

**Botanical Survey of Hartman Reserve Nature Center
including Hartman Bluff State Preserve**

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for

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INTRODUCTION

Hartman Reserve Nature Center (HRNC), which includes Hartman Bluff State Preserve, is located in the northeastern portion of the state of Iowa within Black Hawk County. HRNC is situated directly south of the Cedar River within the incorporated boundaries of the cities of Cedar Falls and Waterloo. The overall size of HRNC is 295 acres owned and managed by the Black Hawk County Conservation Board.. Of that total, 46 acres are included within the recently designated state preserve.

HRNC occurs on the Iowan Surface which is one of the major landform regions within the state. Prior (1991) describes this landscape in part as “having multileveled or stepped surfaces” which “though subdued, occur in a gradual progression from the major stream valleys outward toward the low crests that mark their drainage divides.” The topography of HRNC incorporates a floodplain, adjacent river terrace, valley bluffs and subsequent uplands farthest from the river. The area contains a number of habitats dominated by lowland and upland hardwood forest habitats as well as more open environments which are a result of or influenced by the course of the river and past cultural activities.

Eilers (1971) produced a floristic inventory of the Iowan Surface which formed the botanical foundation of this region of the state. Smaller and more targeted botanical/floristic inventories of protected areas including preserves are few in number and nonexistent for forested habitats within this landform. This is in contrast to adjacent landscapes, particularly the Paleozoic Plateau in northeast Iowa. In this region of the state, numerous botanical/floristic surveys have been accomplished within forested natural areas including White Pine Hollow State Preserve (Thorne, 1964) and Brush Creek Canyon State Preserve (Eilers, 1974). A survey of HRNC including the state preserve should help fill a knowledge gap of Iowa's diverse forest resources. This may offer a better understanding of the transition from the central Iowa forests to those on the Paleozoic Plateau.

During the 2004 and 2005 field seasons, a botanical survey of HRNC was conducted to document the vegetation present at this site. The inventory had three objectives: 1) compile a comprehensive checklist of the vascular plant taxa, 2) identify the existing plant communities and 3) provide habitat management recommendations.

METHODS

Fieldwork pertaining to the botanical survey of HRNC commenced in June 2004 closely following the announcement of funding provided for the project. One complete growing season was to be dedicated to the survey. Therefore, fieldwork continued into spring and early summer 2005 to fulfill the contract requirements. The author then continued additional survey visits for the remaining 2005 field season in an attempt to produce more complete results.

Over the course of both field seasons, surveys were accomplished at scattered time intervals in an attempt to document the vegetation within the study area. Survey dates for 2004 included June 26, 27 and 30; July 7, 8, 19, 22, 25, 26 and 27; August 10, 11, 12, 19, 21, 22 and 30; September 3, 4, 12, 13, 18 and 19; October 31. Survey dates for 2005 included April 9, 10, 15, 27 and 29; May 3, 5, 6, 19 and 21; June 4, 9, 10 and 20; July 2, 12, 28 and 30; August 7, 12 and 28; September 3, 7, 23 and 30; October 17.

During the surveys, all of the identified plant communities/habitats within HRNC were visited and walked through. All vascular plant taxa observed were recorded. Those which were not readily identifiable in the field were collected and processed for later identification. The identification process involved use of numerous floristic manuals and comparative studies of specimens housed in the University of Northern Iowa herbarium in Cedar Falls and to a lesser degree, the Iowa State University herbarium in Ames.

From the surveys, the author compiled a comprehensive checklist of all vascular plant taxa documented to occur within the boundary of HRNC. The only exclusions were those species under direct horticultural management. This included the vegetation within ornamental stone or wood planters. These planters are found adjacent to the nature center and other nearby buildings as well as at the east end of the parking lot and nearby flagpole. Also excluded was the vegetation surrounding the small, artificial pond in front of the nature center and the recently installed water garden behind the nearby program building.

RESULTS AND DISCUSSION

A comprehensive checklist of vascular plants from HRNC is presented in Appendix I. The checklist includes all of the native or naturalized vascular plant taxa encountered during the field study. Also included were those taxa which either appear to be leftover nursery stock from when part of the study area was owned by private business or the result of county sponsored

prairie seed mix plantings. It was felt that inclusion of both these latter categories was important due to ongoing and potential future management of the overall botanical resource of HRNC. Checklist nomenclature for all plant taxa previously reported in Iowa follows Eilers and Roosa (1994) except for the genus *Rubus* L. which follows Widrlechner (1998). A small number of taxa not included within Eilers and Roosa (1994) follows either Wetter et al. (2001) or Voss (1985, 1996).

A total of 451 vascular plant taxa representing 83 families are reported from HRNC during the present study. Within this total, three distinct vegetation categories are identified. 1) Vegetation native to Iowa and occurring naturally in HRNC account for 331 of 451 taxa (74%). 2) A total of 33 plant taxa (7%) are native to North America (30 of 33 are native to Iowa) but apparently do not occur naturally in HRNC. 3) An additional 87 plant taxa, originating from the old world, are non-native/exotic and account for 19% of the total. A large majority of the latter category has become naturalized and is part of the HRNC flora. However, a small number of planted ornamental trees and shrubs recorded on the checklist do not appear to have spread from their point of origin. The present study added a total of 37 native Iowa plant taxa naturally occurring within HRNC which were previously unrecorded for Black Hawk County (Van Norman, 1987).

No naturally occurring populations of vascular plants reported from HRNC during the study appear on the state of Iowa endangered/ threatened/ special concern plant list. However, three species have been proposed for listing: *Carex assiniboinensis* (assiniboiboine sedge), *Poa sylvestris* (woodland bluegrass) and *Uvularia sessilifolia* (sessile-leaved bellwort). Two additional species, *Allium cernuum* (nodding wild onion) and *Echinacea purpurea* (purple coneflower), are presently on the state list but are not native to HRNC. Both were brought in with seed mixes or otherwise planted. The geographic origin of these two species cannot be ascertained and may well be from sources outside of Iowa. All five species are further discussed within the text of the report.

In addition to creation of a comprehensive vascular plant checklist, field work identified 10 plant communities present within HRNC. These habitats were not only surveyed for vascular plants, but also in regard to potential threats and management needs in an effort to better understand and enhance the botanical resource present within HRNC. Recommendations are incorporated under a general description and discussion of each plant community that follows.

1) Dry Hardwood Forest.

This community occurs on the higher and drier uplands of Hartman. The area is bordered by the bluff system to the north and includes the more level topography running to the south and southwest away from the bluff. The area is dissected by several drainages which flow out of the uplands and ultimately into the nearby Cedar River. The dry hardwood forest also occupies the well developed west facing upper slopes of these drainages.

One of the representative canopy species of this community is *Quercus alba* (white oak). The drier portions of the uplands farthest from the bluffs still support a preponderance of *Q. alba* in the canopy as was probably the case in pre-settlement times. Other canopy species commonly associated with this habitat include *Carya ovata* (shagbark hickory), *Fraxinus americana* (white ash) and *Prunus serotina* (black cherry). Within the understory, *Ostrya virginiana* (ironwood) is present as is *Acer saccharum* (sugar maple) which is commonly encountered. The herbaceous zone includes a well developed spring ephemeral flora where adequate light is available.

A rare sedge, *C. assiniboinensis*, can be found in the herbaceous layer of this forest type. A localized but very dense population of this species was observed near River Hills School. Evidently part of the population occurs on school property and part is located on HRNC property within the recently recognized state preserve. The density of the population is striking as this species is excluding most other herbaceous growth in the immediate vicinity where it occurs. While not observed elsewhere, certainly a small number of plants could be overlooked. At present, the area should simply be monitored and not significantly manipulated.

The forest subcanopy as well as the canopy has filled in with more mesic and fire intolerant species, particularly sugar maple. Certainly this has hindered oak regeneration, but additional aspects of the forest vegetation particularly the herbaceous zone have very likely been adversely impacted as well. In portions of the forest the dense stands of young *A. saccharum* have intercepted much of the available light resource. This has resulted in a rather depauperate summer herbaceous zone where these stands are most dense.

In response to some of the perceived changes affecting the forest environment, county conservation personnel initiated a thinning program beginning in 1999. The goal was to remove selected canopy and subcanopy trees from four areas of the forest to enhance oak regeneration (V. Fish, pers. comm., 2004). The three largest thinning zones included White Oak North and South and Red Oak II. White Oak North and South are located on the level uplands north of

Grand Boulevard on either side of a drainage ravine which begins at the River Hills School parking lot. Red Oak II occurs along a steep, west facing slope of the same drainage ravine farther along its course toward the lowland portion of HRNC.

