ILLINOIS NATURAL HISTORY SURVEY

TECHNICAL REPORT

# Vegetation of Isolated Sand Deposits along the Illinois River

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# VEGETATION OF ISOLATED SAND DEPOSITS ALONG THE ILLINOIS RIVER

## INTRODUCTION

Wind blown sand deposits from glacial outwash, common in the northern half of Illinois, are the result of erosional events associated with Wisconsian glaciation (Willman and Frye 1970, Schwegman 1973, King 1981). These sand deposits account for nearly 5% of the land surface of Illinois. The most extensive sand regions in Illinois are the Kankakee sand deposits of northeastern Illinois, and the Illinois River sand deposits in the central part of the state (Gleason 1910, Schwegman 1973). The Kankakee sand deposits were formed when glacial lakes drained about 14,500 years ago after glacial moraines were breached, resulting in the Kankakee Torrent (Willman 1973). The Illinois River sand deposits were formed when these waters of the Kankakee Torrent slowed as they entered the broad lowlands of the Illinois River below present day Hennepin.

These sand deposits, commonly referred to as Parkland Sands or the Parkland Formation consists of windblown sand in dunes and in sheet-like deposits between and bordering the dunes (Willman and Frye 1970). The Parkland Formation is usually found on terraces along major river valleys in the northern half of Illinois and consists of medium-grained sands that are sorted by wind from the underlying glacial outwash. These sands were rework by wind creating the characteristic dune and swale topography characteristic of these deposits. Dunes 6 to 12 meters high are common and occasional dunes exist that are 30 meters high. In the Mississippi River valley in northwestern Illinois, and to some extent in the Illinois River valley, the dunes have migrated onto the bluffs and uplands to the east of the river terraces.

Mostly dry habitats are characteristic of sand deposits, and the commonly associated species are those adapted to xeric conditions (White and Madany 1978). However, plant communities of sand deposits are extremely diverse and include sand ponds (McClain et al. 1997), marshes and sedge meadows (Handel et al. 2003, Feist et al. 2007), sand prairies (Handel et al. 2003, McClain et al. 2003, 2004, Phillippe et al. 2004), sand savannas and sand woodlands (McDowell et al. 1983, Johnson and Ebinger 1992, 1995), sand forests (Jenkins et al. 1991, Coates et al. 1992, McClain et al. 2001), and sand flatwoods (McDowell et al. 1983).

Hart and Gleason (1907), Gleason (1910), and Vestal (1913) where the first to described the principal plant communities of these deposits and the associated animals (insects). Except for these early works, very little has been published concerning the vegetation of the Illinois sand deposits. Though most of these scattered sand deposits are under cultivation, a fairly extensive preserve system has maintained some of the former diversity. The present study was undertaken to determine vascular plant species composition, vegetation structure of the different plant communities based on the life forms of the species present, and the floristic quality of the major plant communities of the nature preserves and other natural areas located in the windblown sand deposits of the Illinois River Section of the Illinois River and Mississippi River Sand Areas Natural Division (Schwegman 1973).

## DESCRIPTION OF THE STUDY AREA

The major wind blown sand deposits along the lower Illinois River extend as isolated small to relatively large areas of exposed sandy soil extending from the "Big Bend" region of the Illinois River near Hennepin in Putman County, south into Greene County. Listed below are these isolated sand deposits by county, starting from the northern edge of the study site at the "Big Bend" region where the Illinois River starts its southern flow at Hennepin, Putnam County, Illinois (Table 1).

**PUTNAM COUNTY:** Two small upland sand deposits with a total area of about 14 square miles were located on the east side of the Illinois River in Putnam County.

*Putnam County*--(Hennepin):
**Extent and position:** A sand deposit of approximately 10 square miles (25.9 $km^2$) with the Illinois River forming the north and western boundary. It extends to the southern edge of the town of Hennepin, Illinois.
**Topography:** Gently rolling upland.
**Vegetation:** The dominant community type was cultural with most of the present vegetation cropland. A few forested areas were found on the steep hillsides which were not suited for cultivation. The forested areas were mostly small, of very poor quality, cut-over, and grazed in the past. Abandoned agricultural fields were common, particularly along the western edge of the sand deposits, many associated with the Donnelley State Wildlife Area. Most of these fields had been cultivated or grazed. Some fields were dominated by introduced perennial grasses, other by shrubs and small trees.
**Natural Areas:** No high quality natural areas were encountered. No remnant prairie areas were encountered along the one railroad that crosses the area, and almost no sand prairie species were encountered. The small, degraded, second and third growth sand forests present were dominated with individuals of *Quercus velutina* that were mostly less than 30 cm dbh. Upland, dry to dry-mesic sand savanna was probably the dominate vegetation of this sand deposit in pre-settlement times.

*Putnam County*--(Senachwine):
**Extent and position:** A sand deposit of approximately 4 square miles (10.4 $km^2$) located about 2 miles south of Hennepin, Illinois. This small deposit is traversed by Illinois route 26 and occurs along both sides of the road.
**Topography:** Gently rolling upland.
**Vegetation:** The dominant community type was cultural with most of the present vegetation cropland along with some pasture. A few forested areas were found on the steep hillsides which were not suited for cultivation.
**Natural Areas:** No high quality natural areas were encountered. No remnant prairie areas were found, and only a few sand prairie species were encountered. Small, degraded, second and third growth sand forests were dominated with individuals of *Quercus velutina* that were mostly less than 30 cm dbh. Upland, dry to dry-mesic sand savanna and sand forest was probably the dominated vegetation of this sand deposit in pre-settlement times.

**MARSHALL COUNTY:** One small upland sand deposit with a total area of about 7 square miles was located on the east side of the Illinois River.

*Marshall County*--(Lacon):
**Extent and position:** A small sand deposit of approximately 7 square miles (18.1 $km^2$) centered on the town of Lacon, Illinois, and extending about 2 miles north and south of this town. The Illinois River is the western boundary of the sand deposit.
**Topography:** Gently rolling upland.
**Vegetation:** The dominant community type was cultural with much of the present vegetation cropland crops or pasture. In rough topography a few small poor quality forests were encountered. Nearly one quarter of the deposit was under the town of Lacon and a housing development at the northern edge of Lacon along Illinois route 26. Johnson Grove Park, at the south edge of Lacon, contains the remnants of a dry-mesic sand savanna with many large open-grown black oaks and a few white oaks, many exceeding 90 cm dbh.
**Natural Areas:** No high quality natural areas were encountered. No remnant prairie areas were encountered. Upland, dry-mesic sand savanna, dominated by black oak, was probably the dominate vegetation of this sand deposit in pre-settlement times.

**WOODFORD COUNTY:** One small upland sand deposit with a total area of about 11 square miles was located on the east side of the Illinois River. This deposit extends south into Tazewell County for about a hundred meters.

*Woodford County*--(Spring Bay):
**Extent and position:** A sand deposit of approximately 11 square miles (28.5 $km^2$). Spring Bay, Illinois forms the northern boundary of the sand deposit which extends to just south of the Woodford/Tazewell county line. The sand deposit, which is approximately 6 miles long, is traversed by Illinois route 26 with the Illinois River forming the western boundary.
**Topography:** Gently rolling upland.
**Vegetation:** The dominant community type was cultural with most of the present vegetation cropland along with a few pastures, an occasional abandoned field, and developed lands. Aggregate surface mining was common between Illinois route 26 and the Illinois River. In rough topography a few small forested areas of very poor quality were found along the edge of the sand deposit.
**Natural Areas:** Except for the tall shrub fen community at Spring Bay Fen Nature Preserve no high quality natural areas were encountered in this sand deposit. No remnant prairie areas were found. Upland, dry to dry-mesic sand savanna was probably the dominated vegetation of this sand deposit in pre-settlement times. Spring Bay Fen Nature Preserve is located at the western edge of the sand deposit in the wet-mesic floodplain of the Illinois River.

**PEORIA COUNTY:** One sand deposit with a total area of about 18 square miles (46.6 $km^2$) was located on a river terrace on the west side of the Illinois River.

*Peoria County*--(Chillicothe):

**Extent and position:** A fairly large sand deposit of approximately 18 square miles located on a terrace of the Illinois River just north of Peoria, Illinois. Chillicothe, Illinois is the northern boundary of the sand deposit, the Illinois River forms the eastern edge, a series of hills and ridges surround the terrace to the south and west. Between the hills and the sand deposit are bands of nearly level, loamy and silty soils formed in alluvium.
**Topography:** Flat to very gently rolling terrace.
**Vegetation:** The dominant community type was cultural with most of the present vegetation cropland. A few small abandoned fields occurred in this sand deposit, with industrial development along the southern edge. A few small forested areas of very poor quality were along the east edge of the deposit with *Quercus velutina* and *Robinia pseudoacacia* (black locust) the common species.
**Natural Areas:** No high quality natural areas were encountered. No remnant prairie areas were found. Dry to dry-mesic sand prairie and very open dry to dry-mesic sand savanna were probably the dominated vegetation of this sand deposit in pre-settlement times.

**TAZEWELL COUNTY:** Two small upland sand deposits with a total area of about 7 square miles (18.2 $km^2$) were located near the town of Pekin on the east side of the Illinois River. In addition, there were two fairly large sand deposits that were extensions of the major sand deposit of Mason County. These two areas which are located in the southwestern and southeastern parts of the county have a total area of approximately 48 square miles (124.3 $km^2$).

*Tazewell County*--(Pekin):
**Extent and position:** A sand deposit of approximately 4 square miles (10.4 $km^2$) that is about 5 miles long and extends through most of Pekin, Illinois.
**Topography:** Flat to gently rolling upland.
**Vegetation:** The dominant community type was cultural with most of the present vegetation on developed land, the city of Pekin. A few cultivated fields, just to the south of Pekin, are included in this sand deposit.
**Natural Areas:** No high quality natural areas were encountered. No remnant prairie areas were found. Upland, dry to dry-mesic sand savanna was probably the dominate vegetation of this sand deposit in pre-settlement times.

*Tazewell County*--(Powerton):
**Extent and position:** A sand deposit of approximately 3 square miles (7.8 $km^2$) located just south of the Powerton Fish and Wildlife Area southwest of Pekin, Illinois.
**Topography:** Flat to gently rolling upland.
**Vegetation:** The dominant community type was cultural with nearly all of the present vegetation cropland. A few small abandoned fields also occurred in the area along with some industrial development. A few small forested areas of very poor quality were along the east edge of the deposit with *Quercus velutina* and *Robinia pseudoacacia* the common species.
**Natural Areas:** No high quality natural areas were encountered. No remnant prairie areas were found. Upland, dry to dry-mesic sand savanna was probably the dominate vegetation of this sand deposit in pre-settlement times.

*Tazewell County*--(SW Extension): Part of the major sand deposit of Mason County. **Extent and position:** A large sand deposit of about 32 square miles (82.9 $km^2$). This lobe of the extensive Mason County sand deposit is about five miles broad and extends from the Mason/Tazewell county line on the south for about nine miles to the northeast into Tazewell County. The western boundary of this deposit is a long ridge adjacent to the broad terrace and floodplain of the Illinois River. The eastern boundary is a smaller ridge adjacent to the broad terrace and floodplain of the Mackinaw River to the east. **Topography:** Mostly flat to gently rolling upland except along the western and eastern boundaries where the slopes can be very steep. Sometimes the large, ancient dunes still have steep sides.
**Vegetation:** The dominant community type was cultural with most of the present vegetation cropland. Some abandoned fields were also present, usually in the perennial herb to pioneer tree stages of succession, while a few large Christmas tree farms and pine plantations were also found. Small woodlots were scattered throughout the sand deposits, while most of the steep slopes along the eastern and western edge of the sand deposits were forested. These poor quality forests (Grade C) were dominated by *Quercus velutina*, but many other native and exotic species were present in the overstory as well as the understory. A few very large trees with broad, open crowns were present, indicating that these forests were probably savanna communities in pre-settlement times. All of these forests had been subjected to excessive cutting, fire suppression, and grazing at various time in the past. Probably the best example of forest quality was at Spring Lake State Fish and Wildlife Area where the forest overstory was dominated by *Quercus velutina* and *Robinia pseudoacacia*, while the woody understory was dominated by a nearly impenetrable thicket of *Lonicera maackii* (Amur honeysuckle). Native prairie species were common along the roadsides, in the Christmas tree farms, and abandoned fields, but no extensive prairie communities were encountered.
**Natural Areas:** One high quality natural areas was encountered. This gravel prairie, at the extreme northwestern edge of this sand deposit, is in the Manito Prairie Nature Preserve located about 1 mile northeast of Talbott, Illinois. Sand and gravel prairie inclusions were probably common along the slope adjacent to the Illinois River terrace in pre-settlement times. Upland, dry to dry-mesic sand savanna was probably the dominated vegetation of this sand deposit, but dry to mesic prairies were also common. The adjacent terraces of the Illinois and Mackinaw rivers probably supported extensive areas of wet prairies, marshes, sloughs, and other wet sand prairie species and communities.

