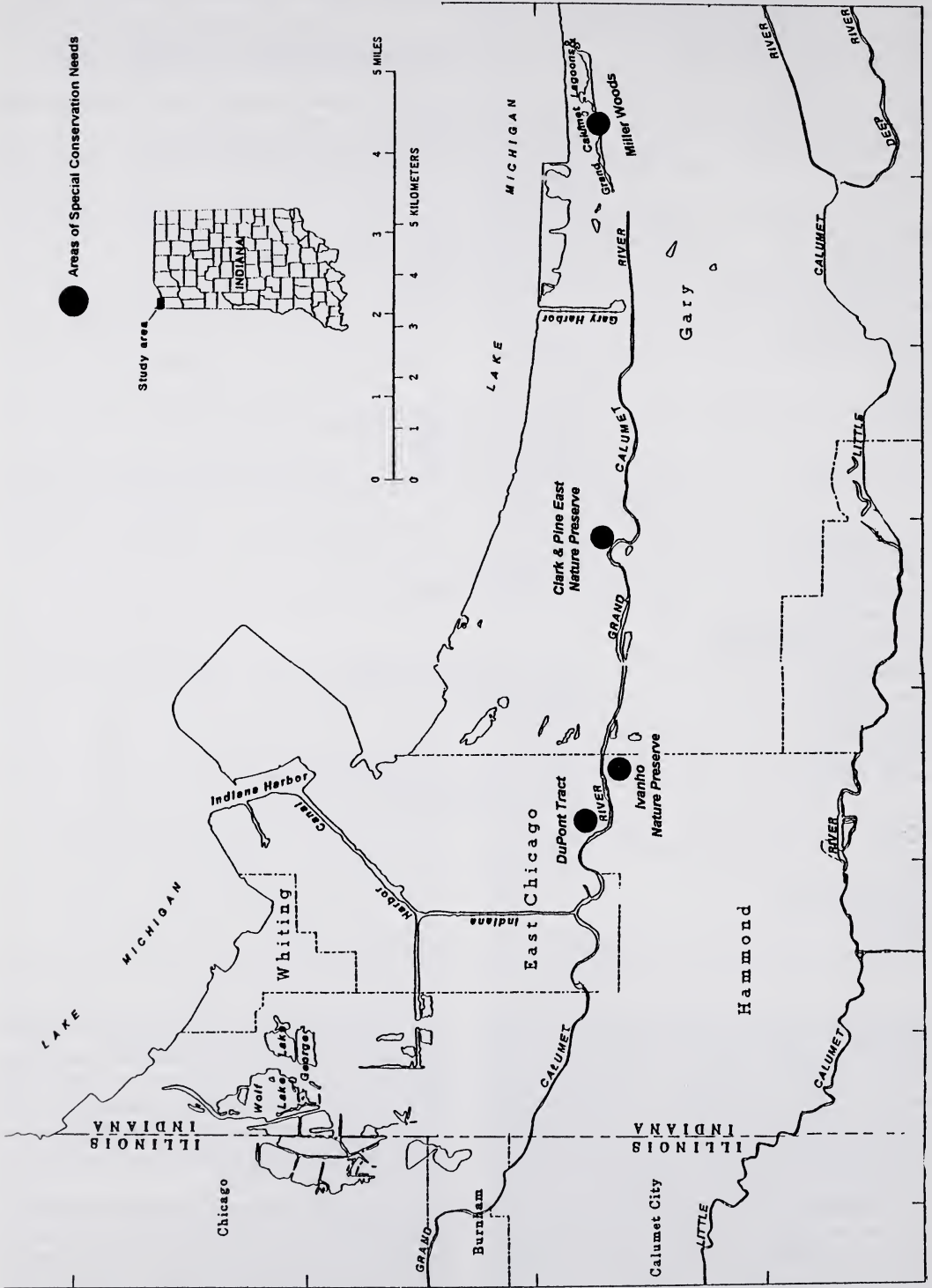


Figure 1.—Natural areas with special conservation needs along the Grand Calumet River in northwest Indiana. The dark circles indicate "Areas of Special Conservation Needs."

ers, so it may serve as a model of restoration for Roxanna Marsh. According to Wilhelm (1990), the following plants are typical of wet flood plain forest: *Acer saccharinum* (silver maple), *Cardamine bulbosa* (smooth spring cress), *Carex amphibola turgida* (gray sedge), *Carya laciniosa* (big shellbark hickory), *Chaerophyllum procumbens* (wild chevil), *Floerkea proserpinacoides* (false mermaid), *Fraxinus pennsylvanica* (green ash), *Populus deltoides* (cottonwood), *Salix nigra* (black willow), and *Viola striata* (striped white violet). Among the suggested species for wet floodplain forest restoration are highly invasive shrubs (e.g., *Populus deltoides* and *Salix nigra*) that produce quantities of seeds or that exhibit rapid vegetative growth. Periodic fires may be necessary to prevent over-growth of these species.

DuPont tract, owned by DuPont Chemical Company, is located to the east of Cline Avenue in Hammond, Indiana (Fig. 1). Despite extensive industrial development during the 1950s and the 1970s, significant portions of classical "dune and swale systems" are preserved in this property. TAMS Consultants (Mierzwa et al. 1991) and IDNR (unpubl.) documented 240 vascular plant species (203 natives and 37 aliens) including 1 endangered, 2 threatened, and 4 rare species (Tables 5, 6, 7 and Appendix). Clark & Pine East Nature Preserve is located in the southeastern corner of the East Chicago-Gary Regional Airport property (Fig. 1). Like the DuPont tract, this area is a classical example of a dune and swale system. TAMS Consultants (Mierzwa et al. 1991) and IDNR records for the area (unpubl.) list 271 species (245 natives and 26 aliens) including 7 endangered, 4 threatened, and 7 rare species (Tables 5, 6, 7 and Appendix). Aggressive expansions of invasive species, both alien and native, pose serious threats to populations of native species in the Clark & Pine East Nature Preserve. The riverbanks in these natural areas are heavily infested with *Phragmites communis berlandieri*, *Lythrum salicaria*, and *Typha angustifolia*. Spread of these species is generally facilitated by their effective pollination systems, seed dispersal (mostly by wind), breeding systems (e.g., facultative apomixis) and, in many circumstances, rapid vegetative growth by "root-suckering" or "stem sprouts" (Baker 1986). These characteristics make this group of spe-

cies very likely to continue expand aggressively in the wetlands of this tract, thereby out-competing native species. Forty alien species have already been found in the natural areas of DuPont and Clark and Pine East tracts. Most wetlands of the Grand Calumet Lagoons are located within the Miller Woods area, which is a part of INDU (Fig. 1). This is home to what probably is the best-preserved and most diverse flora in northwestern Indiana. *Potamogeton pulcher* (spotted pondweed), presumed to be an extirpated species, was found by Wilhelm (1990). Wilhelm (1990) also documented 555 species (453 natives and 102 aliens) including 12 endangered, 12 threatened, and 12 rare species (Tables 5, 6, 7 and Appendix).

POTENTIAL IMPACTS OF SEDIMENT REMOVAL

The U.S. Army Corps of Engineers (1997), after a comparison of 18 different methods for sediment treatment, recommended "mechanical dredging" with a closed bucket (often called a "clam-shell bucket"). Three potential impacts of the dredging operation on the Grand Calumet River riparian wetlands are possible. First, mechanical dredging may cause direct physical damages (e.g., trampling) to the riparian wetlands. Preparation of staging areas and an access road would inevitably remove some riparian vegetation. Physical damages could be critically disruptive if done in sensitive wetland habitats such as the DuPont tract, Clark & Pine East, and Miller Woods. Second, the removal of sediments would certainly deepen the riverbed, steepen the shores and eventually facilitate soil erosion on the stream-banks, and this would lower water quality. Third, local wetland hydrology could be modified by a deepening the river; i.e., deepening of the river bed may facilitate drainage from the adjacent wetlands, and this "probable" drainage may cause drastic changes in plant species composition (e.g., from *Carex* spp. to *Typha* spp.) as evidenced in the nearby Cowles Bog in the Indiana Dunes National Lakeshore (Wilcox & Simonin 1987). To minimize these impacts, I suggest the following considerations for the proposed sediment removal project in the Grand Calumet River and Indiana Harbor Ship Canal:

1. Any sediment removal project should aim to restore full ecosystem function and

Table 4.—Suggested species matrices for restoration of marsh, sedge meadow, and wet prairie along the Grand Calumet River (Wilhelm 1990).