The present field study does not include an in-depth evaluation of vegetation dynamics in response to the tree cutting and opening of the canopy, however, some observations may be warranted. One of the more obvious changes due to the opened canopy is the vegetation response affecting the herbaceous zone. This layer of the forest would be the first to show substantive change and is the location where oak regeneration will meet initial challenges. Some natural oak regeneration was observed on the steep west facing slope of Red Oak II which is a positive sign. However, the number and distribution of these seedlings is unknown. This is the most open of the three thinning zones, receiving significant light at ground level.

Many species inhabiting the herbaceous layer have responded positively to the added sunlight. This has increased the diversity and vegetation density of this forest layer. Several species could probably be considered as dominant. *Eupatorium rugosum* (white snakeroot) appears to have increased exponentially throughout the thinning zones and is very common. Other species such as *Podophyllum peltatum* (mayapple) and *Aralia nudicaulis* (wild sarsaparilla) have produced large, rather dense patches due to their rhizomatous growth pattern and were commonly observed on the west slope of Red Oak II. These species in combination are probably intercepting significant light resources.

Numerous other species can be found throughout the thinning zones. The rare *Uvularia sessilifolia* (sessile-leaved bellwort) occurs on the west facing slope of Red Oak II. This is the only location in HRNC where this species was observed and may prefer an open habitat. Voss (1972) states this species and the closely related *Uvularia grandiflora* (large bellwort) which is more common in HRNC “seem to thrive in openings and borders of woods.” Directly adjacent to the small population of *U. sessilifolia* is a second species of interest. A single stem/ramet of *Trillium recurvatum* (red trillium) was observed. This species while fairly common in southeast Iowa woodlands is not known to occur naturally in Black Hawk County (Van Norman, 1987). A small population of *T. recurvatum* does occur extremely close to the HRNC boundary near a residence on private property. This species may have been planted sometime in the past and escaped into HRNC. *T. recurvatum* is freely available from the horticultural plant trade.

Within a significant portion of the three thinning zones previously mentioned, an apparent growth spike of *Rubus alleghaniensis* (blackberry) and *Rubus occidentalis* (black raspberry) is evident. These armed, shrubby species are having an effect on the herbaceous layer and probably oak regeneration. Due to their woody nature and seasonal growth pattern, these thicket forming plants have produced a rather dense impenetrable zone in significant portions of the thinning stands. While it is generally accepted that some tree removal is necessary for substantial oak regeneration, one unforeseen consequence may be this immediate response affecting the herbaceous layer. While Baughman and Jacobs (1992) state that seedling oaks will probably emerge from dense herbaceous vegetation, they go on to say that “plants that overtop oak seedlings eventually will eliminate them.” Growing through the *Rubus* spp. thickets may be an added impediment threatening oak regeneration as well as some conservative herbaceous species and should be monitored. The removal of slightly fewer trees may have been beneficial in retarding the *Rubus* spp. growth, particularly along the west facing ravine slope in Red Oak II which by its nature would have received significantly more incidental light even before any cutting occurred.

The selective cutting was to be followed by occasional prescribed burning to mimic historical conditions within the oak forest (V. Fish, pers. comm., 2004). However, the extensive *Rubus* spp. growth may actually be suppressing somewhat the process of fire management. These shrubby thickets are not primary carriers of fire and may be shading out native herbaceous species which are. It is also possible that additional moisture or humidity retention beneath these thickets may also inhibit fire.

A smaller forest thinning area occurs at Red Oak I which is located just back from the bluff area near the east boundary of Hartman. At this site the canopy was also opened substantially beginning in 1999 allowing more light to reach ground level. Both *R. allegheniensis* and *R. occidentalis* as well as *E. rugosum* are present but not at the levels observed in the previous management zones. However, there is more woody growth including shrubs and young trees. The herbaceous layer is diverse and appears to have been stimulated by the additional sunlight.

Hopefully, the tree thinning and subsequent opening of the canopy of these four areas will provide the desired goal of oak regeneration over time. If future thinning cuts are planned, it is recommended that effects on, and restoration of, all strata of the forest environment be a

primary focus. Perhaps a series of smaller and more measured cuts could be initiated. These areas may imitate more closely the naturally occurring canopy gaps which are found in all forests. If these canopy gap sites are initiated where significant amounts of shade now exist, it may be desirable to sow collected seed from the surrounding forest habitat. This need may be most pronounced for the herbaceous and shrub layers. Sowing this hartman ecotype seed would probably accelerate growth and restoration of these areas, as well as being in place to compete against the colonization of less desirable exotic species. Ideally, each potential canopy gap cut should be surveyed for invasive non-native species which would be removed before manipulation begins. Monitoring of these sites for the desired results would also be of value. One fairly simple and quick measure would be a series of before and after photo points. This would allow at least a gross comparison of the selected sites over time.

2) Mesic Hardwood Forest

This upland forest assemblage occurs on the slightly more moist, sheltered slopes containing north and east aspects. The canopy is dominated by *A. saccharum*, *Tilia americana* (basswood) along with *Quercus borealis* var. *maxima* (red oak). The subcanopy often contains a significant *A. saccharum* component. A diverse and often dense complement of spring ephemerals also can be found in this habitat. On some slopes a pronounced fern flora is present with species such as *Adiantum pedatum* (maidenhair fern) in fairly significant numbers. The summer herbaceous flora, as in the dry hardwood forest, appears less expressive. This is notable where the canopy and subcanopy are most dense. Experimental management involving removal of a small portion of the *A. saccharum* canopy/subcanopy primarily and monitoring the results may be warranted. This change would probably enhance all forest strata eventually.

Under a more historical regime of ecological processes such as drought and naturally occurring fires, a number of species were probably somewhat restricted to the more protected slope aspects. Some of these processes such as fire, however, have been suppressed for an extended period of time. This has most likely allowed the forest communities to become more intermixed as the mesic species expanded into the drier portions of the uplands. Some caution should be taken when interpreting this, however, as a significant amount of time has passed since early settlement changed the dynamics of the natural processes affecting the composition of the forest. Considering the relatively small area of the entire upland habitat, the interlaced proximity of the drainages and the ameliorating environmental effects of the nearby river, these factors

probably always provided for a certain ebb and flow of species beyond strict boundaries and into what might be considered as secondary habitat.

The upland forest environments of HRNC face a unique problem of erosion along the course of some of the natural drainages. One of the larger drainages has its genesis at the River Hills School and parking lot. Water draining from this area is probably an important factor initiating some of the erosion and should be addressed. Soil erosion is occurring along the entire drainage system and will be a disturbance factor affecting the forest habitat and vegetation for some time to come. Limited control measures such as wooden planks installed at the Kay Romanin Bridge have been put in place. However, additional measures along the course of the drainage should probably be initiated.

Two remedial possibilities are partially in place along the ravine at the present time. The upper reaches of the ravine contain decaying piles of brush from the White Oak North and South forest thinning project. Unfortunately, in some places the density of the piles and the fact that most of the material is not in contact with the soil is probably adding to erosion by allowing runoff water from the parking lot to undercut the soil beneath. In addition, potential vegetation growth is being shaded out which would normally act as a further erosion control. At this time it may not be worth the effort to manipulate these piles as they are slowly decaying and sinking into the drainage and should eventually aid in erosion control.

There are a number of fallen trees across the ravine system which could be utilized for erosion control. Under ideal conditions these “dead falls” should be left in place as part of the natural cycle and wild aesthetic, however the potential value as erosion control may be more important. Portions of these down trees could be cut and dropped into the ravine slowing the flow of water and forming small retention barriers for soil accumulation and as an aid for potential vegetation growth. Some seeding of specific plants which grow well in this environment, such as *Glyceria striata* (fowl manna grass), may be warranted. Seed should come from native species found within HRNC.

3) Lowland Hardwood Forest.

This forest community occupies the majority of the alluvial terrace system in the lowland portion of HRNC. Old flood raceways (scrolls) and adjacent risers provide microhabitat partitioning within the forest environment. The forest contains a diverse canopy with *Gleditsia triacanthos* (honey locust), *Juglans nigra* (black walnut), *Ulmus Americana* (American elm)

among other species. Scattered mature *Quercus macrocarpa* (bur oak) were also found as part of the forest canopy. A rather dense subcanopy has formed over the years which include *Celtis occidentalis* (hackberry), *Acer* spp. (maples), *Ulmus* spp. (elms) and scattered *Crataegus mollis* (downy hawthorne). Surprisingly, a significant number of *Q. macrocarpa* were found scattered throughout portions of the forest subcanopy zone. It may be useful to actually map or acquire a set of global positioning coordinates for all of the canopy and subcanopy oaks within the lowland environments of HRNC. This could provide a better understanding of the actual oak distribution pattern in regard to future management decisions.

Two additional tree species of note occur, at least historically, within the lowland forest. A few *Juglans cinerea* (Butternut) are scattered throughout the forest. This species has become very rare throughout much of its range in Iowa due to an introduced disease which is killing many individual trees. Field observations this past season located approximately five living trees. There may be more but probably not many. Also *Ulmus thomasi* (rock elm) is another rarely encountered tree in Iowa. Van Norman (1987) reports this species from HRNC but it was not observed during the present study. To the uninitiated, this species looks like other elms and any prescribed tree cutting needs to take that into consideration. Further searches for this species may be warranted.