*Tazewell County*--(SE Extension): Part of the major sand deposit of Mason County. **Extent and position:** A large sand deposit of about 16 square miles (41.4 $km^2$). The town of Green Valley, Illinois, is located at the northeastern corner of the sand deposit. This lobe of the extensive Mason County sand deposit is about five miles broad and extends from the Mason/Tazewell county line on the west for about four miles east into Tazewell County. The north and east boundary of this deposit are a long shallow ridge adjacent to the broad terrace and floodplain of the Mackinaw River to the east. The southern boundary is north of the Main Ditch which enters Crain Creek, a tributary of the Mackinaw River. **Topography:** Mostly flat to gently rolling upland, but a few ancient

dunes still have steep sides, while the north and east boundaries adjacent to the terrace of the Mackinaw River were sometimes relatively steep.

**Vegetation:** The dominant community type was cultural with most of the present vegetation cropland. Some abandoned fields were also present, usually in the perennial herb to pioneer tree stages of succession, while a few pine plantations were also found. Small woodlots were scattered throughout the sand deposits. These poor quality forests (Grade C) were usually dominated by *Quercus velutina*, but many other native and exotic species were present in the overstory as well as the understory. A few very large black oak trees with broad, open crowns indicated that these forests were probably savanna communities in pre-settlement times. All of these forests had been subjected to excessive cutting, fire suppression, and grazing at various time in the past. Native prairie species were common along the roadsides, in the Christmas tree farms, and abandoned fields, but no extensive prairie communities were encountered.

**Natural Areas:** No high quality natural areas were encountered. No remnant prairie areas were found. Upland dry to dry-mesic sand savanna was probably the dominated vegetation of this sand deposit in pre-settlement times, but dry to mesic prairie areas were also common. The adjacent terraces of the Mackinaw River probably supported extensive areas of wet prairies, marshes, and sloughs.

**MASON COUNTY:** This very extensive sand deposit extended across most of the western part of Mason County. It covers an area of about 220 square miles (569.8 $km^2$) in Mason County, with the two extensions into Tazewell County adding another 48 square miles (124.3 $km^2$). The extensions of this major sand deposit into Tazewell County are discussed above.

**Extent and position:** This is the largest sand deposit found in the Illinois River valley, encompassing more than 220 square miles in Mason County. It extends as a broad northeast-southwest band 5 to10 miles wide and nearly 32 miles long. The western boundary includes the broad floodplain and terrace of the Illinois River, while the southern and southeastern boundaries are the uplands adjacent to the Sangamon River. To the north the sand deposit extends into southern Tazewell County.

**Topography:** Mostly flat to gently rolling floodplain, terrace, and upland. Dune and dune fields are common, but mostly the sand deposits were flat to gently rolling. A few very large dunes with steep sides exist.

**Vegetation:** The dominant community type was cultural with most of the present vegetation cropland. Abandoned fields were also common, usually in the perennial herb to pioneer tree stages of succession, while a few large Christmas tree farms and pine plantations were also present. Small woodlots were scattered throughout the sand deposits, while some large forested area existed in Sand Ridge State Forest. The forests were dominated by *Quercus velutina*, but many other native and exotic species were present in the overstory as well as the understory. A few very large trees with broad, open crowns were present, indicating that these forests were probably savanna communities in pre-settlement times. All of these forests had been subjected to excessive cutting, fire suppression, and grazing at various time in the past. A few high quality sand communities were present in the state forests and dedicated nature preserves in the county. Grade A and B dry sand prairie remnants were encountered, along with some closed sand savannas and sand forests with relatively high natural quality.

**Natural Areas:** Some high quality natural areas existed in the county. These included sand ponds, sand seeps, sedge meadows, sand marshes, wet-mesic to dry sand prairies, sand savannas, woodlands, and closed-canopy sand forests. In pre-settlement times all of these sand community types were probably common in the Mason County sand deposits. Many of these natural sand communities are located in a series of Nature Preserves mostly purchased about 50 year ago by the state (McFall and Karnes 1995). Many of these nature preserves are large, one more than 590 ha, and include: Henry Allan Gleason Nature Preserve, Long Branch Sand Prairie Nature Preserve, Matanzas Prairie Nature Preserve, Sand prairie-Scrub Oak Nature Preserve, and Tomlin Timber Nature Preserve. Also, good quality sand prairie and sand savanna communities were encountered at Sand Ridge State Forest. This state forest, 3,035 ha (11.7 square miles) in size, is located in northwestern Mason County about 21 km northeast of Havana, and just west of Forest City, Illinois (parts of townships T22N R7W and T23N R7W). Initial land purchases began in 1939, and from the 1940s into the 1950s pine plantations were established on old pastureland and abandoned cultivated fields, as well as on some dry sand prairies that were scattered throughout the forest. Presently 1,012 ha of marketable pine plantations occur in the state forest while most of the remainder is oak-hickory dry sand forest and savanna along with a few dry sand prairie inclusions (Andrews 2004).

**MENARD COUNTY:** The sand deposits along the Sangamon River in northeastern Cass and Menard counties were probably formed in post-glacial times by the prevailing westerly winds blowing sand up the Sangamon River valley. These deposits, which occur on the terrace and associated hill to the south of the Sangamon River, were not extensive with a total area of approximately 10 square miles (25.9 $km^2$). Most of these deposits consisted of small lenses of sand on the flanks and in the valleys of hills adjacent to the River, and most areas were less than a hundred hectare. Only three of these deposits were more than 0.5 square miles (1.3 $km^2$) in size with the largest approximately 8 square miles (20.7 $km^2$).

In addition to the Menard/Cass counties sand deposit discussed below, two other small sand areas were found in the same general area and topographic position. The first, located about 3 miles east of the town of Oakford covered about 0.5 square miles (1.3 $km^2$), the second, about 4 miles east of Oakford covered approximately 1.5 square miles (3.9 $km^2$). The dominant community type of both areas was cultural, the present vegetation abandoned successional fields, croplands, a pine plantation, and pasture. The pasture (SW1/4 S9 T19N R7W) still contained many large, open grown black oaks exceeding 100 cm dbh. These trees probably represent the remnant of an upland dry savanna community from pre-settlement times.

*Menard County*--(Oakford):

**Extent and position:** A small sand deposit of approximately 8 square miles (20.7 $km^2$), located on the upper terrace of the Sangamon River and the low hills adjacent to the terrace. It begins about 4 miles east of Chandlerville, Cass County, Illinois. The deposit extends west along both sides of the Oakford Road for about 8 miles and ends about 2 miles east of the town of Oakford, Menard County, Illinois. Approximately 4.5 miles of this deposit is located in Cass County, with about 3.5 miles in Menard County.

**Topography:** Nearly flat river terrace on the Sangamon River to gently rolling uplands.

**Vegetation:** The dominant community type was cultural with most of the present vegetation cropland. The rolling uplands were sometimes pastured, while some black oak forests were found on the ridges and adjacent slopes.
**Natural Areas:** No high quality natural areas were encountered. No remnant prairie areas were found. The Sangamon River terrace and adjacent uplands were probably dominated by dry to dry-mesic sand savanna and sand forest in pre-settlement times.

**CASS COUNTY:** Four sand deposits, mostly on the river terrace and adjacent hills, have a total area of about 56 square miles (145.1 $km^2$). Three of these deposits with a total area of 51 square miles (132.1 $km^2$) are located entirely within the county, the fourth (S Extension) extend south into Morgan and Scott counties. This sand deposit totals about 19 square miles (49.2 $km^2$); 5 square miles (13.0 $km^2$) in Cass County; 8 square miles (20.7 $km^2$) in Morgan; and 6 square miles (15.5 $km^2$) in Scott County.

*Cass County*--(Beardstown):
**Extent and position:** A long narrow ridge of sand about 9 miles long and nearly one mile wide, covering about 8 square miles (20.7 $km^2$). It extends from 2 miles northeast to about 7 miles southwest of Beadstown, Illinois, and is traversed for most of its north/south length by Illinois route 100 (U. S. route 67).
**Topography:** This low sandy ridge was situated on the broad terrace of the Illinois River and extending a half mile to one mile on each side of Illinois route 100 (U.S. route 67). The northern part was flat and commonly cultivated, while the southern half was rolling with shallow dunes, and contained many forested areas.
**Vegetation:** In the northern half of this sand deposit the dominant community type was cultural with most of the present vegetation cropland except for the town of Beadstown built on dune ridges. The southern half of this sand deposit consisted of low dune ridges that were mostly abandoned successional fields, while a few large Christmas tree farms and pine plantations also present. Small woodlots were scattered throughout the sand deposits. These poor quality forests (Grade C) were usually dominated by *Quercus velutina* with *Quercus marilandica* (blackjack oak) as a subdominant, but many other native and exotic species were present in the overstory as well as the understory. A few very large black oak trees with broad, open crowns were present. All of these forests have been subjected to excessive cutting, grazing, and fire suppression. Some of these forests were dominated by *Robinia pseudoacacia* while *Juniperus virginiana* (common juniper) was found in many of the abandoned fields.
**Natural Areas:** No high quality natural areas were encountered. No remnant prairie areas were found. Upland, dry to dry-mesic sand savanna was probably the dominated vegetation of the dune ridges in pre-settlement times, while dry to wet sand prairie dominated the flat sandy fields around Beadstown, Illinois.

*Cass County*--(Airport):
**Extent and position:** This low sandy ridge is situated on the broad terrace of the Illinois River and averages 2 to 3 miles wide and about 9 miles long. The deposit extends in a NE/SW direction and covers approximately 23 square miles (59.6 $km^2$). This sand deposit is traversed near it northern boundary by Illinois route 125 and includes the Greater Beadstown Airport.

**Topography:** The northern part of this sand deposit was flat or with low dune ridges, the southern half was more rolling with shallow dunes.
**Vegetation:** In nearly all the northern half of the sand deposit the dominant community type was cultural with most of the present vegetation cropland. In the southern half of this sand deposit the dominant community type was cultural with mostly abandoned successional fields, a few large Christmas tree farms, pine plantations, and degraded sand forests. These poor quality sand forests (Grade C) were usually dominated by *Quercus velutina* with some *Quercus marilandica* also present, but many other native and exotic species were present in the overstory as well as the understory. A few very large trees with broad, open crowns were present. All of these forests have been subjected to excessive cutting, grazing, and fire suppression. Some of these forests were dominated by *Robinia pseudoacacia* while *Juniperus virginiana* was common in abandoned fields.
**Natural Areas:** No high quality natural areas were encountered. No remnant prairie areas were found. Upland, dry to dry-mesic sand savanna was probably the dominated vegetation of the dune ridges in pre-settlement times, while dry to wet sand prairie probably dominated the flat sandy fields.

*Cass County*--(Arenzville):
**Extent and position:** This very irregularly shaped sand deposit is about 7 miles long and up to 4 miles wide at its widest point, and covers approximately 20 square miles (51.8 $km^2$). It is located along the eastern edge of the Illinois River upper terrace and extends onto the flanks of the hills just to the east of this terrace. Arzenzville, Illinois is at the southwestern corner of this sand deposit.
**Topography:** This sand deposit on the upper terrace of the Illinois River is flat, no low dune ridges being present. The flat terrace of this sand deposit is a major contrast to the steep and rolling topography of sandy hills in the eastern part of the deposit. These sandy hills were formed when blowing sand from the westerly winds of post glacial times deposited large quantities of sand on the flanks of the hills adjacent to the Illinois River terrace.
**Vegetation:** Nearly all the flat western part was cultural, cropland being the dominant vegetation. The hillsides and ridges were covered by many large and small woodlots. These poor quality forests (Grade C) were usually dominated by *Quercus velutina* and sometimes *Quercus marilandica*, but many other native and exotic species were present in the overstory as well as the understory. On more mesic sites *Quercus alba* was sometimes encountered along with *Juglans nigra*. A few very large oak trees with broad, open crown were present, indicating that there forests were probably more open in pre-settlement times. All of these forests had been subjected to excessive cutting, grazing, and fire suppression. Some of these forests were dominated by *Robinia pseudoacacia* while *Juniperus virginiana* was common in abandoned fields. Some of the flat areas between the hills, as well as the broad ridges were cultivated, while other areas were pastured. A few pine plantations were present on the ridges.
**Natural Areas:** Except for Shick-Shack Sand Pond Nature Preserve, no high quality natural areas were found. No remnant prairie areas were found. Upland, dry to dry-mesic sand savanna and sand forests were probably the dominated vegetation of the dune ridges in pre-settlement times, while dry to wet sand prairie dominated the flat sandy fields of the Illinois River terrace in the western part of this sand deposit.