Marsh

Aster puniceus firmus (marsh aster)
Carex comosa (bristle sedge)
C. haydenii (long-scaled meadow sedge)
C. lacustris
C. lanuginosa (woolly sedge)
C. lasiocarpa americana (narrow-leaved woolly sedge)
C. starwellii
C. stricta (meadow sedge)
C. tribuloides
Decodon verticillatus (swamp loosestrife)
Lysimachia thyrsiflora (tufted loosestrife)
Polygonum hydropiperoides (mild water pepper)
Potentilla palustris (marsh cinquefoil)
Proserpinaca palustris crebra (mermaid weed)
Rumex orbiculatus (great water dock)
Scirpus acutus (hard-stemmed bulrush)
S. validus creber (great bulrush)
Scutellaria epilobiifolia (marsh skullcap)
Sium suave (water parsnip)

Sedge meadow

Aster junciformis (rush aster)
Bidens comosa (swamp tickseed)
Dryopteris thelyteris pubescens (marsh shield fern)
Eupatorium perfoliatum (common boneset)
Hypericum virginicum fraseri (marsh St. John's wort)
Lycopus uniflorus (northern bugle weed)
Mentha arvensis villosa (wild mint)
Polygonum punctatum (smartweed)
P. sagittatum (arrow-leaved tear-thumb)

Wet prairie

Aletris farinosa (colic root)
Cladium marsicoides (twig rush)
Eleocharis melanocarpa (black-fruited spike rush)
Gentiana crinita (fringed gentian)
Juncus canadensis (Canadian rush)
Ludwigia alternifolia (seedbox)
Oxypolis rigidior (cowbane)
Rubus hispidus obovalis (swamp dewberry)
Sisyrinchium atlanticum (eastern blue-eyed grass)
Spiranthes cernua (nodding lady's tresses)

structure of the Grand Calumet River and its adjacent wetlands. The project should not be limited to the simple activity of "getting the dirt out." The river cannot attain full ecological functioning without having its riparian wetlands restored. Only removing the sedi-

ment will certainly waste resources. For this reason, it is critical that the proposed sediment dredging be accompanied by the restoration of riparian wetlands.

2. Physical damages to the wetland communities must be avoided, or at least minimized, during the sediment removal operation. Toward this end, the staging areas must be located as far as possible from the sensitive habitats, such as DuPont tract, Clark and Pine East Nature Preserve, and Miller Woods. The Roxanna Marsh area is an ideal candidate for a staging area, provided that the operation is not done during the breeding seasons for fish and wildlife. The area is considered to be severely degraded land. Such undesirable plants as *Typha* spp. and *Phragmites* spp. would be removed during the preparation of staging area. After sediment-removal operations, this area could be restored as wildlife habitat by establishing native plant communities such as sedge meadow or wet prairie.

3. Disposal sites for removed sediment should be located a safe distance from sensitive wetland habitats. Ecological feasibility of disposal at any proposed disposal site should be evaluated. Restoration of wetland ecosystems in the riparian lands (the areas immediately adjacent to the river) are crucial for establishing full ecological functions of the Grand Calumet River. Therefore, it is recommended that all riparian lands along the Grand Calumet River be excluded from the sediment disposal.

4. Stream-bank erosion should be prevented by the construction of appropriate anti-erosion structures. For example, BioLogs[®] (long rolls of coconut fiber encased in coconut netting) may serve as submersible substrate to anchor native aquatic plants and create calm "eddies" that protect and enhance wildlife. These structures are commercially available, and they have been used successfully (e.g., marsh restoration in Hackensack Meadowlands, New Jersey; Driver 1993).

5. After removing the sediments, it is recommended that the riverbeds be lined with sand to make a gentle slope from the shores to the center. This approach has been used for stream bank stabilization (Abt et al. 1995). The gentle slopes not only prevent drastic bank erosion, but they also provide an important feeding habitat for wildlife because birds (especially wading birds and possibly other

Table 5.—Endangered plant species, as listed by Indiana Department of Natural Resources, in the wetlands of DuPont Tract, Clark & Pine Nature Preserve (C&P), and Miller Woods.

Species		Location		
Scientific name	Common name	DuPont	C&P	Miller
<i>Agalinis purpurea</i>	Purple foxglove		X	
<i>Carex brunnescens</i> <i>sphaerostachya</i>	Brown sedge		X	
<i>Carex bushii</i>	Long-scaled sedge		X	
<i>Carex richardsonii</i>	Prairie hummock sedge		X	
<i>Eleocharis geniculata</i>	Knee spike bush		X	X
<i>Equisetum variegatum</i>	Small scouring rush			X
<i>Glyceria borealis</i>	Northern manna grass			X
<i>Juncus scripoides</i>	Round-headed rush			X
<i>Ludwigia sphaerocarpa deamii</i>	Round-fruited loosestrife			X
<i>Lycopus americana</i>	Common water horehound	X	X	X
<i>Panicum columbianum</i>	Hemlock panic grass			X
<i>Panicum dichotomiflorum</i>	Knee grass			X
<i>Polygonum hydro Piperoides</i>	Mild water pepper			X
<i>Potamogeton robbinsii</i>	Fern pondweed			X
<i>Satureja arkansana</i>	Dogmint			X
<i>Scleria pauciflora caroliana</i>	Few-flowered nut rush		X	
<i>Talinum rugospermum</i>	Fame flower			X

animals, too) favor gentle dish-shaped basins over steep cup-shaped ones (Smith et al. 1994).

6. To investigate the impact of the proposed sediment removal on the local hydrology and plant communities of adjacent wetlands, an experimental pilot dredging project is recommended.

THREATS AND RESTORATION POTENTIALS FOR WETLAND FLORA

Shuey (1996) listed three major threats to biodiversity in the southern shore of Lake Michigan as follows: (1) habitat fragmentation and natural land conversion, (2) infestation of exotic species and (3) anthropogenic disruption of ecosystem processes. Industrial and ur-

Table 6.—Threatened plant species, as listed by Indiana Department of Natural Resources, in the wetlands of DuPont Tract, Clark & Pine Nature Preserve (C&P), and Miller Woods.

Species		Location		
Scientific name	Common name	DuPont	C&P	Miller
<i>Arenaria stricta</i>	Stiff sandwort			X
<i>Aristata intermedia</i>	False arrow feather		X	X
<i>Aster ptarmicoides</i>	Stiff aster		X	X
<i>Cakile edentula</i>	Sea rocket			X
<i>Carex aurea</i>	Golden sedge	X	X	X
<i>Carex bebbi</i>	Bebb's oval sedge	X		
<i>Carex garberi</i>	False golden sedge			X
<i>Cirsium picheri</i>	Dune thistle			X
<i>Eriophorum angustifolium</i>	Narrow-leaved cotton grass		X	
<i>Juncus pelocarpus</i>	Brown-fruited rush			X
<i>Lathyrus orchtoleucus</i>	Pale vetchling			X
<i>Myriophyllum verticillatum</i> <i>pentinatum</i>	Whorled water milfoil			X
<i>Polygonella articulata</i>	Jointweed			X
<i>Utricularia cornuta</i>	Horned bladderwort			X

Table 7.—Rare plant species, as listed by Indiana Department of Natural Resources, in the wetlands of DuPont Tract, Clark & Pine Nature Preserve (C&P), and Miller Woods.

Species		Location		
Scientific name	Common name	DuPont	C&P	Miller
<i>Aralia nudicularis</i>	Wild sarsaparilla		X	X
<i>Arctostaphylos uva-ursi coarctata</i>	Arctic bearberry		X	X
<i>Aster borealis</i>	Rush aster			X
<i>Baptisia leucantha</i>	White wild indigo	X		X
<i>Betula papyrifera</i>	Paper birch	X	X	
<i>Catalpa speciosa</i>	Northern catalpa	X		
<i>Cypripedium calceolus parviflorum</i>	Small yellow lady's slipper		X	
<i>Diervilla lonicera</i>	Dwarf honeysuckle			X
<i>Drosera intermedia</i>	Narrow-leaved sundew			X
<i>Hypericum kalmianum</i>	Kalm's St. John's wort	X	X	
<i>Liparis loeselii</i>	Green twayblade		X	X
<i>Pinus banksiana</i>	Jack pine			X
<i>Pogonia ophioglossoides</i>	Snake-mouth orchid			X
<i>Potamogeton pusillus</i>	Small pondweed			X
<i>Rhynchospora macrostachya</i>	Horned beak rush			X
<i>Solidago ptarmicoides</i>	Prairie golden rod			X
<i>Tofieldia glutinosa</i>	False asphodel		X	

ban development not only eliminated most natural habitats but also fragmented remaining patches of natural lands. Habitat fragmentation has several negative effects. Decline of species richness in isolated small habitats is a classic example of island biogeography that is supported by numerous field evidences (e.g., Schonewald-Cox 1983; Newmark 1995). As distance between habitat patches increases, recolonization following local population crash becomes less likely, which can ultimately lead to the regional collapse and extirpation of highly-sensitive species such as Karner blue butterfly (*Lycaeides melissa samuelis*), an endangered species as listed by U.S. Endangered Species Act, on the southern shore of Lake Michigan (Shuey 1996; Knutson et al. 1999). Fragmentation may also disrupt the life cycles of species with complex habitat requirements, such as species that may require wetlands for reproduction but uplands for foraging. Edge effects from fragmentation are also problematic. Severe fragmentation increases vulnerability to invasion of exotic species into core natural areas (Shuey 1996) and unnatural predation from disturbance-adapted predators, such as raccoons (*Procyon lotor*), skunks (*Spilogale* spp.), and blue jays (*Cyanocitta cristata*) (Yahner 1988; Shuey 1996). Exotic species overrun native habitats, often eliminating entire flora on the southern shore

of Lake Michigan. Severe land disturbance by physical forces (Bowles et al. 1990; Shuey 1996), nutrient enrichment (Inouye & Tilman 1995), and altered hydrology (Wilcox et al. 1986) generally favor exotic species over native plants. The wetlands on the southern shore of Lake Michigan, as well as entire Midwestern U.S., are overrun by *Phragmites communis* (giant reeds), *Typha angustifolia* (narrow-leaf cattail), *Lythrum salicaria* (purple loosestrife), and an exotic genotype of *Phalaris arundinacea* (reed canary grass), whereas the upland fields and oak-savannas are overrun by *Robinia pseudoacacia* (black locust), *Rosa multiflora* (multiflora rose), *Ulmus pumila* (Siberian elm), *Lonicera japonica* (Japanese honeysuckle), *Rhamnus* spp. (buckthorns), *Melilotus* spp. (sweet clovers), *Coronilla varia* (crown vetch), *Allaria officinalis* (garlic mustard), and other exotic plants (Bowles et al. 1990; Wilhelm 1990; Shuey 1996; Choi & Pavlovic 1998; Peloquin & Hiebert 1999).