In some areas of the forest, the density of woody species has left the herbaceous flora as well as other strata somewhat depauperate. However, throughout the habitat as a whole and in areas such as canopy gaps and partial light environments, a diverse and representative flora exists. The overall herbaceous vegetation is dominated by a mix of graminoids - sedges and grasses plus a suite of native wildflowers. A number of sedges characteristic of a lowland forest/woodland environment, such as *Carex amphibola* var. *turgida* (narrow-leaf sedge), *Carex conjuncta* (soft fox sedge) and *Carex grayii* (Gray's sedge) are relatively common within HRNC. Additional species were located including *Carex muskingumensis* (muskingum sedge) which is considered rare in the state (Eilers and Roosa, 1994). Notably, *C. muskingumensis* has not previously been reported from Black Hawk County (Van Norman, 1987) but is frequently encountered in the lowland forest at Hartman. Several other *Carex* spp. also occur within the habitat and as a whole may well have been one of the dominant groups of plants inhabiting the area during pre-settlement times.

A total of 32 native grass species have been identified from HRNC. A number of these are found within the lowland forest including *Elymus virginicus* (Virginia wild rye), *Cinna arundinacea* (wood reed), *Diarrhena americana* (American beak grass) and *Muhlenbergia bushii* (nodding muhly). Both *D. americana* and *M. bushii* appear to be at the northernmost edge of their distributional range within the United States and have most likely migrated up the Cedar River corridor. The wildflower or forb component includes a number of species also present in the upland habitat as well as those restricted to the lowlands such as the rare *Arisaema dracontium* (green dragon). The spring ephemeral flora is well developed and contains a number of species similar to the uplands as well as those more commonly associated with lowland forests such as *Mertensia virginica* (bluebell).

The process of cutting and girdling selected trees for oak regeneration and creation of an oak savannah has begun in the lowland forest. As in the uplands, county personnel are removing a portion of the existing forest canopy and subcanopy. This is occurring near the west boundary of HRNC, south of the Riverside Recreation Trail in an area referred to as Lucy's Meadow. The affected area is easily observed from the nearby overlook platform. Within the limited cutting zone already completed, no naturally occurring oaks are present. However, in the adjacent forest to the east which is slated for cutting, naturally occurring oaks are present. Approximately 20 oaks occur in this area, the majority around Turtle Pond. As such, perhaps further thinning should take a more measured approach similar to recommendations in the upland forest. Cutting could be centered around or in conjunction with oaks already in place. Less cutting or girdling would also produce a more transitional thinning pattern as the western boundary of the newly dedicated state preserve is nearby. This buffer may yield a less stark and more aesthetically pleasing environment as well.

In addition, this area also appears to contain a significant population of *P. sylvestris* commonly found growing under the existing canopy. At this time it is unknown what effect continued thinning of the canopy and attempts to convert the area to oak savannah may have on this rare species. Eilers and Roosa (1994) state the habitat for *P. sylvestris* is moist woods; alluvium.

Within the area already thinned, a number of oak saplings have been planted under supervision of county personnel. Several of these are *Quercus bicolor* (swamp white oak). This species does not otherwise occur in HRNC although it is found naturally along the Wapsipinicon

River in the northeastern corner of the county (Van Norman, 1987). These trees probably should be removed and if plantings are continued, it is recommended that native species to HRNC be used.

Field study observations of the lowland forest clearly support a measured and thoughtful opening of the forest canopy to increase growth of all species and strata present. The difficulty comes in finding the optimum degree and pattern of cutting to enhance the vegetation diversity as well as wildlife which uses the forest. Norris et al. (2003) state that while some bird species were more diverse in frequently disturbed, successional forests, neotropical migratory birds of high conservation concern to the U. S. Fish and Wildlife Service are more diverse in mature, undisturbed forests than in successional forests in northeast Iowa. The overall general recommendation is to err on the side of conservation. This is most obvious in the realization that additional trees can always be cut but it may take several decades to replace them. Smaller cutting zones which mimic natural canopy gaps may be the best pattern to follow.

The creation of scattered canopy gaps throughout the lowland forest could be staggered over time. This would allow a wider range of age classes and successional stages of all woody species as well as a denser and more diverse herbaceous layer to form. Eventually, additional small canopy gaps may coalesce into larger blocks of restored habitat within the lowland forest. These scattered sites should be restored only with hartman ecotype seed if needed.

The lowland forest offers the potential habitat for the only recommended restoration effort using an outside seed source at HRNC. This effort would involve *Napaea dioica* (glade mallow) which is a very rare species in Iowa. At one time, this species was a federal candidate for protection and is presently on the state list of endangered/threatened/special concern vascular plants. While not actually located within HRNC, a small colony was found just outside the boundary during the field study. This is one of several small colonies located along or near the Riverside Recreation Trail in Cedar Falls (Watson, 1993). Unfortunately, some colonies are already extirpated and others are in jeopardy. To protect the local *N. dioica* population, it is recommended that seed be collected, grown under supervision and reintroduced into the appropriate habitat(s) within HRNC. Preferred habitat in Iowa is moist lowland forest openings with partial to full sunlight, riverbanks and perhaps some wetland habitats. If this is attempted, state permission is required and the introduced plants should be monitored.

A complication in this restoration effort is the fact that a small number of *N. dioica* plants were found growing around the pond by the nature center. This artificial habitat contains several rare species which have no historical or biological tie to HRNC or the surrounding landscape. It is recommended that all of the *N. dioica* plants in the pond setting either be destroyed or perhaps given to the University of Northern Iowa greenhouse for possible incorporation into their collection of plants. This would prevent the escape of this species into natural habitats at HRNC and possibly interbreeding with the native population.

There is a significant number of native plants which occur in the lowland forest. Restoration efforts which affect the forest should concentrate on using these local species. Not only are they adapted to the area but they represent the original native vegetation which is the natural heritage of HRNC.

4) Floodplain Forest

This forest habitat is located in close proximity to the Cedar River and floods on a regular basis. Rising water occurs here first and is the last to recede often leaving scour basins filled with water for much of the year. The forest canopy is dominated by *Acer saccharinum* (silver maple). The canopy also contains *Populus deltoides* (cottonwood) which is fairly common as well as scattered *Salix nigra* (black willow). In a significant portion of this habitat, additional forest strata are missing or very depauperate. This is easily observed in the herbaceous layer which can be very sparse. This is probably due in part to prolonged inundation of water. The lack of sunlight reaching ground level due to the dense canopy is probably also a factor. Where light is present an herbaceous flora can be found.

As in other forest habitats at HRNC, small scale or experimental removal of a portion of the canopy is recommended. Many of the wetland species present within HRNC would be potential colonizers. This would include both herbaceous and woody vegetation layers. Follow-up monitoring should take place as this area would be highly susceptible to invasive exotics such as *Phalaris arundinacea* (reed canary grass).

5) Forested Seep

This habitat encompasses a small seepage discharge from a hillside slope above the main drainage system through HRNC. A zone of saturated soil with a slight constant water flow is present. The surrounding forest partially shades the seep along with several young *Fraxinus nigra* (black ash) trees in and at the margin of the seep. The herbaceous layer is dominated by

Equisetum arvense (common horsetail) and *Impatiens* sp. (jewelweed). Also frequently encountered, particularly at the margin is *Carex jamesii* (James' sedge).

One notable species present at this site is *Chelone glabra* (white turtlehead). This is a wetland obligate considered as rare in much of the state (Eilers and Roosa, 1994). Only a single, multi-stemmed plant was observed within this habitat. This was still considered a good botanical find until numerous additional flowering plants were observed in the artificial pond by the nature center. This fact, coupled with the relative proximity of the seep, a lack of *C. glabra* observed elsewhere at HRNC and the presence of a single individual plant strongly suggests this species is an escape from the nature center pond.

Two other possible seeps occur in the dry hardwood forest habitat located toward the eastern boundary. A partial canopy is present with a few mature *F. nigra*. Species located in these areas include several with a wetland affinity such as *Salix amygdaloides* (peach-leaved willow), *Scirpus atrovirens* (dark green bulrush) and the only observed population of *Onoclea sensibilis* (sensitive fern) within HRNC. It is not clear whether these areas formed from ephemeral groundwater discharge or from rainfall temporarily pooling. Either way the vegetation and supporting habitat should be viewed as a unique portion of the forest.

6) Sedge Meadow/Marsh

Two small sedge meadows were located within HRNC during the study. This is a wetland habitat composed mainly of herbaceous species which has developed in a moist, open environment. While a number of forbs are present, the vegetation is dominated by *Carex* spp., particularly *Carex haydenii* (Hayden's sedge) which commonly occurs in this habitat.