*Cass County*--(S Extension): Extends south through Morgan County and into Scott County):

**Extent and position:** This sand deposit is separated by about 0.5 miles from the more northern and western Cass County sand deposits by the floodplain and terrace deposits of Indiana Creek and Clear Creek. This deposit had a north/south extent of about 14 miles (3.5 miles in Cass County, 6 miles in Morgan County, and about 4.5 miles in northern Scott County), and totals about 19 square miles (49.2 $km^2$). It averages about 2 miles in width but is nearly 4 miles wide near the Cass/Morgan County line.

**Topography:** This sand deposit included extensive areas of the Illinois River terrace in southern Cass County, all of the Illinois River terrace in Morgan County, and the northern part of the Illinois River terrace in Scott County.

**Vegetation:** In Cass County this sand deposit consists of low dune ridges on which the plant communities were mostly cultural with mostly abandoned successional fields, along with a few large Christmas tree farms, pine plantations, and occasional cropland. Small woodlots were scattered throughout the sand deposits. These poor quality forests (Grade C) were usually dominated by *Quercus velutina* and *Quercus marilandica,* but many other native and exotic species were present in the overstory as well as the understory. A few very large trees with broad, open crowns were present, indicating that there forests were probably savanna communities in pre-settlement times. All of these forests had been subjected to excessive cutting, grazing, and fire suppression. Some of these forests were dominated by *Robinia pseudoacacia.* To the south in Morgan County, the sand ridges were shallower and there was more cultivated ground. Pastures and hay fields were common, while a few Christmas tree farms occur. Meredosia National Wildlife Refuge is in this area with many abandoned fields along with some areas of prairie restoration. In Scott County the sand deposits consisted of shallow ridges. Some of the shallow ridges were cultivated, others were used for pasture, while Christmas tree plantations occurred on a few ridges.

**Natural Areas:** No high quality natural areas were encountered. No remnant prairie areas were found. Dry to dry-mesic sand savanna was probably the dominated vegetation of the dune ridges in pre-settlement times, while dry to wet sand prairie dominated the flat sandy fields of the Illinois River terrace.

**MORGAN COUNTY:** The sand deposit in Morgan County is the extension of the southern sand deposit in Cass County.

*Morgan County*--(Meredosia): This deposit, which extents for about 6 miles in Morgan County, covers about 8 square miles (20.7 $km^2$) on the terrace along the east side of the Illinois River. The characteristics of this deposit are discussed under Cass County (S Extension).

**SCOTT COUNTY:** The sand deposit in Scott County is the extension of the deposit in Cass County that extends through Morgan County.

*Scott County*--(Naples): This deposit which extents for about 4.5 miles in Morgan County covers about 6 square miles (15.5 $km^2$) on the terrace along the east side of the Illinois River. The characteristics of this deposit are discussed under Cass County (S Extension).

*Scott County*--(Dune Field):
**Extent and Position:** To the south and east of the elongated sand deposit that extends along the Illinois River terrace into northwestern Scott County (Cass County--S Extension), are a series of dune ridges that are mostly south of the town of Naples, Illinois. Covering a total area of about 13 square miles (33.7 $km^2$), the individual dunes varied from a few hectares to about 3 square miles (7.8 $km^2$), were longer than wide, and mostly had a north/south orientation. Many of these low dunes were on the Illinois River terrace, while some had been deposited on the flanks of the hills to the east of the terraces, the sand sometimes extended to the ridge tops.
**Topography:** These low sand ridges, many with an elevation of only a few feet above the surrounding Illinois River terrace, had slowly migrated to the east along the Illinois River terrace due to the prevailing westerly winds. Most of these sand dunes were still migrating.
**Vegetation:** The dominant community type for the very low sand ridges was cultural with most of the present vegetation cropland along with a few abandoned fields in the perennial herb stage of succession along with some pastureland. The most extensive and taller dunes were covered with very poor quality forests (Grade C) and pine plantations. These forests were usually dominated by *Quercus velutina*, but many other native and exotic species were present in the overstory as well as the understory. The sand deposits along the eastern edge of the Illinois River terrace were mostly covered with second and third growth *Quercus velutina* forests of very poor quality.
**Natural Areas:** No high quality natural areas were encountered. No remnant prairie areas were encountered. Dry to dry-mesic sand savanna was probably the dominated vegetation of the larger dunes and the sandy flanks of the hills to the east of the Illinois River terrace in pre-settlement times, while dry to wet sand prairie dominated the flat sandy fields of the Illinois River terrace. The Illinois threatened species *Asrtragalus distortus* (bent milk vetch) is known from the Sand Creek Cemetery northwest of Glasgow, Illinois. This cemetery is at the extreme southern edge of the most southern sand deposit on the flanks of the hills at the edge of the Illinois River terrace.

**GREENE COUNTY:** Many small sand deposits were located in the floodplain and terrace along the east side of the Illinois River in Greene County. Most of these appeared to be relatively recent deposits associated with flooding. All were small, mostly covering less than 50 hectares. In all of these areas the dominant community type was cultural with most of the present vegetation cropland. A few small deposits were also located on the flanks and tops of the hills adjacent to the terrace. These upland deposits are scattered, and alternate with other soil types. Only two small areas were found both less than 1 square mile (1.3 $km^2$) in size.

*Greene County*--(Apple River):
**Extent and position:** A very small sand deposit of approximately 1 square mile (1.3 $km^2$) with Apple River the southern boundary.

**Topography:** Flank of hills and hilly uplands adjacent to the terrace of the Illinois River to the west. A small part of the terrace was also included.
**Vegetation:** The dominant community type was cultural with most of the present vegetation cropland along with some hayfields, pastures, and a pine plantation. Most of the hilly slopes were in second and thirds growth dry to dry-mesic upland forests. The forested areas were of very poor quality, cut-over, and grazed in the past. *Quercus velutina* was the dominant tree, but a few mesic species were encountered along with exotic shrubs.
**Natural Areas:** No high quality natural areas were encountered. No remnant prairie areas were found. Dry to dry-mesic sand forest was probably the dominated vegetation of this sand deposit in pre-settlement times.

*Greene County*--(Macoupin Creek):
**Extent and position:** A very small sand deposit of approximately 0.4 square miles (1.0 $km^2$) with Macoupin Creek near the southern boundary.
**Topography:** Flank of hills and hilly uplands adjacent to the terrace of the Illinois River to the west. A small part of the terrace was also included.
**Vegetation:** On the terrace the dominant community type was cultural with most of the present vegetation cropland. The hilly slopes and ridges were in second and thirds growth dry to dry-mesic upland forests. The forested areas were of very poor quality, cut-over, and grazed in the past. *Quercus velutina* was the dominant tree but a few mesic species were encountered along with exotic shrubs.
**Natural Areas:** No high quality natural areas were encountered. No remnant prairie areas were found. Dry to dry-mesic sand forest was probably the dominated vegetation of this sand deposit in pre-settlement times.

Climate of the lower Illinois River valley is continental with warm summers and cold winters. Based on weather data from Havana, Illinois, located near the middle of the study area, mean annual precipitation is 96.0 cm, with May having the highest precipitation (11.3 cm). Mean annual temperature is 10.8°C with the hottest month being July (average of 24.6°C), and the coldest January (average of -5.0°C). Frost free days range from 140 to 206, with the average being 173 day per year (Midwestern Regional Climate Center 2006).

## MATERIALS AND METHODS

*Field Evaluation:* Soil maps of the entire study area were examined and the sand deposits marked on county road maps. These areas were then examined for Grade A and B quality sand communities (White and Madany 1978) by traveling all roads in these sand areas during the winter and early spring of 2006. All potential sites were visited during the summer and fall of 2006. Also the pertinent literature was examined as were the files of the Natural Areas Inventory and the Natural Heritage Data Base at the Illinois Department of Natural Resources, Springfield, Illinois.

*Vascular Plant Species and Community Types:* The natural areas found were visited two or more times during the growing season of 2006. Many of these sites had been studied

by the authors on earlier occasions, and the data from the earlier visits has also been included in this report. Voucher specimens of plant species were collected, identified, and deposited in the herbarium of the Illinois Natural History Survey, Champaign, Illinois (ILLS), and the Stover-Ebinger Herbarium of Eastern Illinois University, Charleston, Illinois (EIU). Criteria for designating non-native species followed Mohlenbrock (2002), Gleason and Cronquist (1991), and Taft et al. (1997). Nomenclature follows Mohlenbrock (2002). We recorded the location of any threatened and endangered plant species found (Herkert and Ebinger 2002). See Appendix 1 for a listing of species encountered at the Sand Ridge State Forest, which encompasses most of the plant species encountered in this paper.

The plant communities encountered were described, for the most part, using the classification system of White and Madany (1978). All of the sand prairie communities examined during the present studied would be described as various successional stages of a dry sand prairie, including the blowout and blowing sand communities. In some instances we added modifiers in parenthesis to indicate successional trends, and sometimes the dominant species when discussing a particular community. We consider a mature sand prairie to be equivalent to the Grade A and B used by the Natural Area Inventory, while successional sand prairie to be equivalent to a low Grade B or Grade C (White 1978).

The Floristic Quality Index (FQI) is used to evaluate some of the communities examined. The FQI was determined using the coefficient of conservatism (CC) assigned each species based on a species tolerance to disturbance and its fidelity to habitat integrity (Taft et al. 1997). The FQI, therefore, is a weighted index of species richness (N = number of species present on a site), and is the arithmetic product of the average coefficient of conservatism (mean CC = the average of all species CC's) multiplied by the square root of the native species richness ($\sqrt{N}$) of an inventory site: FQI = mean CC($\sqrt{N}$). For relatively small areas that are intensively studied, the FQI gives a rapid means of comparison and an indication of the floristic integrity of the site. Using the FQI along with other floristic measures, such as quadrat-based sampling methods, provides a meaningful way to making comparisons among sites. Prairies with an FQI of 35 or higher are considered good quality natural areas (Taft et al. 1997). Though area dependent, the FQI can still be useful in explaining the variation among sites of similar size and habitat (Taft et al. 2006).

The Sorensen Index of Similarity (ISs) was used to determine the degree of vegetation similarity between the prairie areas surveyed (Mueller-Dombois and Ellenberg 1974). In this index [ISs = 2C/A+B x 100], A equals the number of species in the first community, B equals the number of species in the second community, and C equals the number of species common between the two communities.

*Ground Layer Sampling:* The sand prairie communities were studied in late summer using transects located randomly along cardinal compass directions within the communities studied. These transects were located using aerial photographs and ground observation to ensure that transects did not cross ecotone boundaries. Within each community surveyed one or more 50 m long transect was located. Along each transect, $1m^2$ quadrats were located at 1 m intervals (n=50/transect), alternately along transects. A random numbers table was used to determine the number of meters (0 to 9) a quadrat was

located from the transect line. Species cover was determined using the Daubenmire (1959) cover class system as modified by Bailey and Poulton (1968). The modified Daubenmire cover scale is as follows: class 1 = 0 to 1%; class 2 = >1 to 5%; class 3 = >5 to 25%; class 4 = >25 to 50%; class 5 = >50 to 75%; class 6 = >75 to 95%; class 7 = >95 to 100%. Importance value (IV) was determined by summing relative cover and relative frequency.

*Overstory Sampling:* Savanna and forests communities were surveyed by dividing a portion of each community into contiguous quadrats 25 m on a side. These study areas were located near the central part of each woodlot and more than 50 m from the nearest woodland edge. All living and dead-standing woody individuals ≥10.0 cm dbh were identified and diameters recorded. From these data, living-stem density (stems/ha), basal area ($m^2$/ha), relative density, relative dominance (basal area), importance value (IV), and average diameter (cm) were calculated for each species. Determination of the IV follows the procedure used by McIntosh (1957), and is the sum of the relative density and relative dominance (basal area) for a total sum of 200. Dead-standing density (stem/ha) and basal area ($m^2$/ha) were also determined. Woody understory composition and density (stems/ha) were determined using nested circular plots 0.0001, 0.001, and 0.01 ha in size located at 15 m intervals along randomly located east-west transects within each study area. Four additional 0.0001 ha circular plots were located 6 m from the center points of each plot center along cardinal compass directions. In the 0.0001 ha plots, woody seedlings (≤50 cm tall) were counted; in the 0.001 ha circular plots small saplings (>50 cm tall and <2.5 cm dbh) were recorded; and in the 0.01 ha circular plots large saplings (2.5-9.9 cm dbh) were tallied.