Closely related to the impact of habitat loss is the elimination or alteration of ecosystem processes. The ecological communities of the southern shore of Lake Michigan were among the most dynamic in the midwestern U.S., created and maintained by wildfires, hydrological fluctuations, and onshore transport of sands and sediments. Wildfires originally played a

critical role in maintaining open habitats in the area. Habitats such as oak-savanna, tall-grass prairie, and sedge meadow have been maintained by periodic wildfires that discouraged the invasions by woody plants such as *Robinia pseudoacacia*, *Sassafras albidum* (sassafras), *Populus deltoides* (cottonwoods), *Cornus* spp. (dogwoods), and *Salix* spp. (willows) and the over-growth and over-reproduction of oaks (*Quercus* spp.) (Taylor 1990; Wilhelm 1990; Choi & Pavlovic 1998). Unfortunately, modern culture has traditionally abhorred wildfires because of the perceived destructive nature of fire, and this mentality led to artificial suppression of wildfires for more than a century. Without the influence of fire, open habitats such as oak-savannas have succeeded to oak forests with full closure of their canopies now interrupting penetration of sunlight to ground layer. This transformation of community types has caused significant decline of *Lupinus perennis* (wild lupine) which favors openings in oak-savannas, and the decline of *L. perennis* lead to the endangerment of the endemic Karner blue butterfly whose larvae forage exclusively on the leaves of lupines (Grundel et al. 1998).

Historically, fluctuations of the local water table played a critical role in maintaining lakeplain and marsh communities. The swales collect water from well-drained soils of ridges as well as from underground. Therefore, water levels in the swales are dependents of above-ground runoff, seepage from sandy ridges, underground water table depths, short term fluctuations of Lake Michigan water level and the long term retreat of the lake (Thompson 1992; Chrzastowski et al. 1994; Brown 1997; Labus et al. 1999). Periodic episodes of elevated water tables re-set succession and maintain the highly productive herb-dominated systems. Many rare species, such as *Utriculata* spp. (bladderworts), and *Cypripedium* spp. (lady's slippers), in the lakeplain ponds are annuals. These annuals are dormant until a favorable moisture condition stimulates germination. When this happens, they quickly reach matu-

riety and set seed before drought or inundation ensues. Alteration of ground water regime has disrupted these delicate cycles (Keddy 1990). On the other hand, *Carex* spp., *Scirpus* spp., and *Juncus* spp. (sedges and rushes) were dominant perennials in the lakeplain wetlands because they could tolerate seasonal droughts better than other perennials such as cattails. However, extensive runoff from impervious land surfaces (e.g., highways, parking lots, and residential discharge) inundated the soil all year long causing massive invasions of *Typha*, followed by *Phragmites*, *Lythrum*, and *Phalaris* (Wilcox et al. 1986; Choi 2001).

The onshore deposition of sandy sediments has been responsible for the formation of dunes and beaches in the southern shore of Lake Michigan. Sand grains from eroding banks and tributary mouths are carried by on-shore currents and winds and accrete to form dunes, beaches, sandbars, and spits that shelter the pannes (wetlands with highly alkaline water) in intradunal depressions (Thomson 1992; Chrzastowski et al. 1994). Today, lakefront development (e.g., marinas, piers, and concrete walkways) in Chicago in Illinois, and Hammond and Gary in Indiana interrupts much of the sediment movements and depositions along the shoreline. These interruptions arrest the formation of new beaches, dunes, swales, and pannes (Shuey 1996; Labus et al. 1999).

Choi (2001) identified 34,771 ha of wetlands (from the National Wetland Inventory (NWI) - a Geographic Information System (GIS) database) along the Grand Calumet River. Of these wetlands, only 197 ha (0.6%) were high quality and 657 ha (1.9%) are restorable to natural conditions. Much of the others (33,917 ha, 97.5%) are also restorable to certain conditions; however, limited technology, high financial cost, and social and political ramifications (i.e., conflicts between economic growth and environmental conservation) only solidify the unlikelihood of restoration in this highly industrialized region (PAHLS 1993).

Appendix.—Check list of plant species in DuPont tract (DT), Clark and Pine East Nature Preserve (CP), and Miller Woods (MW). Three classes of protection (status) by State of Indiana, extirpated (Ex), endangered (E), threatened (T), rare (R), and watch list (W) are indicated. Alien species (A) are also indicated. Data compiled from Wilhelm (1990), Mierzwa et al. (1991), and unpublished data from the Indiana Department of Natural Resources.

Scientific name	Common name	DT	CP	MW	Status
<i>Abutilon theophrasti</i>	Velvetleaf			X	A
<i>Acer negundo</i>	Boxelder	X		X	
<i>Acer platanoides</i>	Norway maple			X	A
<i>Acer rubrum</i>	Red maple		X	X	
<i>Acer saccharinum</i>	Silver maple	X	X	X	
<i>Achillia millefolium</i>	Yarrow	X		X	A
<i>Agalinis purpurea</i>	Purple false foxglove	X	X	X	
<i>Agalinis skinneriana</i>	Pale false foxglove		X		E
<i>Agalinis tenuifolia</i>	Slender false foxglove			X	
<i>Agropyron repens</i>	Quack grass			X	A
<i>Agropyron smithii</i>	Western wheat grass			X	A
<i>Agropyron trachycaulum unilaterale</i>	Bearded wheat grass		X	X	
<i>Agrostis alba</i>	Redtop	X	X	X	A
<i>Agrostis hymnalis</i>	Tickle grass			X	
<i>Ailanthus altissima</i>	Tree of heaven	X			A
<i>Aletris farinosa</i>	Colic root			X	
<i>Alisma subcordatum</i>	Common water plantain		X	X	
<i>Alisma trivale</i>	Large-flowered water plantain	X		X	
<i>Allaria officinalis</i>	Garlic mustard			X	A
<i>Allium cernuum</i>	Nodding wild onion			X	
<i>Althaea rosea</i>	Hollyhock	X			A
<i>Ambrosia artemisiifolia elatior</i>	Common ragweed	X		X	
<i>Ambrosia psilostachya coronopifolia</i>	Western ragweed			X	A
<i>Ambrosia trifida</i>	Giant ragweed	X	X	X	
<i>Amelanchier arborea</i>	Serviceberry		X		
<i>Amelanchier interior</i>	Inland shadbush			X	
<i>Amelanchier laevis</i>	Allegheny shadbush			X	
<i>Ammophila breviligulata</i>	Merram grass			X	W
<i>Amorpha canescens</i>	Lead plant	X			
<i>Amphicarpa bracteata</i>	Upland hog peanut			X	
<i>Andropogon gerardii</i>	Big bluestem grass	X	X	X	
<i>Anemone canadensis</i>	Meadow anemone			X	
<i>Anemone cylindrica</i>	Thimbleweed	X	X	X	
<i>Antennaria neglecta</i>	Cat's foot		X		
<i>Antennaria plantaginifolia</i>	Pussy toes		X	X	
<i>Anthriscus caucalis</i>	Bur chervil			X	
<i>Apios americana</i>	Ground nut	X		X	
<i>Apocynum androsemfolium</i>	Spreading dogbane			X	
<i>Apocynum cannabinum</i>	Indian hemp	X	X	X	
<i>Apocynum sibiricum</i>	Prairie Indian hemp	X	X	X	
<i>Aquilegia canadensis</i>	Wild columbine	X	X		
<i>Arabis lyrata</i>	Sand cress	X	X	X	
<i>Aralia nudicaulis</i>	Wild sarsaparilla		X	X	R
<i>Arctostaphylos uva-ursi coatilis</i>	Arctic bearberry	X	X	X	R
<i>Arenaria lateriflora</i>	Wood sandwort	X			
<i>Arenaria serpyllifolia</i>	Thyme-leaved sandwort			X	A
<i>Arenaria stricta</i>	Stiff sandwort			X	T
<i>Aristata intermedia</i>	False arrow feather		X	X	T
<i>Aristata oligantha</i>	Plains three-awn grass			X	A
<i>Aristata purpurascens</i>	Arrow feather			X	A
<i>Aronia melanocarpa</i>	Black chokeberry			X	

Appendix.—Continued.