The first sedge meadow occurs north of the recreational trail in a shallow basin partly surrounded by trees. The second sedge meadow is located just south of Lake Manatt. This site is being rapidly colonized by a *Salix exigua* spp. *interior* (sandbar willow) grove which is forming a canopy. Without some management activity, including cutting and selective stump treatment with herbicide, this habitat will disappear. In addition, while fire was probably not a primary process in this portion of HRNC, it may be of use at least in the short term to set back the woody growth.

A somewhat disturbed marsh remnant occurs at the southeast side of Lake Manatt adjacent to the sedge meadow. A marsh flora can also be found along the moist interface of the open water environments where some sunlight is available. A fairly large number of herbaceous

species can be found in these scattered locations including *Lobelia cardinalis* (cardinal flower), *Mimulus ringens* (monkeyflower), *Carex laeviconica* (long-toothed lake sedge) and *Glyceria striata* (fowl manna grass). In addition, the shrub *Cephalanthus occidentalis* (buttonbush) is a frequently encountered species in this community.

The marsh habitat appears more dispersed and less easily delineated. This may be due to extensive alteration of the preferred habitat by past sand and gravel mining as well as other cultural activities. The forest canopy over many of the flood raceways and scour basins of the lowland environments may also be inhibiting colonization of potential areas by both plant communities.

7) Sand Terrace

This habitat occurs in dry, open sandy areas of the HRNC lowlands which lacks a forest canopy. This includes fresh alluvial sands deposited by the river, dry flats and embankments at the edges of bodies of open water and early successional sites where cultural disturbances play a part. Many of these species are rather diminutive such as *Androsace occidentalis* (rock jasmine), *Corydalis micrantha* (slender fumewort), *Mollugo verticillata* (carpetweed), *Dichanthelium oligosanthos* var. *scribnerianum* (Scribner's panic grass) and *Sporobolus vaginiflorus* (poverty grass) and are a reflection of the environment they inhabit. Other species relatively commonly encountered include *Carex brevior* (plains oval sedge), *Carex molesta* (field oval sedge) and *Polanisia dodecandra* spp. *trachysperma* (clammy weed).

Under a natural regime lacking human disturbance, the vegetation of this plant community probably shifted readily as habitat became available. Most of these species are fairly rapid colonizers of fresh sites.

8) Old Field

This herbaceous dominated habitat is located north of the Riverside Recreation Trail and south of Shirey Way Road near the west end of HRNC. Prior to acquisition by HRNC, the area was used by Platts Nursery as a holding area for its retail trade (V. Fish, pers. comm., 2004). Remnants of this can be found in scattered trees and shrubs left behind. This includes species native to Iowa such as *Quercus palustris* (pin oak) and *Betula nigra* (river birch) or to North America such as *Robinia pseudoacacia* (black locust) but not native to HRNC. *Q. palustris* occurs naturally in southeast Iowa and *B. nigra* is common along the Wapsipinicon River which flows through the northeast portion of Black Hawk County. In addition, exotic species of the old

world used in the horticultural trade such as *Tilia cordata* (little leaf linden) and *Syringa reticulata* (Japanese tree lilac) are also present.

Since acquisition by HRNC, most of the area has been slowly reverting to a wild state. At present, the dominant species of the area is the exotic cool-season grass *Bromus inermis* (smooth brome). This was probably planted originally as a ground cover crop. Although hindered by this aggressive exotic grass, native vegetation is also present particularly in micro-habitats which *B. inermis* does not prefer. The previously described sedge meadow is an example. On the drier substrate a fairly diverse mix of native sedges, grasses and wildflowers are colonizing the area. This includes a number of herbaceous species found in the sand terrace community as well as more ubiquitous members of the native flora such as *Solidago canadensis* (tall goldenrod), *Cirsium discolor* (field thistle) and *Monarda fistulosa* (wild bergamot). The more rarely encountered *Eupatorium altissimum* (tall thoroughwort) is also present. In general however they are lacking in density due to the tenacity of *B. inermis*. A management strategy directed toward eliminating or substantially reducing the *B. inermis* over time may be valuable. Small experimental areas could be treated with herbicide and then planted with seed and/or plant stock originating from HRNC or simply monitored for change. If successful, larger portions could then be treated. Prescribed fire may also be useful. Willson (1990) states that late spring burns are detrimental to *B. inermis*. While fire can be useful in controlling *B. inermis*, this would preclude or strongly hinder woody growth. The old field habitat is ecologically related to the lowland forest. This area occupies a similar topography and under natural successional conditions would eventually form a canopy similar to the surrounding forest and should probably be encouraged to proceed in that direction.

Certain vegetation manipulations and management activities put in place by county personnel are affecting what happens in this habitat. Management programs include planting oak trees within the old field. This area offers an excellent oak restoration opportunity to enhance the overall woodland/forest community within HRNC and should be continued. Other woody species have also been planted such as *J. nigra*. Additional recommendations would involve collecting seeds from *J. cinera* and *U. thomasi* (if it can be relocated) and either sowing the seeds within the old field or at first growing out seedlings/saplings and then planting them. The area offers a potential site for preserving these rare trees as well as many other more common

native tree and shrub species. Some woody species however should eventually be removed, such as left over nursery stock which includes *Q. palustris* and *B. nigra*.

Management activities also include attempts to eliminate some of the non-native species colonizing this area including *R. pseudoacacia* and *Cirsium arvense* (Canada thistle). These efforts are valuable and should be continued. However, caution needs to be taken when selecting species to be eliminated. One representative example is *C. discolor* which also inhabits the old field. This native thistle colonizes open disturbed sites and can compete with *B. inermis*. Observations during the field study noted a significant number of these plants had been cut and eliminated. This species feeds and otherwise supports a number of birds and butterflies and should be considered part of the natural vegetation. As natural succession occurs in the plant community, this species will decrease in number.

9) Prairie Plantings

A series of county sponsored prairie plantings using a number of external seed mixes are found within the HRNC. These areas are dominated by what may best be described as a classic mix of herbaceous upland prairie species. This includes a number of grasses often used in these types of plantings: *Andropogon gerardii* (big bluestem), *Schizachyrium scoparium* (little bluestem), *Sorghastrum nutans* (Indian grass), *Elymus canadensis* (Canada wild rye) and *Panicum virgatum* (switch grass) as well as a number of forbs, most of which are native to Iowa but apparently not to HRNC. These plantings were installed throughout the 1990's (V. Fish, pers. comm., 2005).

Four plantings were identified. The first occupies the yard of the county owned house near North Hackett Road. This planting is probably the least intrusive as it is not directly competing with a natural habitat. One species of interest is *Senna hebecarpa* (northern wild senna). This species does not naturally occur in Iowa but is native to Illinois and states to the east and southeast. This may offer some insight into the location of seed origin for this particular planting. The second planting occurs in a narrow band beneath the powerline along Shirey Way Road. This area contains a mix of herbaceous species, shrubs and trees cut by the power company.

The third planting occurs at the northeast corner of the old field habitat and also borders Shirey Way Road on the north side. This planting has a dense prairie grass cover with numerous forbs present. Two of these species are *Echinacea purpurea* (purple coneflower) and *Allium*

cernuum (nodding wild onion). These two introduced species are the only vascular plants located within HRNC which are presently on the state of Iowa's endangered/threatened/special concern list. The natural habitat for *E. purpurea* is open woodlands of southeast Iowa. It does not naturally occur this far north. *A. cernuum* is reported as rare from the Paleozoic Plateau by Eilers and Roosa (1994) and is not known from Black Hawk County (Van Norman, 1987). It is likely that both of these species will eventually colonize the wooded habitats of HRNC if not removed. Vegetation originally native to HRNC can also be found in this planting and is in direct competition with the introduced species.

The fourth planting occurs south of the Riverside Recreation Trail in an area referred to as Gentian Prairie. The vegetation at this site is dominated by the classic prairie grasses present in the previous planting. Also present are a number of forbs including *E. purpurea*, *Liatris pycnostachya* (prairie blazing star) and *Silphium laciniatum* (compass plant) among others. The Gentian Prairie planting is the most recent, occurring in 1999/2000 with seed acquired from a private prairie restoration near New Hartford in Butler County. The seed for the New Hartford restoration came from a central Iowa grower and seed dealer (V. Fish, pers. comm., 2005).

Growing with the introduced vegetation are a number of species which are most likely native to HRNC. Most have an affinity to the sand terrace community and can be found growing in other areas of HRNC. Representative of this vegetation are *Sporobolus asper* (dropseed), *D. oligosanthos* var. *scribnerianum*, *C. brevior* and *C. molesta*. Also present are *Solidago gigantea* (smooth goldenrod) and *S. canadensis* which are more ubiquitous species as well as *Gentiana alba* (pale gentian). The latter species is also found in the old field habitat and on adjacent private property.

