PROJECT TITLE: Vegetation Surveys of Selected Sites in Brown and Schuyler Counties
Project #04-L22W

Final report submitted by:

Dr. Sean E. Jenkins
Department of biological Sciences
Western Illinois University
215 Waggoner Hall
1 University Circle
Macomb, IL 61455
309-298-2045
SE-Jenkins@wiu.edu

Matthew E. Schramm
Senior Scientist & Forest Ecologist
Natural Resources Consulting, Inc.
19 Westwood Drive
Geneseo, IL 61254
309-441-6580
mschramm@nrc-inc.net

Submitted to:
Tim Kelley
Illinois Department of Natural Resources
District Heritage Biologist
700 South 10th Street
Havana, IL 62644

Table of Contents

1.0 Introduction

The landscape of Illinois has changed drastically since European settlement. Modern agriculture, fire suppression, timber harvesting, flood attenuation and other human activities have severely reduced the extent of the majority of forest, wetland and prairie communities in Illinois. Many of these upland and riparian communities were among the most diverse ecosystems in the temperate zone and were historically maintained by anthropogenic fire, windstorms, ice storms, flooding and other disturbances and. However, the vast majority of these communities have been reduced to small isolated remnants. Some vegetation types like barrens and hill prairies are critically endangered with 99.98 % loss in their original extent since the mid 1800s (Nuzzo 1986,Christensen *et al.* 1996). Fire suppression in the last few decades has resulted in changes in the composition and structure of the remaining remnants with a dramatic shift from oak dominated woodland/barrens systems to closed canopy forests dominated by shade tolerant, fire intolerant species. The resulting closed canopy conditions have dramatically reduced the abundance and diversity of the herbaceous ground flora. These successional changes and continued landscape fragmentation have isolated, degraded and in some instances initiated the localized extinction of populations of threatened or endangered plant species.

Two of the primary goals of conservation and conservation biology are to preserve threatened and endangered species and maintain the communities and landscapes in which they occur. In order, to insure the long-term fitness of rare species the maintenance of a diverse gene pool is of paramount importance for the purpose of preservation and often for the reintroduction of these species. The continued need to identify and delineate remnant populations of threatened or endangered plant species and the plant communities in which they occur was the impetus for this study.

During the spring of 2001, the State of Illinois purchased an approximately 2300 acre addition to the Siloam Springs State Park (herein referred to as the "Buckhorn Addition"). About 1300 acres of the property are a mosaic of natural habitat (woods and grasslands), with the remaining 1000 acres composed of active agricultural leases, old pastures, and abandoned farm fields. Although the site contains a large block of relatively undeveloped habitat, no formal surveys had been performed to characterize the floristic resources of the Buckhorn Addition. Therefore, the IDNR identified a need to develop baseline information on the flora (to include rare species) as well as types and extent of vegetative communities present at the site.

A need was also identified by IDNR to re-inventory three privately-owned, state-designated nature preserves in the region: the Benville Area INAI site (Brown County), Little Missouri Creek Dells INAI site (Brown County), and Sugar Creek INAI site (Schuyler County). While each site had been identified in the late 1980's as supporting a number of populations of rare plants and containing significant natural habitat, no formal monitoring or additional surveys had been undertaken on these properties since the time of their original designation. In addition, little or no historic information exists in the IDNR files to provide a baseline of the floristic resources or ecological conditions of each site.

This remainder of this section discusses the objectives and scope of the rare plant surveys, and provides information regarding the project contract.

1.1 Project Objectives and Scope

The primary objectives for this study were to conduct field surveys to develop a more complete list of the vascular flora for the Buckhorn Addition and to document and describe any populations of state or federal listed threatened and endangered plants encountered on the site. In addition, general descriptions and locations of significant vegetative communities such as prairie remnants, high quality wetlands and oak barrens, and other unique habitat features were documented during the field surveys. Information on the general conditions and integrity of the vegetative resources of the site was also recorded to assist with later development of ecological restoration plans for the Buckhorn Addition.

Primary objectives for the field surveys conducted at the privately owned nature preserves included re-locating the previously documented populations of rare plants and assessing the general conditions of the sites, to include any potential threats to identified rare plant populations. A secondary objective was to develop, within the time allotted for the rare plant searches, a baseline list of vascular flora present at each nature preserve.

Table 1 identifies the target rare species and their habitats for the Buckhorn Addition, Little Missouri Creek, Benville Area, and Sugar Creek sites. This list was identified from analysis of existing INAI records for the three privately owned sites, discussions with Illinois Nature Preserve Commission's Preservation Specialist, Angella Moorehouse, and comparison with data on known occurrences of rare species at Siloam Springs State Park and other sites within Brown and Schuyler Counties.

1.2 Contract Information

Sean E. Jenkins, PhD
Assistant Professor of Plant Ecology
Director of Alice L. Kibbe Life Science Station
Department of Biological Sciences
Western Illinois University
215 Waggoner Hall
Macomb, IL 61455
(309) 298-2045
se-jenkins@wiu.edu
http://faculty.wiu.edu/SE-Jenkins/

Matthew E. Schramm
Senior Scientist & Forest Ecologist
Natural Resources Consulting, Inc.
19 Westwood Drive
Geneseo, IL 61254
309-441-6580
mschramm@nrc-inc.net

Table 1. Target Species for the Rare Plant Survey

Site	Species	Habitat	Status
Buckhorn Addition	*Trifolium reflexum* L.	Oak barrens, dry woodlands	ST
	Poa wolfii Scribn.	Oak barrens, dry woodlands	SE
	Carex communis Bailey	Mesic to dry woods	ST
	Liatris scariosa (L.) Willd. var. *nieuwlandii* (Lunell) E.G. Voss	Dry woodlands, dry-mesic prairies	ST
	Polygala incarnate L.	Dry-mesic prairies (hill prairies)	SE
	Viburnum molle Michx.	Oak barrens, dry woodlands	ST
	Carex prasina Wahlenb.	Low, rich woods	ST
	Scirpus polyphyllus Vahl	Low woodlands and areas adjacent to seep springs	
Benville Area	**Carex prasina* Wahlenb.	Low, rich woods	ST
	**Scirpus polyphyllus* Vahl	Low woodlands and areas adjacent to seep springs	ST
Little Missouri Creek Dells	*Trifolium reflexum* L.	Oak Barrens, dry woodlands	ST
	Poa wolfii Scribn.	Oak barrens, dry woodlands	SE
Sugar Creek	**Lycopodium dendroideum* Michx.	Woodlands on moist sandstone detritus	SE

* Target species for which populations were successfully found at the site
SE: State Endangered
ST: State Threatened

2.0 Background

This section provides a general overview of the ecology of the physiographic region for the survey areas. Descriptions of environmental conditions found in each specific survey are also discussed below.

2.1 Regional Overview

Each of the four survey areas falls within the southeastern portion of the Galesburg Section of the Western Forest-Prairie Natural Division (Mohlenbrock 2002). The physiography of this region is dominated by a strongly dissected till plain of Illinoian and pre-Illinoian age, with level to rolling uplands interrupted by incised drainages that generally flow south and east towards the Illinois River. Most of the soils in upland areas developed in thick deposits of relatively young, late Pleistocene age loess. These soils are highly fertile and typically supported prairie vegetation at the time of European settlement. Soils found on the side slopes and within ravines are generally shallower and more acidic than the upland areas; these soils supported primarily forest vegetation. Droughty areas of soils are also present on stepper slopes and southern exposures. Bedrock outcrops of Pennsylvanian and Mississippian age limestone, and sandstone, along with shallow deposits of carboniferous shales and coals, are commonly found along valleys and within the channels of larger streams and rivers.

At the time of settlement, the Galesburg Section was characterized by a mosaic of roughly equal amounts of forest and prairie vegetation (Mohlenbrock 2002). Forest communities present on upper and middle slopes included the dry upland type dominated by various oak-hickory (*Quercus-Carya*) associations, with a mesic type dominated by white oak (*Quercus alba* L.), red oak (*Quercus rubra* L.), shagbark hickory (*Carya ovata* (P. Mill.) K. Koch), basswood (*Tilia Americana* L.), sugar maple (*Acer saccharum* Marsh.), and slippery elm (*Ulmus rubra* Muhl.) on lower slope and along deeper ravines. Sites with droughty soils tended to support post oak (*Quercus stellata* Wangenh.) – blackjack (*Quercus marilandica* Muenchh.)- oak barrens. Mohlenbrock (2002) notes that the post oak – blackjack oak type were also common in transition between forest and prairie communities, a possible indicator of more frequent or higher intensity fires. Floodplain forests in the region are currently dominated by silver maple (*Acer saccharinum* L.), American elm (*Ulmus americana* L.), green ash (*Fraxinus pennsylvanica* Marsh.), and boxelder (*Acer negundo* L.).

Grassland vegetation present within the Galesburg Section at the time of settlement was primarily dry and mesic prairies, along with scattered occurrences of wet prairies (Mohlenbrock 2002). Dry upland prairies

occurred mainly on steeper slopes or areas of droughty soils that supported grasses such as little bluestem [*Schizachyrium scoparium* (Michx.) Nash] and side-oats gramma [*Bouteloua curtipendula* (Michx.) Torr.]. Dominant forbs found in dry prairies included slimflower scurf pea [*Psoralidium tenuiflorum* (Pursh) Rydb.], pale beard-tongue (*Penstemon pallidus* Small), and fringed puccoon (*Lithospermum incisum* Lehm.). Mesic prairies were dominated by tallgrasses such as big bluestem (*Andropogon gerardii* Vitman), Indian grass (*Sorghastrum nutans* (L.) Nash), and switchgrass (*Panicum virgatum* L.), along with little bluestem and prairie dropseed grass [*Sporobolus heterolepis* (Gray) Gray]. Characteristic dominant forbs in mesic prairies included leadplant (*Amorpha canescens* Pursh), compass plant (*Silphium laciniatum* L.), prairie dock (*Silphium terebinthinaceum* Jacq.), and rattlesnake master (*Eryngium yuccifolium* Michx.). Wet prairies were dominated by prairie cordgrass (*Spartina pectinata* Bosc ex Link), various sedges (*Carex sp.* L. and *Scripus sp.* L.), bluejoint grass [*Calamagrostis canadensis* (Michx.) Beauv.], and forbs such as ironweed (*Vernonia fasciculata* Michx.), boneset (*Eupatorium perfoliatum* L.) and swamp milkweed (*Asclepias incarnata* L.).

These natural vegetation patterns were substantially altered across much of the region during european settlement, when the majority of prairie vegetation was converted to either row crop agriculture or pasture and forests were harvested and often intensively grazed. Warnock (1974) observed that "most wooded areas in Brown County are of very low natural quality because of repeated harvest of very young trees, pasturing (especially hogs) and generally poor land management." Fire also has been widely excluded from surviving prairies and woodlands throughout the region, which has allowed encroachment of woody vegetation into grassland environments. Despite these intensive land use changes, scattered prairies were noted in Adams and Brown Counties as late as the mid-1970's, where they could be commonly found along roadways, fencerows, formerly disturbed waste areas, and isolated hilltop spurs too narrow or rugged for cultivation (Stannard and Evers 1975; Warnock 1974). Such remnants may have also served as refugia for re-establishment of disturbed prairie sites. In a report on hilltop prairies at Siloam Spring State Park, Stannard and Evers (1975) found that some areas under cultivation until about 1945 were being naturally invaded by native vegetation and animals present in prairie remnants which persisted on hilltop spurs and along former fencerows.

About 350 acres of high quality dry-mesic oak barren, mesic woodland, and seep spring communities can also be found at Siloam Springs State Park, about three miles southwest of the Buckhorn Addition (Moorehouse and Corgiat 2003). These forested sites were apparently protected from extensive grazing or other agricultural uses and historically managed for recreational use since the 1880's (Moorehouse 2003). The sites are now managed as a Category I and II natural area (McKee Creek Barrens) by the

IDNR. Collectively, these remnant communities support five State of Illinois listed plant species: savanna blazing star, buffalo clover, drooping sedge, Wolf's bluegrass, and leafy bulrush.

2.2 Site Descriptions

This section provides detailed information on the environmental conditions of each site, including the topography, hydrology, general vegetation patterns, and known information regarding site management histories.

2.2.1 Buckhorn Addition

This new addition to Siloam Springs State Park is located in the southwest part of Brown County, Illinois within Buckhorn Township. The site is about 2300 acres in size and occupies most of Sections 3, 4, 9, and 10, most of the NE¼ of Section 16, and small part of the NW¼ of Section 15, T2S, R4W, Mt. Sterling 7.5' Quadrangle. With the exception of the town of Mt. Sterling (about 7 miles to the northeast) and several small, unincorporated communities, the region encompassing the Buckhorn Addition is predominantly rural with agricultural, forested, and recreational land uses. The property is bounded on the northern, most of the western and parts of the southern sides by gravel township roads. A mixture of agricultural fields, forest habitat, and open areas (brushy old fields and grasslands) occur along the eastern and south-central boundaries of the site.

The primary topographic features of the Buckhorn Addition include two broad stream valleys along branches of Doby Creek, small bluffs along the stream valleys, and broad, tabular uplands between the stream drainages (see Figure 1). The terrain is moderately rugged, with generally a dendritic drainage pattern and about 100 feet (30.5 m) of relief between the valley floors and uplands. A small rock outcrop occurs in the extreme southwest corner of the site where the channel of Doby Creek is controlled by bedrock. A small waterfall also occurs near this location (See Figure 1). Slope aspects are highly variable throughout the Buckhorn Addition, but with a prominent series of southerly and westerly exposures along the bluff lines in the central part of the property. Elevations range from about 570 feet (174 m) above mean sea level (amsl) where Doby Creek exits the southwestern corner of the property to about 710 feet (216 m) amsl on the flat uplands in the northern part of the site.

The hydrology of the Buckhorn Addition varies from saturated conditions within wetlands present in portions of Doby Creek and sheltered drainages to dry-mesic conditions on the west- and south-facing

uplands positions on the uplands associated with the main stream valleys. Stream flow through the lower portions of Doby Creek appear to be perennial, but with periods of extremely shallow water (less than 12 inches deep). Most tributary drainages appear to have only intermittent or seasonal flow. Old stock ponds dot the the uplands and headwaters of drainages. Many of these ponds were probably built at locations of former natural springs.

With the exception of the bedrock area in the southwest corner of the site, the channels of Doby Creek and most tributary streams are incised 6 to 10 feet below their natural floodplains. In some places, gullies greater than 20 feet (6.0 m) deep were observed on the uplands in the central part of the property, suggesting that significant erosion has occurred in the past. Evidence of active headwater erosion and gully formation such as undercut fences was also observed in a number of locations.

The vegetation of the site includes closed canopy hardwoods forests on the side slopes of the bluffs and along most of the smaller drainages, with areas of interspersed grasslands and old fields. Limited amount of forest habitat also occurs on the margins and noses of a few of the tabular uplands. However, most of the flatter upland areas were converted to agriculture at some time in the past. The floodplains of Doby Creek are a mixture of old fields (pasture) and patches of open woods and shrubs. Some less disturbed sites along Doby Creek are shaded by the forest canopy, but most of the lower channel is open and dominated by herbaceous vegetation. More detailed information on the composition and conditions of these vegetative communities are discussed in Section 4.1.