Scientific name	Common name	DT	CP	MW	Status
<i>Aronia prunifolia</i>	Chokeberry		X	X	
<i>Artemisia caudata</i>	Beach wormwood	X	X	X	
<i>Artemisia vulgaris</i>	Mugwort			X	A
<i>Asclepias amplexicaulis</i>	Sand milkweed			X	
<i>Asclepias incarnata</i>	Swamp milkweed	X	X	X	
<i>Asclepias syriaca</i>	Common milkweed	X	X	X	
<i>Asclepias tuberosa</i>	Butterfly weed	X	X	X	
<i>Asclepias verticillata</i>	Whorled milkweed	X	X	X	
<i>Asclepias viridiflora</i>	Short green milkweed			X	
<i>Asparagus officinalis</i>	Asparagus	X	X	X	A
<i>Aster azureus</i>	Sky-blue aster	X	X	X	
<i>Aster borealis</i>	Rush aster			X	R
<i>Aster dumosus</i>	Rice-button aster	X	X		
<i>Aster ericoides</i>	Heath aster	X		X	
<i>Aster laevis</i>	Smooth blue aster			X	
<i>Aster lateriflorus</i>	Side-flowering aster		X	X	
<i>Aster liniariifolius</i>	Flax-leaved aster			X	
<i>Aster novae-angliae</i>	New England aster		X	X	
<i>Aster pilosus</i>	Hairy aster			X	
<i>Aster ptarmicoides</i>	Stiff aster		X	X	T
<i>Aster puniceus firmus</i>	Shining aster			X	
<i>Aster sagittifolius</i>	Arrow-leaved aster			X	
<i>Aster sagittifolius drummondii</i>	Drummond's aster			X	
<i>Aster simplex</i>	Panicled aster	X	X	X	
<i>Aster umbellatus</i>	Flat-top aster		X	X	
<i>Aureolaria pedicularia ambigens</i>	Clammy false foxglove			X	
<i>Baptisia leucantha</i>	White wild indigo	X		X	R
<i>Babarea vulgaris</i>	Yellow rocket			X	A
<i>Betula papyrifera</i>	Paper birch	X	X		R
<i>Bidens cernua</i>	Nodding bur marigold			X	
<i>Bidens comosa</i>	Swamp tickseed			X	
<i>Bidens coronata</i>	Tall swamp marigold		X	X	
<i>Boehneria cylindrica</i>	False nettle	X		X	
<i>Boltonia latisquama recognita</i>	False aster			X	
<i>Bromus inermis</i>	Hungarian brome			X	A
<i>Bromus japonicus</i>	Japanese chess			X	A
<i>Bromus kalmii</i>	Prairie brome		X	X	
<i>Bromus tectorum</i>	Downy brome	X		X	A
<i>Bulbostylis capillaris</i>	Hair sedge			X	
<i>Cacalia plantaginea</i>	Prairie Indian plantain			X	
<i>Cakile edentula</i>	Sea rocket			X	T
<i>Calamagrostis canadensis</i>	Blue joint grass	X	X	X	
<i>Calamovilfa longifolia</i>	Sand reed	X	X	X	
<i>Camassia scilloides</i>	Wild hyacinth			X	
<i>Campanula aparinoides</i>	Marsh bellflower	X	X	X	
<i>Campanula rotundifolia</i>	Harebell		X		
<i>Campanula uliginosa</i>	Marsh bellflower	X			
<i>Cannabis sativa</i>	Hemp		X		A
<i>Capsella bursa-pastoris</i>	Shepherd's purse			X	A
<i>Carduus nutans</i>	Musk thistle	X			A
<i>Carex alata</i>	Winged oval sedge			X	R
<i>Carex aurea</i>	Golden sedge	X	X	X	T
<i>Carex bebbii</i>	Beb's oval sedge	X			T
<i>Carex brevior</i>	Plains oval sedge	X	X		
<i>Carex buxbaumii</i>	Dark-scaled sedge	X	X		

Appendix.—Continued.

Scientific name	Common name	DT	CP	MW	Status
<i>Carex brunnescens sphaerostachya</i>	Brown sedge		X		E
<i>Carex bushii</i>	Long-scaled green sedge		X		E
<i>Carex comosa</i>	Bristly sedge			X	
<i>Carex crawei</i>	Early fen sedge		X		T
<i>Carex emoryi</i>	Riverbank sedge			X	
<i>Carex garberi</i>	False golden sedge		X	X	T
<i>Carex granularis</i>	Pale sedge			X	
<i>Carex haydenii</i>	Long-scaled tussock sedge			X	
<i>Carex hystrixina</i>	Porcupine sedge		X		
<i>Carex interia</i>	Prairie star sedge			X	
<i>Carex lanuginosa</i>	Woolly sedge	X	X	X	
<i>Carex muhlenbergii</i>	Sand bracted sedge	X		X	
<i>Carex pennsylvanica</i>	Common oak sedge	X		X	
<i>Carex richardsonii</i>	Prairie hummock sedge		X		E
<i>Carex starwellsii</i>	Running marsh sedge	X		X	
<i>Carex siccata</i>	Running savanna sedge			X	
<i>Carex stricta</i>	Common tussock sedge	X	X	X	
<i>Carex suberecta</i>	Wedge-fruited oval sedge	X	X		
<i>Carex tenera</i>	Narrow-leaved oval sedge		X		
<i>Carex tetanica</i>	Common stiff sedge	X			
<i>Carex tonsa</i>	Smooth-fruited sedge			X	
<i>Carex tribuloides</i>	Awl-fruited oval sedge			X	
<i>Carex umbellata</i>	Early oak sedge	X	X	X	
<i>Carex viridula</i>	Green yellow sedge		X	X	
<i>Carex vulpinoidea</i>	Brown fox sedge		X		
<i>Cassia fasciculata</i>	Partridge pea			X	W
<i>Cassia nititans</i>	Wild sensitive plant			X	
<i>Castilleja coccinea</i>	Indian paintbrush	X	X	X	
<i>Catalpa speciosa</i>	Northern catalpa	X			R
<i>Ceanothus americanus</i>	New Jesey tea	X		X	
<i>Celastrus scandens</i>	Climbing bittersweet	X	X		
<i>Cenchrus longispinus</i>	Sandbur	X		X	
<i>Centaurium pulchellum</i>	Showy centaury	X	X		A
<i>Cephalanthus occidentalis</i>	Buttonbush	X	X	X	
<i>Chelone glabra</i>	Turtlehead	X			A
<i>Chenopodium album</i>	Lamb's quarters			X	A
<i>Chenopodium leptophyllum</i>	Narrow-leaved goosefoot			X	
<i>Chenopodium standleyanum</i>	Woodland goosefoot			X	
<i>Cicuta bulbifera</i>	Bulblet-bearing water hemlock			X	
<i>Cinna arundinacea</i>	Common wood reed	X	X		
<i>Cirsium arvense</i>	Field thistle		X	X	A
<i>Cirsium discolor</i>	Pasture thistle	X	X	X	
<i>Cirsium muticum</i>	Swamp thistle	X	X	X	
<i>Cirsium pitcheri</i>	Dune thistle			X	T
<i>Cirsium vulgare</i>	Bull thistle	X	X	X	A
<i>Cladium maricoides</i>	Twig rush	X	X	X	
<i>Commandra umbellata</i>	False toadflax	X		X	
<i>Commelina communis</i>	Common day flower	X			A
<i>Commelina erecta deamiana</i>	Narrow-leaved day flower			X	
<i>Conium maculatum</i>	Poison hemlock	X			A
<i>Convolvulus arevensis</i>	Field bindweed	X			A
<i>Convolvulus sepium</i>	Hedge bindweed	X		X	
<i>Coreopsis lanceolata</i>	Sand coreopsis	X	X	X	
<i>Coreopsis palmata</i>	Prairie coreopsis		X	X	
<i>Coreopsis tripteris</i>	Tall coreopsis	X	X	X	

Appendix.—Continued.