This site is located under a powerline and prior to the planting was occupied by a successional woody vegetation due to cutting by the powerline company. County personnel further cleared the woody vegetation prior to planting. In the middle of this vegetation was a very small patch of prairie grasses including *A. gerardii*, *P. virgatum* and *S. nutans* which were observed in the 1980's (V. Fish, pers. comm., 2005). Whether these grasses were naturally occurring or planted may be a moot point at this time due to the county sponsored seeding which also included these species. It is probably no longer possible to decipher any biological distinction between the species in question.

Valuable interpretation of the site may be found in a 1937 aerial photograph of HRNC which appears to show a crop field signature for the area now inhabited by Gentian Prairie. While this would not necessarily preclude eventual recolonization by these classic prairie grasses if they were present in the immediate area, it does appear to be an unlikely scenario since these species were not located anywhere else within HRNC during the field study except in the plantings. *P. virgatum* was found around Bullfrog Bayou but was evidently planted as erosion control after the conclusion of sand and gravel mining (V. Fish, pers. comm., 2004).

Further interpretation of the original pre-settlement vegetation of the plantings as well as the entire HRNC landscape has to be considered in the context of forest habitats. Anderson (1996) produced a map of the original vegetation of Black Hawk County from the surveyors' maps which delineated all of HRNC as timber. Van Metre (1904) describes what early settlers encountered in Black Hawk County: "Along the whole course of the Cedar River, running through the county, the stream was bordered with timber, at no point extending far out, but much of it what is denominated heavy timber." This historical landscape would have probably characterized at least the entire lowland environment at HRNC between the bluffs and river.

Ideally, restoration of the plantings would include elimination of all the introduced species. Growth of designated native species already in place could be assisted and seeding or planting of additional native plants naturally occurring in HRNC would be a possibility. This area would also then be available for limited oak regeneration although not directly under the power line. Other possibilities include dedicating the area directly under the power line to a series of native shrubs. Many of these occur in HRNC including *Cornus drummondii* (rough-leaved dogwood), *Sambucus canadensis* (elderberry) and *Viburnum lentago* (nannyberry) which are excellent sources of food and cover for many wildlife species (Kurz, 1997). These shrubs could also be considered for restoration in the larger old field environment described earlier.

These plantings are representative of a decision which needs to be made on whether the habitats within HRNC are to be treated as natural areas in all of their successional stages or artificially enhanced using outside seed sources with species which may or may not have ever been present. There is a wide array of native vegetation found within HRNC. The author strongly recommends the entire HRNC ecosystem be viewed as one interrelated natural area with each distinct habitat restored accordingly with local native species.

10) Aquatic

There are a number of bodies of water within HRNC, most of which were artificially created from past sand and gravel mining. These sites, as well as the naturally occurring scour basins filled with periodic floodwater from the Cedar River, are quite depauperate in regard to vegetation. Only three species of vascular plants were observed in this habitat: *Lemna minor* (common duckweed), *Spirodela polyrhiza* (greater duckweed) and *Wolffia columbiana* (watermeal). These are all very small, floating plants which prefer quiet pools and stagnant water. One additional species associated with this habitat is the semi-aquatic *Ranunculus scleratus* (cursed crowfoot). This species appears to have a very localized distribution within HRNC. It was observed north of Dragonfly Pond restricted to a small basin which holds water for part of the year. The lack of aquatic vegetation may be due to the artificial nature and fluctuating water table of the larger bodies of water. The smaller scour basins probably do not hold water all season long in most years which would preclude colonization.

SYNOPSIS OF RECOMMENDATIONS

1. Expand and prioritize the program to eliminate exotic vegetation from the HRNC landscape. This should involve all foreign species including those composed of past plantings which do not naturally occur in HRNC.
2. Initiate a comprehensive vegetation restoration program within all habitats using native plants and seed mixes from HRNC (hartman ecotype.)
3. Address soil erosion problems within the drainage ravines to provide long term protection for affected habitats.
4. Consider smaller, dispersed tree cutting zones in the forested habitats focused on optimizing diversity of all native species and strata which naturally occur there.
5. Map the distribution of oaks and possibly size classes to provide pertinent information involving future management decisions.
6. Install a baseline monitoring program of existing habitats based on photo points and/or a series of permanent plots put in place to measure change over time.
7. Introduce a population of *Napaea dioica* (glade mallow) into appropriate HRNC habitats to preserve the local population.

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APPENDIX I

Vascular Plant Checklist Hartman Reserve Nature Center Including Hartman Bluff State Preserve

Checklist nomenclature for all plant taxa previously reported in Iowa follows Eilers and Roosa (1994) except for the genus *Rubus* L. which follows Widrlechner (1998). A small number of taxa not included within Eilers and Roosa (1994) follows either Wetter et al. (2001) or Voss (1985, 1996). Status of the taxa occurring on the checklist is indicated prior to each binomial as either native (no symbol), non-native (*) or native to Iowa but probably introduced into HRNC (#). A common name for all taxa occurs in parentheses following the binomial. Names were selected from either Eilers and Roosa (1994), Wetter et al. (2001) or Voss (1985, 1996).

PTERIDOPHYTES

ADIANTACEAE

Adiantum pedatum L. (northern maidenhair fern)

ASPLENIACEAE

Athyrium filix-femina (L.) Roth var. *angustum* (Willd.) Moore (northern lady fern)

Cystopteris protrusa (Weath.) Blasdell (creeping fragile fern)

Onoclea sensibilis L. (sensitive fern)

EQUISETACEAE

Equisetum arvense L. (common horsetail)

Equisetum laevigatum A. Br. (smooth scouring-rush)

OPHIOGLOSSACEAE

Botrychium dissectum Sprengel f. *obliquum* (Muhl.) Fern. (oblique grape fern)

Botrychium virginianum (L.) SW. (rattlesnake fern)

GYMNOSPERMS

CUPRESSACEAE

Juniperus virginiana L. (red cedar)

ANGIOSPERMS: DICOTYLEDONS

ACERACEAE

Acer negundo L. (box elder)

Acer nigrum Michx. f. (black maple)

Acer saccharinum L. (silver maple)
Acer saccharum Marsh (sugar maple)

AIZOACEAE

Mollugo verticillata L. (carpetweed)

AMARANTHACEAE

Amaranthus tuberculatus (Moq.) Sauer (water hemp)

ANACARDIACEAE

Rhus glabra L. (smooth sumac)
Toxicodendron radicans (L.) Kuntze spp. *negundo* (Greene) Gillis (poison ivy)
Toxicodendron rydbergii (Small ex Rydb.) Greene (Rydberg's poison ivy)

APIACEAE (UMBELLIFERAE)

Chaerophyllum procumbens (L.) Crantz (Chervil)
Cryptotaenia canadensis (L.) Dc. (honestwort)
**Daucus carota* L. (Queen Anne's lace)
Heracleum lanatum Michx. (cow parsnip)
Osmorhiza claytonii (Michx.) C. B. Clarke (sweet cicely)
**Pastinaca sativa* L. (wild parsnip)
Sanicula canadensis L. (Canadian black snakeroot)
Sanicula gregaria Bickn. (common snakeroot)
Sium suave Walter (water parsnip)
Zizia aurea (L.) Koch (golden alexanders)

APOCYNACEAE

Apocynum sibiricum Jacq. (clasping dogbane)

ARALIACEAE

Aralia nudicaulis L. (wild sarsaparilla)
Aralia racemosa L. (spikenard)
Panax quinquefolius L. (ginseng)

ARISTOLOCHIACEAE

Asarum canadense L. (wild ginger)

ASCLEPIADACEAE

Asclepias incarnata L. (swamp milkweed)
Asclepias syriaca L. (common milkweed)
Asclepias verticillata L. (whorled milkweed)

ASTERACEAE (COMPOSITAE)

Ambrosia artemisiifolia L. (common ragweed)
Ambrosia trifida L. (giant ragweed)
Antennaria plantaginifolia (L.) Richardson (Ladies'-tobacco)