Although a written management history was not available for the Buckhorn Addition, interviews with IDNR personnel indicated that the site was intensively used for agricultural purposes (row crops, hay, and grazing) prior to acquisition by the State of Illinois. Most of the larger tabular upland areas were likely cultivated at the time of settlement. Based on the dates of earlier tombstones found in a cemetery located in the central part of the site (Doby Cemetery), these land use changes probably began in the 1830's or 1840's.

In addition, the property was apparently used for intensive cattle grazing operations from the 1950's until some time in the 1970's. Many of the stock ponds, barns and other facilities from this operation still remain on the property. It was also reported by IDNR personnel from Siloam Springs State Park that repeated aerial herbicide applications were made across large parts of the parcel in an unsuccessful attempt to control brush and convert forested areas to pastures. Old field fences were routinely

encountered in forested areas during the field surveys, suggesting that the property was once cross fenced into numerous paddocks for grazing livestock.

Timber harvesting apparently has also been conducted across the Buckhorn Addition prior to acquisition by IDNR. Old skid roads and an abandoned portable sawmill was located in the extreme southwest part of the site (see Figure 1); the mill did not appear to have been in use for a number of decades. In addition, evidence of more recent timber harvesting (cut stumps) was observed on the bluffs along the western branch of Doby Creek.

The Buckhorn Addition is currently designated by IDNR for use as hunting and other recreational purposes. Parking lots staged around the site provide access to hunting areas and ponds used for fishing. A number of the agricultural fields remain in active crop production as private out leases from the IDNR. However, the site is no longer open to grazing by livestock. Several active oil fields are also located on the uplands adjacent to and within the Buckhorn Addition. These developments typically involve a single pump head or small groups of wells, above ground storage facilities, and gravel access roads. A limited amount of active management of wildlife habitat (prescribed burning) has been conducted in a few of the larger grassland areas west and south of Doby Cemetery. Recent evidence of fire was also found in several upland woods north of the cemetery.

2.2.2 Sugar Creek Site

This privately owned nature preserve is located in the south-central part of Schuyler County, Illinois within Browning Township. The site is approximately 20 acres in size and occupies parts of the SE¼ of the NE¼ and N½ of the SE¼ of Section 30, T2N, R1E, Beardstown 7.5' Quadrangle. The nature preserve is situated in a rural area of mixed agricultural and forested land uses, with several vacation homes and campsites on adjacent properties. The site is bounded by agricultural land to the west, north and south. The channel of Sugar Creek marks the approximate eastern boundary of the nature preserve.

The primary topographic feature of the Sugar Creek site is a deep and narrow, northeast trending ravine that contains an intermittent tributary to Sugar Creek (see Figure 2). Both the main stream and several small side channels are incised into bedrock. Very limited amounts of flat upland areas occur along the edges of the ravine and in a few wider spots within the valley floor; the terrain is otherwise steeply sloping to nearly vertical in many places. Slope aspects are primarily either northwesterly to northerly (about 300 to 0 degrees), or southeasterly to southerly (about 50 to 90 degrees), depending on which side

of the ravine the slope occurs. Elevations range from about 620 feet (189 m) amsl at the head of the ravine near the western boundary of the nature preserve to about 460 feet (140 m) amsl on the floodplain of Sugar Creek on the eastern boundary of the site.

The hydrology of the site varies from dry mesic conditions on the upper slopes and edges of the ravine to mesic conditions on lower and middle slopes of the ravine. Soils at the site appear to have developed in a thick loess deposit underlain by sandstones and shales. Seeps and springs are present in several areas along the contact between the loess parent material and bedrock, which may be a factor in the unstable nature of the soils and numerous slump blocks along the length of the ravine. Muck soils are also present within parts of the larger seeps, suggesting that hydric conditions persist for a significant portion of the growing season. Flow through the upper reaches of the stream appears to be intermittent and fed primarily by the seeps along the length of the channel. However, numerous debris dams and bedrock scours suggest that peak discharge is extremely flashy and the stream is subject to periods of turbulent, high-velocity flow (one of these events may have occurred after a severe thunderstorm on May 31, 2004). Slackwater was present in the lower reaches of the stream channel at the time of the field survey (late May to mid-June) and it appears that the floodplain environment in the extreme eastern part of the site may be periodically inundated by the intermittent stream or Sugar Creek (or both).

The vegetation of the site is primarily a closed canopy hardwoods forest on both the uplands and along most of the length of the ravine. Small openings are present in the forest canopy (less than 0.5 acre in size) in two areas where wetland seeps dominated by herbaceous vegetation occur on the south wall of the ravine (See Figure 2). The forest overstory is also more open in several areas where extremely steep and unstable slopes apparently do not support the weight of mature trees or where recent storm damage has uprooted or snapped the tops of large trees. An emergent herbaceous wetland/floodplain forest complex occurs in the eastern part of the preserve on the floodplain of Sugar Creek. More detailed information on the composition and conditions of these vegetative communities are discussed in Section 4.2.

No management history was available for the Sugar Creek site. Access to the site appears to be limited and no trails or other development were observed during the field surveys. However, parts of the ravine immediately upstream of the site have been heavily disturbed in several areas by the placement of fill material, to include construction debris and other trash such as large appliances. In addition, a buffer is generally lacking between the preserve and the surrounding agricultural lands, with actively plowed farm field extending up to the edge of the ravine in several areas.

2.2.2 Little Missouri Creek Dells

This privately owned nature preserve is located in the north-central part of Brown County, Illinois within Pea Ridge Township. The site is about 15 acres in size and occupies parts of the SE¼ of the SW¼ and SW¼ of the SE¼ in Section 12, and the NE¼ of the NW¼ and NW ¼ of the NE ¼ in Section 13, T1N, R4W, Lake Mt. Sterling 7.5' Quadrangle. The nature preserve is situated in a rural area of mixed agricultural and forested land uses. The site is bounded by agricultural fields (hay meadows and row crops) to the north, east and west, and forest to the south along Little Missouri Creek.

The primary topographic feature of the nature preserve is a bedrock gorge or "dells" along the northeast-trending valley of Little Missouri Creek that contains sandstone ledges and a small waterfall (see Figure 3). Most of the bedrock exposures are located on the east side of the gorge above a hairpin turn in the stream valley. Significant accumulations of loose talus and large slump blocks occur on the steep slopes below the sandstone outcrops. The talus slopes terminate abruptly at the eastern edge of the stream channel. On the west side of the stream, a floodplain terrace sits about ten feet higher than the current channel baseline. A flat upland knoll occupies the northwestern quarter of the preserve. The terrain varies from extremely rugged on the east side of the Dells to relatively flat conditions along the stream valley, with more moderate slopes on the uplands in the western part of the site. Slope aspects are highly variable throughout much of the site, but are primarily west and northwesterly along the major rock outcrops. Elevations range from about 520 feet (159 m) amsl where the stream channel exits the northeastern eastern boundary of the site to about 610 feet (186 m) amsl on the eastern boundary of the site.

The hydrology of the site is dominated by Little Missouri Creek, a high-quality perennial stream that bisects the central part of the preserve. The stream is about 20 to 25 feet wide and 18 to 24 inches deep in most places, with numerous riffles and pools where the channel cuts through the bedrock of the Dells. A mesic floodplain terrace above the stream channel is likely only inundated intermittently during more extreme flood events. Mesic to wet-mesic conditions occur along the sandstone ledges and steep slopes immediately east of the stream channel, where numerous small seeps and springs are located. Several of the larger seeps appear to be saturated throughout a significant portion of the growing season and support hydrophytic vegetation. Dry-mesic conditions prevail across most of the uplands in the western part of the site.

The vegetation of the site is a primarily a mixture of upland and floodplain hardwood forest with minor amounts of interspersed shrub lands, barrens and grassland communities. The floodplain terrace contains more open canopy conditions, with a mosaic of scattered forest, shrub, and herbaceous vegetation (old field). Aside from the forested stream banks, the open channel of the stream is rocky and generally devoid of woody vegetation. More detailed information on the composition and conditions of these vegetative communities are discussed in Section 4.3.

No management history was available for the Little Missouri Creek nature preserve. The land was formerly owned by the Black Beauty Coal Company of Evansville, Indiana. Although an old quarry is located about 0.25 miles upstream of the site, no evidence of past mining activities was found within the boundaries of the nature preserve. An adjoining landowner contacted during the field survey indicated that the property is currently owned by a private hunting club. No established trails, roads or other developments were noted during the field survey. However, an old roadbed runs for a short distance along the uplands from the northwest corner of the site towards the southeast; this area appears to have been previously disturbed. An old fence was located along the eastern boundary of the nature preserve, which apparently once protected the site from livestock grazing (the fence is now dilapidated in many locations).

2.2.4 Benville Area

This privately owned nature preserve is located in the southwest part of Brown County, Illinois within Buckhorn Township. The site is about 8 acres in size and occupies parts of the S½ of the SE¼ of Section 22 and the NW¼ of the NE¼ of Section 27, T2S, R4W, Perry West 7.5' Quadrangle. The nature preserve is situated in a rural area of mixed agricultural and forested land uses. The site is bounded by a gravel township road to the south and agricultural land to the west, northwest and east.

The primary topographic features of the Benville Area consist of a west to east trending stream valley, several associated tributary side channels, and a limited amount of upland area on the valley side slopes (see Figure 4). The terrain across the site is generally moderately rugged with steep slopes along the side slopes of the stream valley and the uplands. The floor of the stream valley is also quite narrow throughout most of its length, except where the stream exits its confined channel and enters a broad, open valley near the eastern boundary of the site. More gentle slopes generally occur on small terraces located

within the wider parts of the stream valley. Slope aspects vary from about 0 to 270 degrees, but are primarily north to northeast. Elevations range from about 580 feet (177 m) amsl where the stream channel exits the eastern boundary of the nature preserve to about 700 feet (213 m) amsl on the western boundary of the site.

The hydrology of the site varies from saturated conditions within wetlands present in lower portions of the stream valley to dry-mesic conditions on upper slope positions on the uplands surrounding the stream valley. An unnamed, intermittent tributary to McKee Creek flows through the central portions of the site. The stream is fed by several perennial seeps located along the margins of the valley floor and within incised side channels on the north side of the valley. However, surface flow within the stream itself appears to be seasonal, particularly in the upstream parts of the channel. Active erosion is occurring in the headwaters of several of the small ravines and side channels where seeps are present in sandy soils; this phenomenon does not appear to be directly related to any human activities.

The vegetation of the site is primarily a closed canopy hardwoods forest on both the uplands and most of the length of the stream valley. The forest canopy becomes more open along the lower reaches of the stream valley as the channel gradient decreases and the valley floor widens. A mixture of forest, shrub, and herbaceous wetland vegetation occur in this part of the site. More detailed information on the composition and conditions of these vegetative communities are discussed in Section 4.4

No management history was available for the Benville Area nature preserve. However, the current owner indicated that the property is currently used for nature watching and hunting. A small trail runs along a portion of the stream valley from the eastern boundary to the central part of the site. The current owner indicated that the site is currently protected from grazing.

3.0 Methodology

Non-random, meandering transects were used to inventory the flora at the Buckhorn Addition and the private nature preserves. This qualitative vegetation survey method involved teams of two to three persons traveling on foot through as much of the survey sites as possible within the timeframe allotted for field work. Each team member covered a slightly different route during the transects and compiled a running list of species observed in the different vegetation layers (ground cover, shrub, and overstory) within each habitat area. The team members then compared lists and general notes of the area before

moving to the next habitat area. This method is biased and does not allow quantitative estimates of plant populations, but it is effective for documenting botanical diversity in a limited amount of time at sites where little or no prior data exist (Carbonneau and Allen 1995; Crow and others 1994). This method is also effective for detecting endangered, threatened, or rare plant species (Kruse 1993).

More concentrated searches were conducted in locations of suitable habitats for the target rare plants and other microhabitats, such as landscape depressions, seep-springs and other wetlands, remnant barrens, rock outcrops and areas of higher quality forest habitat. These locations were generally identified in advance of the field surveys through examination of topographic maps, aerial photos, and known habitat preferences of each species. A reconnaissance survey was also conducted at the Buckhorn site in late March to screen potential survey areas for examination later in the growing season. Based on this effort, a decision was made to concentrate survey efforts on the less disturbed forest and grassland habitats along the main (western) branch and lower reaches of Doby Creek.

Multiple survey periods for the Buckhorn Addition were chosen to provide a range of observations over the growing season and phenologies of different plant families. These times were also selected to coincide with the optimum period of identification for the targeted rare plants listed in Table 1. Survey dates for the private nature preserves were timed to coincide with the optimum period of identification for the previously documented rare plants.

A total of approximately 226 person hours were expended on the field surveys (to include travel time to and from the WIU Campus in Macomb). The Buckhorn Addition was visited on March 31, May 24, May 28, August 22, September 26, and October 17 for a total of approximately 150 person hours. In general, the limit of the scope precluded multiple visits to the privately-owned nature preserves. However, the Sugar Creek site was visited twice (May 31 and June 19) for an approximate total of 32 person hours. The Little Missouri Creek Dells site was visited on June 12 for an approximate total of 24 person hours and the Benville Area on June 19th for an approximate total of 20 person hours.

The field team generally identified plants on site with the aid of various field guides listed in the references section of this report. The status of identified species (native or non-native) was also determined through information contained in the field guides and botanical texts. Invasive plant species were identified as they were encountered during the field activities; however, the locations of these species were not mapped with the exception of a large autumn olive infestation at the Buckhorn Addition. In some cases, it was necessary to collect representative specimens to confirm species identification using

botanical keys and herbarium collections. Unidentified species from each survey area were recorded as unknowns, and a specimen was collected, dried, and mounted on herbarium sheets for possible later identification. However, it was not possible to identify some species or classify specimens to the species level in all instances because of the absence of diagnostic characteristics at the time of the field surveys.

Voucher specimens were collected for drooping sedge (*Carex prasina* Wahlenb.) and leafy sedge (*Scirpus polyphyllus* Vahl.) at the Benville Area nature preserve, and for tree groundpine (*Lycopodium dendroideum* Michx.) at the Sugar Creek nature preserve. These specimens are being archived in the Myers Herbarium of the Department of Biological Sciences at Western Illinois University.

Digital photographs were taken using a Cannon G2 digital camera of all documented occurrences of rare plants as well as representative examples of plant communities and unique habitats or conditions at each site. Copies of these photographs are provided on a separate compact disk. A photolog for this report is provided in Appendix 1. During the field surveys, the locations of documented rare plant populations, high quality natural communities, and other unique habitats or feature were recorded using a global positioning system (GPS). A Garmin 12XL and Garmin WAAS-enabled IQUE3600 GPS receiver were used in most instances to map individual points. Positional error of the Garmin receivers was generally 3 to 5 meters. At the Buckhorn Addition, a Corvallis Micro Technology (CMT) handheld GPS receiver (Model MC-GPS) with a post-differential processing accuracy of one to three meters was used to map larger areas of prairie and higher quality wetland habitat. Data collection for all GPS receivers was performed using UTM projection (Zone 15) and North American Datum of 1983 as the map datum. Although the CMT unit was more accurate than the Garmin receivers in open canopy conditions, the rugged terrain and heavy shading from the forest overstory present at all of the sites generally precluded obtaining adequate signal strength for highly-precise, 3-dimensional triangulations of geographic positions.

The field data was downloaded from the GPS receivers on a daily basis, differentially corrected using CMT's PC-GPS software as appropriate, and exported as ARCVIEW shapefiles. Maps of each site with locations of significant features were then generated using ARCVIEW. GPS metadata for the report is contained in Appendix 2 (On CD).