Scientific name	Common name	DT	CP	MW	Status
<i>Corispermum hyssopifolium</i>	Bugseed			X	
<i>Cornus obliqua</i>	Pale dogwood	X	X	X	
<i>Cornus racemosa</i>	Gray dogwood	X	X		
<i>Cornus rugosa</i>	Round-leaved dogwood		X		T
<i>Cornus stolonifera</i>	Red-osier dogwood	X	X	X	
<i>Cornus stolonifera baileyi</i>	Dunes dogwood			X	
<i>Crepis capillaris</i>	Hawk's bear			X	A
<i>Cuscuta coryli</i>	Hazel dodder			X	
<i>Cuscuta gornovii</i>	Common dodder			X	
<i>Cycloloma atriplicifolium</i>	Winged pigweed		X	X	
<i>Cyperus erythrorhizos</i>	Red-footed nut sedge			X	
<i>Cyperus esculentus</i>	Field nut sedge		X		
<i>Cyperus ferruginescens</i>	Rusty nut sedge	X	X	X	
<i>Cyperus filiculmis</i>	Slender sand cyperus		X		
<i>Cyperus rivularis</i>	Brook nut sedge	X	X	X	
<i>Cyperus schweinitzii</i>	Rough sand cyperus	X		X	
<i>Cyperus strigosus</i>	Long-scaled nut sedge	X		X	
<i>Cypripedium acaule</i>	Stemless lady's slipper				W
<i>Cypripedium calceolus parviflorum</i>	Small yellow lady's slipper		X		R
<i>Cypripedium calceolus pubescens</i>	Large yellow lady's slipper		X		W
<i>Daucus carota</i>	Wild carrot	X	X	X	A
<i>Descurainia sophia</i>	Flixweed		X	X	A
<i>Desmodium canadense</i>	Showy tick trefoil	X	X	X	
<i>Desmodium paniculatum</i>	Panicled tick trefoil	X	X	X	
<i>Desmodium sessilifolium</i>	Sessile-leaved trefoil	X			
<i>Dianthus armeria</i>	Deptford pink			X	A
<i>Diervilla lonicera</i>	Dwarf honeysuckle			X	R
<i>Digitaria ischaemum</i>	Smooth crab grass			X	A
<i>Digitaria sanguinalis</i>	Ciliate crab grass			X	A
<i>Diplotaxis muralis</i>	Wall rocket		X	X	A
<i>Diplotaxis tenuifolia</i>	Sand rocket		X		A
<i>Drosera intermedia</i>	Narrow-leaved sundew			X	R
<i>Dryopteris spinulosa</i>	Spinulose shield fern			X	
<i>Dryopteris thelypteris</i>	Marsh shield fern	X	X	X	
<i>Dulichium arundinaceum</i>	Three-way sedge			X	
<i>Echinochloa crusgalli pubescens</i>	Barnyard grass		X	X	
<i>Echinocystis lobata</i>	Wild cucumber		X		
<i>Echium vulgare</i>	Viper's bugloss	X			A
<i>Eleocharis acicularis</i>	Needle spike rush			X	
<i>Eleocharis compressa</i>	Flat-stemmed spike rush			X	
<i>Eleocharis elliptica</i>	Golden-seeded spike rush	X	X	X	
<i>Eleocharis engelmannii</i>	Engleman's spike rush		X		
<i>Eleocharis erythropoda</i>	Red-footed spike rush	X	X	X	
<i>Eleocharis geniculata</i>	Knee spike rush		X	X	E
<i>Eleocharis intermedia fernaldii</i>	Matted spike rush			X	
<i>Eleocharis smallii</i>	Marsh spike rush			X	
<i>Elodea canadensis</i>	Common waterweed			X	
<i>Elodea nuttallii</i>	Slender waterweed			X	
<i>Elymus canadensis</i>	Canada rye	X	X	X	
<i>Epilobium ciliatum</i>	Northern willow herb			X	
<i>Equisetum arvense</i>	Horsetail	X	X	X	
<i>Equisetum hymale</i>	Tall scouring rush	X	X	X	
<i>Equisetum variegatum</i>	Small scouring rush			X	E
<i>Equisetum × ferrissii</i>				X	
<i>Equisetum × laevigatum</i>	Smooth scouring rush	X		X	
<i>Equisetum × trachyodon</i>			X		

Appendix.—Continued.

Scientific name	Common name	DT	CP	MW	Sta- tus
<i>Eragrostis cilianensis</i>	Stink grass			X	A
<i>Eragrostis hypnoides</i>	Creeping love grass				A
<i>Eragrostis pectinacea</i>	Small love grass	X		X	
<i>Eragrostis poaeoides</i>	Low love grass		X	X	A
<i>Eragrostis spectabilis</i>	Purple love grass	X		X	
<i>Eragrostis trichodes</i>	Tall love grass			X	A
<i>Erechtites hieracifolia</i>	Fireweed				
<i>Erigeron annuus</i>	Annual fleabane			X	
<i>Erigeron canadensis</i>	Horseweed	X	X	X	
<i>Erigeron philadelphicus</i>	Marsh fleabane			X	
<i>Erigeron pulchellus</i>	Robin's plaintain		X	X	
<i>Erigeron strigosus</i>	Daisy fleabane	X	X		
<i>Eriophorum angustifolium</i>	Narrow-leaved cotton grass		X	X	T
<i>Eryngium yuccifolium</i>	Rattlesnake master		X		
<i>Eupatorium altissimum</i>	Tall boneset	X	X	X	
<i>Eupatorium maculatum</i>	Spotted joe pye weed	X	X	X	
<i>Eupatorium perfoliatum</i>	Common boneset	X	X	X	
<i>Eupatorium rugosum</i>	White snakeroot		X		
<i>Eupatorium serotinum</i>	Late boneset	X	X	X	
<i>Euphorbia corollata</i>	Flowering spurge	X	X	X	
<i>Euphorbia dentata</i>	Toothed spurge			X	A
<i>Euphorbia maculata</i>	Nodding spurge			X	A
<i>Euphorbia polygonifolia</i>	Seaside spurge			X	
<i>Euphorbia supina</i>	Spotted creeping spurge			X	A
<i>Festuca elatior</i>	Tall fescue		X		A
<i>Fragaria virginiana</i>	Wild strawberry	X	X	X	
<i>Fraxinus americana</i>	White ash			X	
<i>Fraxinus pennsylvanica subintegerrima</i>	Green ash		X		
<i>Galium aparine</i>	Annual bedstraw			X	
<i>Galium concinnum</i>	Shining bedstraw			X	
<i>Galium obtusum</i>	Wild madder	X	X		
<i>Galium pilosum</i>	Hairy bedstraw				
<i>Galium tinctorium</i>	Stiff bedstraw			X	
<i>Gaylussacia baccata</i>	Box huckleberry			X	
<i>Gentiana andrewsii</i>	Closed gentain			X	
<i>Gentiana crinita</i>	Fringed gentain		X	X	
<i>Gentiana procera</i>	Small fringed gentain		X	X	
<i>Geranium carolinianum</i>	Carolina cranesbill			X	
<i>Geranium maculatum</i>	Wild geranium			X	
<i>Geum laciniatum trichocarpum</i>	Rough avens		X		
<i>Glechoma hederacea</i>	Ground ivy			X	A
<i>Gleditsia triacanthos</i>	Honey locust	X		X	A
<i>Glyceria borealis</i>	Northern manna grass			X	E
<i>Glyceria septentrionalis</i>	Floating manna grass			X	
<i>Glyceria striata</i>	Fowl meadow grass	X	X	X	
<i>Gnaphalium obtusifolium</i>	Old-field balsam			X	
<i>Habenaria ciliaris</i>	Orange fringed orchid			X	
<i>Habenaria clavellata</i>	Club-spur orchid			X	
<i>Habenaria flava herbiola</i>	Tuberled orchid	X		X	
<i>Habenaria hyperborea huronesis</i>	Northern bog orchid			X	
<i>Habenaria psycodes</i>	Purple fringed orchid			X	
<i>Hamamelis virginiana</i>	Witch hazel			X	
<i>Helianthemum canadense</i>	Common rockrose			X	
<i>Helianthus divaricatus</i>	Woodland sunflower	X	X	X	
<i>Helianthus grosseserratus</i>	Sawtooth sunflower	X		X	
<i>Helianthus occidentalis</i>	Western sunflower	X		X	

Appendix.—Continued.