*Canopy Cover Analysis:* Aerial photographs from 1939, 1957, 1969, 1988, and 1998 were digitized to show woody encroachment (tree and large shrub) at Sand Ridge State Forest, Mason County, Illinois. These aerial photographs were borrowed from the University of Illinois Map Library, Urbana, Illinois, and scanned with an Epson Expression 1640 XL color scanner. Fifty stratified random 5 hectare sites, approximately 8.24% of Sand Ridge State Forest, were interpreted and then digitized using ARC GIS.

## PLANT COMMUNITY TYPES

**Sand ponds:** In early settlement time sand ponds were common on the floodplains and terraces in the sand deposits of the Illinois River valley. At that time the water table was close to the surface, many sand ponds were permanent or only rarely became dry in late summer or during drought years. Presently, most remaining sand ponds of the Illinois River sand deposits are ephemeral and in most years these low area are farmed. The time between flooding in these sand ponds may be 20 years or more.

Schwegman (1984) described wetlands on agricultural lands near Snicarte in Mason County during the wet year of 1974 when many emergent wetland species dominated a flooded agricultural field. In dry years this field was farmed, but retained water during years of above average precipitation. This field, along with many others, was also flooded from fall of 1993 to the late summer of 1995 (McClain et al. 1997). At that time 72 vascular plant species were collected from five temporary sand ponds

located on farmed agricultural land in Cass and Mason counties, Illinois. Illinois endangered and threatened plant species encountered included *Schenoplectus hallii* (Hall's bulrush), *Schenoplectus purshiana* (Pursh's bulrush), and *Boltonia decurrens* (decurrent false aster) (Herkert and Ebinger 2002). The continued re-emergence of many of these species during wet years suggested the persistence of seeds within the soil seed bank (Van der Valk and Davis 1978). For the species encountered and the locations of the sites studied see McClain et al. (1997).

Sand ponds are known from two nature preserves in the Illinois River sand deposits, Shick Shack Sand Pond Nature Preserve and Sand Prairie-Shrub Oak Nature Preserve. At Sand Prairie-Scrub Oak Nature Preserve, near Kilbourne in Mason County, there was a sizeable sand pond prior to the lowering of the water table by drainage of the land surrounding the preserve (SW1/4 S14 T20N RR9W). Presently water rarely accumulates in this stabilized blowout, but many plant species probably persist in the soil seed bank (McClain et al. 2007b).

A sand pond that commonly retains water in the spring and early summer of most years is at Shick Shack Sand Pond Nature Preserve, located about 6 kms south of Bluff City in Cass County, Illinois (SE1/4 S9 T17N R11W). The nature preserve is about 18 ha in size, with the majority of the preserve dominated by degraded second growth upland, dry-mesic oak forest (Grade C). This forest surrounded a sand pond of about 1.5 ha (McFall and Karnes 1995). The vegetation of the pond is in three zones (shrub, reed canary grass, mixed herbaceous). The shrub zone, at the very edge of the pond, was dominated by *Cephalanthus occidentalis* (buttonbush), *Salix interior* (sandbar willow), *Salix nigra* (black willow), and *Sambucus canadensis* (common elderberry). The reed canary grass (*Phalaris arundinacea*) zone was next with *Persicaria lapathifolia* (pale smartweed) common and scattered. The remainder of the pond was dominated by the mixed herbaceous zone with a mixture of wetland species that commonly occur as emergents in shallow water and on mud flats. The common species of this zone included: *Bidens cernua* (nodding bur marigold), *Bidens frondosa* (common beggar's-tick), *Boehmeria cylindrica* (false nettle), *Bolboschoenus fluviatilis* (river bulrush), *Echinochloa crus-galli* (barnyard grass), *Eragrostis hypnoides* (pony grass), *Eupatorium perfoliatum* (perfoliate boneset), *Impatiens capensis* (spotted touch-me-not), *Leersia oryzoides* (rice cut grass), *Persicaria hydropiperoides* (mild water pepper), *Persicaria pensylvanica* (pinkweed), *Pontederia cordata* (pickerelweed), *Schoenoplectus tabernaemontani* (soft-stem bulrush), *Scirpus cyperinus* (wool grass), and *Sparganium androcladum* (bur-reed).

**Sand seeps:** Seep communities occur in areas with saturated soil caused by groundwater reaching the surface in a diffuse flow (White and Madany 1978). These seeps, which rarely exceed 0.5 ha, are common along the lower slopes of glacial moraines, in ravines, and on stream terraces. Ground water of seeps usually flows through sand and gravel deposits above an impervious soil layer to the outlet area where it forms a distinct seep line and a permanently wet, marshy area. Localized areas of concentrated flow (springs) may be associated with seeps.

Gates (1912) first described the seep community along the Illinois River south of Havana, Illinois. This series of small seeps were the only seeps of high natural quality found during the present study. These seeps were located along White Oak Creek about 6

km south of Havana, Mason County, Illinois (NW1/4 S23 T21N R9W). At this site numerous small seeps were located along both sides of White Oak Creek on a sandy terrace about 400 m east of the Illinois River. The largest seep was nearly 125 m long and varied in width from 1 to 8 m. This seep was in an open area with nearly continual sunlight throughout the day. The remaining seeps were smaller with the largest approximately 100 m long, 1 to 10 m wide, and shaded nearly the entire day (McClain et al. 2007a).

In the seep community in full sunlight the perennial vine *Apios americana* (groundnut) and the annual herb *Impatiens capensis* were the dominant species. In many parts of the seep groundnut overtopped and covered the other vegetation. *Leersia oryzoides*, *Decodon verticillatus* (swamp loosestrife), and *Saururus cernuus* (lizard's-tail) were next in importance. In the shaded seeps *Symplocarpus foetidus* (skunk cabbage) was the dominant species while spotted touch-me-not and lizard's-tail were second and third in importance. Although Gates (1912) reported the occurrence of the state endangered *Mimulus glabratus* (yellow monkey flower) and the state threatened *Veronica scutellata* (marsh speedwell), neither of these species nor any other state threatened or endangered species were encountered by McClain et al (2007a) (Herkert and Ebinger 2002).

**Tall Shrub Fen:** This community which was dominated by many tall shrubs occurred on gently sloping ground and had heavy peat soils with calcareous seepage. The fen is located at the eastern edge of an *Acer saccharinum* (silver maple) wet floodplain forest of the Illinois River about 3 kms south of Spring Bay, Illinois (McFall and Kearns 1995). This community is rare in the Illinois River sand deposits with the only high quality example known at Spring Bay Nature Preserve, Woodford County, Illinois (SE1/4 S14 T27N R4W).

A few trees were growing in the fen with *Acer saccharinum* and *Fraxinus lanceolata* (green ash) the most common. Most trees were less than 25 cm dbh. Common shrubs included *Cornus sericea* var. *sericea* (red-osier dogwood), *Salix discolor*, *Sambucus canadensis*, *Toxicodendron vernix* (poison sumac), and *Viburnum lentago* (nannyberry). A few exotic shrubs were also present, but in low numbers. These included *Lonicera morrowi* (Morrow's honeysuckle) and *Viburnum opulus* (European high-bush cranberry). Many herbaceous species were observed in the fen, the most common being *Chelone glabra* (white turtlehead), *Helianthus tuberosus* (Jerusalem artichoke), *Impatiens capensis*, *Leersia oryzoides*, *Peltandra virginica* (arrow arum), *Rudbeckia laciniata* (goldenglow), *Sagittaria latifolia* (common arrowhead), *Silphium perfoliatum* (cup-plant), *Solidago patula* (swamp goldenrod), and *Symplocarpus foetidus*. The state endangered *Cypripedium reginae* (showy lady's-slipper), and the state threatened *Boltonia decurrens* (decurrent false aster) have both been reported from this fen community (Herkert and Ebinger (2002).

**Sedge Meadow:** This wetland community was dominated by *Carex stricta* (tussock sedge) and occurred on a deep, acid soil with a dark A horizon. This community is rare in the Illinois River sand deposits the only extant example occurs at Matanzas Nature Preserve about 3 kms north of Bath, Mason County, Illinois (NE1/4 S4 T20N R9W). In this community surface water was present during the winter and spring and the soil was nearly always saturated. In 1999 this sedge meadow was dominated by *Carex stricta* (IV

of 66.6), *Calamagrostis canadensis* (bluejoint grass) and *Rosa palustris* (swamp rose) both with IV's of 28.3 (Feist et al. 2007). Other species with IVs greater than 5 included *Boehmeria cylindrica*, *Tracaulon sagittatum* (tear thumb), *Thelypteris palustris* (marsh fern), *Doellinger umbellata* (flat-topped aster), and *Lycopus virginicus* (bugleweed). Only 13 other taxa were present in the plots, though a total of 61 taxa were observed in the sedge meadow, most being rare. Colonies of *Rosa palustris* were common throughout the sedge meadow, accounting for nearly one quarter of the entire cover. In these colonies few other species occurred. The FQI of the sedge meadow was 38.80 with a mean CC of 4.89.

The sedge meadow at the Matanzas Prairie Nature Preserve is similar to three sedge meadows in Lee County, Illinois (Handel et al. 2003). Species composition was similar with *Carex stricta* having a very high importance value and many of the subordinate species were also present. The Lee County sedge meadows, however, had higher species diversity, and *Onoclea sensibilis* (sensitive fern) ranked high in IV, while it was very uncommon at the Matanzas Prairie. In contrast, *Calamagrostis canadensis* ranked high in IV on the Matanzas Prairie sedge meadow, being relative uncommon in the Lee County sedge meadows.

**Wet-mesic Sand Prairie:** In this wetland community water is present for short periods, particularly in winter and spring, and occurred on a deep, acid soil with a dark A horizon. Wet-mesic sand prairies are rare in the Illinois River sand deposits the only extant example occurred at Matanzas Nature Preserve about 3 kms north of Bath, Mason County, Illinois (NE1/4 S4 T20N R9W). In a 1999 survey (Feist et al. 2007) this wet-mesic sand prairie was dominated by *Solidago canadensis* (Canada goldenrod) with an IV of 34.2, followed by *Andropogon gerardii* (big bluestem) (25.9) and *Carex stricta* (21.9). Fourth in dominance, the exotic species *Poa pratensis* (Kentucky bluegrass) was found throughout much of the wet-mesic prairie. Other common species included *Euthamia graminifolia (*grass-leaved goldenrod), *Fragaria virginiana* (wild strawberry), *Rubus flagellaris* (common dewberry), *Vernonia missurica* (Missouri ironweed), *Potentilla simplex* (common cinquefoil), and *Sorghastrum nutans* (Indian grass), all with IVs greater than 5. Numerous species were encountered, 52 occurring in the quadrates with a total of 92 taxa found within the boundary of the wet-mesic sand prairie. The FQI of the wet-mesic sand prairie was 43.65 with a mean CC of 4.89. The Illinois endangered *Platanthera flava* var. *herbiola* (tubercled orchid) and the Illinois threatened *Tomanthera auriculata* (ear-leaved foxglove) were encountered in the prairie communities at this preserve (Herkert and Ebinger 2002)

The wet-mesic sand prairie at Matanzas Nature Preserve was similar to the wet-mesic sand prairie remnants encountered at the Richardson Wildlife Foundation, Lee County (Handel et al. 2003). Many of the species were common to both sites, as were some of the dominant species. Both sites had high species diversity and *Andropogon gerardii, Sorghastrum nutans, Solidago canadensis, Euthamia graminifolia,* and *Potentilla simplex* had high IV's. The Lee County prairie remnants, however, were drier and would be classified as wet-mesic to mesic sand prairies.