4.0 Results

This section discusses the results of the rare plant survey for the Buckhorn Addition, Sugar Creek site, Little Missouri Creek Dells, and the Benville Area. General descriptions of the conditions and quality of the vegetative communities are also discussed for each survey site.

4.1 Buckhorn Addition

A total of 252 plant species representing 79 families were documented at the Buckhorn Addition site during the field survey (see Table 2– Buckhorn Master List). Notable species observed include shining clubmoss (*Huperzia lucidula* (Michx.) Trevisan), brown widelip orchid, (*Liparis liliifolia* (L.) L.C. Rich. ex Ker-Gawl.) and Northern slender ladies' tresses (*Spiranthes lacera* (Raf.) Raf. var. *gracilis* (Bigelow) Luer.). No state or federally listed rare plants were observed on the site during the field surveys.

Vegetative communities observed at the Buckhorn Addition include dry-mesic forest, mesic hardwoods forest, floodplain forest, emergent herbaceous wetlands, shrub-scrub wetlands, remnant tallgrass prairies, and disturbed old fields (former pastures or abandoned cropland). Small seep-spring communities dominated by bryophytes and various ferns also occur in widely scattered locations across the site. Virtually all of these plant communities have been disturbed to some degree by past human activities and in many areas both the vegetation and soil resources have been significantly degraded. Eroded ravines with deep gullies, compacted soils on uplands, and low-diversity communities dominated by early succesional native species or non-native plants (such as tall fescue and reed canary grass) are generally common features in areas that were heavily impacted by grazing or pasture conversions. There is also a conspicuous absence of advanced regeneration (tree seedlings) in the forest understory in many locations, which suggests that grazing was likely a significant disturbance in the forests of the Buckhorn Addition.

In addition, many of the forested stands across the Buckhorn Addition are also undergoing a slow process of recovery from timber harvesting that appears to have removed most of the larger (and presumably better quality) trees of commercial value. Observations of mature forest canopies, large snags, or large coarse woody debris were relatively uncommon during the field surveys and few overstory trees encountered were larger than about 16 to 18 inches in diameter. However, small trees of coppice or stump sprout origin (particularly oaks) are abundant in many forest stands where past harvesting has occurred.

In general, the most highly disturbed communities tend to be located on the floodplains of Doby Creek and its tributaries where many areas were converted to cool-season pastures. Many of the forested ravines and side slopes located off the main channel of Doby Creek are also heavily disturbed. However, the high degree of spatial variation in the intensity of such disturbances has tended to create a "chaotic" vegetation pattern across the landscape, with the condition and quality of the plant communities often changing significantly on the scale of a 50 to 100 feet (usually when crossing an old fence line or paddock boundary). Numerous small (usually less than 0.25 acre in size) remnants of prairie vegetation are also scattered across the uplands and floodplains of the Buckhorn Addition. These conditions precluded a comprehensive field mapping effort of the vegetative communities within the time allotted for this project. Isolated prairie remnants of higher quality and larger prairies were mapped as they were encountered during the field surveys (see Figure 1). The spatial locations of better quality wetland communities and unique features such as rock outcrops are also shown in Figure 1. Descriptions of "average" conditions of the major types of vegetative communities at the Buckhorn Addition are provided below.

Dry-mesic forest occurs thoughout the Buckhorn Addition on the tabular uplands (those which were not converted to rowcrop agriculture) and upper slopes above Doby Creek and its tributaries. This forest type is particularly prevalent on slopes with south and west aspects and on the noses of some of the ridges between drainages. Dominant overstory species include black oak, post oak, shingle oak (*Quercus imbricaria* Michx.), white oak, bur oak (*Quercus macrocarpa* Michx.), bitternut hickory (*Carya cordiformis* (Wangenh.) K. Koch.), shagbark hickory, and white ash (*Fraxinus americana* L.). Scattered chinkapin oak (*Quercus muehlenbergii* Engelm.) and osage orange (*Maclura pomifera* (Raf.) Schneid.) were also encountered in several locations. Musclewood (*Carpinus caroliniana* Walt.), hazelnut (*Corylus americana* Walt.), American plum (*Prunus americana* Marsh.), Missouri gooseberry (*Ribes missouriense* Nutt.), blackberries (*Rubus spp.* L.), and fragrant sumac (*Rhus aromatica* Ait.) are common in the midstory and shrub layers. Multiflora rose (*Rosa multiflora* Thunb. ex Murr.) is also prevalent in more heavily disturbed stands. Commonly observed species in the herbaceous understory include poverty oat grass (*Danthonia spicata* (L.) Beauv. ex Roemer & J.A. Schultes), Pennsylvania sedge (*Carex pensylvanica* Lam.), woodland sunflower (*Helianthus divaricatus* L.), whorled milkweed (*Asclepias verticillata* L.), zig-zag goldenrod (*Solidago flexicaulis* L.), pussytoes (*Antennaria plantaginifolia* (L.) Hook. and *Antennaria neglecta* Greene), and various bush clovers (*Lespedeza spp.* Michx.). Kentucky bluegrass (*Poa pratensis* L.) is also well-established throughout these communities. Although many of these areas appear to be degraded oak barren communities, better quality habitat was encountered on a west-facing slope in the north-central part of the Buckhorn Addition (northwest of Doby Cemetery).

Multiple fire scars evident on many of the larger oak and hickory trees and the relatively open understory suggest that wildfires or prescribed fires may have affected this location in the recent past.

These dry-mesic forest communities intergrade with mesic hardwoods forest on the side and lower slopes and numerous small ravines present across the site. More extensive areas of mesic hardwoods forest are also found in the extreme southwestern part of the Buckhorn Addition. Dominant overstory species include northern red oak, bur oak, basswood, pignut hickory, shagbark hickory, hackberry (*Celtis occidentalis* L.), walnut (*Juglans nigra* L.), and American elm. Heavily degraded areas of this forest type are typically dominated by elms, honey locust (*Gleditsia triacanthos* L.), and black cherry (*Prunus serotina* Ehrh.). Oddly, sugar maple (*Acer saccharum* Marsh.) trees were encountered at only one location during the field surveys (on a floodplain terrace near the southwest boundary of the property). Dominant midstory trees and shrubs include ironwood (*Ostrya virginiana* (P. Mill.) K. Koch), musclewood, sassafras (*Sassafras albidum* (Nutt.) Nees), multiflora rose, buckbrush (*Symphoricarpos orbiculatus* Moench), poison ivy (*Toxicodendron radicans* (L.) Kuntze), Virginia creeper (*Parthenocissus quinquefolia* (L.) Planch.), and fragrant sumac. Ohio buckeye (*Aesculus glabra* Willd.), hazelnut, and eastern redbud (*Cercis canadensis* L.) are also present on better quality sites. Common species in the herbaceous layer include black snakeroot (*Sanicula canadensis* L.), bedstraws (*Galium spp.* L.), Christmas fern (*Polystichum acrostichoides* (Michx.) Schott), jack-in-the-pulpit (*Arisaema triphyllum* (L.) Schott.), and green dragon (*Arisaema dracontium* (L.) Schott.). A well developed community of spring ephemerals, including wild ginger (*Asarum canadense* L.), jacob's ladder (*Polemonium reptans* L.), mayapple (*Podophyllum peltatum* L.), cut-leaf toothwort (*Cardamine concatenata* (Michx.) Sw.), and wild geranium (*Geranium maculatum* L.), is present in several areas that have a better developed and more mature overstory. However, many of the ravines are heavily eroded and dominated by weedy or early succesional species.

Areas of floodplain forest are not extensive at the Buckhorn Addition due to the apparent conversion of large expanses of floodplain habitat to agricultural pastures. Where present, the overstory of this forest type is typically dominated by an irregular overstory of cottonwood, eastern sycamore, green ash, boxelder, and black willow. Scattered pockets of bur oak, pecan (*Carya illinoinensis* (Wangenh.) K. Koch), walnut, and river birch (*Betula nigra* L.) are also present in some better quality locations. The midstory and shrub layer of this community tend to be rather sparse and dominated by Missouri gooseberry, blackberries, and multiflora rose. The herbaceous layer on the floodplains is often dominated by a monoculture of reed canary grass and tall fescue. More common native species observed in the herbaceous layer in less disturbed areas include hog peanut (*Amphicarpaea bracteata* (L.) Fern.),

moonseed vine (*Menispermum canadense* L.),Virginia wild rye (*Elymus virginicus* L.), bottlebrush grass (*Elymus hystrix* L. var. *hystrix*), Indian woodoats (*Chasmanthium latifolium* (Michx.) Yates), sensitive fern (*Onoclea sensibilis* L.), American bellflower (*Campanulastrum americanum* (L.) Small var. *americanum*), spotted jewelweed (*Impatiens capensis* Meerb.) and Virginia waterleaf (*Hydrophyllum virginianum* L.).

Wetland communities (other than floodplain forest) encountered at the Buckhorn Addition include small, widely scattered pockets of emergent herbaceous and scrub-shrub vegetation across the floodplains of Doby Creek and its tributaries. The best quality example of an emergent wetland is an isolated wetland about 0.25 acres in size located just west of the bridge over Doby Creek along the northern boundary of the site (see Figure 1). Species present at this location include sweet flag, rattlesnake manna grass (,*Glyceria canadensis* (Michx.) Trin.), fox sedge (*Carex vulpinoidea* Michx.), Short's sedge (*Carex shortiana* Dewey), horsetail rush (*Equisetum hyemale* L. var. *affine* (Engelm.) A.A. Eat.), spotted water hemlock (*Cicuta maculata* L.), and wingstem (*Verbesina alternifolia* (L.) Britt. ex Kearney). Another higher quality emergent wetland is located on a floodplain terrace of Doby Creek downslope of a large prairie remnant (Doby Prairie). Species present in this wetland include, sharpwing monkeyflower (*Mimulus alatus* Ait.), fowl manna grass (*Glyceria striata* (Lam.) A.S. Hitchc.), Giant goldenrod (*Solidago gigantea* Ait.), fox sedge, wingstem, Virginia water horehound (*Lycopus virginicus* L.), and marsh hedgenettle (*Stachys palustris* L.). Most of the emergent wetlands encountered intergrade with scrub-shrub communities along streambanks and on low alluvial deposits within the main channel of Doby Creek. These wetlands are commonly dominated by black willow (*Salix nigra* Marsh.), sandbar willow (*Salix interior* Rowlee), and boxelder, with a sparse herbaceous layer due to frequent flooding and scour within the stream channel. Spatial locations of larger examples of this community type are shown in Figure 1. Most of these communities were not identified on the NWI map for the Buckhorn Addition.

Degraded seep-spring wetlands are also found in widely scattered locations in forested ravines and various slope positions across the Buckhorn Addition. More commonly observed species in these seeps include fragile fern, sensitive fern, Christmas fern, toothed plagiomnium moss (*Plagiomnium cuspidatum*), spotted jewelweed, horsetail rush (*Equisetum arvense* L.), cinnamon fern (*Osmunda cinnamomea* L.) and maidenhair fern (*Adiantum pedatum* L.). A better quality example of this community type is found on a small bluff above Doby Creek in the extreme southwest part of the site. The steep and unstable slope of the rock outcrop likely protected this site from grazing by cattle. Most of the other seeps encountered at the Buckhorn Addition are located in obviously disturbed and degraded

areas. In addition, the creation of stock ponds likely destroyed some seeps and other wetland communities that were once located in the headwaters of tributary drainages to Doby Creek.

Despite the pervasive nature of past disturbances, prairie remnants of varying degrees of quality are relatively common on the uplands above Doby Creek and larger tributary drainages. Most of these remnants are small (less than 0.25 acre in size) and often isolated in a matrix of forest vegetation. However, a series of larger prairies was mapped along the west-facing bluffs to the south and north of Doby Cemetary (see Figure 1). In addition, a large prairie is present in along the northern boundary of the property. A few isolated patches of prairie vegetation also occur on the broad floodplain of Doby Creek in the central part of the Buckhorn Addition. Better quality examples of this community type include native grasses such as big bluestem (*Andropogon gerardii* Vitman.), Indiangrass (*Sorghastrum nutans* (L.) Nash.), Virginia wild rye, and little bluestem (*Schizachyrium scoparium* (Michx.) Nash). Native forbs commonly encountered on better quality sites include Canada goldenrod (*Solidago canadensis* L.), Wild Bergamont (*Monarda fistulosa* L.), slender mountain mint (*Pycnanthemum tenuifolium* Schrad.), prairie ironweed (*Vernonia fasciculata* Michx.), blazing star (*Liatris aspera* Michx.), slender bush clover (*Lespedeza virginica* (L.) Britt.), and purple coneflower (*Echinacea purpurea* (L.) Moench). Leadplant (*Amorpha canescens* Pursh), partridge pea (*Chamaecrista fasciculata* (Michx.) Greene var. *fasciculata*), prairie dock, Carolina rose (*Rosa carolina* L.), and gray goldenrod (*Solidago nemoralis* Ait.) are also locally abundant in a few of the prairies. A large population of pale purple coneflower (*Echinacea pallida* (Nutt.) Nutt.) was also documented in one of the better quality areas.

Although prescribed burns have been conducted some of the larger prairies, oak saplings and shrubs such as rough leaf dogwood (*Cornus drummondii* C.A. Mey.), blackberries, and multiflora rose are invading the margins of many remnant prairies across the site. Autumn olive (*Elaeagnus umbellata* Thunb.), a non-native invasive shrub, has also started to invade the larger of the prairies near Doby Cemetery (Doby prairie). Most of the smaller and isolated prairies do not appear to have be burnt or mowed recently and will likely succeed to forest vegetation without future maintenance.

Numerous old fields (formerly cultivated fields) are also located on the tabular uplands above Doby Creek. Although typically low in species diversity and often dominated by monocultures of Canada goldenrod, native grasses such Indiangrass and big bluestem are invading old fields in several locations. These areas would serve as excellent areas for potential prairie restoration projects.

4.2 Sugar Creek Site

A total of 104 plant species representing 54 families were documented at the Sugar Creek site during the field survey (see Table 3– Sugar Creek Master List). Notable species observed include *Lycopodium dendroideum* and *Huperzia lucidula var. lucidula.* Vegetative communities present at the site include seep-springs, mesic hardwoods forest, floodplain forest, and dry-mesic hardwoods forest. Several seep-springs occur in the central part of the site along the intermittent tributary to Sugar Creek. Both of the larger examples of this community type are located on the south side of the ravine on steep mid-slopes and concave lower slopes with north to northeast aspects (see Figure 2). Small pockets of muck soils occur in several locations within the seeps. Although occurring within a matrix of mesic hardwoods forest, the seeps are generally dominated by herbaceous vegetation with a notable absence of woody shrubs or trees in areas of saturated or mucky soils. Dominant species observed within the seeps include *Huperzia lucidula var. lucidula* (formerly known as *Lycopodium lucidulum*), cinnamon fern , interrupted fern (*Osmunda claytoniana* L.), Polytrichum spp., and various other bryophytes.

Mesic hardwoods forest occurs along the length of the ravine on middle and lower slope positions. The forest overstory of this community type is dominated by moderately large (16 to 18 inches in diameter) sugar maple, basswood, northern red oak, and white oak trees. In contrast to the seep-spring communities, the forest understory layer is somewhat sparse and densely shaded by a well-defined and diverse midstory layer of sugar maple, Florida dogwood (*Cornus florida* L.), eastern redbud (*Cercis canadensis* L.), ironwood, and musclewood trees and bladdernut (*Staphylea trifolia* L.) shrubs. Regeneration of sugar maple trees (primarily seedlings and small saplings) is also dense on the lower and mid-slop positions, particularly in more heavily shaded locations.