Scientific name	Common name	DT	CP	MW	Sta- tus
<i>Helianthus petiolaris</i>	Petioled sunflower			X	A
<i>Helianthus rigidus</i>	Prairie sunflower			X	
<i>Heliopsis helianthoides</i>	False sunflower		X		
<i>Heteranthera dubia</i>	Water star grass			X	
<i>Hieracium caespitosum</i>	Field hawkweed			X	A
<i>Hieracium canadense fasciculatum</i>	Canada hawkweed			X	
<i>Hieracium gronovii</i>	Hairy hawkweed			X	
<i>Hieracium scabrum</i>	Rough hawkweed			X	
<i>Hordeum jubatum</i>	Squirrel-tail grass			X	A
<i>Hypericum canadense</i>	Canadian St. John's wort			X	
<i>Hypericum lamianum</i>	Kalm's St. John's wort	X	X		
<i>Hypericum majus</i>	Sand St. John's wort			X	R
<i>Hypericum virginicum fraseri</i>	Marsh St. John's wort			X	
<i>Hypoxis hirsuta</i>	Yellow star grass	X			
<i>Hystrix patula</i>	Bottlebrush grass			X	
<i>Ilex verticillata</i>	Winterberry		X	X	
<i>Impatiens capensis</i>	Spotted touch-me-not	X	X	X	
<i>Impatiens pallida</i>	Pale touch-me-not	X	X	X	
<i>Iris germanica</i>	German iris			X	A
<i>Iris pseudacorus</i>	Tall yellow iris			X	A
<i>Iris virginica shrevei</i>	Blue flag	X	X	X	
<i>Juncus balticus littoralis</i>	Lake shore rush	X	X	X	W
<i>Juncus brachycephalus</i>	Short-headed rush		X	X	
<i>Juncus canadensis</i>	Canadian rush		X	X	
<i>Juncus diffusissimus</i>	Slimpod rush			X	
<i>Juncus dudleyi</i>	Dudley's rush	X	X	X	
<i>Juncus effusus solutus</i>	Common rush			X	
<i>Juncus greenei</i>	Greene's rush			X	
<i>Juncus interia</i>	Inland rush		X		
<i>Juncus marginatus</i>	Grass-leaved rush			X	
<i>Juncus nodosus</i>	Joint rush	X	X	X	
<i>Juncus pelocarpus</i>	Brown-fruited rush			X	T
<i>Juncus scripoides</i>	Round-headed rush			X	E
<i>Juncus tenuis</i>	Path rush	X	X	X	
<i>Juncus torreyi</i>	Torrey's rush	X	X	X	
<i>Juniperus virginiana crebra</i>	Eastern red cedar			X	
<i>Koeleria cristata</i>	June grass	X		X	
<i>Krigia biflora</i>	False dandelion	X		X	
<i>Krigia virginica</i>	Dwarf dandelion			X	
<i>Kuhnia eupatroides corymbulosa</i>	False boneset			X	
<i>Lactuca canadensis</i>	Wild lettuce			X	
<i>Lactuca serriola</i>	Prickly lettuce	X			A
<i>Lathyrus japonicus glaber</i>	Beach pea			X	
<i>Lathyrus orchroleucus</i>	Pale vetchling			X	T
<i>Lathyrus palustris myrtifolius</i>	Marsh vetchling	X		X	
<i>Lechea villosa</i>	Hairy pinweed			X	
<i>Leersia oryzoides</i>	Rice cut grass		X	X	
<i>Leersia virginica</i>	White grass	X			
<i>Lepidium virginicum</i>	Common peppergrass			X	
<i>Leptoloma cognatum</i>	Fall witch grass			X	
<i>Lespedeza capitata</i>	Round-headed bush clover	X		X	
<i>Lespedeza virginica</i>	Slender bush clover			X	
<i>Liatris aspera</i>	Rough blazing star	X	X	X	
<i>Liatris cylindracea</i>	Cylindrical blazing star	X	X	X	
<i>Liatris spicata</i>	Marsh blazing star	X	X	X	
<i>Lilium philadelphicum andinum</i>	Prairie lily	X	X	X	

Appendix.—Continued.

Scientific name	Common name	DT	CP	MW	Sta- tus
<i>Linaria canadensis</i>	Blue toadflax			X	
<i>Linaria vulgaris</i>	Butter-and-eggs			X	A
<i>Linum medium texanum</i>	Small yellow flax		X	X	
<i>Liparis lilifolium</i>	Purple twayblade	X		X	
<i>Liparis loeselii</i>	Green twayblade		X	X	R
<i>Liriodendron tulipifera</i>	Tulip tree		X		
<i>Lithospermum canescens</i>	Hoary puccoon	X	X	X	
<i>Lithospermum croceum</i>	Hairy puccoon	X	X	X	
<i>Lobelia kalmii</i>	Bog lobelia		X	X	
<i>Lobelia siphilitica</i>	Great blue lobelia	X		X	
<i>Lobelia spicata</i>	Pale spiked lobelia	X	X		
<i>Lonicera dioica</i>	Red honeysuckle		X	X	
<i>Lonicera</i> × <i>muendenuensis</i>	Common fly honeysuckle	X	X	X	A
<i>Lonicera tatarica</i>	Tartarian honeysuckle	X	X		A
<i>Ludwigia alternifolia</i>	Seedbox			X	
<i>Ludwigia palustris americana</i>	Marsh purslane			X	
<i>Ludwigia polycarpa</i>	False loosestrife			X	
<i>Ludwigia sphaerocarpa deamii</i>	Round-fruited loosestrife			X	E
<i>Lupinus perennis occidentalis</i>	Wild lupine	X		X	
<i>Lychnis alba</i>	White campion	X		X	A
<i>Lycopus americanus</i>	Common water horehound	X	X	X	E
<i>Lycopus asper</i>	Rough water horehound	X		X	A
<i>Lycopus rubellus</i>	Stalked water horehound			X	
<i>Lycopus uniflorus</i>	Northern bugle weed		X	X	
<i>Lycopus virginicus</i>	Bugle weed			X	
<i>Lysimachia lanceolata</i>	Lance-leaved loosestrife	X		X	
<i>Lysimachia quadriflora</i>	Four-leaved loosestrife	X	X		
<i>Lysimachia terrestris</i>	Swamp candles	X		X	
<i>Lysimachia thysiflora</i>	Tufted loosestrife			X	
<i>Lythrum alatum</i>	Winged loosestrife	X	X	X	
<i>Lythrum salicaria</i>	Purple loosestrife	X	X	X	A
<i>Maianthemum canadense interius</i>	Hairy Canada mayflower	X	X	X	
<i>Malus ioensis</i>	Iowa crabapple	X	X	X	
<i>Medicago lupulina</i>	Black medic	X		X	A
<i>Melampyrum lineare latifolium</i>	Cow wheat			X	
<i>Melilotus alba</i>	Sweet white clover	X	X	X	A
<i>Melilotus officinalis</i>	Sweet yellow clover			X	A
<i>Mentha arvensis villosa</i>	Wild mint			X	
<i>Mimulus ringens</i>	Monkey flower		X	X	
<i>Mirabilis nyctaginea</i>	Wild four o'clock			X	A
<i>Mollugo verticillata</i>	Carpet weed			X	A
<i>Monarda fistulosa</i>	Wild bergamot	X	X	X	
<i>Monarda punctata villicaulis</i>	Horse mint	X	X	X	
<i>Monotropa uniflora</i>	Indian pipe			X	
<i>Morus alba</i>	White mulberry		X	X	A
<i>Muhlenbergia mexicana</i>	Leafy stain grass			X	
<i>Muhlenbergia racemosa</i>	Upland wild timothy			X	A
<i>Myosotis scorpioides</i>	Common forget-me-not			X	A
<i>Myriophyllum exalbescens</i>	Spiked water milfoil			X	
<i>Myriophyllum verticillatum pentinatum</i>	Whorled water milfoil			X	T
<i>Najas flexilis</i>	Slender naiad			X	
<i>Nepeta cataria</i>	Catnip	X		X	A
<i>Nuphar advena</i>	Yellow pond lily			X	
<i>Nymphaea tuberosa</i>	White water lily		X	X	
<i>Nyssa sylvatica</i>	Sour gum			X	

Appendix.—Continued.

Scientific name	Common name	DT	CP	MW	Status
<i>Oenothera biennis</i>	Common evening primrose	X	X	X	
<i>Oenothera rhombipetala</i>	Western sand evening primrose		X	X	
<i>Onoclea sensibilis</i>	Sensitive fern	X		X	
<i>Opuntia humifusa</i>	Eastern prickly pear	X	X	X	
<i>Orobanche uniflora</i>	One-flowered broom rape			X	
<i>Osmunda cinnamomea</i>	Cinnamon fern			X	
<i>Osmunda regalis spectabilis</i>	Royal fern	X	X	X	
<i>Oxalis europaea</i>	Tall wood sorrel			X	
<i>Oxypolis rigidior</i>	Cowbane	X	X	X	
<i>Panicum capillare</i>	Old witch grass			X	
<i>Panicum columbianum</i>	Hemlock panic grass			X	E
<i>Panicum depauperatum</i>	Starved panic grass			X	
<i>Panicum dichotomiflorum</i>	Knee grass			X	E
<i>Panicum flexile</i>	Wiry panic grass		X	X	
<i>Panicum implicatum</i>	Old-field panic grass	X	X	X	
<i>Panicum latiflorum</i>	Broad-leaved panic grass			X	
<i>Panicum lindheimeri</i>	Smooth woolly panic grass			X	
<i>Panicum oligosanthos scribnerianum</i>	Scribner's panic grass		X	X	
<i>Panicum perlongum</i>	Long-stalked panic grass			X	
<i>Panicum rigidulum</i>	Munro grass			X	
<i>Panicum villosissimum</i>	White-haired panic grass		X	X	
<i>Panicum villosissimum pseudopubescens</i>	False white-haired panic grass			X	
<i>Panicum virgatum</i>	Switch grass	X	X	X	
<i>Parnassia glauca</i>	Grass of parnassus			X	
<i>Parthenocissus inserta</i>	Thicket creeper	X	X	X	
<i>Parthenocissus quinquefolia</i>	Virginia creeper	X	X	X	
<i>Pedicularis canadensis</i>	Wood betony	X	X	X	
<i>Penthorum sedoides</i>	Ditch stonecup			X	
<i>Petalostemum purpureum</i>	Purple prairie clover		X		
<i>Phalaris arundinacea</i>	Reed canary grass	X		X	A
<i>Phleum pratense</i>	Timothy			X	A
<i>Phlox divaricata</i>	Blue phlox		X		
<i>Phlox glaberrima interior</i>	Marsh phlox			X	
<i>Phlox peniculata</i>	Garden phlox			X	A
<i>Phlox pilosa</i>	Sand prairie phlox	X	X	X	
<i>Phragmites australis</i>	Common reed	X	X	X	A
<i>Physalis heterophylla</i>	Clammy ground cherry	X			
<i>Physalis pubescens</i>	Hairy ground cherry			X	A
<i>Physalis subglabrata</i>	Tall ground cherry			X	
<i>Physalis virginiana</i>	Lance-leaved ground cherry				
<i>Physocarpus opulifolius</i>	Ninebark		X	X	
<i>Physostegia virginiana</i>	False dragonhead	X	X		
<i>Phytolacca americana</i>	Pokeweed	X			
<i>Pinus banksiana</i>	Jack pine			X	R
<i>Plantago major</i>	Common plantain			X	A
<i>Plantago rugelii</i>	Red-stalked plantain	X		X	
<i>Platanus occidentalis</i>	Sycamore			X	
<i>Poa annua</i>	Annual blue grass			X	A
<i>Poa compressa</i>	Canada blue grass	X	X	X	A
<i>Poa pratensis</i>	Kentucky blue grass	X	X	X	A
<i>Pogonia ophioglossoides</i>	Snake-mouth orchid			X	R
<i>Polanisia graveolens</i>	Slammy weed			X	A
<i>Polygala cruciata aquilonia</i>	Cross milkwort			X	
<i>Polygala polygama obtusata</i>	Purple milkwort			X	