**Shrub sand prairie:** This sand community, which is dominated by shrubs and prairie grasses, occurred on deep, acid soil with a dark A horizon. Shrubs prairies are rare in the

Illinois River sand deposits the only known example occurring at Matanzas Nature Preserve about 3 kms north of Bath, Mason County, Illinois (NE1/4 S4 T20N R9W). The ground layer of this community was dominated by many of the same species encountered in the wet-mesic sand prairie adjacent to the shrub prairie. In a 1999 survey (Feist et al. 2007) this shrub prairie was dominated by *Solidago canadensis* (IV of 36.5) followed by *Carex stricta* (21.2). Third in dominance, the exotic species, *Poa pratensis* was found throughout much of the shrub prairie. Other common native prairie species included *Euthamia graminifolia, Andropogon gerardii, Rubus flagellaris, Fragaria virginiana, Helianthus grosseserratus* (sawtooth sunflower), *Vernonia missurica,* and *Rosa palustris*, all with IVs greater than 5. The ground layer species were similar to those associated with the wet-mesic sand prairie, although the rarer taxa were not encountered. Thirty-six species were encountered in the quadrates with a total of 61 taxa found within the boundary of the shrub prairie. The FQI of the shrub prairie was 31.76 with a mean CC of 3.19

This shrub prairie rarely burns due to wet depressions that prevent the movement of fire. The shrubs *Cornus drummondii* (rough-leaved dogwood), *Cornus obliqua* (pale dogwood), *Rosa palustris*, *Rubus* spp. (blackberries), and *Salix discolor* were common woody species along with some thickets of *Betula nigra* (river birch). In the past a 2-3 ha forest dominated by river birch was present between the sedge meadow and the shrub prairie (Uhlarik et al. 1990). In this small forest, tree density averaged 579 stems/ha and basal area averaged 24.04 $m^2$/ha. *Betula nigra*, which accounted for 90% of the importance value, had an average diameter of 22.6 cm dbd. Prescribed burns within the past 13 years have decreased the size of this small forest.

**Dry Sand Prairie:** Common in pre-settlement times, these prairies were found on the upper slopes and ridges of dunes and other dry areas throughout the Illinois River sand deposits. In this community the soil lacked a dark A horizon, and the grasses, most of which were bunch-grasses, were mostly less than 1 m tall. This community, in the absence of recurring fires, developed into a dry sand savanna community (White and Madany 1978). Gleason (1910) was probably the first to quantify the species composition of the Mixed Consocies of the Bunch-Grass Association, which corresponds to the dry sand prairie community of White and Madany (1978). As described by Gleason (1910) this associated was dominated by native bunch-grasses and sedges with most of the remaining species restricted to the areas of bare soil between bunch-grasses. These secondary species were divided into ecological groups based on their habit and structure: large perennials and shrubs that competed with the bunch-grasses; mat-plants, such as *Opuntia humifusa* (common prickly pear); interstitial herbs that were mostly annuals and were restricted to the bare sand between the bunch-grasses; and parasitic herbs.

A few dry sand prairie communities were studied in the Illinois River sand deposits, most from nature preserves and other state lands in Mason County. Some of the studies involved relatively mature dry sand prairie communities subjected to some present day minor disturbances and probably past grazing, but were never cultivated. Other studies involved successional communities that were cultivated in the past, and natural blow-out communities with extensive moving sand. These studies have been completed since the summer of 2000 at three nature preserves and a state forest. At Long Branch Nature Preserve (Mason Co. NW1/4 S31 T21N R8W) a mature sand prairie

community was surveyed by Phillippe et al. (2004); while McClain et al (2005) studied a blow-out, a disturbed and a mature dry sand prairie community were examined at Henry Allan Gleason Nature Preserve (Mason Co. SE1/4 S6, NE1/4 S7 T22N R7W). At Sand Prairie-Scrub Oak Nature Preserve (Mason Co. S13, 14, 23, 26 T20N R9W) early-successional, late-successional and mature dry sand prairie communities were studied by McClain et al. (2007b), while at Sand Ridge State Forest two small prairie inclusions were just recently surveyed, the 4 ha Burns Sand Prairie (S1/2 NW1/4 SW1/4 T22N R7W) and the 2.4 ha Quiver Sand Prairie (E1/2 NW1/4 SE1/4 S28 T23N R7W).

*Mature dry sand prairie*: Since 2000 five relatively mature dry sand prairie remnants have been surveyed in three dedicated nature preserves and a state forest in Mason County, Illinois. None of the study sites showed any indication of past disturbances except for a few paths and occasionally tracks of off-road-vehicles, though all were probably heavily grazed prior to being purchased by the state of Illinois. All sites were dominated by *Schizachyrium scoparium* (little bluestem). This bunch grass commonly formed a dense mass through which few species grew, were 20-60 cm across, and nearly circular in outline. Some of the larger clumps had centers that had died and in which no other species were found growing.

At Long Branch Nature Preserve 45 taxa were encountered in the plots with *Schizachyrium scoparium* the most important having an IV of 55.7 and a mean cover of 26.77% (Phillippe 2004). Also common, *Ambrosia psilostachya* (western ragweed) was second with an IV of 28.5, while *Opuntia humifusa* was third with an IV of 19.0. Overall, five native prairie species that are typical components of dry sand prairies, had IVs greater than 10. All would be expected in good quality dry sand prairies in Illinois.

At Henry Allen Gleason Nature Preserve only 17 species were encountered in the plots of a small mature dry sand prairie remnant. The small size (less than 1 ha), and occasional foot traffic has resulted in some disturbances, but the prairie still contains the dominant species commonly associated with dry sand prairies (McClain et al. 2005). *Schizachyrium scoparium* (IV of 84.6) was the leading dominant. *Tephrosia virginiana* (goat's-rue) and *Opuntia humifusa* were second and third with IVs of 27.3 and 25.1 respectively, while *Ambrosia psilostachya* and *Dichanthelium villosissimum* also had IVs that exceeded 15.

At Sand Prairie-Scrub Oak Nature Preserve 16 species were encountered in the plots (McClain et al. 2007b). *Schizachyrium scoparium* was the dominant species with an IV of 79.4 and a mean cover of 46.35%. Other common species, all with IVs greater than 15 and mean covers above 3% included *Dichanthelium villosissimum, Tephrosia virginiana, Ambrosia psilostachya,* and *Opuntia humifusa.* Only 16 species were encountered in the plots of this dry sand prairie remnant of about 16 ha which is the largest dry sand prairie remnant in this 591 ha preserve.

Burns and Quiver dry sand prairies were located in small forest openings on ridges and swales of large stabilized dunes at Sand Ridge State Forest, Mason County, Illinois. Both prairie had high species diversity, 42 species were encountered in the plots of Burns prairie and 48 taxa in the plots of Quiver Prairie. Dominant species were nearly identical on both prairies. *Schizachyrium scoparium* had an importance value of 40.1 on Quiver Prairie and 35.7 on Burns Prairie (Table 2). *Tephrosia virginiana*, *Opuntia humifusa*, and *Ambrosia psilostachya* were among the top five species on both prairies.

Other common grasses were *Dichanthelium villosissimum* (hairy panic grass) on both prairies and *D. depauperatum* (panic grass) on Quiver Prairie. Overall, the five native prairie species that were typical components of dry sand prairies had IVs greater than 10. All would be expected in high quality dry sand prairies in Illinois. The exotic species *Fallopia convolvulus* (black bindweed) was encountered in the plots of these prairies, while 11 other exotic were found in areas of disturbance at the edges of the prairies.

Burns and Quiver dry sand prairies were very similar to the mature dry sand prairies at Henry Allen Gleason Nature Preserve (McClain et al. 2005), Long Branch Nature Preserve (Phillippe et al. 2005), and Sand Prairie-Scrub Oak Nature Preserve (McClain et al. 2005). Four of the top five dominants were identical in all preserves with little bluestem dominant and western ragweed, common prickly pear, and goat's-rue important subdominants. Of these species, goat's-rue was not found in the plots at Long Branch Nature Preserve. This species is relatively common on that prairie, but had a clumped distribution and was absent in the general area where transects were placed (Phillippe et al. 2005).

*Late successional dry sand prairie*: Based on aerial photographs from 1939 and later years it was possible to determine when many agricultural fields were abandoned in the nature preserves of the Illinois River sand deposits. At Sand prairie-Scrub Oak Nature Preserve a 60-year-old successional field abandoned in the early 1940's was surveyed by McClain et al. (2007b). This field had high species diversity with 20 native herbaceous species encountered in the plots. *Eragrostis trichodes* (thread love grass) dominated with an IV of 51.2 and a mean cover of 25%. This field contained many taxa commonly associated with mature sand prairies. Four of the top five species in IV (*Schizachyrium scoparium, Ambrosia psilostachya, Dichanthelium villosissimum*, and *Opuntia humifusa*) were common components of mature dry sand prairies.

A disturbed dry sand prairie at Henry Allan Gleason Nature Preserve was surveyed in 2000 (McClain et al. 2005). This successional field was located on the south flank of "Devil's Tower" a large sand dune that dominates the preserve. Gleason (1910) indicated that Devil's Tower was originally covered with prairie but most had been destroyed by cultivated and pasturing. Later the slopes of this dune were planted in pines that were removed in 1978. The slopes presently contain a disturbed dry sand prairie having high species diversity including some taxa commonly associated with mature dry sand prairies: *Schizachyrium scoparium, Opuntia humifusa,* and *Dichanthelium villosissimum. Eragrostis trichoides* was the dominant species with an IV of 47.8 and a mean cover of 16.15. Other common species included *Chrysopsis camporum* (prairie golden aster), *Ambrosia psilostachya*, Rhus aromatica (fragrant sumac), and Opuntia humifusa all with IVs greater than 10 and mean covers that exceeded 3.25%.

*Early successional dry sand prairie*: Successional fields 30 to 40 years of age are relatively common in the Illinois River sand deposits. At Sand Prairie-Scrub Oak Nature Preserve a 30-year-old successional field was surveyed in 2000 (McClain et al. 2007b). This field, which was taken-out of cultivation when the preserve was purchased in 1969, was dominated by Eragrostis trichodes with an IV of 97.4 and a mean cover of 61.7%. Other common species included *Strophostyles helvula* (wild bean) with an IV of 43.7 while *Monarda punctata* (horsemint) was third with an IV of 16.9. Of the dominants

associated with mature dry sand prairie, little bluestem, western ragweed, and goat's rue were not encountered while hairy panic grass and common prickly pears were rare.

*Blow-out community*: Early studies suggested that blow-out communities were extremely common in the sand deposits of Illinois because of over-grazing and farming practices (Hart and Gleason 1907, Gleason 1910, Vestal 1913). Since the establishment of nature preserves in the Illinois sand deposits during the 1970s most bow-outs became stabilized with successional vegetation. One large blowout at Henry Allan Gleason Nature Preserve was surveyed (McClain et al. 2005). In this community the vegetation was widely scattered and bare ground and litter averaged 81%. Only 12 species were encountered, *Aristida tuberculosa* (needle grass) was the dominant species (IV of 95.5), followed by *Cyperus grayoides,* and *Diodia teres* (rough buttonweed), with IVs of 68.0 and 14.8 respectively. Only eight species were encountered in the plots and all but three had IVs lower than 10. The Illinois threatened species *Cyperus grayoides* was also a common associate of dry sand prairie blow-out communities at Long Branch Nature Preserve, Sand Prairie-Scrub Oak Nature Preserve, and Burns sand prairie at Sand Ridge State Forest.

**Dry Gravel Prairie:** This prairie community was dominated by many of the grasses and forbs associated with dry sand prairies. These prairies occur on gravel soils with little organic material and high water permeability. On these dry prairies the flora had an average height of less than 1 m, the dominant grasses usually being *Schizachyrium scoparium* and *Bouteloua curtipendula* (side-oats grama). This community is rare in the Illinois River sand deposits; the only good quality example is located at Manito Prairie Nature Preserve about 12 kms southwest of Pekin, Tazewell County, Illinois (SW1/4 S15 T24N R6W). Gravel prairies were more common in pre-settlement times on the slopes of gravel terraces along the Illinois River, particularly north of present day Peoria, Illinois. Most have been destroyed by excessive grazing, cultivation, and surface mining for gravel.

McFall (1984) reported 212 vascular plant species on Manito Prairie, the largest majority were dry prairie grasses and forbs. In a 2002 survey by McClain et al. (2004) this gravel prairie was dominated by the bunch-grass *Schizachyrium scoparium* (IV of 61.8), that was more than four time as abundant as the next most important species, *Dichanthelium oligosanthes* (panic grass) with an IV of 12.3. Other common native grasses included *Sorghastrum nutans, Sporobolus clandestinus* (dropseed), and *Bouteloua curtipendula*. Common forbs included *Chrysopsis camporum* (prairie golden aster), *Dalea purpurea* (purple prairie clover), *Echinacea pallida* (pale coneflower), *Ambrosia psilostachya, Opuntia humifusa, Lespedeza capitata* (round-headed bush clover) and *Senecio platensis* (prairie groundsel), all with IVs greater than 5. Some state endangered and threatened species occurred here, including *Astragalus tennesseensis* (ground plum) and *Besseya bullii* (kitten tails), along with *Tetraneuris herbacea* (lakeside daisy) which was planted and has persisted (Herkert and Ebinger 2002). The FQI of the dry gravel prairie was 40.71 with a mean CC of 2.71.