This mesic hardwoods forest intergrades with a floodplain forest type on small terraces that occur in the wider portions of the ravine and near the mouth of the ravine at its confluence with Sugar Creek. Dominant species include sycamore (*Platanus occidentalis* L.), green ash, and black walnut in the forest overstory and sassafras and Ohio buckeye in the midstory layer. The cover of the overstory is somewhat patchy and irregular along most of the length of the stream floodplain, with larger canopy openings on the lower floodplain near Sugar Creek. Virginia wild rye, cupplant (*Silphium perfoliatum* L.), and giant ragweed (*Ambrosia trifida* L.) are abundant in the more open areas of the lower floodplain near Sugar Creek.

Dry-mesic hardwoods forest occurs on the upper slopes along the length of the ravine and in a few flat upland locations along the northern and southern margins of the nature preserve (most of the surrounding uplands are in active row crop agricultural production). Mature white oak, black oak, pignut hickory, and white ash are the dominant trees in the forest overstory. Ironwood, sassafras, prickly ash (*Zanthoxylum americanum* P. Mill.), and multiflora rose dominate the midstory and shrub layers. The herbaceous layer is sparse to discontinuous, with several areas of bare soil beneath the forest canopy. Pennsylvania sedge, zig-zag goldenrod, and Virginia snakeroot (*Aristolochia serpentaria* L.) are abundant in the herbaceous layer; oak barren species such as largeflower yellow false foxglove (*Aureolaria grandiflora* (Benth.) Pennell) are also occasionally present. This community type is generally more heavily disturbed than those found on the mid to lower slope positions and on the floodplain of the ravine. Erosion problems were observed in several locations where run-off from adjoining farm fields appears to have accentuated downcutting of side channels into the forest soils. A few firescars were also observed on larger oak trees on the upper slopes on the northwest side of the ravine.

A single population of *Lycopodium dendroideum* was documented at the Sugar Creek site during the field survey for rare plants (See Figure 2). Other areas of potentially suitable habitat (rock outcrops, upper slopes and seeps) were intensively but unsuccessfully searched for this species in May and June 2004. The observed population occurs on the shoulder (concave) and middle portions of a north-facing (358 degree), very steep (50 to 60 degree) slope near one of the larger seeps in the central part of the nature preserve. About 200-250 individual stems were located in the population; it was not possible to determine how many individually-rooted plants were present without significantly disturbing the site. The *Lycopodium dendroideum* plants are growing in a lightly to moderately shaded location beneath a gap in the canopy of the forest overstory. Common associates of this species were cinnamon fern and Interrupted fern. Although storm damage had recently broken the tops and uprooted several large trees in the vicinity, no immediate threats were observed to the *Lycopodium dendroideum* population. However, the slopes of the adjoining seep were observed to be unstable, with several slump blocks and areas that likely experience periodic mass slope failure.

In addition to natural erosion processes, stormwater events mediated by human land uses appear to be a cause of active bank sloughing and channel incision throughout the Sugar Creek nature preserve. These periodic, high-volume surges of run-off are apparently responsible for movement of a large volume of sediment and deposition of more than 24 inches of mud within the lower reaches of the ravine channel during the period of May to June 2004. The sediment plume likely extends into (or will eventually reach) the channel of Sugar Creek itself. Surface run-off and sheet erosion from surrounding farm fields appears

to be the source for at least some of this sediment deposition. Gully formation was also observed on the forested upper slopes in several areas that are receiving storm water run-off from the adjacent fields.

4.3 Little Missouri Creek Dells

A total of 96 plant species representing 41 families were documented at the Little Missouri Creek Dells site during the field survey (see Table 4 – LMC Master List). Notable species observed include southern rusty black haw (*Viburnum rufidulum* Raf.) and blue ash (*Fraxinus quadrangulata* Michx.). No occurrences of rare plants were observed during the field survey.

Vegetative communities present at this privately-owned nature preserve include mesic hardwoods forest, dry-mesic forest, seep-springs, and floodplain forest. Areas of early-successional hardwoods forest and shrub thickets occur on the uplands located on the west side of Little Missouri Creek. In general, significant compositional and structural diversity was observed between plant communities across the site due to pronounced variations in topography and moisture regimes. The intensity and types of past disturbances to vegetation also appears to vary considerably between the east and west sides of Little Missouri Creek.

On the east side of the creek, a dry-mesic forest type dominated by white oak, shagbark and pignut hickory, and sugar maple occurs on the upper slopes and flatter portions of the uplands. The forest overstory in these areas appears to be about 40 to 60 years old, with a somewhat sparse understory that suggests past grazing pressure (an old pasture fence was found near the preserve boundary). This community type intergrades with a relatively undisturbed mesic hardwoods forest dominated by northern red oak, sugar maple, and basswood located on the steep slopes and rock outcrops above Little Missouri Creek. Both the forest midstory and understory layers are highly diverse and do not appear to have been significantly impacted by past agricultural activities (the area was likely fenced to keep cattle away from the steep slopes and cliffs). Dominant midstory trees and shrub species include musclewood, Ohio buckeye, eastern redbud, bladdernut, and fragrant sumac. More common herbaceous species include hog peanut, Brittle bladderfern (*Cystopteris fragilis* (L.) Bernh.), maidenhair fern, enchanter's nightshade (*Circaea lutetiana* L. ssp. *canadensis* (L.) Aschers. & Magnus), wild ginger, mayapple, golden alexander (*Zizia aurea* (L.) W.D.J. Koch), and various bedstraws. The rock outcrops and small forested seeps also support a diverse bryophyte community as well as plants with more southern affinities such as southern rusty black haw.

Several small (less than 0.25 acre in size) openings occur in the forest overstory on the east side of Little Missouri Creek. These canopy breaks are generally located on the steeper parts of the side slopes or upper slope positions in areas of seeps, slump blocks and rocky talus slopes. Several of the seeps support wet prairie vegetation with a number of characteristic species including rice cutgrass, fowl mannagrass, yellow jewelweed, and common elderberry (*Sambucus nigra* L. ssp. *canadensis* (L.) R. Bolli).

The vegetative communities located on the uplands on west side of Little Missouri Creek appear to be both drier and more heavily disturbed than the forests on the east side of the creek. Most of the overstory is dominated by relatively young forest (4 to 8 inches in diameter) consisting of post oak, shingle oak, black oak, black cherry, and slippery elm. A few scattered osage orange trees were also observed along what appears to be an old roadbed or skid trail. In addition, a small area of rocky soils and bedrock outcrop supports slightly larger (12 to 14 inch diameter) shagbark hickory, white oak, and sugar maple trees. Forest midstory and understory conditions are also highly variable on the west side of the creek, suggesting that the upland may have been more open or possibly grazed in the past. Dominant midstory tree species include sugar maple, eastern red cedar (*Juniperus virginiana* L.), and sassafras. An area about one acre in size that once appears to have been more open is now dominated by a thicket of rough-leaved dogwood, blackberries, multiflora rose, and shrubby St. John's wort (*Hypericum prolificum* L.). Fragrant sumac and Missouri gooseberry are also locally dominant shrubs. Dominant herbaceous species on the forested areas of the upland include poverty oat grass, black snakeroot, and Pennsylvania sedge. Disturbed openings also contain remnants of grassland vegetation such as mountain mint, wild bergamont, round-headed bush clover (*Lespedeza capitata* Michx.), and yarrow (*Achillea millefolium* L.).

A disturbed floodplain forest community also occurs in the central portions of the nature preserve. This community type is located primarily on a relatively flat terrace on the west side of Little Missouri Creek; most of the eastern bank is extremely steep and lacks a floodplain (see Figure 4). The forest overstory on the terrace is somewhat discontinuous and contains several larger openings that are dominanted by herbaceous vegetation. Dominant overstory tree species on the include mature eastern sycamore, silver maple, bitternut hickory, pecan, and bur oak. Aside from a few scattered honey locust trees, a well-defined midstory layer is generally absent from this community type. Scattered shrubs present on the floodplain include hazelnut, multiflora rose, bladdernut, and Missouri gooseberry. The understory layer on the terrace is relatively diverse, suggesting that the upper parts of the floodplain terrace do not receive regular inundation for prolonged periods of time. Dominant herbaceous species include Virginia wild rye, hog peanut, cup plant, and wood nettle(*Laportea canadensis* (L.)). The lower floodplain and channel

of Little Missouri Creek itself is rocky and generally lacking vegetative cover other than a few weedy species such as lambs quarters and curly dock.

No occurrences of *Poa wolfii* or *Trifolium reflexum* plants were documented during the rare plant survey. Unfortunately, the INAI records for the preserve do not provide precise spatial data or descriptions where the rare plants were originally observed on the site. However, it would appear that suitable habitat for both species (oak barrens and dry woodlands) is generally lacking on the east side of Little Missouri Creek. Understory conditions on the west side of the creek appear to have been more open in the past, but are probably now too heavily shaded by shrubs and small trees to support populations of either *Poa wolfii* or *Trifolium reflexum.*

4.4 Benville Area

A total of 47 plant species representing 28 families were documented at the Benville site during the field survey (see Table 5 – Benville Master List). Notable species observed include *Carex prasina* and *Scirpus polyphyllus.*

Vegetative communities present at the site include sedge meadows, shrub-carr wetlands, forested seep-springs, floodplain forest, mesic hardwoods forest, and dry-mesic hardwoods forest. The primary sedge meadow is located within the eastern part of the nature preserve in a wider, gently sloping portion of the valley floor. Dominant species include various bulrushes (*Scripus sp.*) and sedges (*Carex sp.*), horsetail rush, boneset, rice cutgrass, and fowl mannagrass. This community intergrades with a shrub-carr wetland dominated by black willow, sandbar willow, elderberry shrubs, and common cattails. A limited amount of immature floodplain forest dominated by sycamore, walnut, and green ash also occurs along the western margins and immediately upstream of this wetland. Further upstream, in the central part of the nature preserve, a second sedge meadow dominated by *Carex sp.* and *Scirpus sp.* occurs on a sandy terrace located at the junction of the main stream and a small tributary channel.

Further upstream, mesic hardwoods forests dominated by white oak, northern red oak, sugar maple, American elm, basswood, and shagbark hickory occur along the margins of the stream channel and on lower slope positions. Musclewood, ironwood, redbud, and flowering dogwood dominate the forest midstory in these locations. This forest type grades into a dry-mesic forest dominated by mature northern red oak, hickories, and sassafras on the mid and upper slope positions. The forest midstory is generally sparse on the upper slope positions. Forested seeps occur in several areas on the side slopes, margins of

the stream channel, and in small tributary channels of the main stream. Where seeps are present, the understory herbaceous layer is generally lush and dominated by species such as Christmas fern, sensitive fern (*Onoclea sensibilis* L.), baneberry (*Actaea pachypoda* Ell), bloodroot (*Sanguinaria canadensis* L.), and honewort (*Cryptotaenia canadensis* (L.) DC.). Several populations of goldenseal were also noted within the nature preserve. The herbaceous layer on the mid and upper slopes is otherwise sparse and dominated by Virginia creeper, elm leaved goldenrod (*Solidago ulmifolia* Muhl. ex Willd.), greenbriar, and brittle bladderfern.

Most of the vegetative communities present at the Benville area generally appear to be relatively undisturbed by agriculture or other recent human activities. However, anthracnose appears to be affecting the health of many of the flowering dogwood trees along the length of the ravine. In addition, dieback was observed in the crowns of several mature northern red oak trees on mid and upper slope positions; it was not possible at the time of the field survey to determine if oak wilt was responsible for these conditions.

Several healthy populations of *Carex prasina* and *Scirpus polyphyllus* were documented at the Benville Area during the field survey for rare plants (See Figure 4). The largest number of *Scripus polyphyllus* individuals (>50 plants) were observed growing in open canopy conditions of the sedge meadow located near the eastern boundary of the site. Upstream of this location, two other distinct populations of *Scirpus polyphyllus* were also found in lightly shaded conditions within the stream floodplain environment; each of these populations contained 20 to 25 plants.

Similarly, most *Carex prasina* plants were located in light to moderately shaded forest environments. Seven distinct populations of this species were documented at the site along the margins of the main stream channel, on small floodplain terraces, or at the bases of small seeps. Most occurrences of *Carex prasina* were in small groups of 5-10 plants. However, a larger population (>25 plants) was located under a larger canopy gap at the head of a ravine near the center of the site. A population of *Scirpus polyphyllus* was also observed growing in close proximity to *Carex prasina* at this same location and the head of another side channel along the main stream channel.

None of the observed rare plant populations appeared to be directly or immediately threatened by grazing, erosion, or other human induced impacts. However, encroachment of woody shrubs and trees was noted in the sedge meadow/shrub-carr wetland that supports the largest *Scripus polyphyllus* population. A minor amount of common cattail (*Typha latifolia* L.) is present on the margins of the sedge meadow.

Multiflora rose is also present in this habitat and in scattered locations across the rest of the site. Sugar maple is prevalent in the understory of the dry-mesic forest located on the side slopes adjacent to the stream channel. Although Mohlenbrock (2001, 1999a) reports that both *Carex prasina* and *Scirpus polyphyllus* occur in low or rich woodlands in Illinois, neither species is likely tolerant of deep shade and therefore controlling competition for light resources may be a future concern for maintaining the health of the rare plant populations.

5.0 Recommendations

This section discusses recommendations for natural resource management and other land use practices to protect rare plant species and sensitive or unique plant communities identified at the Buckhorn, Sugar Creek, Little Missouri Creek Dells, and Benville Area sites during the field surveys. In addition, suggestions for future monitoring and additional studies are provided for each site.

5.1 Buckhorn Addition

As discussed in earlier sections, most of the vegetative communities found on the Buckhorn site have been heavily disturbed by past land use activities (row crop agriculture, grazing, and timber harvesting). In addition, historic alteration of natural disturbance regimes associated with wildland fire has likely contributed to the further degradation of native plant communities across the site. Contemporary browse pressure from white-tailed deer may also be adversely impacting the diversity of native forest herbs as well as regeneration of desired native tree species such as oaks.

Restoration of the entire site to native vegetation would entail a significant, long-term effort, particularly for forest communities composed primarily of early succesional and weedy species or grassland (former pasture) areas currently dominated by non-native, cool-season species such as tall fescue and smooth brome. However, more cost-effective restoration efforts that include the expanded use of prescribed fire and control of invasive plant species could be directed towards better quality areas that currently support prairie and oak barrens remnants. In addition to the re-introduction of fire, physical manipulation (e.g., thinning and removal of selected trees) of the forest canopy may also be necessary to restore the structure and function of more degraded oak barren communities (Nielson and others 2003). Similarly, old fields and disturbed grassland areas that contain a native grass and forb component could also be targeted for enhancement to encourage faster development of true prairie vegetation.

Although the forest communities present across the site generally appear to be relatively young, quantitative studies of the age-structure of the forest canopy would be useful to formally characterize the disturbance history of the Buckhorn Unit and develop more specific forest management and restoration recommendations. Such studies could also explain the curious lack of sugar maple within the forest understory and midstory layers across most of the site. In addition, a routine monitoring program should be established to facilitate the early detection and control of any future infestations of invasive species, as well to track general observations of ecosystem health conditions.