Appendix.—Continued.

Scientific name	Common name	DT	CP	MW	Status
<i>Polygonatum canaliculatum</i>	Smooth Solomon's seal	X	X	X	
<i>Polygonella articulata</i>	Jointweed			X	T
<i>Polygonum amphibium stipulaceum</i>	Water knotweed	X	X	X	
<i>Polygonum aviculare</i>	Common knotweed			X	A
<i>Polygonum coccineum</i>	Water heartease		X	X	
<i>Polygonum convolvulus</i>	Black bindweed			X	A
<i>Polygonum hydropiperoides</i>	Mild water pepper			X	E
<i>Polygonum lapathifolium</i>	Heartease			X	
<i>Polygonum pensylvanicum</i>	Pennsylvania knotweed			X	
<i>Polygonum persicaria</i>	Lady's thumb			X	A
<i>Polygonum punctatum</i>	Smartweed	X		X	
<i>Polygonum scandens</i>	Climbing false buckweat			X	
<i>Polygonum tenue</i>	Slender knotweed			X	
<i>Pontederia cordata</i>	Pickerel weed			X	
<i>Populus deltoides</i>	Eastern cottonwood	X	X	X	
<i>Populus grandidentata</i>	Large-toothed aspen		X		
<i>Populus tremuloides</i>	Quaking aspen	X	X	X	
<i>Portulaca oleracea</i>	Purslane		X		A
<i>Potamogeton amplifolius</i>	Large-leaved pondweed			X	
<i>Potamogeton foliosus</i>	Leafy pondweed			X	
<i>Potamogeton gramineus</i>	Grass-leaved pondweed			X	
<i>Potamogeton illinoensis</i>	Illinois pondweed			X	
<i>Potamogeton natans</i>	Common pondweed			X	
<i>Potamogeton nodosus</i>	Long-leaved pondweed			X	
<i>Potamogeton pectinatus</i>	Sago pondweed			X	
<i>Potamogeton pulcher</i>	Spotted pondweed			X	Ex
<i>Potamogeton pusillus</i>	Small pondweed			X	R
<i>Potamogeton robbinsii</i>	Fern pondweed			X	E
<i>Potentilla fruticosa</i>	Shrubby cinquefoil		X	X	
<i>Potentilla palustris</i>	Marsh cinquefoil		X	X	
<i>Potentilla recta</i>	Sulfur cinquefoil			X	A
<i>Potentilla simplex</i>	Common cinquefoil			X	
<i>Prenanthes alba</i>	White lettuce		X	X	
<i>Prenanthes racemosa</i>	Glaucous white lettuce		X	X	
<i>Proserpinaca palustris crebra</i>	Mermaid weed		X	X	
<i>Prunella vulgaris lanceolata</i>	Self heal		X	X	
<i>Prunus pumila</i>	Sand cherry		X	X	
<i>Prunus serotina</i>	Wild black cherry	X	X	X	
<i>Prunus virginiana</i>	Choke cherry	X	X	X	
<i>Ptelea trifoliata</i>	Hop tree			X	
<i>Ptelea trifoliata millis</i>	Downy hop tree			X	
<i>Pteridium aquilinum latiuscuum</i>	Bracken fern	X	X	X	
<i>Pycnanthemum virginianum</i>	Common mountain mint	X	X	X	
<i>Quercus alba</i>	White oak	X	X	X	
<i>Quercus ellipsoidalis</i>	Hill's oak	X			
<i>Quercus velutina</i>	Black oak	X	X	X	
<i>Ranunculus flabellaris</i>	Yellow water crowfoot			X	
<i>Ranunculus sceleratus</i>	Cursed buttercup			X	
<i>Ratibida pinnata</i>	Yellow coneflower	X			
<i>Rhamnus cathartica</i>	Common buckthorn	X	X		A
<i>Rhamnus frangula</i>	Glossy buckthorn	X	X	X	A
<i>Rhus aromatica</i>	Fragrant sumac	X	X	X	
<i>Rhus aromatica arenaria</i>	Dwarf fragrant sumac		X	X	
<i>Rhus copallina latifolia</i>	Winged sumac	X	X	X	

Appendix.—Continued.

Scientific name	Common name	DT	CP	MW	Status
<i>Rhus glabra</i>	Smooth sumac				
<i>Rhus toxicodendron</i>	Poison ivy	X	X	X	
<i>Rhus typhina</i>	Staghorn sumac	X	X	X	
<i>Rhynchospora capillacea</i>	Hair beak rush		X	X	
<i>Rhynchospora macrostachya</i>	Horned beak rush		X	X	R
<i>Ribes americanum</i>	Wild black currant	X			
<i>Robinia pseudoacacia</i>	Black locust			X	A
<i>Rorippa palustris hispida</i>	Rough marsh cress			X	
<i>Rosa blanda</i>	Early wild rose			X	
<i>Rosa multiflora</i>	Multiflora rose	X		X	A
<i>Rosa palustris</i>	Swamp rose		X	X	
<i>Rotala ramosior</i>	Wheelwort			X	
<i>Rubus flagellaris</i>	Common dewberry	X		X	
<i>Rubus hispidus</i>	Swamp dewberry			X	
<i>Rubus idaeus strigosus</i>	Red raspberry		X	X	
<i>Rubus occidentalis</i>	Black raspberry			X	
<i>Rudbeckia hirta</i>	Black-eyed Susan	X	X	X	
<i>Rumex acetosella</i>	Field sorrel			X	A
<i>Rumex altissimus</i>	Pale dock			X	
<i>Rumex crispus</i>	Curley dock			X	
<i>Satabia angularis</i>	Rose gentain		X	X	A
<i>Sagittaria graminea</i>	Grass-leaved arrowhead			X	
<i>Sagittaria latifolia</i>	Common arrowhead			X	
<i>Salix amygdaloides</i>	Peach-leaved willow	X	X	X	
<i>Salix discolor</i>	Pussy willow	X		X	
<i>Salix eriocephala</i>	Heart-leaved willow			X	
<i>Salix glaucophylloides</i>	Blue-leaved willow	X	X	X	
<i>Salix humilis</i>	Prairie willow	X	X	X	
<i>Salix interior</i>	Sandbar willow		X	X	
<i>Salix nigra</i>	Black willow	X	X	X	
<i>Salix pedicellaris hypoglauca</i>	Bog willow			X	
<i>Salix petiolaris</i>	Meadow willow			X	
<i>Salix purpurea</i>	Purple willow		X		A
<i>Salix syrticola</i>	Dune willow			X	
<i>Salsola kali tenuifolia</i>	Russian thistle		X	X	A
<i>Sambucus canadensis</i>	Elderberry	X	X	X	
<i>Sanguinaria canadensis</i>	Bloodroot			X	
<i>Sanicula marilandica</i>	Black snakeroot			X	
<i>Saponaria officinalis</i>	Bouncing bet	X		X	
<i>Sassafras albidum</i>	Sassafras	X	X	X	A
<i>Satureja arkansana</i>	Dogmint			X	E
<i>Saxifraga pensylvanica</i>	Swamp saxifrage		X		
<i>Schizachyrium scoparium</i>	Little bluestem	X	X	X	
<i>Scirpus acutus</i>	Hard-stemmed bulrush		X	X	
<i>Scirpus atrovirens</i>	Dark green rush		X	X	
<i>Scirpus cyperinus</i>	Wool grass			X	
<i>Scirpus pendulus</i>	Red bulrush		X		
<i>Scirpus pungens</i>	Chairmaker's rush	X	X	X	
<i>Scirpus validus creber</i>	Great bulrush	X	X	X	
<i>Scleria pauciflora caroliniana</i>	Few-flowered nut rush		X		E
<i>Scleria triglomerata</i>	Tall nut rush			X	
<i>Scleria verticillata</i>	Low nut rush		X	X	
<i>Scutellaria epilobiifolia</i>	Marsh skullcap	X		X	
<i>Scutellaria lateriflora</i>	Mad-dog skullcap	X	X	X	

Appendix.—Continued.