**Dry Sand Savanna:** Savanna communities are generally defined as having overstories consisting of scattered, open-grown trees, and a ground cover dominated by grasses

(Curtis 1959, Bray 1960, Nuzzo 1986, White and Madany 1978). In dry sand savannas the soil lacked a dark A horizon; the ground cover was composed of many prairie species with the dominant bunch-grasses mostly less than 1 m tall; while the canopy was dominated by *Quercus velutina* with a canopy cover that averaged between 10 and 40%. Also, dry sand savannas were associated with dune and swale topography which probably limited the severity of fires (White and Madany 1978, Anderson and Brown 1986, Anderson 1991, Abrams 1992).

Dry sand savannas are still relatively common in the Illinois River sand deposits. Most, however, have been degraded by fire suppression and invasion by woody and exotic species (McClain and Elzinga 1994). Many are now closed forests that lack the characteristic prairie ground layer species, particularly grasses. In pre-settlement times Sand Prairie-Scrub Oak Nature Preserve was dominated by open woodland and savanna as well as sand prairie communities (Rogers and Anderson 1979). Presently, due mostly to fire suppression, these open savanna communities have become closed forests (McClain et al. 2001). In this preserve *Quercus velutina* dominated the forest with importance values of 148 to 196 (possible 200), and 260 to 468 stems/ha in various parts of the preserve. Other common overstory species included *Q. marilandica*, *Carya texana* (black hickory), and *C. tomentosa* (mockernut hickory). Black oaks, which averaged around 25 cm dbh, were commonly multiple-stemmed with 2-5 stems from near the base, and indication of past fires. Most of these coppice stem were the result of occasional wild fires previous to the preserve being purchased in 1969. The forests of the preserve are presently being subjected to management fires to simulate the pre-settlement conditions.

Degraded dry sand savannas, that are presently forests due to fire suppression, are the dominant community of ridges and slopes on large stabilized dunes at Sand Ridge State Forest, Mason County, Illinois. Based on an analysis of 1939 aerial photographs approximately 50.18% of the present area of Sand Ridge State Forest was covered by trees and large shrubs. Canopy cover increased dramatically by 1957 to 68.96%, in 1969 the cover increased to 78.66%, in 1988 cover increased to 88.08%, while in 1998 canopy cover was 89.50%. In approximately 60 years the sand savanna at Sand Ridge State Forest became a closed forest. The woody encroachment is most obvious where pine plantations were introduced in the 1940s and 1950s. The cover in 1939 lacked introduced conifers, and only the native *Juniperus virginiana* was present. Conifers were not observed in the 50 sites digitized from the 1939 aerial photographs, but these same 50 sites that were digitized in 1939 contained conifers in 35 of the 50 digitized sites in 1998.

In the dry sand savanna community surveyed at Sand Ridge State Forest 11 tree species were encountered (Table 3). Black oak dominated all diameter classes, accounted for 65% of the stems/ha, and was the only species with stems greater than 60 cm dbh. This species had an IV of 143.5, averaged 321.1 stems/ha, averaged 23.6 cm dbh, and accounted for 78.1% of the total basal area. *Quercus marilandica*, second in IV (34.7), was mostly restricted to smaller diameter classes, averaged 111.6 stems/ha, and averaged 16.5 cm dbh. The remaining species were mostly in the 10-39 cm diameter classes, *Carya texana* (black hickory) averaged 26.3 stems/ha, while *Pinus strobus* (white pine) averaged 26.1 stems/ha. Coppice stems accounted for about 16% of the stems encountered. Black oak accounted for the majority, averaging 27 coppice trees/ha with 57.7 stems/ha (Table 4). Dead-standing individuals averaged 24.6 stems/ha with a basal

area of 1.01 $m^2$/ha, nearly all being oaks. A few dead-standing black oaks exceeded 40 cm dbh.

In this degraded dry sand savanna the woody understory averaged 15,200 seedlings/ha, 1,775 small saplings/ha, and 295 large saplings/ha (Table 5). Black oak and black hickory accounted for nearly all of the tree seedlings. Because of the relatively few saplings, the woody understory was open. Woody shrubs were also important in the understory, *Rubus allegheniensis* (common blackberry), *Rhus aromatica* (fragrant sumac), *Toxicodendron radicans* (poison ivy), and *Cornus drummondii* being the most common. In the herbaceous layer species diversity was relatively high though cover was low, bare ground and litter averaged greater than 65%. Few prairie grasses were encountered though many prairie forbs were present in low numbers.

The forests of Sand Ridge State Forest are very different today compared to the early 1800s, mostly due to a reduced fire frequency followed by the total absence of fire in recent decades (Taft 1997). Presently, however, the droughty conditions have allowed for the perpetuation of oak species. Black oak is reproducing on the site with numerous seedlings and saplings in the understory (Table 5). Blackjack oak, in contrast, has a very low rate of reproduction. The large number of seedlings, saplings, and small diameter trees of black hickory suggests that this species will increase in importance. As canopy closure continues, however, the shade-intolerant oaks may not effectively reproduce. Black hickory, a fire-sensitive, but relatively shade-tolerant species, could become the dominant understory species and became more common in the lower diameter classes.

Using GLO survey records, Rodgers and Anderson (1979) described the pre-settlement vegetation of Mason County (Hutchison 1988). They found that in savanna communities tree density averaged 7.44 trees/ha with an average basal area of 1.19 $m^2$/ha, much lower than what was found during the present study. Black oak was, by far, the dominant woody species, accounting for more than half of the IV. Blackjack oak was second in IV followed by various species of hickory. The many small diameter witness trees reported in the GLO survey indicate that oaks and hickories were reproducing, and these relatively shade-tolerant species were replacing themselves (Rodgers and Anderson 1979).

**Dry-mesic Sand Savanna:** Sand savannas associated with lower dunes slopes and ravines, particularly north-facing and east-facing slopes, were more mesic than dry sand savannas (White and Madany 1978). In these dry-mesic sand savannas *Quercus velutina* was present, but more mesic tree species also entered the canopy, particularly *Quercus alba*. Depending on fire frequency and intensity other species were present in low numbers, and included *Celtis occidentalis* (hackberry), *Juglans nigra*, Sassafras *albidum* (sassafras), and *Ulmus americana* (American elm). Due to the lower topographic position there was usually some development of a soil A horizon; some mesic ground layer prairie species were present; and some prairie grasses commonly exceeded 1 m in height. Due to fire suppression and exotic species encroachment good quality examples of dry-mesic sand savannas no longer exist in the Illinois River sand deposits. A few degraded examples which would now be classified as forest communities were encountered in Cass and Mason counties.

The Mason County site was located in Speckman-Stelter Woods Land and Water Reserve (White Oak Creek Woods Natural Area) about 6 km south of Havana, Illinois

(SE1/4 NW1/4 S23 T21N R9W). This site, about 2 ha in size, was located on a sandy upland terrace about 500 m east of the Illinois River. Ten tree species were recorded for the site with an average of 180.4 stems/ha and an average basal area of 28.715 $m^2$/ha (Table 6). White oak dominated the larger diameter classes with an IV of 144.2, and an average diameter of 53.4 cm. Most of the larger white oaks had an open-grown form with large branches or branch scars within 4 m of the ground. Black oak, also restricted to the larger diameter classes, was second in IV (12.7) and had an average diameter of 71.3 cm. The remaining tree species were mostly in the 10-29 cm diameter classes. Dead-standing white and black oaks averaged 11.7 stems/ha with an average basal area of 2.641 $m^2$/ha. The density of tree seedlings, shrubs and woody vines was high, totaling 19,000 individuals/ha, small saplings averaged 2,250 stems/ha, and large saplings totaled 1,370 stems/ha (Table 7). *Sassafras albidum* dominated the seedling and sapling categories with 4300 seedlings/ha, 1600 small saplings/ha, and 545 large saplings/ha. Oak seedlings were fairly common, but no oak saplings were recorded.

According to Lerczak (2000), Ms. Stelter, the present owner of the property, recalled her great grandfather stating that it was possible to drive a wagon through the woods in the 1840s, an indication of the openness of the woods. It also was mentioned that many oaks were present as grubs, suggesting frequent fires (Taft 1997). The present appearance of White Oak Creek Woods compared to 150 years ago is probably due to a reduced fire frequency followed by a total absence of fire in recent decades (Taft 1997). In pre-settlement time frequent fires maintained much of this dry-mesic to mesic oak cover type, particularly along the western edge of its range (Ebinger and McClain 1991, McClain and Elzinga 1994).

The Cass County site was located on a north-facing dune slope in a ravine on the John Wagner property about 5 kms south of Bluff Spring, Illinois (SE1/4 SE1/4 S4 T17N R11W). This woodlot, degraded by fire suppression and grazing contained one small area, less than 1ha in size, where mesic species entered the canopy (Table 8). Nine tree species were recorded for the site with an average of 360.0 stems/ha and an average basal area of 32.544 $m^2$/ha (Table 8). Black oak dominated the larger diameter classes with an IV of 58.0, and an average diameter of 60.3 cm. White oak, in contrast, was represented in most diameter classes, averaged 64.0 stems/ha, 10.056 m2/ha, and an average diameter of 41.9 cm. Most of the larger oaks had an open-grown form with large branches or branch scars within 4 m of the ground. The remaining tree species were mostly in the smaller diameter classes (Table 8).

**Dry Sand Forests:** Forests are generally defined as communities that are dominated by tress and have nearly closed overstories with more than 80% cover (Nuzzo 1986, White and Madany 1978). In dry sand forests the soil commonly has a dark A horizon from accumulated leaf litter, the ground cover has some prairie species but native shade-tolerant forest species are more common, while prairie bunch-grasses are rare except in forest openings. The species composition of the woody understory and overstory of dry sand forests is similar to that of dry sand savannas with *Quercus velutina* the dominant overstory species. Also, dry sand forests are associated with dune and swale topography and other natural fire breaks that greatly limited frequency and severity of fires. Post-settlement fire exclusion has increased the acreage of sand forest at the expense of sand

savannas (White and Madany 1978, Anderson and Brown 1986, Anderson 1991, Abrams 1992).

Presently dry sand forests are common in the Illinois River sand deposits. Most, however, have been degraded by fire suppression and invasion by woody and exotic species (McClain and Elzinga 1994). According to Rogers and Anderson (1979) pre-settlement forests were common in Mason County and accounted for about 30% of the vegetation. Overall, in these forests tree density averaged 263 stems/ha, while basal area averaged 29 $m^2$/ha. Rogers and Anderson (1979), using government land office survey records found that these sand forests were mostly restricted to the areas along the Illinois River and areas of extensive dunes in the northern and central parts of the county. As the forests became denser the more shade-tolerant, fire-sensitive species, such as maple and ash, increased in importance. The dry sand forests of three natural areas have been studied in Mason County, Bishop's Woods Natural Area, Barkhausen Woods Natural Area, and Tomlin Timber Nature Preserve.

Bishop's Woods Natural Area is located in the southern part of Sand Ridge State Forest about 3 km west of Forest City, Mason County, Illinois (SE1/4 S10 SW1/4 S11 NW1/4 S14 NE1/4 S15 T22N R7W). This sand forest, which was surveyed in 1990, had an average density of 247.5 stems/ha (≥10 cm dbh) and an average basal area of 16.1 $m^2$/ha (Jenkins et al. 1991). *Quercus velutina* dominated with an importance value of 144.9 (possible 200), averaged 150.1 stems/ha, and with an average basal area of 13.50 $m^2$/ha. *Carya texana* (IV of 22.6), *Q. marilandica* (IV of 15.0), and *C. tomentosa* (IV of 10.9) were the other common species in the overstory. The woody understory was relatively dense, woody seedlings averaged 3,653 stems/ha, while saplings averaged 3,544 stems/ha, with black hickory and black oak accounting for more than 50% of these totals. Shrub density was 26,488 stems/ha with *Toxicodendron radicans, Rhus aromatica, Zanthoxylum americanum* (prickley ash), and *Cornus racemosa* (gray dogwood) the dominant species (Jenkins et al. 1991).

Barkhausen Woods Natural Area is located about 10 miles SW of Bath in the SW corner of Mason County, Illinois (NW1/4 S19 T19N R10W). This closed canopy sand forest was surveyed in 1991 and stand composition averaged 237.9 stems/ha with an average basal area of 16.3 $m^2$/ha (Coates et al. 1992). At this site 26 woody species were encountered, 17 were trees while 9 were shrubs and vines. Black oak was the leading dominant with 82.2 stems/ha, an average basal area of 12.5 $m^2$/ha, an importance value of 111.2, and an average dbh of 41.3. Black hickory was second in importance (IV of 61.5) with an average of 109.6 stems/ha, most in the 10-30 cm diameter classes as indicated by an average dbh of 15.9. Blackjack oak ranked third with an IV of 22.0, most individuals in the smaller diameter classes. The woody understory was dense, woody seedlings averaged 7,190 stems/ha, while saplings averaged 3,985 stems/ha with oaks and hickories accounting for more than 75% of these totals. Shrubs averaged 9,235 stems/ha with *Toxicodendron radicans, Rubus allegheniensis*, and *Cornus racemosa* accounting for 84% of the total (Coates et al. 1992).