Consideration should also be given towards future acquisitions that would enhance the biological diversity of the Buckhorn Addition. During the field surveys, a number of better-than-average quality natural communities were observed along the southern boundary of the state-owned land. Most of these sites are located in the eastern parts of Section 16 or the western parts of Section 15 of Buckhorn Township and associated with the floodplain and channel of Doby Creek. Unique or good quality habitat observed at these locations includes remnant barrens, rocky bluffs, and waterfalls, as well as pool and riffle aquatic habitat. In the same area, a small, high-quality remnant prairie was also observed on the south-facing nose of a bluff above Doby Creek, about 200 feet off the southeast the boundary of the Buckhorn Addition.

5.2 Sugar Creek Site

Although the *Lycopodium dendroideum* population at this site appears to be relatively stable, its restricted distribution (one location) and exposed position make it susceptible to erosion and mass movement (slumping) of the steep slopes. The population should therefore be protected from ground disturbances and periodically monitored for potential threats stemming from slope instability.

In addition to potential impacts to the rare plant population, the effects of erosion and sedimentation constitute a significant threat to both the ecological integrity of the Sugar Creek site as a whole and the aquatic resources present in the downstream watershed of Sugar Creek. These threats should be reduced or mitigated if possible through development and implementation of a storm water management plan. The plan should address threats from channel erosion and bank sloughing within the stream and tributaries of the nature preserve, as well as downstream movement of the sediment plume into the main channel of Sugar Creek. Best management practices and mitigation measures should also be implemented to prevent gully formation and sediment deposition on the upper slopes and upland areas

adjacent to the surrounding farm fields. In addition, the plan should address removal of trash, large appliances, and other debris from the headwaters of the watershed.

5.3 Little Missouri Creek Dells

Strategies for future management of this nature preserve should be tailored to the unique ecological conditions encountered on either side of Little Missouri Creek. On the east side of the stream valley, the relatively undisturbed plant communities present on the seeps, rock outcrops and boulders should continue to be protected from grazing and excessive trampling. Reduction of the browse pressure and traffic from white-tailed deer would allow vegetation in the numerous small seeps to recover; fencing may be appropriate for some of the more sensitive areas.

On the west of the stream channel, ecological restoration should be considered for the more heavily disturbed portions of the floodplain and surrounding uplands. Multiflora rose shrubs present on both the floodplain and uplands should be controlled to prevent their further spread across the nature preserve. In addition, consideration should be given towards removal of the dogwood thickets that have developed on the uplands in areas of potentially suitable *Poa wolfii* habitat. Re-introduction of fire should also be considered for these areas, as well as the degraded barren communities present on the uplands.

If not completed already, a survey of Little Missouri Creek for aquatic resources (primarily invertebrates) and water quality should be undertaken. Suitable habitat may also be present along the rocky bluffs of the Dells for timber rattlesnakes (*Crotalus horridus*). A periodic monitoring program for invasive species and forest health is also recommended for the entire site.

5.4 Benville Area

Given the relatively high quality conditions of the sedge meadows observed during the field survey, future management of the Benville Area nature preserve should focus primarily on sustaining suitable conditions for the rare plant populations present at this site. The rare plant populations should continue to be protected from grazing and other ground-disturbing activities that could negatively impact individual plants or soil resources. Encroachment of shrubs such as willows (*Salix sp.*), dogwoods (*Cornus sp.*) and other woody plants into *Carex prasina* and *Scirpus polyphyllus* populations also should be limited, using manual controls if possible. In addition, it would be advisable to eradicate the multiflora rose plants

found on upland areas of the site to prevent their spread into habitats currently occupied by the rare plant populations.

Although multiflora rose was the only problematic invasive species observed within the nature preserve, the site should be monitored periodically to facilitate early detection and control of any new infestations that may threatened the rare plant populations. It may also be useful to conduct a study to evaluate potential succesional trajectories and community-level changes that could occur from senescence of larger trees in the forest overstory.

6.0 References

Carbonneau, L.E., and S.D. Allen. 1995. *Botanical Reconnaissance of the Bowl Research Natural Area.* General Technical Report NE-189. U.S. Department of Agriculture (USDA) Forest Service, Northeastern Forest Experiment Station.

Chadde, S.W. 2002. A Great Lakes Wetlands Flora. Laurium, Michigan: Pocketflora Press.

Crow, G.E., and others. 1994. *Botanical Reconnaissance of Mountain Pond Research Natural Area.* General Technical Report NE-187. USDA Forest Service, Northeastern Forest Experiment Station.

Gleason, H.A. and A. Cronquist. 1991. Manual of Vascular Plants of Northeastern United States and Adjacent Canada, 2nd Edition. Bronx, New York: New York Botanical Garden.

Kruse, G. 1993. Methods for surveys of Illinois Endangered and Threatened Species. Springfield, Illinois: Illinois Department if Conservation, Division of Natural Heritage.

Kucera, C.L. 1998. The Grasses of Missouri, Revised Edition. Columbia, Missouri: University of Missouri Press.

Kurz, D. 1997. *Shrubs and Woody Vines of Missouri.* MDC. Jefferson City, Missouri.

Mohlebrock, R.H. 2002. Vascular Flora of Illinois. Carbondale, Illinois: Southern Illinois University Press.

-. 2002a. The Illustrated Flora of Illinois. Grasses: Bromus to Paspalum, 2nd Edition. Carbondale, Illinois: Southern Illinois University Press.

-. 2001. The Illustrated Flora of Illinois. Sedges: Cyperus to Scleria, 2nd Edition. Carbondale, Illinois: Southern Illinois University Press.

-. 1999a. The Illustrated Flora of Illinois. Sedges: Carex. Carbondale, Illinois: Southern Illinois University Press.

-. 1999b. The Illustrated Flora of Illinois. Ferns, 2nd Edition. Carbondale, Illinois: Southern Illinois University Press.

-. 1973. The Illustrated Flora of Illinois. Grasses: Panicum to Danthonia. Carbondale, Illinois: Southern Illinois University Press.

Moorehouse, A.K. and D. Corgiat. 2003. A proposal for registration of Rovert A. Evers Reserve as an Illinois registered land and water reserve. Illinois Department of Natural Resources and Illinois Nature Preserves Commission. INPC 180, Item 9.

Moorehouse, A.K. 2003. Site management schedule for registered reserve – management goals. Illinois Nature Preserve Commission. Unpublished report.

Nielson, S., C. Kirschbaum and A. Haney. 2003. Restoration of Midwest oak barrens: structural manipulation or process-only? Conservation Ecology. 7(2): 10 [online article http://www.consecol.org/vol7/iss2/art10]

Stannard, L.J and R.A. Evers. 1975. Report on Siloam Springs State Park (Adams & Brown Co., Illinois) Hilltop Prairies. Urbana, Illinois: Illinois Natural History Survey. INPC 57, Item 11.

State of Illinois. 2000. A Field Guide to the Wetlands of Illinois, 2nd Edition. Springfield, Illinois: Illinois Department of Natural Resources.

Steyermark, J.A. 1963. *Flora of Missouri.* Iowa State University Press. Ames, Iowa.

Warnock, J. 1974. Brown County, Illinois Nature Preserve and Natural Resources Land Survey. Macomb, Illinois: Western Illinois University.

Yatskievych, George. 1999. Steyermark's Flora of Missouri. Volume 1. Jefferson City and St. Louis, Missouri: Missouri Department of Conservation and Missouri Botanical Garden Press

Table 2. Buckhorn Addition Master Species List

Scientific Name	Common Name	Family	Habitat(s)	Remarks
Herbaceous Plants				
Acorus calamus L.	Sweetflag	Acoraceae	Emergent wetland	
Cicuta maculata L.	Spotted water hemlock	Apiaceae	Emergent wetland	
Conium maculatum L.	Poison hemlock	Apiaceae	Disturbed field edges	
Erigenia bulbosa (Michx.) Nutt.	Harbinger of spring	Apiaceae	Mesic forested slopes	
Sanicula canadensis L.	Canadian black snakeroot	Apiaceae	Dry to mesic upland woods	
Apocynum androsaemifolium L.	Spreading dogbane	Apocynaceae	Prairie remnant	
Apocynum cannabinum L.	Common dogbane	Apocynaceae	Old fields, Prairie remnants, Dry Upland woods	
Arisaema dracontium (L.) Schott.	Green dragon	Araceae	Mesic forested slopes, forested floodplains	
Arisaema triphyllum (L.) Schott.	Jack-in-the-pulpit	Araceae	Emergent/shrub-shrub wetland	
Aralia nudicaulis L.	Wild sarsaparilla	Araliaceae	Mesic woods	
Asarum canadense L.	Wild Ginger	Aristolochiaceae	Mesic Woods	
Asclepias hirtella (Pennell) Woods	Tall green milkweed	Asclepiadaceae	Prairie remnants	
Asclepias quadrifolia Jacq.	Fourleaf milkweed	Asclepiadaceae	Dry upland woods	
Asclepias syriaca L.	Common milkweed	Asclepiadaceae	Prairie remnants, old fields	
Asclepias verticillata L.	Whorled milkweed	Asclepiadaceae	Prairie remnants	
Asplenium platyneuron (L.) B.S.P.	Ebony spleenwort	Aspleniaceae	Prairie remnant; oak barren remnants	
Achillea millefolium L.	Common yarrow	Asteraceae	prairie remnants; olf fields	
Ageratina altissima (L.) King & H.E. Robins. var. *altissima*	White snakeroot	Asteraceae	Oak Barren remnants	*Eupatorium rugosum* Houtt.
Ambrosia artemisiifolia L.	Common ragweed	Asteraceae	Field edges, old fields; disturbed forest	
Ambrosia trifida L.	Giant ragweed	Asteraceae	open floodplains	
Antennaria neglecta Greene	Field pussytoes	Asteraceae	prairie remnants	
Antennaria plantaginifolia (L.) Hook.	Plantain leaf pussytoes	Asteraceae	Prairie remnant	
Arctium minus Bernh.	Lesser burdock	Asteraceae	floodplains throughout site	Introduced

Bidens aristosa (Michx.) Britt.	Bearded beggarticks	Asteraceae	Prairie remnants/open floodplain	
Cirsium vulgare (Savi) Tenore	Bull thistle	Asteraceae	Prairie remnants, old fields	Introduced
Coreopsis palmata Nutt.	Prairie coreopsis/stiff tickseed	Asteraceae	prairie remnants; remnant barrens	
Echinacea pallida (Nutt.) Nutt.	Pale purple coneflower	Asteraceae	Prairie remnants	
Echinacea purpurea (L.) Moench	Eastern purple coneflower	Asteraceae	Prairie remnants	
Erigeron philadelphicus L.	Daisy fleabane	Asteraceae	dry to mesic woods	
Eupatorium serotinum Michx.	Late flowering thoroughwort	Asteraceae	Dry to mesic upland woods	
Helenium autumnale L.	Sneezeweed	Asteraceae	Emergent wetlands	
Helianthus divaricatus L.	Woodland sunflower	Asteraceae	South slopes	
Helianthus grosseserratus Martens	Sawtooth Sunflower	Asteraceae	Prairie remnants; dry upland forests	
Helianthus hirsutus Raf.	Hispid sunflower	Asteraceae	remnant barrens	
Heliopsis helianthoides (L.) Sweet	Smooth oxeye sunflower	Asteraceae	Open floodplains	
Hieracium gronovii L.	Hairy hawkweed/queen devil	Asteraceae	Barren remnants	
Krigia biflora (Walt.) Blake	Twoflower dwarf dandelion	Asteraceae	Mesic Woods	
Leucanthemum vulgare Lam.	Oxeye daisy	Asteraceae	prairie remnants; old fields	introduced
Liatris aspera Michx.	Tall or rough blazing star	Asteraceae	remnant barrens	
Rudbeckia subtomentosa Pursh	Sweet black-eyed susan/sweet coneflower	Asteraceae	Prairie remnants	
Rudbeckia triloba L.	Browneyed susans	Asteraceae	Dry to mesic woods; Forest floodplain	
Silphium perfoliatum L.	Cup-plant	Asteraceae	Prairie remnants/ Floodplains	
Silphium terebinthinaceum Jacq.	Prairie dock	Asteraceae	Prairie remnants	
Solidago canadensis L.	Canada golderod	Asteraceae	Emergent wetlands; prairie remnants; old fields	
Solidago flexicaulis L.	Zig-zag goldenrod	Asteraceae	Dry upland woods	
Solidago gigantea Ait.	Giant goldenrod	Asteraceae	Emergent wetland	
Solidago nemoralis Ait.	Gray goldenrod	Asteraceae	Prairie remnants	
Solidago ulmifolia Muhl. ex Willd.	Elm-leaved goldenrod	Asteraceae	Oak Barren remnants	
Symphyotrichum anomalum (Engelm.) Nesom	Manyray aster	Asteraceae	prairie remnants/dry woodlands	*Aster anomalus* Engelm.
Symphyotrichum laeve (L.) A.& D. Löve var. *laeve*	Smooth aster	Asteraceae	Prarie remnants	*Aster laevis* L.
Symphyotrichum novae-angliae (L.) Nesom	New England Aster	Asteraceae	Prairie remnants	*Aster novae-angliae* L.

Silphium terebinthinaceum Jacq.	Paririe dock or rosinweed	Asteraceae	Prairie remnants	
Verbesina alternifolia (L.) Britt. ex Kearney	Wingstem	Asteraceae	Emergent wetland	
Vernonia fasciculata Michx	Prairie ironweed	Asteraceae	Prarie remnants	
Xanthium strumarium L.	Cocklebur	Asteraceae	Old fields; open floodplains	
Impatiens capensis Meerb.	Spotted jewelweed	Balsaminaceae	Emergent wetland	
Podophyllum peltatum L.	Mayapple	Berberidaceae	Mesic forested slopes	
Buglossoides arvensis (L.) I.M. Johnston	Corn gromwell	Boraginaceae	Dry upland woods	*Lithospermum arvense* L., Introduced
Cardamine concatenata (Michx.) Sw.ata Muhl.	Cutleaf toothwort	Brassicaceae	Mesic forested slopes	
Campanulastrum americanum (L.) Small var. *americanum*	American bellflower	Campanulaceae	Dry to mesic upland woods	
Lobelia inflata L.	Indian tobacco	Campanulaceae	Floodplain; remnant barrens	
Lobelia spicata Lam. var. *spicata*	Pale spiked lobelia	Campanulaceae	prairie remnants	
Triodanis perfoliata (L.) Nieuwl.	Venus's looking glass	Campanulaceae	Disturbed field edges	
Dianthus armeria L.	Deptford pink	Caryophyllaceae	remnant prairies	Introduced
Hypericum prolificum L.	Shrubby St. John's Wort	Clusiaceae	Prairie remnants	Hypericum spathulatum (Spach) Steud.
Hypericum punctatum Lam.	Spotted St. John's wort	Clusiaceae	Dolby Cemetray; prairie remnants	
Tradescantia ohiensis Raf	Ohio spiderwort/bluejacket	Commelinaceae	Dry upland woods, field edges	
Convolvulus arvensis L.	Field bindweed	Convolvulaceae	Field edges, distrubed woods	Introduced
Carex blanda Dewey	eastern woodland sedge	Cyperaceae	Dry to mesic woods	Carex laxiflora Lam. var. *blanda* (Dewey) Boott
Carex bushii Mack.	Bush's sedge	Cyperaceae	Dry woods/oak barren remnants	
Carex pensylvanica Lam.	Pennsylvania sedge	Cyperaceae	Oak Barren remnants	
Carex shortiana Dewey.	Short's Sedge	Cyperaceae	Emergent wetland, Forest floodplains	
Carex vulpinoidea Michx.	Fox sedge	Cyperaceae	Emergent wetland	
Cyperus esculentus L.	Chufa flatsedge	Cyperaceae	Forest floodplain	
Scirpus atrovirens Willd.	Green bulrush	Cyperaceae	Open floodplains	
Scirpus pendulus Muhl.	Nodding bulrush	Cyperaceae	Open floodplains	
Dioscorea villosa L.	Wild yam	Dioscoreaceae	mesic woods	
Athyrium filix-femina (L.) Roth	Lady fern	Dryopteridaceae	Mesic woods; forest floodplains	