**Arctium minus* Bernh. (common burdock)
Aster cordifolius L. (blue wood aster)
Aster lateriflorus (L.) Britton (side-flowered aster)
Aster novae-angliae L. (New England aster)
Aster ontarionis Wieg. (Ontario aster)
Aster pilosus Willd. (hairy aster)
Bidens connata Muhl. ex Willd. (purple-stemmed tickseed)
Bidens cernua L. (nodding bur marigold)
Bidens frondosa L. (beggars-ticks)
Bidens vulgata Greene (tall beggars-ticks)
Boltonia asteroides (L.) L'Her (false aster)
 **Cirsium arvense* (L.) Scop. (Canada thistle)
Cirsium discolor (Muhl. ex Willd.) (field thistle)
 **Cirsium vulgare* (Savi) Tenore (bull thistle)
Conyza canadensis (L.) Cronq. (horseweed)
 #*Echinacea purpurea* (L.) Moench (purple coneflower)
Eclipta alba (L.) Hassk. (yerbo-de-tajo)
Erechtites hieracifolia (L.) Raf. ex DC. (fireweed)
Erigeron annuus (L.) Pers. (annual fleabane)
Erigeron philadelphicus L. (common fleabane)
Erigeron strigosus Muhl. ex Willd. (daisy fleabane)
Eupatorium altissimum L. (tall boneset)
Eupatorium purpureum L. (purple Joe-pye-weed)
Eupatorium rugosum Houtt. (white snakeroot)
 **Galinsoga quadriradiata* Ruiz & Pavon (Peruvian daisy)
Helenium autumnale L. (sneezeweed)
Helianthus decapetalus L. (pale sunflower)
Helianthus strumosus L. (pale-leaved sunflower)
Helianthus tuberosus L. (Jerusalem artichoke)
 #*Heliopsis helianthoides* (L.) Sweet (ox-eye)
Hieracium scabrum Michx. (rough hawkweed)
Lactuca floridana (L.) Gaertner (blue lettuce)
 #*Liatris pycnostachya* Michx. (prairie blazing star)
 **Matricaria matricarioides* (Less.) Porter (pineapple weed)
Prenanthes alba L. (rattlesnake-root)
 #*Ratibida pinnata* (Vent.) Barnh. (gray-headed coneflower)
Rudbeckia hirta L. (black-eyed Susan)
Rudbeckia laciniata L. (tall coneflower)
 #*Rudbeckia triloba* L. (brown-eyed susan)
Senecio pauperculus Michx. (prairie ragwort)
Senecio plattensis Nutt. (prairie ragwort)
 #*Silphium laciniatum* L. (compass plant)
 #*Silphium perfoliatum* L. (cup plant)
Solidago canadensis L. (tall goldenrod)
Solidago flexicaulis L. (zig-zag goldenrod)
Solidago gigantea Aiton (smooth goldenrod)

#*Solidago rigida* L. (stiff goldenrod)
Solidago ulmifolia Muhl. ex Willd. (elm-leaved goldenrod)
**Sonchus asper* (L.) Hill (spiny-leaved sow thistle)
**Taraxacum officinale* Weber (common dandelion)
**Tragopogon dubius* Scop. (goat's-beard)
Vernonia fasciculata Michx. (ironweed)
**Xanthium strumarium* L. (cocklebur)

BALSAMINACEAE

Impatiens capensis Meerb. (orange jewelweed)
Impatiens pallida Nutt. (yellow jewelweed)

BERBERIDACEAE

**Berberis thunbergii* DC. (Japanese barberry)
Caulophyllum thalictroides (L.) Michx. (blue cohosh)
Podophyllum peltatum L. (mayapple)

BETULACEAE

#*Betula nigra* L. (river birch)
#*Betula papyrifera* Marsh. (paper birch)
Ostrya virginiana (P. Miller) K. Koch (ironwood)

BIGNONIACEAE

#*Catalpa speciosa* Warder (cigar tree)

BORAGINACEAE

Hackelia virginiana (L.) I.M. Johnston (beggar's lice)
Mertensia virginica (L.) Pers. ex Link (bluebell)

BRASSICACEAE (CRUCIFERAE)

Arabis hirsuta (L.) Scop. (hairy rock-cress)
Arabis shortii (Fern.) Gl. (Short's rock-cress)
**Barbarea vulgaris* R. Br. (yellow rocket)
**Berteroa incana* (L.) DC. (hoary alyssum)
**Brassica nigra* (L.) W. D. J. Koch (black mustard)
**Capsella bursa-pastoris* (L.) Medicus (shepherd's purse)
Cardamine pensylvanica Muhl. ex Willd. (bitter cress)
Dentaria laciniata Muhl. ex Willd. (toothwort)
Descurainia pinnata (Walter) Britton var. *brachycarpa* (Richardson) Fern. (tansy mustard)
**Erysimum cheiranthoides* L. (wormseed mustard)
**Hesperis matronalis* L. (dame's rocket)
Iodanthus pinnatifidus (Michx.) Steudel (purple rocket)
Lepidium virginicum L. (poor-man's pepper)
Rorippa palustris (L.) Besser (Marsh-cress)
Rorippa sessiliflora (Nutt.) A. S. Hitchc. (stalkless yellow-cress)
**Thlaspi arvense* L. (penny cress)

CAMPANULACEAE

- Campanula americana* L. (tall bellflower)
- Lobelia cardinalis* L. (cardinal flower)
- Lobelia siphilitica* L. (great lobelia)

CAPPARIDACEAE

- Polanisia dodecandra* (L.) DC. spp. *trachysperma* (T. & G.) Iltis (clammy weed)

CAPRIFOLIACEAE

- **Lonicera x bella* Zabel (Bell's honeysuckle)
- **Lonicera maackii* (Rupr.) Maxim. (Maack's honeysuckle)
- **Lonicera morrowi* Gray (Morrow's honeysuckle)
- Lonicera prolifera* (Kirchner) Rehder (wild honeysuckle)
- Sambucus canadensis* L. (elderberry)
- Symphoricarpos orbiculatus* Moench (coralberry)
- Triosteum perfoliatum* L. (perfoliate horse-gentian)
- Viburnum lentago* L. (nannyberry)
- **Viburnum opulus* L. (guelder-rose)

CARYOPHYLLACEAE

- Ceratium nutans* Raf. (nodding chickweed)
- **Dianthus armeria* L. (deptford pink)
- Moehringia lateriflora* (L.) Fenzl (sandwort)
- **Myosoton aquaticum* (L.) Moench (giant chickweed)
- **Saponaria officinalis* L. (bouncing bet)
- **Silene pratensis* (Rafn) Gren. & Godron (white campion)
- Silene stellata* (L.) Aiton f. (starry campion)
- **Stellaria media* (L.) Vill. (common chickweed)

CELASTRACEAE

- Celastrus scandens* L. (bittersweet)
- **Euonymus alatus* (Thunb.) Sieb (winged wahoo)

CHENOPODIACEAE

- **Chenopodium album* L. (lamb's quarters)
- Chenopodium berlandieri* Moq. (pit-seed goosefoot)
- Chenopodium hybridum* L. (maple-leaved goosefoot)
- Chenopodium standleyanum* Aellen (woodland goosefoot)

CONVOLVULACEAE

- Calystegia sepium* (L.) R. Br. (hedge bindweed)
- Cuscuta polygonorum* Engelm. (smartweed dodder)

CORNACEAE

- Cornus alternifolia* L. (alternate-leaved dogwood)
- Cornus drummondii* C. A. Meyer (rough-leaved dogwood)

Cornus foemina P. Miller ssp. *racemosa* (Lam.) J. S. Wilson (gray dogwood)
#*Cornus rugosa* Lam. (round-leaved dogwood)

ELAEAGNACEAE

**Elaeagnus umbellata* Thunb. (autumn olive)

EUPHORBIACEAE

Acalypha rhomboidea Raf. (three-seeded mercury)
Euphorbia dentata Michx. (toothed spurge)
**Euphorbia esula* L. (leafy spurge)
Euphorbia maculata (carpet spurge)

FABACEAE (LEGUMINOSAE)

Amphicarpaea bracteata (L.) Fern. (hog peanut)
#*Cercis Canadensis* L. (redbud)
#*Chamaecrista fasciculata* (Michx.) Greene (partridge pea)
**Coronilla varia* L. (crown vetch)
#*Desmodium canadense* (L.) DC. (showy tick-trefoil)
Desmodium glutinosum (Muhl. ex Willd.) Wood (pointed tick-trefoil)
Gleditsia triacanthos L. (honey locust)
Gymnocladus dioica (L.) K. Koch (Kentucky coffee tree)
#*Lespedeza capitata* Michx. (round-headed bush clover)
**Medicago lupulina* L. (black medic)
**Medicago sativa* L. (alfalfa)
**Melilotus alba* Medicus (white sweetclover)
**Melilotus officinalis* (L.) Pallas (yellow sweetclover)
#*Robinia pseudoacacia* L. (black locust)
#*Senna hebecarpa* (Fernald) H. S. Irwin & Barneby (northern wild senna)
**Trifolium hybridum* L. (Alsike clover)
**Trifolium pratense* L. (red clover)
**Trifolium repens* L. (white clover)

FAGACEAE

Quercus alba L. (white oak)
#*Quercus bicolor* Willd. (swamp white oak)
Quercus borealis Michx. f. var. *maxima* (Marsh.) Ashe (northern red oak)
Quercus ellipsoidalis E. J. Hill (Hill's oak)
Quercus macrocarpa Michx. (bur oak)
#*Quercus palustris* Muench. (pin oak)

GENTIANACEAE

Gentiana alba Muhl. (pale gentian)

GERANIACEAE

Geranium carolinianum L. (cranesbill)
Geranium maculatum L. (wild geranium)