Scientific name	Common name	DT	CP	MW	Sta- tus
<i>Senecio pauperculus</i>	Balsam ragwort		X	X	
<i>Setaria faberii</i>	Giant foxtail			X	A
<i>Setaria glauca</i>	Yellow foxtail			X	A
<i>Setaria viridis</i>	Green foxtail			X	A
<i>Silene antirrhina</i>	Sleepy catchfly	X		X	
<i>Silene cserei</i>	Glaucous campion			X	A
<i>Silene cucubalus</i>	Bladder campion			X	A
<i>Siphium integrifolium</i>	Rosin weed	X			
<i>Sisymbrium altissimum</i>	Tumble mustard			X	A
<i>Sisyrinchium albidum</i>	Common blue-eyed grass	X	X	X	
<i>Sium suave</i>	Tall water parsnip		X	X	
<i>Smilacina racemosa</i>	Feathery false Solomon's seal	X		X	
<i>Smilacina stellata</i>	Stary false Solomon's seal	X	X	X	
<i>Similax lasioneura</i>	Common carrion flower	X		X	
<i>Smililax rotundifolia</i>	Green briar			X	
<i>Smilax tamnoides hispida</i>	Bristly green briar	X	X		
<i>Solanum americanum</i>	Black nightshade			X	A
<i>Solanum ducamara</i>	Bittersweet nightshade	X	X	X	A
<i>Soliago altissima</i>	Tall goldenrod		X	X	
<i>Solidago caesia</i>	Blue-stem goldenrod	X	X	X	
<i>Solidago gigantea</i>	Late goldenrod		X	X	
<i>Solidago grammifolia</i>	Smooth grass-leaved goldenrod		X	X	
<i>Solidago grammifolia nutallii</i>	Hairy grass-leaved goldenrod	X	X	X	
<i>Solidago gymnospermoides</i>	Vicid grass-leaved goldenrod		X	X	
<i>Solidago juncea</i>	Early goldenrod			X	
<i>Solidago missouriensis fasciculata</i>	Missouri goldenrod		X	X	
<i>Solidago nemoralis</i>	Old-field goldenrod	X	X	X	
<i>Solidago ohioensis</i>	Ohio goldenrod		X	X	
<i>Solidago ptarmicoides</i>	Prairie goldenrod			X	R
<i>Solidago racemosa gillmanii</i>	Dune goldenrod			X	
<i>Solidago riddellii</i>	Riddell's goldenrod		X		
<i>Solidago ridida</i>	Stiff goldenrod			X	
<i>Solidago rugosa</i>	Rough goldenrod		X	X	
<i>Solidago sempervirens</i>	Seaside goldenrod		X		A
<i>Solidago speciosa</i>	Showy goldenrod	X	X	X	
<i>Solidago tenuifolia</i>	Slender-leaved goldenrod			X	
<i>Solidago uliginosa</i>	Bog goldenrod		X		
<i>Sonchus asper</i>	Spiny sow thistle			X	A
<i>Sonchus oleraceus</i>	Store-front sow thistle			X	A
<i>Sonchus uliginosus</i>	Common sow thistle			X	A
<i>Sorghastrum nutans</i>	Indian grass		X	X	
<i>Sparganium americanum</i>	American bur reed	X		X	
<i>Sparganium chlorocarpum</i>	Dwarf bur weed			X	
<i>Sparganium eurycarpum</i>	Common bur reed			X	
<i>Spartina pectinata</i>	Prairie cord grass	X	X	X	
<i>Sphenopholis intermedia</i>	Slender wedge grass			X	
<i>Spiraea alba</i>	Meadowsweet	X	X	X	
<i>Spiraea tomentosa rosea</i>	Steeple bush		X	X	
<i>Spiranthes ceruna</i>	Nodding ladys' tresses		X	X	
<i>Sporobolus asper</i>	Rough dropseed			X	A
<i>Sporobolus cryptandrus</i>	Sand dropseed			X	
<i>Stachys palustris homotricha</i>	Woundwort			X	
<i>Stachys tenuifolia hispida</i>	Marsh hedge nettle			X	
<i>Stipa spartea</i>	Porcupine grass	X	X	X	

Appendix.—Continued.

Scientific name	Common name	DT	CP	MW	Sta- tus
<i>Strophostyles helvula</i>	Trailing wild bean			X	
<i>Symphoricarpos orbiculatus</i>	Coral berry			X	A
<i>Talinum rugospermum</i>	Fame flower			X	E
<i>Taraxacum officinale</i>	Common dandelion	X		X	A
<i>Tephrosia virginiana</i>	Goat's rue	X		X	
<i>Teucrium canadense</i>	Germander			X	
<i>Thalictrum dioicum</i>	Early meadow rue			X	
<i>Tilia ameriana</i>	Basswood			X	
<i>Tofieldia glutinosa</i>	False asphodel				R
<i>Tradescantia ohimensis</i>	Spider wort	X	X	X	
<i>Tragopogon dubius</i>	Sand goat's beard	X		X	A
<i>Tragopogon pratensis</i>	Common goat's bear			X	A
<i>Trifolium hybridum</i>	Alsike clover			X	A
<i>Trifolium pratense</i>	Red clover			X	A
<i>Trifolium repens</i>	White clover			X	A
<i>Triglochin maritima</i>	Common bog arrow grass		X	X	
<i>Tripasis purpurea</i>	Sand grass			X	
<i>Triticum aestivum</i>	Wheat			X	A
<i>Typha angustifolia</i>	Narrow-leaved cattail	X	X	X	A
<i>Typha latifolia</i>	Broad-leaved cattail	X	X	X	
<i>Ulmus pumila</i>	Siberian elm			X	A
<i>Utricularia cornuta</i>	Horned bladderwort			X	T
<i>Utricularia gibba</i>	Humped bladderwort			X	
<i>Utricularia minor</i>	Small bladderwort			X	
<i>Utricularia vulgaris</i>	Great bladderwort			X	
<i>Vaccinium angustifolium</i>	Early low blueberry			X	
<i>Vaccinium pallidum</i>	Late low blueberry			X	
<i>Vallisneria americana</i>	Eel grass			X	
<i>Verbascum thapsus</i>	Common mullein	X	X	X	
<i>Verbena hastata</i>	Blue vervain	X	X	X	A
<i>Verbena stricta</i>	Hoary vervain	X		X	
<i>Veronia missurica</i>	Missouri ironweed			X	
<i>Veronicastrum virginicum</i>	Culver's root		X		
<i>Viburnum acerifolium</i>	Maple-leaved arrow-wood			X	
<i>Viburnum lentago</i>	Nannyberry			X	
<i>Viburnum prunifolium</i>	Black haw	X			
<i>Viburnum rafinesquianum</i>	Downy arrow-wood			X	
<i>Vicia americana</i>	American vetch	X			
<i>Viola conspersa</i>	Dog violet		X		
<i>Viola fimbriatula</i>	Sand violet			X	
<i>Viola lanceolata</i>	Lance-leaved violet	X			
<i>Viola pedata lineariloba</i>	Bird's foot violet			X	
<i>Viola pubescens</i>	Yellow violet			X	
<i>Viola sagittata</i>	Arrow-leaved violet	X			
<i>Viola sororia</i>	Common blue violet		X		
<i>Viola tricolor</i>	Pansy violet			X	
<i>Vitis aestivalis</i>	Summer grape	X			A
<i>Vitis labrusca</i>	Fox grape	X			
<i>Vitis riparia</i>	Riverbank grape		X	X	
<i>Vitis vulpina</i>	Froot grape	X			
<i>Xanthium strumarium</i>	Cocklebur			X	A
<i>Zizania aquatica</i>	Wild rice	X		X	
<i>Zizia aurea</i>	Golden Alexander	X		X	

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A view of railroad trestles and a toll road (I-90) crossing south of U.S. Steel property and within the U.S. Steel river reach. Transportation corridors crisscross the Calumet Region and the Grand Calumet River, with many roads and rails and an airport.



Much of the native vegetation along the Grand Calumet River has been replaced by nonnative invasive species. Cattails tend to dominate the bordering wetlands, but there are a few remaining high-quality areas that maintain native populations, including Clark and Pine East and the DuPont property.