Cystopteris protrusa (Weatherby) Blasdell	Fragile fern/lowland bladderfern	Dryopteridaceae	South slopes	
Onoclea sensibilis L.	Sensitive fern	Dryopteridaceae	Emergent wetlands; forest floodplains	
Polystichum acrostichoides (Michx.) Schott	Christmas fern	Dryopteridaceae	Mesic forested slopes	
Equisetum arvense L.	Common horsetail rush	Equisetaceae	Emergent wetlands	
Equisetum hyemale L. var. *affine* (Engelm.) A.A. Eat.	Scouringrush horsetail	Equisetaceae	Floodplain, emergent wetlands	
Croton monanthogynus Michx.	Prairie tea	Euphorbiaceae	Prairie remnants	
Euphorbia corollata L.	Prairie spurge	Euphorbiaceae	remnant barrens	
Amorpha canescens Pursh	Leadplant	Fabaceae	prairie remnants	
Amphicarpaea bracteata (L.) Fern.	American hogpeanut	Fabaceae	Emergent wetland	
Baptisia alba (L.) Vent.	White wild indigo	Fabaceae	Prairie remnants	
Chamaecrista fasciculata (Michx.) Greene var. *fasciculata*	Partridge pea/sleepingplant	Fabaceae	Prairie remnants	*Cassia fasciculata* Michx.
Desmodium cuspidatum (Muhl. ex Willd.) DC. ex Loud.	Largebract ticktrefoil	Fabaceae	Dry to mesic upland woods	
Desmodium glutinosum (Muhl. ex Willd.) Wood	Pointed tick trefoil	Fabaceae	Upland woods	
Desmodium illinoense Gray	Illinois ticktrefoil	Fabaceae	remnant barrens, dry upland woods	
Desmodium laevigatum (Nutt.) DC.	Smooth ticktrefoil	Fabaceae	Prairie remnants	
Desmodium pauciflorum (Nutt.) DC.	Fewflower ticktrefoil	Fabaceae	Prairie remnants	
Desmodium sessilifolium (Torr.) Torr. & Gray	Sessileleaf ticktrefoil	Fabaceae	Prairie remnants	
Lespedeza capitata Michx.	Round-headed bush clover	Fabaceae	Prairie remnants	
Lespedeza violacea (L.) Pers.	Violet bush clover	Fabaceae	dry to mesic upland woods, oak barren remnants	
Lespedeza virginica (L.) Britt.	Slender bush clover	Fabaceae	prairie remnants	
Medicago lupulina L.	Black medic	Fabaceae	Old fields; field edges	Introduced
Trifolium repens L.	White clover	Fabaceae	prairie remnants; old fields	Introduced
Dicentra canadensis (Goldie) Walp.	Squirrel corn	Fumariaceae	Mesic forested slopes	
Dicentra cucullaria (L.) Bernh.	Dutchman's breeches	Fumariaceae	Mesic forested slopes	
Geranium maculatum L.	Wild geranium	Geraniaceae	South slopes	
Hydrophyllum virginianum L.	Shawnee salad/Virginia waterleaf	Hydrophyllaceae	Forest floodplain	
Sisyrinchium angustifolium P. Mill.	Narrowleaf Blue eyed grass	Iridaceae	Prairie remnants	
Sisyrinchium campestre Bickn.	Prairie Blue eyed grass	Iridaceae	Remnant barrens	

Juncus tenuis Willd.	Poverty rush	Juncaceae	prairie remnants; mesic woods; forest floodplains	
Lycopus virginicus L.	Virginia water horehound	Lamiaceae	Emergent wetland	
Monarda fistulosa L.	Wild Bergamont	Lamiaceae	Open floodplain; prairie remnants	
Pycnanthemum tenuifolium Schrad.	Narrowleaf mountain mint	Lamiaceae	Prairie remnant	
Scutellaria incana Biehler	Hoary scullcap	Lamiaceae	Prairie remnants; field edges	
Stachys palustris L.	Marsh hedgenettle	Lamiaceae	Emergent wetland	
Erythronium albidum Nutt.	White fawnlily	Liliaceae	Mesic forested slopes	
Polygonatum biflorum (Walt.) Ell. var. *commutatum* (J.A. & J.H. Schultes) Morong	Solomon's seal	Liliaceae	Dry to mesic upland woods	
Trillium recurvatum Beck	Purple wake robin/blood butcher	Liliaceae	Mesic forested slopes	
Uvularia grandiflora Sm.	Largeflower bellwort	Liliaceae	Mesic woods	
Huperzia lucidula (Michx.) Trevisan	Shinning clubmoss	Lycopodiaceae	only at Dolby Cemetery	
Menispermum canadense L.	Common moonseed vine	Menispermaceae	Emergent/shrub-shrub wetland; Mesic Forest Slopes	
Monotropa uniflora L.	Indian pipe	Monotropaceae	mesic woods	
Oenothera biennis L.	Evening primrose	Onagraceae	Prairie remnants	
Botrychium dissectum Spreng.	Cut leaf grape fern	Ophioglossaceae	South slopes	
Botrychium virginianum (L.) Sw.	Rattlesnake fern	Ophioglossaceae	Mesic woods	
Liparis liliifolia (L.) L.C. Rich. ex Ker-Gawl.	Brown widelip or Twayblade orchid	Orchidaceae	remnant barrens	
Spiranthes lacera (Raf.) Raf. var. *gracilis* (Bigelow) Luer	Northern slender ladies' tresses	Orchidaceae	Prairie remnant	
Osmunda cinnamomea L.	Cinnamon fern	Osmundaceae	Seeps	
Oxalis stricta L.	Yellow wood sorrel	Oxalidaceae	Prairie remnants; dry to mesic upland forests	
Phytolacca americana L.	Pokeweed	Phytolaccaceae	Disturbed field edges	
Plantago lanceolata L.	English plantain	Plantaginaceae	Old fields; field edges	
Plantago major L.	Common plantain	Plantaginaceae	Old fields; disturbed woods	
Andropogon gerardii Vitman.	Big bluestem	Poaceae	Prairie remnants	
Aristida oligantha Michx.	Three-awn prairie grass	Poaceae	Prairie remnants	
Bromus inermis Leyss.	Smooth Brome	Poaceae	Prairie remnants,open floodplains	Introduced
Bromus japonicus Thunb. ex Murr.	Japanese brome	Poaceae	Disturbed field edges	Introduced

Bromus pubescens Muhl. ex Willd.	Hairy woodland brome	Poaceae	Southern forested slopes; remnant barrens	
Chasmanthium latifolium (Michx.) Yates	Indian woodoats	Poaceae	Mesic woods/wooded floodplains	*Uniola latifolia* Michx.
Dactylis glomerata L.	Orchard grass	Poaceae	prairie remnant; old fields	Introduced
Danthonia spicata (L.) Beauv. ex Roemer & J.A. Schultes	Poverty Oat Grass	Poaceae	South slopes	
Diarrhena americana Beauv.	Northern beakgrass	Poaceae	Oak barren remnants	
Dicanthelium dichotomum (L.) Gould var. *barbulatum* (Michx.) Mohlenbr.	Cypress panicgrass	Poaceae	Dry woods/oak barren remnants	
Echinochloa crus-galli (L.) Beauv.	Barnyard grass	Poaceae	Open floodplains	
Elymus hystrix L. var. *hystrix*	Eastern bottlebrush grass	Poaceae	South slopes	
Elymus villosus Muhl. ex Willd.	Hairy wild rye	Poaceae	Dry upland woods	
Elymus virginicus L.	Virginia wild rye	Poaceae	Forested floodplains	
Glyceria striata (Lam.) A.S. Hitchc.	Fowl manna grass	Poaceae	Emergent wetland	
Glyceria canadensis (Michx.) Trin.),	Rattlesnake manna grass	Poaceae	Emergent wetland	
Lolium arundinaceum (Schreb.) S.J. Darbyshire	Tall Fescue	Poaceae	Prairie remnants; old fields; open floodplains	*Festuca arundinacea* Schreb., Introduced
Lolium pratense (Huds.) S.J. Darbyshire Huds.	Meadow fescue	Poaceae	Old fields; prairie remnants	*Festuca pratensis* Huds., Introduced
Muhlenbergia schreberi J.F. Gmel.	Nimble Will	Poaceae	Dry upland woods	
Muhlenbergia sobolifera (Muhl. ex Willd.) Trin.	Woodland satin grass/rock muhly	Poaceae.	Remnant barrens	
Paspalum setaceum Michx.	Thin paspalum	Poaceae	Dolby Cemetray; prairie remnants	
Phalaris arundinacea L.	Reed canary grass	Poaceae	Floodplain	
Phleum pratense L.	Timothy	Poaceae	Prairie remnants; old fields	
Poa chapmaniana Scribn.	Chapman's blue grass	Poaceae	remnant barrens	
Poa pratensis L.	Kentucky blue grass	Poaceae	Throughout site	
Schizachyrium scoparium (Michx.) Nash	Little bluestem	Poaceae	Prairie remnant	
Sorghastrum nutans (L.) Nash.	Indian grass	Poaceae	Prairie remnant	
Tridens flavus (L.) A.S. Hitchc.	Purpletop grass	Poaceae	Prairie remnants, old fields	
Phlox divaricata L.	Wild blue phlox	Polemoniaceae	remnant barrens; dry upland woods	
Polemonium reptans L.	Jacob's ladder	Polemoniaceae	South slopes (barrens), mesic forested slopes	

Polygonum amphibium L.	Water smartweed	Polygonaceae	Forest floodplain; mesic woods	
Polygonum hydropiper L.	Marshpepper knotweed	Polygonaceae	Forested floodplain	
Polygonum scandens L. var. scandens	Climbing false buckwheat	Polygonaceae	Forest floodplain	*Fallopia scandens* (L.) Holub
Rumex acetosella L.	Field sorrel	Polygonaceae	old fields, field edges	Introduced
Claytonia virginica L.	Virginia springbeauty	Portulacaceae	South slopes	
Adiantum pedatum L.	Northern maidenhair	Pteridaceae	Mesic forested slopes	
Pellaea atropurpurea (L.) Link	Purple cliffbrake	Pteridaceae	prairie remnants	
Actaea pachypoda Ell.	White baneberry	Ranunculaceae	mesic woods	
Anemone cylindrica Gray.	Thimbleweed	Ranunculaceae	Prairie remnant	
Ranunculus abortivus L.	Littleleaf/small flowered crowfoot	Ranunculaceae	mesic woods	
Thalictrum thalictroides (L.) Eames & Boivin	Rue Anemone	Ranunculaceae	South slopes	
Ceanothus americanus L.	New Jersy Tea	Rhamnaceae	Prairie remnants	
Agrimonia gryposepala Wallr.	Swamp agrimony	Rosaceae	Emergent/shrub-shrub wetland	
Agrimonia pubescens Wallr.	Soft agrimony	Rosaceae	dry upland woods	
Agrimonia rostellata Wallr.	Beaked agrimony	Rosaceae	Oak Barren remnants	
Aruncus dioicus (Walt.) Fern.	Bride's feathers	Rosaceae	mesic woods	
Fragaria virginiana Duchesne	Wild strawberry	Rosaceae	prairie remnant	
Geum canadense Jacq.	White avens	Rosaceae	Dry to mesic upland woods	
Geum laciniatum Murr.	Rough avens	Rosaceae	Emergent wetland	
Galium pilosum Ait.	Hairy bedstraw	Rubiaceae	Oak Barren remnants	
Galium triflorum Michx.	Fragrant bedstraw	Rubiaceae	Mesic forest slopes	
Comandra umbellata (L.) Nutt.	Bastard toadflax	Santalaceae	remnant barrens	
Heuchera americana L.	Americam alumroot	Saxifragaceae	Dry upland woods	
Mimulus alatus Ait.	Sharpwing monkey flower	Scrophulariaceae	Open floodplains	
Penstemon pallidus Small	Pale beardstongue	Scrophulariaceae	remnant barrens	
Physalis spp. L.	Ground cherry	Solanaceae	Prairie remnants	
Solanum carolinense L.	Canadian horsenettle	Solanaceae	Prairie remnants	
Phegopteris hexagonoptera (Michx.) Fée	Broad beech fern	Thelypteridaceae	Mesic woods	
Laportea canadensis (L.) Weddell	Canadian woodnettle	Urticaceae	Forest floodplain	
Pilea pumila (L.) Gray	Canadian clearweed	Urticaceae	Emergent wetland	
Valerianella radiata (L.) Dufr.	Beaked cornsalad	Valerianaceae	Emergent/shrub-shrub wetland	
Phyla lanceolata (Michx.) Greene	Frog fruit	Verbenaceae	Open floodplains	*Lippia lanceolata* Michx
Verbena hastata L.	Swamp vervain	Verbenaceae	Open floodplain	
Verbena urticifolia L.	White vervain	Verbenaceae	remnant barrens; field edges	

Viola palmata L.	Early blue violet	Violaceae	Mesic woods	
Viola pubescens Ait. var. pubescens	Downy yellow violet	Violaceae	Dry to mesic upland woods	
Viola sororia Willd.	Common blue violet	Violaceae	Mesic woods; forest floodplains	
Woody Plants				
Acer negundo L.	Box elder	Aceraceae	Emergent wetland	
Acer saccharum Marsh.	Sugar Maple	Aceraceae	Floodplain terrace	
Rhus aromatica Ait.	Fragrant sumac	Anacardiaceae	South slopes	
Rhus glabra L.	Smooth sumac	Anacardiaceae	Old fields; prairie remnants	
Toxicodendron radicans (L.) Kuntze	Poison ivy	Anacardiaceae	Throughout site	
Betula nigra L.	River birch	Betulaceae	Open Floodplains	
Carpinus caroliniana Walt.	Musclewood/Am. Hornbeam	Betulaceae	South slopes	
Corylus americana Walt.	American hazelnut	Betulaceae	South slopes	
Ostrya virginiana (P. Mill.) K. Koch	Ironwood/hophornbeam	Betulaceae	dry to mescic woods	
Symphoricarpos orbiculatus Moench	Buckbrush/coralberry	Caprifoliaceae	Disturbed woods; throughout site	
Euonymus atropurpurea Jacq.	Eastern wahoo	Celastraceae	Floodplain	
Cornus drummondii C.A. Mey.	Rough-leaved dogwood	Cornaceae	Prairie remnants, barren remnants, old fields	
Juniperus virginiana L.	Eastern red cedar	Cupressaceae	Floodplain, Upland Woods, Remnant barrens	
Elaeagnus umbellata Thunb.	Autumn olive	Elaeagnaceae	field edges; old fields; prairie remnants	Introduced
Cercis canadensis L.	Eastern Redbud	Fabaceae	Mesic forest slopes, Floodplain	
Gleditsia triacanthos L.	Honey locust	Fabaceae	Mesic forest slopes, Floodplain	
Quercus alba L.	White oak	Fagaceae	South slopes	
Quercus coccinea Muenchh.	Scarlet oak	Fagaceae	Dry upland woods	
Quercus imbricaria Michx.	Shingle oak	Fagaceae	Disturbed field edges	
Quercus macrocarpa Michx.	Bur oak	Fagaceae	South slopes	
Quercus muehlenbergii Engelm.	Chinkapin oak	Fagaceae	Floodplain	
Quercus rubra L.	Northern red oak	Fagaceae	Mesic forested slopes	
Quercus stellata Wangenh.	Post Oak	Fagaceae	South slopes	
Quercus velutina Lam.	Black oak	Fagaceae	Dry upland woods	