HYDROPHYLLACEAE

Ellisia nyctelea L. (waterpod)
Hydrophyllum virginianum L. (Virginia waterleaf)

HYPERICACEAE

Hypericum punctatum Lam. (spotted St. John's wort)
#*Hypericum pyramidatum* Aiton (giant St. John's wort)
Hypericum sphaerocarpum Michx. (round-fruited St. John's wort)

JUGLANDACEAE

Carya cordiformis (Wang.) K. Koch (bitternut hickory)
Carya ovata (P. Miller) K. Koch (shagbark hickory)
Juglans cinerea L. (butternut)
Juglans nigra L. (black walnut)

LAMIACEAE (LABIATAE)

Agastache scrophulariifolia (Willd.) Kuntz (purple giant-hyssop)
Agastache nepetoides (L.) Kuntze (yellow giant-hyssop)
**Glechoma hederacea* L. (creeping Charlie)
**Leonurus cardiaca* L. (motherwort)
**Leonurus marrubiastrum* L. (motherwort)
Lycopus americanus Muhl. ex. Barton (American water-horehound)
Lycopus virginicus L. (Virginia water-horehound)
Mentha arvensis L. (wild mint)
Monarda fistulosa L. (wild bergamot)
**Nepeta cataria* L. (catnip)
Physostegia virginiana (L.) Bentham (false dragonhead)
Prunella vulgaris L. var. *lanceolata* (Bartram) Fern. (self heal)
Scutellaria lateriflora L. (mad-dog skullcap)
Stachys tenuifolia Willd. (smooth hedge-nettle)
Tuechrium canadense L. (American germander)

LYTHRACEAE

Ammania robusta Heer & Regel (sessile tooth-cup)

MALVACEAE

**Abutilon theophrasti* Medicus (velvet leaf)

MENISPERMACEAE

Menispermum canadense L. (moonseed)

MORACEAE

**Morus alba* L. (white mulberry)

NYCTAGINACEAE

Mirabilis nyctaginea (Michx.) MacM. (wild four-o'clock)

OLEACEAE

- Fraxinus americana* L. (white ash)
Fraxinus nigra Marsh. (black ash)
Fraxinus pennsylvanica Marsh. var. *lanceolata* (Borkh.) Sarg. (green ash)
**Ligustrum obtusifolium* Siebold & Zucc. (privet)
**Syringa reticulata* (Blume) Hara (Japanese tree lilac)

ONAGRACEAE

- Circaea lutetiana* L. ssp. *canadensis* (L.) Ascherson & Magnus (enchanter's nightshade)
Epilobium coloratum Biehler (cinnamon willowherb)
#*Gaura biennis* L. (biennial gaura)
Oenothera biennis L. ssp. *centralis* Munz (common evening primrose)

OXALIDACEAE

- Oxalis dillenii* Jacq. (southern yellow wood-sorrel)
Oxalis stricta L. (tall wood-sorrel)

PAPAVERACEAE

- Corydalis micrantha* (Engelm.) Gray (slender fumewort)
Dicentra cucullaria (L.) Bernh. (Dutchman's breeches)
Sanguinaria canadensis L. (bloodroot)

PHRYMACEAE

- Phryma leptostachya* L. (lopseed)

PLANTAGINACEAE

- **Plantago lanceolata* L. (buckhorn plantain)
Plantago rugelii Dcne. (common plantain)

PLATANACEAE

- #*Platanus occidentalis* L. (sycamore)

POLEMONIACEAE

- Phlox divaricata* L. (sweet William)
Polemonium reptans L. (Jacob's ladder)

POLYGONACEAE

- **Polygonum aviculare* L. (knotweed)
**Polygonum convolvulus* L. (black bindweed)
Polygonum lapathifolium L. (dock-leaved smartweed)
Polygonum pensylvanicum L. var. *laevigatum* Fern. (Pennsylvania smartweed)
**Polygonum persicaria* L. (lady's thumb)
Polygonum punctatum Ell. (water smartweed)
Polygonum ramosissimum Michx. (bushy knotweed)
Polygonum scandens L. (climbing false buckwheat)
Polygonum virginianum L. (jumpseed)
Rumex altissimus Wood (pale dock)
**Rumex crispus* L. (curly dock)

**Rumex maritimus* L. var. *fuegins* (Phil.) Dusen (golden dock)

PORTULACACEAE

Claytonia virginica L. (spring beauty)

**Portulaca oleracea* L. (common purslane)

PRIMULACEAE

Androsace occidentalis Pursh (rock jasmine)

Lysimachia ciliata L. (fringed loosestrife)

**Lysimachia nummularia* L. (moneywort)

RANUNCULACEAE

Actaea pachypoda Ell. (white baneberry)

Actaea rubra (Aiton) Willd. (red baneberry)

Anemone canadensis L. (Canada anemone)

Anemone quinquefolia L. (wood anemone)

Anemone virginiana L. (tall anemone)

Aquilegia canadensis L. (columbine)

Clematis virginiana L. (virgin's bower)

Hepatica nobilis P. Miller var. *acuta* (Pursh) Steyerl. (sharp-lobed hepatica)

Isopyrum biternatum (Raf.) T. & G. (false rue anemone)

Ranunculus abortivus L. (small-flowered crowfoot)

Ranunculus sceleratus L. (cursed crowfoot)

Ranunculus septentrionalis Poiret (swamp buttercup)

Thalictrum thalictroides (L.) Eames & Boivin (rue anemone)

RHAMNACEAE

**Rhamnus cathartica* L. (common buckthorn)

**Rhamnus frangula* L. (glossy buckthorn)

ROSACEAE

Agrimonia gryposepala Wallr. (tall agrimony)

Crataegus mollis (T. & G.) Scheele (downy hawthorn)

Crataegus punctata Jacq. (dotted hawthorn)

**Duchesnea indica* (Andrews) Focke (false strawberry)

Fragaria virginiana Duchesne (wild strawberry)

Geum canadense Jacq. (white avens)

**Malus sylvestris* (L.) P. Miller (apple)

Physocarpus opulifolius (L.) Maxim. (ninebark)

Potentilla norvegica L. (Norwegian cinquefoil)

Prunus americana Marsh. (wild plum)

Prunus serotina Ehrh. (wild black cherry)

**Prunus tomentosa* Thunb. (Nanking cherry)

Prunus virginiana L. (choke cherry)

Rosa blanda Aiton (meadow rose)

**Rosa multiflora* Thunb. ex Murray (multiflora rose)

Rubus allegheniensis Porter ex L. H. Bailey (blackberry)
Rubus occidentalis L. (black raspberry)

RUBIACEAE

Cephalanthus occidentalis L. (buttonbush)
Galium aparine L. (cleavers)
Galium concinnum T. & G. (shining bedstraw)
Galium triflorum Michx. (sweet-scented bedstraw)

RUTACEAE

Zanthoxylum americanum P. Miller (prickly ash)

SALICACEAE

Populus deltoides Bartram ex. Marsh. (cottonwood)
Populus tremuloides Michx. (quaking aspen)
Salix amygdaloides Andersson (peach-leaved willow)
Salix exigua Nutt. spp. *interior* (Rowlee) Cronq. (sandbar willow)
Salix nigra Marsh. (black willow)

SAXIFRAGACEAE

Mitella diphylla L. (bishop's cap)
Ribes missouriense Nutt. ex T. & G. (wild gooseberry)

SCROPHULARIACEAE

Agalinis tenuifolia (Vahl) Raf. (common false foxglove)
#*Chelone glabra* (white turtlehead)
Lindernia dubia (L.) Pennell (false pimpernel)
Mimulus ringens L. (monkey flower)
Pedicularis canadensis L. (lousewort)
#*Penstemon digitalis* Nutt. (foxglove penstemon)
Scrophularia marilandica L. (late figwort)
**Verbascum thapsus* L. (common mullein)
Veronica peregrina L. (purslane-speedwell)
**Veronica serpyllifolia* L. (thyme-leaved speedwell)
Veronicastrum virginicum (L.) Farw. (culver's-root)

SIMAROUBACEAE

**Ailanthus altissima* (P. Miller) Swingle (tree of heaven)

SOLANACEAE

Physalis heterophylla Nees (clammy ground-cherry)
Solanum americanum P. Miller (black nightshade)
Solanum carolinense L. (horse nettle)

STAPHYLEACEAE

Staphylea trifolia L. (bladdernut)

TILIACEAE

Tilia americana L. (basswood)
**Tilia cordata* Mill. (littleleaf linden)

ULMACEAE

Celtis occidentalis L. (hackberry)
Ulmus americana L. (American elm)
Ulmus pumila L. (Siberian elm)
Ulmus rubra Muhl. (red elm)

URTICACEAE

Boehmeria cylindrica (L.) Sw. (bog hemp)
Laportea candensis (L.) Wedd. (wood nettle)
Pilea pumila (L.) Gray (clearweed)
Urtica dioica L. (stinging nettle)