During the present study the dry to dry-mesic upland sand forest at the Tomlin Timber Nature Preserve was surveyed. This preserve is located about 2 kms southwest of Easton, Mason County, Illinois (SE1/4 NW1/4 S11 T20N R7W). Little is known about the past history of this 8 ha tract of timber. A comment by Onstot (1902) mentions that Walker's Grove (of which Tomlin Timber is a remnant) "embraces 40 acres of as fine a

body of timber as can be found anywhere; a fine growth of oaks, black walnut, soft and sugar maple, hickory, butternut, mulberry, sassafras, redbud, pawpaw, and dogwood". The size of the black oaks, most are in the 50-70 cm diameter classes, suggests that the woods was never clear-cut. When purchased by the Tomlin family in 1912 a one-room schoolhouse was located on the east edge of the property. When surveyed by the Illinois Natural Areas Inventory (White 1978), the owner indicated that the woods had been selectively logged 50 to 60 years ago, but never grazed. Don McFall (Illinois Department of Natural Resources, personal communication) mentions that he first walked through the woods in the early 1980s, and there was a fairly dense woody understory and a number of large dead black oaks. The preserve was dedicated in 1987 (McFall and Karnes 1995).

When surveyed by the Illinois Natural Areas Inventory in 1976, the preserve was considered an old-growth "grade A" dry upland sand forest due to the "excellent timber of good size, height, and form" (Wallace and Rowe 1976). Tree density averaged 244 stems/ha with a basal area of 27.6 $m^2$/ha. Black oak was the dominant overstory species with 120 stems/ha and a basal area of 22.0 $m^2$/ha, most of the individuals in the 50 to 70 cm diameter classes. *Sassafras albidum*, *Carya tomentosa*, and *Carya texana* followed in importance. The sapling layer averaged 3,900 stems/ha, sassafras being the dominant species with 1,700 stems/ha (Wallace and Rowe 1976).

During the present survey, which was completed in 2004, 19 tree species were present in the overstory. Sassafras dominated with an importance value of 54.9 (possible 200), an average dbh of 24.4 cm, and with most individuals in the 10-40 cm diameter classes (Table 8). Black oak, in contrast, was second with an IV of 38.5, an average dbh of 62.7 cm, and dominated the larger diameter classes. The remaining tree species were mostly in the 10-39 cm diameter classes with, all with IVs of 30 or below and average diameters less than 20 cm dbh (Table 8).

The woody understory in Tomlin Timber was dense with 18,639 woody seedlings/ha, 4,862 small saplings/ha, and 1,222 large saplings/ha (Table 9). Few open areas existed in the woody understory, the more open areas being under the extensive colonies of *Asimina triloba* (pawpaw). Pawpaw averaged 4,028 seedlings/ha, 2,986 small saplings/ha, 854 large saplings/ha, along with 14.9 stems/ha that exceeded 10 cm dbh (Table 8 and 9). Few other taxa occurred under these dense pawpaw colonies. Hackberry, sassafras, bitternut hickory, and American elm were also extremely common. Many other tree species were present, but in low numbers. Woody shrubs and vines were also important in the understory, *Toxicodendron radicans*, *Rubus pensilvanicus*, and *Ribes missouriense* being the most common (Table 9).

Dead-standing individuals averaged 43.5 stems/ha with a basal area of 5,059 $m^2$/ha, the most important being black oak, sassafras and American elm (Table 10). Sassafras exceeded black oak in the number of dead-standing stems/ha, but dead-standing black oak was responsible for most of the basal area (4.188 of 5.059 $m^2$/ha). Dead-downed trees were common and averaged 46.7 stems/ha with a basal area of 6.115 $m^2$/ha. Black oak was the most important taxon in this category and accounted for 37.3 stems/ha and 5.781 $m^2$/ha of basal area (Table 10).

Tomlin Timber was part of an open, dry to dry-mesic sand forest or woodland in pre-settlement times. Canopy closure and the increase in importance of mesic trees, resulting from fire suppression, has altered the structure of Tomlin Timber. With canopy closure shade-intolerant black oaks could not effectively reproduce. Sassafras, a fire-

sensitive but relatively shade-tolerant species, became the dominant understory species, entered the canopy, and now is the dominant species.

The high mortality of black oak observed in the woods indicates that this species was susceptible to oak wilt (Henry et al. 1944). Oak wilt disease was observed in the woods in the early 1980s, and several large diameter black oaks were killed (W.E. McClain, personal observation). The death of large oaks created canopy openings that were filled by sassafras. Though the growth of sassafras is not rapid, this species has a relatively high gap-phase-replacement potential and commonly reproduces by root suckers.

At the present time no black oaks were observed in the sapling or 10-20 cm diameter class, suggesting that this species will continue to decrease in importance as veteran trees die. Also, few individuals of black oak were in the 20-29 cm diameter class. Tomlin timer is another example of oaks being replaced by more mesic tree species due to a reduced fire frequency (Ebinger and McClain 1991, Taft 1997). The loss of dominance by black oak since the 1976 inventory has been profound. This site may no longer qualify as an "old growth grade A" forest community.

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Table 1. Geographic area, topographic position, extent ($km^2$), and the county soil surveys used to determine the extent of the sand deposits along the Illinois River valley from the "Big Bend" in Putnam County, south to the Mississippi River valley.

| County and Number | Geographic Area | Topographic Position | Area ($km^2$) | County Soil Survey |
|---|---|---|---|---|
| Putnam #1 | Hennepin | upland | 25.9 | Zwicker et al. (1992) |
| Putman #2 | Senachwine | upland | 10.4 | Zwicker et al. (1992) |
| Marshall #1 | Lacon | upland | 18.1 | Teater and Walker (2002) |
| Woodford #1 | Spring Bay | upland | 28.5 | Teater (1999) |
| Peoria # 1 | Chillicothe | terrace | 46.6 | Walker (1992) |
| Tazewell # 1 | Pekin | terrace | 10.4 | Teater (1996) |
| Tazewell # 2 | Powerton | terrace | 7.8 | Teater (1996) |
| Tazewell # 3[a] | SW extension | upland | 82.9 | Teater (1996) |
| Tazewell # 4[a] | SE Extension | upland | 41.4 | Teater (1996) |
| Mason # 1 | W ½ of county | terrace/upland | 569.8 | Calsyn (1995) |
| Menard # 1[b] | Oakford | upland | 25.9 | Fehrenbacher and Odell (1953) |
| Cass # 1 | Beadstown | terrace | 20.7 | Calsyn (1989) |
| Cass # 2 | Airport | terrace | 59.6 | Calsyn (1989) |
| Cass # 3 | Arenzville | terrace/upland | 51.8 | Calsyn (1989) |
| Cass # 4[c] | S extension | terrace | 13.0 | Calsyn (1989) |
| Morgan # 1 | Meredosia | terrace | 20.7 | Gotsch (1988) |
| Scott # 1 | Naples | terrace | 15.5 | Gotsch (1988) |
| Scott # 2 | dune fields | terrace/upland | 33.7 | Gotsch (1988) |
| Greene # 1 | Apple River | upland | 2.6 | Downey et al. (1974) |
| Greene # 2 | Macoupin Creek | upland | 1.0 | Downey et al. (1974) |

[a]These sand deposits are extensions of the major sand deposit of Mason County.

[b]About half of this sand deposit is in Cass County and includes three small deposits of 20.7 $km^2$, 3.9 $km^2$, and 1.3 $km^2$, respectively.

[c]This sand deposit has a north/south extent of about 14 miles and extends through Morgan and the northern part of Scott counties and totals about 49.2 $km^2$, 13.0 $km^2$ in Cass County, 20.7 $km^2$ in Morgan County, and 15.5 $km^2$ in Scott County.

Table 2. Frequency (%), mean cover, and importance values (I.V.) of the ground-layer species encountered at Burns and Quiver dry sand prairies, Sand Ridge State Forest, Mason County, Illinois. (*exotic species)

| *Species* | Burns Dry Sand Prairie | | | Quiver Dry Sand Prairie | | |
|---|---|---|---|---|---|---|
| | Freq. % | Mean Cover | I.V. | Freq. % | Mean Cover | I.V. |
| *Schizachyrium scoparium* | 99 | 18.26 | 35.7 | 100 | 25.90 | 40.1 |
| *Tephrosia virginiana* | 60 | 13.49 | 25.2 | 43 | 11.80 | 18.0 |
| *Dichanthelium villosissimum* | 96 | 9.44 | 22 6 | 56 | 2.12 | 8.3 |
| *Ambrosia psilostachya* | 96 | 8.21 | 20.8 | 98 | 19.62 | 32.7 |
| *Opuntia humifusa* | 84 | 6.51 | 17.2 | 100 | 9.46 | 21.4 |
| *Crotonopsis linearis* | 94 | 0.50 | 9.4 | 29 | 0.15 | 3.3 |
| *Pseudognaphalium obtusifolium* | 45 | 2.56 | 7.9 | 14 | 0.63 | 2.2 |
| *Cyperus lupulinus* | 73 | 0.37 | 7.3 | 68 | 0.42 | 7.7 |
| *Leptoloma cognatum* | 33 | 2.76 | 7.0 | 5 | 0.08 | 0.6 |
| *Carex muhlenbergii* | 64 | 0.55 | 6.8 | 22 | 0.83 | 3.3 |
| *Commelina erecta* | 58 | 0.34 | 5.9 | 5 | 0.05 | 0.6 |
| *Carex tonsa* | 43 | 0.74 | 5.1 | 6 | 0.28 | 0.9 |
| *Conyza canadensis* | 50 | 0.33 | 5.1 | 26 | 0.21 | 3.0 |
| *Croton glandulosus* | 34 | 0.20 | 3.5 | 1 | 0.01 | 0.1 |
| *Rhus aromatica* | 10 | 1.77 | 3.5 | 7 | 2.56 | 3.6 |
| *Oenothera clelandii* | 21 | 0.13 | 2.2 | 41 | 0.63 | 5.0 |
| *Eragrostis spectabilis* | 14 | 0.49 | 2.0 | 10 | 0.37 | 1.5 |
| *Lespedeza capitata* | 10 | 0.54 | 1.7 | 11 | 0.13 | 1.4 |
| *Dichanthelium depauperatum* | 7 | 0.52 | 1.4 | -- | -- | -- |
| *Aristida tuberculosa* | 12 | 0.11 | 1.3 | -- | -- | -- |
| *Cyperus schweinitzii* | 10 | 0.05 | 1.0 | 6 | 0.03 | 0.6 |
| *Dichanthelium perlongum* | -- | -- | -- | 63 | 6.18 | 13.7 |
| *Sporobolus cryptandrus* | -- | -- | -- | 36 | 1.50 | 5.5 |
| *Monarda punctata* | -- | -- | -- | 36 | 1.40 | 5.4 |
| *Dichanthelium oligosanthes* | 5 | 0.10 | 0.7 | 22 | 0.46 | 2.8 |
| *Physalis heterophylla* | -- | -- | -- | 15 | 0.74 | 2.5 |
| **Fallopia convolvulus* | 3 | 0.02 | 0.3 | 19 | 0.25 | 2.3 |
| *Solidago nemoralis* | 1 | 0.03 | 0.1 | 20 | 0.15 | 2.3 |
| *Bouteloua hirsuta* | -- | -- | -- | 13 | 0.44 | 1.9 |
| *Chamaecrista fasciculata* | -- | -- | -- | 11 | 0.35 | 1.6 |
| *Brickellia eupatorioides* | -- | -- | -- | 9 | 0.44 | 1.5 |
| *Polygonum tenue* | -- | -- | -- | 10 | 0.05 | 1.2 |
| Others | | 1.12 | 6.3 | | 0.90 | 5.0 |
| Totals | | 69.14 | 200.0 | | 88.14 | 200.0 |
| Average bare ground and litter | | 27.31 | | | 15.06 | |

Table 3. Densities (stems/ha) by diameter classes (cm), basal areas ($m^2$/ha), relative values, importance values (I.V.) and average diameters (cm) of the woody species at Sand Ridge State Forest, Mason County, Illinois. (*exotic species)

| Species | Diameter Classes (cm) | | | | | | Total | Basal Area | Rel. | Rel. | | ***Av. Diam.*** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 10-19 | 20-29 | 30-39 | 40-49 | 50-59 | 60+ | #/ha | $m^2$/ha | Den. | Dom. | I.V. | ***(cm)*** |
| *Quercus velutina* | 145.3 | 107.7 | 37.7 | 20.7 | 6.7 | 3.0 | 321.1 | 16.995 | 65.4 | 78.1 | 143.5 | 23.6 |
| *Quercus marilandica* | 92.0 | 17.0 | 2.3 | 0.3 | -- | -- | 111.6 | 2.601 | 22.8 | 11.9 | 34.7 | 16.5 |
| **Pinus strobus* | 12.7 | 8.7 | 2.7 | 2.0 | -- | -- | 26.1 | 1.243 | 5.3 | 5.7 | 11.0 | 23.0 |
| *Carya texana* | 20.0 | 3.3 | 1.7 | 1.0 | 0.3 | -- | 26.3 | 0.849 | 5.4 | 3.9 | 9.3 | 17.0 |
| Others (7 species)[a] | 5.7 | -- | -- | -- | -- | -- | 5.7 | 0.080 | 1.1 | 0.4 | 1.5 | |
| **TOTALS** | 275.7 | 136.7 | 44.4 | 24.0 | 7.0 | 3.0 | 490.8 | 21.768 | 100.0 | 100.0 | 200.0 | |

[a]Other species included: *Carya tomentosa*, *Diospyros virginiana*, *Juniperus virginiana*, **Pinus banksiana*, **Pinus sylvestris*, *Prunus serotina*, *Ulmus americana*.