Aesculus glabra Willd.	Ohio buckeye	Hippocastanaceae	Mesic forest slopes/stream terraces	
Carya cordiformis (Wangenh.) K. Koch	Bitternut hickory	Juglandaceae	South slopes	
Carya illinoinensis (Wangenh.) K. Koch	Pecan	Juglandaceae	Forest floodplain	
Carya ovalis (Wangenh.) Sarg.	Pignut hickory/red hickory	Juglandaceae	Dry Upland Forest	
Carya ovata (P. Mill.) K. Koch	Shagbark hickory	Juglandaceae	South slopes	
Juglans nigra L.	Black walnut	Juglandaceae	Floodplain	
Sassafras albidum (Nutt.) Nees	Sassafras	Lauraceae	Old fields, prairie remnants, dry upland woods, field edges	
Maclura pomifera (Raf.) Schneid.	Osage orange	Moraceae	Disturbed woods; throughout site	Introduced
Fraxinus americana L.	White ash	Oleaceae	South slopes, Upland woods; mesic forest	
Fraxinus pennsylvanica Marsh.	Green ash	Oleaceae	Emergent wetland	
Platanus occidentalis L.	Eastern sycamore	Platanaceae	Floodplain; emergent wetlands	
Amelanchier arborea (Michx. f.) Fern.	Serviceberry	Rosaceae	Forest floodplain	
Prunus americana Marsh.	American plum	Rosaceae	South slopes	
Prunus serotina Ehrh.	Black Cherry	Rosaceae	Upland woods	
Rosa carolina L.	Carolina rose	Rosaceae	Prairie remnants; oak barren remnants	
Rosa multiflora Thunb. ex Murr.	Multiflora rose	Rosaceae	Emergent wetland; upland woods, prairie remnants, old fields, floodplains	Introduced
Rosa setigera Michx.	Climbing rose	Rosaceae	Remnant barrens	
Rubus flagellaris Willd.	Common dewberry	Rosaceae	Upland woods	
Rubus occidentalis L.	Black raspberry	Rosaceae	throughout	
Cephalanthus occidentalis L.	Buttonbush	Rubiaceae	Emergent/shrub-shrub wetland	
Populus deltoides Bartr. ex Marsh.	Eastern cottonwood	Salicaceae	Emergent/shrub-shrub wetland	
Salix interior Rowlee	Sandbar willow	Salicaceae	Open floodplains	
Salix nigra Marsh.	Black willow	Salicaceae	Floodplain	
Smilax rotundifolia L.	Roundleaf greenbriar	Smilacaceae	Dry upland woods; field edges; old fields	
Tilia americana L.	Basswood	Tiliaceae	Mesic woods; forest floodplains	

Celtis occidentalis L.	Hackberry	Ulmaceae	Dry to mesic upland woods
Ulmus americana L.	American elm	Ulmaceae	Upland woods; forest floodplain
Ulmus rubra Muhl.	Slippery elm	Ulmaceae	Dry to mesic upland woods
Parthenocissus quinquefolia (L.) Planch.	Virginia creeper	Vitaceae	Dry to mesic forest
Vitis vulpina L.	Frost grape	Vitaceae	Mesic woods; floodplains

Table 3. Sugar Creek Area Mater Species List

Scientific Name	Common Name	Family	Habitat(s)	Remarks
Herbaceous Plants				
Osmorhiza claytonii (Michx.) C.B. Clarke	Clayton's sweetroot	Apiaceae	Mesic forested slope	
Sanicula canadensis L.	Canadian black snakeroot	Apiaceae	Upland woods	
Arisaema dracontium (L.) Schott	Green dragon	Araceae	Mesic forested slopes	
Arisaema tryphyllum (L.) Schott.	Jack-in-the-pulpit	Araceae	Mesic forested slopes	
Aralia nudicaulis L.	Wild sarsaparilla	Araliaceae	Mesic forested slopes	
Aristolochia serpentaria L.	Virginia snakeroot	Aristolochiaceae	Mesic forested slopes	
Aristolochia tomentosa Sims	Woolly dutchman's pipevine	Aristolochiaceae	Mesic forests, flooplain lower reaches of valley	
Asarum canadense L.	Wild Ginger	Aristolochiaceae	Mesic forested slopes	
Asclepias exaltata L.	Poke milkweed	Asclepiadaceae	Upper slopes	
Ambrosia trifida L.	Giant ragweed	Asteraceae	Floodplain, valley mouth	
Antennaria plantaginifolia (L.) Richards.	Woman's tobacco	Asteraceae	Upper slopes above bluff line, ridge summits	
Ageratina altissima (L.) King & H.E. Robins. var. *altissima*	White snakeroot	Asteraceae	Upland forest/barrens	*Eupatorium rugosum* Houtt.
Symphyotrichum anomalum (Engelm.) Nesom	Manyflowered aster	Asteraceae	Upper slopes	
Krigia biflora (Walt.) Blake	Twoflower dwarf dandelion	Asteraceae	Mesic forested slopes	
Silphium perfoliatum L.	Cup plant	Asteraceae	Flooplain, valley mouth	
Solidago flexicaulis L.	Zig-zag goldenrod	Asteraceae	Mesic forested slopes	
Podophyllum peltatum L.	Mayapple	Berberidaceae	Mesic forested slopes	
Arabis canadensis L.	Sicklepod	Brassicaceae	Lower slope beneath cliff	
Tradescantia ohiensis Raf	Ohio spiderwort/bluejacket	Commelinaceae	Dry upland woods/barrens	
Carex albursina Sheldon	White bear sedge	Cyperaceae	Mesic forested slopes	
Carex blanda Dewey	Eastern woodland sedge	Cyperaceae	Mesic forested slopes	
Carex grayi Carey	Gray's sedge	Cyperaceae	Wet floodplain	
Carex interior Bailey	Inland sedge	Cyperaceae	Wet floodplain	

Carex intumescens Rudge	Great bladder sedge	Cyperaceae	Wet floodplain
Carex pennsylvanica	Pennsylvania sedge	Cyperaceae	Dry upland woods/barrens
Carex shortiana Dewey.	Short's Sedge	Cyperaceae	Wet floodplain
Dioscorea villosa L.	Wild yam	Dioscoreaceae	Upland forest
Athyrium filix-femina (L.) Roth	Common lady fern	Dryopteridaceae	Mesic forested slopes
Cystopteris protrusa (Weatherby)	Fragile fern/lowland bladderfern	Dryopteridaceae	Upland forest
Dryopteris marginalis (L.) Gray	Marginal woodfern	Dryopteridaceae	Rocky slopes associated with bluffs
Onoclea sensibilis L.	Sensitive fern	Dryopteridaceae	Mesic forested slopes
Polystichum acrostichoides (Michx.) Schott	Christmas fern	Dryopteridaceae	Mesic forested slopes
Amphicarpaea bracteata (L.) Fern.	American Hog peanut	Fabaceae	Lower ravine slopes, deposition bars
Desmodium glutinosum (Muhl. Ex Willd.) A. Wood.	Pointedleaf ticktrefoil	Fabaceae	Upland forest
Geranium maculatum L.	Spotted geranium	Geraniaceae	Mesic forested slopes
Hydrophyllum virginianum L.	Virginia waterleaf/Shawnee salad	Hydrophyllaceae	Forest floodplain, terrace
Monarda fistulosa L.	Wild Bergamont	Lamiaceae	Open floodplain/barrens
Allium canadense L. var. *canadense*	meadow garlic	Liliaceae	Mesic areas
Polygonatum biflorum (Walt.) Ell. var. *commutatum* (J.A. & J.H. Schultes) Morong	Smooth solomon's seal	Liliaceae	Mesic forested slopes
Maianthemum racemosum (L.) Link ssp. *racemosum*	Feathery false lily of the valley	Liliaceae	Mesic forested slopes
Trillium recurvatum Beck	Purple wake robin/bloody butcher	Liliaceae	Mesic forested slopes
Uvularia grandiflora Sm.	Largeflower bellwort	Liliaceae	Mesic forested slopes
Huperzia lucidula (Michx.) Trevisan	Shining clubmoss	Lycopodiaceae	Wet concavities associated sandstone bedrock
Lycopodium dendroideum Michx.	Tree groundpine	Lycopodiaceae	Wet concavities associated sandstone bedrock
Menispermum canadense L.	Common moonseed vine	Menispermaceae	Mesic forested slopes
Botrychium virginianum (L.)	Rattlesnake fern	Ophioglossaceae	Mesic forested slopes

Sw.			
Goodyera pubescens (Willd.) R. Br. ex Ait. f.	Downy rattlesnake plantain	Orchidaceae	Mesic forested slopes
Osmunda cinnamomea L.	Cinnamon fern	Osmundaceae	Mesic forested slopes, terraces
Osmunda claytoniana L.	Interrupted fern	Osmundaceae	Mesic forested slopes, terraces
Oxalis stricta L.	Yellow wood sorrel	Oxalidaceae	Upper mesic forested slopes
Oxalis violacea L.	Violet wood sorrel	Oxalidaceae	Upper mesic forested slopes above blluff line
Sanguinaria canadensis L.	Bloodroot	Papaveraceae	Mesic forested slopes
Phytolacca americana L.	Pokeweed	Phytolaccaceae	Disturbed areas
Brachyelytrum erectum (Schreb. ex Spreng.) Beauv.	Bearded shorthusk	Poaceae	Mesic forested slopes
Danthonia spicata (L.) Beauv. ex Roemer & J.A. Schultes	Poverty oatgrass	Poaceae	Upper slopes above bluff line, ridge summits
Dichanthelium latifolium (L.) Gould & C.A. Clark	Broadleaf rosette grass	Poaceae	Upland woods, mesic forested slopes
Elymus virginicus L.	Virginia wild rye	Poaceae	Forested floodplain
Polemonium reptans L.	Jacob's ladder	Polemoniaceae	Mesic forested slopes
Adiantum pedatum L.	Northern maidenhair fern	Pteridaceae	Mesic forested slopes
Thalictrum thalictroides (L.) Eames & Boivin	Rue Anemone	Ranunculaceae	Mesic forested slopes
Hepatica nobilis Schreb. var. *acuta* (Pursh) Steyermark	Sharplobe hepatica	Ranunculaceae	Mesic forested slopes
Ranunculus abortivus L.	Small flowered/small leaf crowfoot	Ranunculaceae	Mesic forested slopes
Aruncus dioicus (Walt.) Fern.	Bride's feathers	Rosaceae	Mesic forested slopes (mid to lower positions)
Galium triflorum Michx.	Fragrant bedstraw	Rubiaceae	Mesic forested slopes
Aureolaria grandiflora (Benth.) Pennell	Large flower yellow false foxglove	Scrophulariaceae	Upland dry woodlands/Barrens on Summitts
Scrophularia marilandica L.	Carpenter's square	Scrophulariaceae	Mesic forested slopes
Phegopteris hexagonoptera (Michx.) Fée	Broad beech fern	Thelypteridaceae	Mesic forested slopes
Laportea canadensis (L.) Weddell	Canadian woodnettle	Urticaceae	Mesic toeslopes, terraces and floodplain

Urtica dioica L.	Stinging nettle	Urticaceae	Mesic forested lower slopes, terraces, floodplain	
Pilea pumila (L.) Gray	Canadian clearweed	Urticaceae	Floodplain	
Viola palmata L.	Early blue violet	Violaceae	Mesic forested slopes	
Woody Plants				
Acer saccharum Marsh.	Sugar Maple	Aceraceae	Mesic forested slopes, terraces	
Rhus aromatica Ait	Fragrant sumac	Anacardiaceae	Dry Upland woods/barrens	
Toxicodendron radicans (L.) Kuntze	Poison ivy	Anacardiaceae	Woodlands	
Carpinus caroliniana Walt.	Musclewood	Betulaceae	Mesic forested slopes	
Ostrya virginiana (P. Mill.) K. Koch	Ironwood/hophornbeam	Betulaceae	Dry summits to mescic forested slopes	
Cornus florida L.	Flowering dogwood	Cornaceae	Mesic forested slopes	Northern extent of range
Juniperus virginiana L.	Eastern red cedar	Cupressaceae	Terraces, upland woods, remnant barrens	
Vaccinium pallidum Ait.	Blue Ridge blueberry	Ericaceae	Upper slopes above bluff line, ridge summits on acid soils over sandstone (rare, not reported in area, not in flower)	
Cercis canadensis L.	Eastern Redbud	Fabaceae	Lower valley slopes	
Quercus alba L.	White oak	Fagaceae	Upland woods	
Quercus rubra L.	Northern red oak	Fagaceae	Upland woods	
Quercus stellata Wangh.	Post Oak	Fagaceae	Upland woods above bluff line	
Quercus velutina Lam.	Black oak	Fagaceae	Upland woods	
Aesculus glabra Willd.	Ohio buckeye	Hippocastanaceae	Mesic forested slopes	
Carya ovalis (Wangenh.) Sarg.	Pignut hickory/red hickory	Juglandaceae	Upland forest	
Carya ovata (P. Mill.) K. Koch	Shagbark hickory	Juglandaceae	Upland forest	
Juglans nigra L.	Black walnut	Juglandaceae	Upland, terrace forest	
Sassafras albidum (Nutt.) Nees	Sassafras	Lauraceae	Upland woods	
Fraxinus americana L.	White ash	Oleaceae	Upland woods; mesic forested slopes	

Fraxinus pennsylvanica Marsh.	Green ash	Oleaceae	Floodplain, valley mouth	
Platanus occidentalis L.	American sycamore	Platanaceae	Floodplain, stream banks	
Amelanchier arborea (Michx. f.) Fern.	Serviceberry	Rosaceae	Upper slopes	
Rosa multiflora Thunb. ex Murr.	Multiflora rose	Rosaceae	Disturbed areas in uplands	Introduced
Rubus occidentalis L.	Black raspberry	Rosaceae	Disturbed areas, bluffs	
Zanthoxylum americanum P. Mill.	Prickly ash	Rutaceae	Mesic forested slopes	
Smilax rotundifolia L.	Roundleaf greenbrier	Smilacaceae	Upland woods	
Staphylea trifolia L.	American bladdernut	Staphyleaceae	Mesic forested slopes, cutbanks along stream	
Tilia americana L.	American basswood	Tiliaceae	Mesic forested slopes, terraces	
Ulmus americana L.	American elm	Ulmaceae	Upland woods; forest floodplain	
Ulmus rubra Muhl.	Slippery elm	Ulmaceae	Dry to mesic upland woods	
Parthenocissus quinquefolia (L.) Planch.	Virginia creeper	Vitaceae	Upland woods	

Table 4. Little Missouri Creek Dells INAI site (Brown Co.) Master Species List
A. Species list by community at site:
1. Shoulder slope/summit oak woodland area along rock outcrop