VERBENACEAE

Phyla lanceolata (Michx.) Greene (fogfruit)
Verbena bracteata Lag. & Rodr. (creeping vervain)
Verbena hastata L. (blue vervain)
Verbena stricta Vent. (hoary vervain)
Verbena urticifolia L. (white vervain)

VIOLACEAE

Viola missouriensis Greene (Missouri violet)
Viola pubescens Aiton (downy yellow violet)
Viola sororia Willd. (hairy blue violet)

VITACEAE

Parthenocissus quinquefolia (L.) Planchon (Virginia creeper)
Parthenocissus vitacea (Knerr) A. S. Hitchc. (Woodbine)
Vitis riparia Michx. (riverbank grape)

ANGIOSPERMS: MONOCOTYLEDONS

ALISMATACEAE

Alisma plantago-aquatica L. (water plantain)

ARACEAE

Arisaema dracontium (L.) Schoot (green dragon)
Arisaema triphyllum (L.) Schott (Jack-in-the-pulpit)

COMMELINACEAE

**Commelina communis* L. (day-flower)
Tradescantia ohiensis Raf. (common spiderwort)

CYPERACEAE

Carex albursina Sheldon (blunt-scaled wood sedge)
Carex amphibola Steudel var. *turgida* Fern. (narrow-leaf sedge)
Carex assiniboensis W. Boott (Assiniboine sedge)
Carex blanda Dewey (common wood sedge)
Carex brevior (Dewey) Mack. ex Lunell (plains oval sedge)
Carex cephalophora Willd. (woodbank sedge)
Carex conjuncta Boott (soft fox sedge)
Carex convoluta Mack. (curly-styled wood sedge)
Carex davisii Schwein. & Torrey (Davis' sedge)
Carex emoryi Dewey (Emory's sedge)
Carex gracillima Schwein. (graceful sedge)
Carex gravida Bailey (heavy sedge)
Carex grayi Carey (Gray's sedge)
Carex haydenii Dewey (Hayden's sedge)
Carex hirtifolia Mack. (hairy wood sedge)
Carex hitchcockiana Dewey (Hitchcock's sedge)
Carex jamesii Schwein. (James' sedge)
Carex laeviconica Dewey (long-toothed lake sedge)
Carex lupulina Muhl. ex Willd. (common hop sedge)
Carex molesta Mack. (field oval sedge)
Carex muskingumensis Schwein. (muskingum sedge)
Carex normalis Mack. (greater straw sedge)
Carex oligocarpa Willd. (few-fruited gray sedge)
Carex pennsylvanica Lam. (common oak sedge)
Carex rosea Schkuhr ex Willd. (straight-styled wood sedge)
Carex sparganoides Muhl. ex Willd. (bur-reed sedge)
Carex sprengelii Dewey ex sprengel (long-beaked sedge)
Carex vulpinoidea Michx. (fox sedge)
Cyperus aristatus Rottb. (umbrella sedge)
Cyperus esculentus L. (umbrella sedge)
Cyperus odoratus L. var. *squarrosus* (umbrella sedge)
Eleocharis acicularis (L.) R. & S. (needle spike-rush)
Eleocharis sp. (spike-rush)
Hemicarpha micrantha (Vahl) Pax (small-flowered hemicarpha)
Scirpus atrovirens Willd. (dark green bulrush)

DIOSCOREACEAE

Dioscorea villosa L. (wild yam)

IRIDACEAE

Iris shrevei Small (blue flag)

JUNCACEAE

Juncus interior Wieg. (inland rush)
Juncus tenuis Willd. (path rush)

LEMNACEAE

Lemna minor L. (common duckweed)
Spirodela polyrhiza (L.) Schleiden (greater duckweed)
Wolffia columbiana Karsten (watermeal)

LILIACEAE

Allium canadense L. (wild onion)
#*Allium cernuum* Roth (nodding wild onion)
Allium tricoccum Aiton (wild leek)
**Asparagus officinalis* L. (asparagus)
Erythronium albidum Nutt. (white trout lily)
**Hemerocallis fulva* (L.) L. (day lily)
**Lycoris* sp. (surprise lily)
Polygonatum biflorum (Walter) Ell. (Solomon's seal)
Smilicina racemosa (L.) Desf. (false Solomon's seal)
Smilicina stellata (L.) Desf. (starry false Solomon's seal)
Smilax ecirrhata (Engelm. ex Kunth) S. Watson (upright carrion-flower)
Smilax herbacea L. (common carrion-flower)
Smilax hispida Muhl. (greenbrier)
Trillium flexipes Raf. (nodding trillium)
#*Trillium recurvatum* Beck (red trillium)
Uvularia grandiflora Small (large bellwort)
Uvularia sessilifolia L. (sessile-leaved bellwort)

ORCHIDACEAE

Cypripedium calceolus L. var. *pubescens* (Willd.) Correll (yellow lady's-slipper orchid)

POACEAE (GRAMINEAE)

**Agropyron repens* (L.) Beauv. (quack grass)
Agrostis hyemalis (Walter) BSP. (ticklegass)
Agrostis perennans (Walter) Tuckerman (upland bent)
#*Andropogon gerardii* Vitman (big bluestem)
#*Bouteloua curtipendula* (Michx.) torrey (side-oats grama)
Brachyelytrum erectum (Schreber) Beauv. (long-awned wood grass)
**Bromus inermis* Leysser (smooth brome)
**Bromus japonicus* Thunb. ex Murray (Japanese brome)
Bromus latiglumis (Shear) A. S. Hitchc. (ear-leaved brome)
Bromus pubescens Muhl. ex Willd. (hairy woodland brome)
Cinna arundinacea L. (wood reed)
**Dactylis glomerata* L. (orchard grass)
Diarrhena americana Beauv. var. *obovata* Gl. (obovate beak grain)
Dichanthelium acuminatum (Sw.) Gould & Clark var. *implicatum* (Scribner) Gould and Clark
(western panic grass)
Dichanthelium latifolium (L.) Gould & Clark (broad-leaved panic grass)
Dichanthelium oligosanthos (Schultes) Gould var. *scribnerianum* (Nash) Gould (Scribner's
panic grass)

**Digitaria ischaemum* (Schreber ex Schweigger) Schreber ex Muhl. (smooth crabgrass)
 **Echinochloa crusgalli* (L.) Beauv. (barnyard grass)
Echinochloa muricata (Beauv.) Fern. (barnyard grass)
 #*Elymus canadensis* L. (Canada wild rye)
Elymus villosus Muhl. ex Willd. (slender wild rye)
Elymus virginicus L. (Virginia wild rye)
Eragrostis hypnoides (Lam.) BSP. (pony grass)
Eragrostis pectinacea (Michx.) Nees (low lovegrass)
 **Eragrostis poaeoides* Beauv. ex R. & S. (little lovegrass)
Eragrostis spectabilis (Pursh) Steudel (purple lovegrass)
 **Festuca arundinacea* Schreber (alta fescue)
Festuca obtusa Biehler (nodding fescue)
Glyceria striata (Lam.) A.S. Hitchc. (fowl manna grass)
Hordeum jubatum L. (squirrel-tail barley)
Hystrix patula Moench (bottlebrush grass)
Leersia virginica Willd. (white grass)
 **Lolium perenne* L. (perennial rye grass)
 **Lolium perenne* L. var. *italicum* Parn. (annual rye grass)
Muhlenbergia bushii Pohl (nodding muhly)
Muhlenbergia frondosa (Poiret) Fern. (wire-stem muhly)
Muhlenbergia racemosa (Michx.) BSP. (marsh muhly)
Muhlenbergia schreberi J. F. Gmelin (nimble-will muhly)
Oryzopsis racemosa (Smith) Ricker (black-seeded rice-grass)
Panicum capillare L. (witchgrass)
 #*Panicum virgatum* (switch grass)
 **Phalaris arundinacea* L. (reed canary grass)
 **Phleum pratense* L. (timothy)
 **Poa compressa* L. (Canada bluegrass)
Poa palustris L. (fowl meadow grass)
 **Poa pratensis* L. (Kentucky bluegrass)
Poa sylvestris Gray (woodland bluegrass)
 #*Schizachyrium scoparium* (Michx.) Nash (little bluestem)
 **Setaria faberi* Herrm. (giant foxtail)
 **Setaria glauca* (L.) Beauv. (yellow foxtail)
 **Setaria viridis* (L.) Beauv. (green foxtail)
 #*Sorghastrum nutans* (L.) Nash (Indian grass)
Sphenopholis obtusata (Michx.) Scribner var. *major* (torrey) K.S. Erdman (wedge grass)
Sporobolus asper (Michx.) Kunth (tall dropseed)
Sporobolus vaginiflorus (Torrey ex Gray) Wood (poverty grass)