Species	Common name	Family	Habitat/Remarks
Herbaceous			
Zizia aurea (L.) W.D.J. Koch	Golden Alexander	Apiaceae	Upland woods
Arisaema triphyllum (L.) Schott	Jack in the pulpit	Araceae	Shoulder slope
Asarum canadense L.	Canadian wildginger	Aristolochiaceae	Shoulder slope
Paronychia canadensis (L.) Wood	Smooth forked chickweed	Caryophyllaceae	Summit oak woodlands, shoulder slope
Hypericum prolificum L.	Shrubby St. John's Wort	Clusiaceae	Upland woods, species was *Hypericum spathulatum* (Spach) Steud.
Carex bushii Mackenzie	Bush's sedge	Cyperaceae	Summit oak woodlands, shoulder slope
Carex rosea Schkuhr ex Willd.	Rosy sedge	Cyperaceae	Summit oak woodlands, shoulder slope
Polystichum acrostichoides (Michx.) Schott	Christmas fern	Dryopteridaceae	Shoulder slope
Acalypha gracilens Gray	Slender threeseed mercury	Euphorbiaceae	Outcrop
Maianthemum racemosum L.	False lily of the valley	Liliaceae	Shoulder slope
Circaea lutetiana *L. ssp.* canadensis *(L.)*	Enchanter's nightshade	Onagraceae	Summit oak woodlands, shoulder slope
Sanguinaria canadensis L.	Bloodroot	Papaveraceae	shoulder slope
Brachyelytrum erectum (Schreb. ex Spreng.) Beauv.	Bearded shorthusk	Poaceae	Shoulder slope
Bromus pubescens Muhl. ex Willd	Hairy woodland brome	Poaceae	Summit oak woodlands. shoulder slope
Dichanthelium boscii (Poir.) Gould & C.A.	Bosc's panicgrass	Poaceae	Summit oak

Clark			woodlands, shoulder slope
Dichanthelium villosissimum (Nash) Freckmann var. *praecocius* (A.S. Hitchc. & Chase) Freckmann	Whitehair rosette grass	Poaceae	Summit oak woodlands, shoulder slope
Elymus villosus Muhl. ex Willd.	Hairy wildrye	Poaceae	Summit oak woodlands, shoulder slope
Adiantum pedatum L.	Northern maidenhair	Pteridaceae	Shoulder slope
Porteranthus stipulatus (Muhl. ex Willd.) Britt.	Indian physic	Rosaceae	Shoulder slope
Potentilla arguta Pursh	Tall cinquefoil	Rosaceae	Summit oak woodlands, shoulder slope
Galium circaezans Michx.	Licorice bedstraw	Rubiaceae	Summit oak woodlands, shoulder slope
Galium triflorum Michx.	Fragrant bedstraw	Rubiaceae	Summit oak woodlands, shoulder
Pilea pumila (L.) Gray	Clearweed	Urticaceae	Shoulder slope/outcrop

2. Small Barrens/Seep Areas/Mid to Lower slope upland woods:

Species	Common name	Family	Habitat/remarks
Herbaceous Plants			
Ruellia strepens L.	Limestone wild petunia	Acanthaceae	Barrens
Osmorhiza claytonii (Michx.) C.B. Clarke	Clayton's sweetroot	Apiaceae	Upland woods
Sanicula canadensis L.	Canadian black snakeroot	Apiaceae	Upland woods
Taenidia integerrima (L.) Drude	Yellow pimpernel	Apiaceae	Upland woods
Apocynum cannabinum L.	Indian hemp	Apocynaceae	Upland woods
Arisaema dracontium (L.) Schott	Green dragon	Araceae	
Aristolochia serpentaria L.	Virginia snakeroot	Aristolochiaceae	Seep/Barrens
Asarum canadense L.	Canadian wildginger	Aristolochiaceae	Upland woods
Achillea millefolium L.	Yarrow	Asteraceae	Upland woods (openings)
Antennaria plantaginifolia (L.) Richards.	Woman's tobacco	Asteraceae	Barrens
Bidens spp L.	Beggartick	Asteraceae	Seep
Coreopsis palmata Nutt.	Stiff tickseed	Asteraceae	Barrens

Echinacea purpurea (L.) Moench	Purple coneflower	Asteraceae	Barrens
Helianthus divaricatus L.	Woodland sunflower	Asteraceae	Barrens
Helianthus hirsutus Raf.	Hairy sunflower	Asteraceae	Barrens
Hieracium spp. L.	Hawkweed	Asteraceae	Barrens
Liatris aspera Michx.	Tall blazingstar	Asteraceae	Barrens
Parthenium integrifolium L.	Wild quinine	Asteraceae	Barrens
Solidago ulmifolia Muhl. ex Willd.	Elmleaf goldenrod	Asteraceae	Upland woods
Symphyotrichum anomalum (Engelm.) Nesom	Manyray or woodland aster	Asteraceae	Barrens
Symphyotrichum laeve (L.) A.& D. Löve var. *laeve*	Smooth blue aster	Asteraceae	Upland woods
Verbesina helianthoides Michx.	Yellow crownbeard	Asteraceae	Upland woods
Impatiens capensis Meerb.	Jewelweed	Balsaminaceae	Seep
Podophyllum peltatum L.	Mayapple	Berberidaceae	Mesic woodlands
Calystegia spithamaea (L.) Pursh ssp. *spithamaea*	Low false bindweed	Convolvulaceae	Seep
Carex bushii Mackenzie	Bush's sedge	Cyperaceae	Native perennial
Cystopteris fragilis (L.) Bernh.	Brittle bladderfern	Dryopteridaceae	Mesic woodlands
Cystopteris protrusa (Weatherby) Blasdell	Lowland bladderfern	Dryopteridaceae	On rock Ledge
Euphorbia corollata L.	Flowering spurge	Euphorbiaceae	Barrens
Amphicarpaea bracteata (L.) Fern.	American hogpeanut	Fabaceae	Barrens
Desmodium canadense (L.) DC.	Showy ticktrefoil	Fabaceae	Barrens
Desmodium glutinosum (Muhl. ex Willd.) Wood	Pointedleaf ticktrefoil	Fabaceae	Barrens
Lespedeza violacea (L.) Pers.	Violet lespedeza	Fabaceae	Barrens
Lespedeza capitata Michx	Round headed lespedeza	Fabaceae	Upland woods (openings)
Hydrophyllum virginianum L.	Shawnee salad	Hydrophyllaceae	
Scutellaria ovata Hill	Heartleaf skullcap	Lamiaceae	Barrens
Scutellaria parvula Michx. var. *missouriensis* (Torr.) Goodman & Lawson	Leonard's skullcap	Lamiaceae	Bluff
Circaea lutetiana L. ssp. *canadensis* (L.) Aschers. & Magnus	Enchanter's nightshade	Onagraceae	Woodlands
Oxalis stricta L.	Common yellow wood sorrel	Oxalidaceae	Woodlands
Andropogon gerardii Vitman	Big bluestem	Poaceae	Barrens

Bromus pubescens Muhl. ex Willd.	Hairy woodland brome	Poaceae	Barrens
Dactylis glomerata L.	Orchardgrass	Poaceae	Barrens exotic
Danthonia spicata (L.) Beauv. ex Roemer & J.A. Schultes	Poverty oatgrass	Poaceae	Barrens
Elymus hystrix L.	Eastern bottlebrush grass	Poaceae	Barrens
Glyceria striata (Lam.) A.S. Hitchc.	Fowl mannagrass	Poaceae	Seep
Leersia oryzoides (L.) Sw.	Rice cutgrass	Poaceae	Seep
Lolium arundinaceum (Schreb.) S.J. Darbyshire	Tall fescue	Poaceae	Barrens, introduced
Muhlenbergia sobolifera (Muhl. ex Willd.) Trin.	Rock muhly	Poaceae	Upland woods
Polemonium reptans L.	Jacob's ladder	Polemoniaceae	Upland woods
Polygonum virginianum L.	Jumpseed	Polygonaceae	Upland woods
Adiantum pedatum L.	Northern maidenhair	Pteridaceae	Upland woods
Anemone virginiana L.	Tall thimbleweed	Ranunculaceae	Upland woods
Aquilegia canadensis L.	Red columbine	Ranunculaceae	Upland woods
Porteranthus stipulatus (Muhl. ex Willd.) Britt.	Indian physic	Rosaceae	Barrens
Comandra umbellata (L.) Nutt.	Bastard toadflax	Santalaceae	Barrens
Agalinis tenuifolia (Vahl) Raf.	Slenderleaf false foxglove	Scrophulariaceae	Barrens
Aureolaria grandiflora (Benth.) Pennell var. *grandiflora*	Largeflower yellow false foxglove	Scrophulariaceae	Barrens
Penstemon pallidus Small	Pale beardtongue	Scrophulariaceae	Barrens
Laportea canadensis (L.)	Canadian woodnettle	Urticaceae	Seep/ floodplain woodlands
Pilea pumila (L.) Gray	Canadian clearweed	Urticaceae	Seep/ mesic woodlands
Viola palmata L.	Early blue violet	Violaceae	Mesic woodlands
Woody plants			
Acer saccharum Marsh.	Sugar Maple	Aceraceae	Upland woods
Rhus aromatica Ait.	Fragrant sumac	Anacardiaceae	Barrens
Lonicera dioica L.	Limber honeysuckle	Caprifoliaceae	Seep/Barrens
Sambucus nigra L. ssp. *canadensis* (L.) R. Bolli	Common elderberry	Caprifoliaceae	Seep/stream banks
Viburnum rufidulum Raf.	Rusty blackhaw	Caprifoliaceae	Seep
Viburnum prunufolium L..	Blackhaw	Caprifoliaceae	Rock outcrops
Juniperus virginiana L.	Eastern red cedar	Cupressaceae	Outcrop/barrens
Cercis canadensis L.	Eastern redbud	Fabaceae	Upland woods

Quercus alba L.	White oak	Fagaceae	Upland woods/Barrens
Quercus muehlenbergii Engelm.	Chinkapin oak	Fagaceae	Upland woods/Barrens
Quercus rubra L.	Northern red oak	Fagaceae	Upland woods
Ribes missouriense Nutt.	Missouri gooseberry	Grossulariaceae	Upland woods
Aesculus glabra Willd.	Ohio buckeye	Hippocastanaceae	Upland woods
Carya ovata (P. Mill.) K. Koch	Shagbark	Juglandaceae	Upland woods
Carya ovalis (Wangenh.) Sarg.	Pignut hickory/red hickory	Juglandaceae	Upland Forest
Sassafras albidum (Nutt.) Nees	Sassafras	Lauraceae	Barrens
Fraxinus americana L.	White ash	Oleaceae	Upland woods
Rosa carolina L.	Carolina rose	Rosaceae	Barrens

Table 5. Benville Area Master Species List (Main seep and side ravines)

Species	Common name	Family	Habitat
Herbaceous Plants			
Osmorhiza claytonii (Michx.) C.B. Clarke	Clayton's sweetroot	Apiaceae	Wooded ravine
Sanicula canadensis L.	Canadian black snakeroot	Apiaceae	Wooded ravine
Apocynum cannabinum L.	Indian hemp	Apocynaceae	Wooded ravine
Arisaema triphyllum (L.) Schott	Jack in the pulpit	Araceae	Wooded ravine
Aralia racemosa L.	Spikenard	Araliaceae	Wooded ravine
Aralia spinosa L.	Devil's walkingstick	Araliaceae	Wooded ravine
Solidago canadensis L.	Canada goldenrod	Asteraceae	Wooded ravine
Impatiens capensis Meerb.	Jewelweed	Balsaminaceae	In seep
Podophyllum peltatum L.	Mayapple	Berberidaceae	Wooded ravine
Carex prasina Wahlenb.	Drooping sedge	Cyperaceae	Threatened Plant In Illinois, Located in large colonies in side ravines
Scirpus atrovirens	Dark green bulrush	Cyperaceae	In seep
Scirpus polyphyllus Vahl.	Leafy bulrush	Cyperaceae	Threatened Plant In Illinois, Located in Lower seep Branch
Cystopteris fragilis (L.) Bernh.	Brittle bladderfern	Dryopteridaceae	Wooded ravine
Onoclea sensibilis L.	Sensitive fern	Dryopteridaceae	In seep
Polystichum acrostichoides (Michx.) Schott	Christmas fern	Dryopteridaceae	Wooded ravine
Equisetum arvense L.	Field horsetail	Equisetaceae	In seep
Amphicarpaea bracteata (L.) Fern.	American hogpeanut	fabaceae	Wooded ravine
Desmodium glutinosum (Muhl. ex Willd.) Wood	Pointedleaf ticktrefoil	Fabaceae	Wooded ravine
Rhexia virginica L.	Handsome Harry	Melastomataceae	
Circaea lutetiana L.	Broadleaf enchanter's nightshade	Onagraceae	Wooded ravine
Botrychium virginianum (L.) Sw.	Rattlesnake fern	Ophioglossaceae	Wooded ravine
Phytolacca americana L.	Pokeweed	Phytolaccaceae	Wooded ravine
Bromus tectorum L.	Downy brome	Poaceae	Invasive exotic
Calamagrostis canadensis (Michx.) Beauv.	Bluejoint grass	Poaceae	In seep
Dichanthelium villosissimum (Nash) Freckmann var. *praecocius* (A.S. Hitchc. & Chase) Freckmann	Whitehair rosette grass	Poaceae	Wooded ravine
Glyceria striata (Lam.) A.S. Hitchc.	Fowl mannagrass	Poaceae	In seep
Leersia oryzoides (L.) Sw.	Rice cutgrass	Poaceae	In seep
Lolium arundinaceum (Schreb.) S.J. Darbyshire	Tall fescue	Poaceae	In seep
Phalaris arundinacea L.	Reed canarygrass	Poaceae	In seep
Phleum pratense L.	Timothy	Poaceae	Invasive exotic
Adiantum pedatum L.	Northern maidenhair	Pteridaceae	Wooded ravine
Actaea pachypoda Ell.	White baneberry	Ranunculaceae	Wooded ravine
Hydrastis canadensis L.	Goldenseal	Ranunculaceae	Wooded ravine
Phegopteris hexagonoptera (Michx.) Fée	Broad beechfern	Thelypteridaceae	Wooded ravine
Typha latifolia L.	Broadleaf cattail	Typhaceae	In seep
Boehmeria cylindrica (L.) Sw.	Smallspike false nettle	Urticaceae	Wooded ravine
Laportea canadensis (L.) Weddell	Canadian woodnettle	Urticaceae	In seep
Pilea pumila (L.) Gray	Clearweed	Urticaceae	

Woody Plants			
Asimina triloba (L.) Dunal	Paw paw	Annonaceae	In seep
Corylus americana Walt.	Hazelnut	Betulaceae	Wooded ravine
Sambucus nigra L. ssp. *canadensis* (L.) R. Bolli	Common elderberry	Caprifoliaceae	In seep
Cornus florida L.	Flowering dogwood	Cornaceae	Wooded ravine
Rosa multiflora Thunb. ex Murr.	Multiflora rose	Rosaceae	Invasive exotic
Salix interior Rowlee	Sandbar willow	Salicaceae	Seep border
Salix nigra Marsh.	Black willow	Salicaceae	Seep border
Parthenocissus quinquefolia (L.) Planch.	Virginia creeper	Vitaceae	Wooded ravine


GEORGE M DOBEY
PVT CO B 48 NC INF
CONFEDERATE STATES ARMY
JAN 1 1840
MAY 10 1923