Table 4. Density (#/ha) of coppice trees and stems, coppice stems per tree, average basal area ($m^2$/ha) of coppice stems, and the average diameters (cm) of coppice stems at Sand Ridge State Forest, Mason County, Illinois.

| Species | Trees (#/ha) | Stems (#/ha) | Stems/trees | Basal Area ($m^2$/ha) | Average Diameter (cm) |
|---|---|---|---|---|---|
| *Quercus velutina* | 27.0 | 57.7 | 2.1 | 2.721 | 23.4 |
| *Quercus marilandica* | 9.0 | 19.3 | 2.2 | 0.540 | 17.9 |
| *Carya texana* | 1.7 | 3.3 | 2.0 | 0.099 | 17.1 |
| Totals | 37.7 | 80.3 | | 3.360 | |

Table 5. Density (stems/ha) of woody understory species in a woodland community at Sand Ridge State Forest, Mason County, Illinois. (*exotic species)

| Species | Seedlings | Small Saplings | Large Saplings |
|---|---|---|---|
| *Quercus velutina* | 3750 | 575 | 100.0 |
| *Carya texana* | 2850 | 600 | 85.0 |
| *Prunus serotina* | 250 | 250 | 20.0 |
| *Quercus marilandica* | 250 | 25 | 30.0 |
| *Carya tomentosa* | 150 | 125 | 17.5 |
| **Pinus strobus* | 150 | 25 | 17.5 |
| *Juniperus virginiana* | -- | 100 | 15.0 |
| **Pinus sylvestris* | -- | -- | 5.0 |
| *Ulmus americana* | -- | -- | 2.5 |
| *Celtis occidentalis* | -- | -- | 2.5 |
| *Rubus allegheniensis* | 2250 | -- | -- |
| *Rhus aromatica* | 1850 | -- | -- |
| *Toxicodendron radicans* | 1650 | -- | -- |
| *Cornus drummondii* | 1600 | 50 | -- |
| *Rubus occidentalis* | 300 | -- | -- |
| *Ribes missouriense* | 100 | -- | -- |
| *Viburnum prunifolium* | 50 | -- | -- |
| **Lonicera maackii* | -- | 25 | -- |
| Totals | 15200 | 1775 | 295.0 |

Table 6. Density (stems/ha) by diameter classes (cm), basal area ($m^2$/ha), relative values, importance value, and average diameter (cm) of woody overstory species at dry-mesic sand savanna communities, Mason and Cass counties, Illinois. (*exotic species)

| Species | Diameter Classes (cm) | | | | | | Total | Basal Area | Rel. | Rel. | | *Av. Diam.* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 10-19 | 20-29 | 30-39 | 40-49 | 50-59 | 60+ | #/ha | $m^2$/ha | Den. | Dom. | I.V. | *(cm)* |
| **White Oak Creek** | | | | | | | | | | | | |
| *Quercus alba* | -- | -- | 11.7 | 29.9 | 35.2 | 28.8 | 105.6 | 24.577 | 58.6 | 85.6 | 144.2 | 53.4 |
| *Quercus velutina* | -- | -- | -- | -- | 1.1 | 5.4 | 6.5 | 2.611 | 3.6 | 9.1 | 12.7 | 71.3 |
| *Prunus serotina* | 18.1 | 2.1 | -- | -- | -- | -- | 20.2 | 0.284 | 11.2 | 1.0 | 12.2 | 12.9 |
| *Sassafras albidum* | 17.1 | -- | -- | -- | 1.1 | -- | 18.2 | 0.466 | 10.0 | 1.6 | 11.6 | 14.1 |
| *Robinia pseudoacacia* | 9.6 | 2.1 | -- | -- | -- | -- | 11.7 | 0.240 | 6.5 | 0.8 | 7.3 | 15.6 |
| **Morus alba* | 8.5 | -- | -- | -- | -- | -- | 8.5 | 0.094 | 4.7 | 0.4 | 5.1 | 11.8 |
| Others (4 species)[a] | 6.4 | 1.1 | 1.1 | 1.1 | -- | -- | 9.7 | 0.443 | 5.4 | 1.5 | 6.9 | |
| TOTALS | 59.7 | 5.3 | 12.8 | 31.0 | 37.4 | 34.2 | 180.4 | 28.715 | 100.0 | 100.0 | 200.0 | |
| **Wagner Property** | | | | | | | | | | | | |
| *Quercus velutina* | -- | 4.0 | -- | -- | 24.0 | 20.0 | 48.0 | 14.536 | 13.3 | 44.7 | 58.0 | 60.3 |
| *Quercus alba* | -- | 16.0 | 16.0 | 16.0 | 8.0 | 8.0 | 64.0 | 10.056 | 17.8 | 30.9 | 48.7 | 41.9 |
| *Sassafras albidum* | 52.0 | 32.0 | 8.0 | 4.0 | -- | -- | 96.0 | 3.724 | 26.8 | 11.4 | 38.2 | 21.0 |
| *Ulmus americana* | 36.0 | 8.0 | -- | 4.0 | -- | -- | 48.0 | 1.684 | 13.3 | 5.2 | 18.5 | 19.0 |
| *Prunus serotina* | 40.0 | 8.0 | -- | -- | -- | -- | 48.0 | 0.892 | 13.3 | 2.8 | 16.1 | 14.9 |
| *Ulmus rubra* | 24.0 | 8.0 | 4.0 | -- | -- | -- | 36.0 | 1.200 | 10.0 | 3.7 | 13.7 | 19.2 |
| Others (3 species)[b] | 20.0 | -- | -- | -- | -- | -- | 20.0 | 0.452 | 5.5 | 1.3 | 6.8 | |
| **TOTALS** | 172.0 | 76.0 | 28.0 | 24.0 | 32.0 | 28.0 | 360.0 | 32.544 | 100.0 | 100.0 | 200.0 | |

[a]Other species included: * *Maclura pomifera, Ulmus americana,, Celtis occidentalis,* and *Juglans nigra.*
[b]Other species included: *Carya tomentosa, Carya cordiformis* and *Cornus florida.*

Table 7. Density (stems/ha) of the woody understory species at Speckman-Stelter Woods Land and Water Reserve (White Oak Creek Woods Natural Area), Mason County, Illinois. (*exotic species)

| Species | Seedlings | Small Saplings | Large Saplings |
|---|---|---|---|
| *Sassafras albidum* | 4300 | 1600 | 545 |
| *Celtis occidentalis* | 1700 | 100 | 25 |
| *Quercus alba* | 1100 | -- | -- |
| *Quercus velutina* | 800 | -- | -- |
| *Carya texana* | 300 | 200 | 95 |
| *Ulmus americana* | 300 | -- | 15 |
| *Prunus serotina* | 200 | 100 | 375 |
| **Morus alba* | 100 | -- | 45 |
| *Cercis canadensis* | 100 | -- | 20 |
| *Asimina triloba* | 100 | -- | -- |
| *Carya tomentosa* | -- | 50 | -- |
| *Ulmus rubra* | -- | -- | 145 |
| *Robinia pseudoacacia* | -- | -- | 75 |
| *Crataegus mollis* | -- | -- | 5 |
| *Tilia americana* | -- | -- | 5 |
| *Fraxinus lanceolata* | -- | -- | 5 |
| *Juglans nigra* | -- | -- | 5 |
| *Cornus drummondii* | 200 | 200 | 10 |
| *Toxicodendron radicans* | 7700 | -- | -- |
| *Rubus allegheniensis* | 1200 | -- | -- |
| *Ribes missouriense* | 900 | -- | -- |
| *Totals* | 19000 | 2250 | 1370 |

Table 8. Density by diameter classes (stems/ha), basal area ($m^2$/ha), relative values, importance value (IV), and average diameter (cm) of woody overstory species at dry-mesic sand savanna communities, Mason and Cass counties, Illinois. (*exotic species)

| Species | Diameter Classes (cm) | | | | | | Total | Basal Area | Rel. | Rel. | | *Av. Diam.* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 10-19 | 20-29 | 30-39 | 40-49 | 50-59 | 60+ | #/ha | $m^2$/ha | Den. | Dom. | I.V. | *(cm)* |
| *Sassafras albidum* | 41.1 | 59.8 | 26.7 | 4.2 | 0.7 | -- | 132.5 | 6.898 | 26.5 | 28.4 | 54.9 | 24.4 |
| *Quercus velutina* | -- | 0.7 | 0.9 | 1.1 | 5.8 | 16.9 | 25.4 | 8.102 | 5.1 | 33.4 | 38.5 | 62.7 |
| *Carya texana* | 51.6 | 34.0 | 3.8 | 0.7 | -- | -- | 90.1 | 2.905 | 18.1 | 12.0 | 30.1 | 19.3 |
| *Celtis occidentalis* | 64.7 | 13.1 | 2.0 | 0.7 | -- | 0.2 | 80.7 | 1.900 | 16.2 | 7.8 | 24.0 | 16.2 |
| *Prunus serotina* | 42.0 | 8.0 | 2.2 | 0.4 | -- | 0.2 | 52.8 | 1.380 | 10.6 | 5.7 | 16.3 | 16.7 |
| *Ulmus americana* | 31.8 | 5.8 | -- | -- | -- | -- | 37.6 | 0.791 | 7.5 | 3.3 | 10.8 | 15.7 |
| *Carya tomentosa* | 13.3 | 10.0 | 3.6 | 0.2 | -- | -- | 27.1 | 1.051 | 5.4 | 4.3 | 9.7 | 20.9 |
| *Ulmus rubra* | 24.4 | 4.4 | 0.4 | -- | -- | -- | 29.2 | 0.626 | 5.9 | 2.6 | 8.5 | 15.7 |
| *Asimina triloba* | 14.9 | -- | -- | -- | -- | -- | 14.9 | 0.166 | 3.0 | 0.7 | 3.7 | 11.8 |
| Others (10 species)[a] | 4.2 | 1.3 | 1.1 | 0.9 | 0.2 | 0.2 | 7.9 | 0.466 | 1.7 | 1.8 | 3.5 | |
| **TOTALS** | 288.0 | 137.1 | 40.7 | 8.2 | 6.7 | 17.5 | 498.2 | 24.285 | 100.0 | 100.0 | 200.0 | |

[a]Other species included: *Juglans nigra* (black walnut), *Carya cordiformis* (bitternut hickory), *Morus rubra* (red mulberry), **Morus alba* (white mulberry), *Acer saccharum* (sugar maple), **Robinia pseudoacacia* (black locust), **Catalpa binonioides* (catalpa), *Acer saccharinum* (silver maple), **Maclura pomifera* (Osage orange), and *Diospyros virginiana* (persimmon).

Table 9. Density (stems/ha) of woody understory species at Tomlin Timber Nature Preserve, Mason County, Illinois.

| Species | Seedlings | Small Saplings | Large Saplings |
|---|---|---|---|
| *Asimina triloba* | 4028 | 2986 | 854 |
| *Celtis occidentalis* | 2000 | 944 | 115 |
| *Sassafras albidum* | 1806 | 625 | 103 |
| *Cary cordiformis* | 1667 | 167 | 25 |
| *Ulmus americana* | 1222 | 56 | 18 |
| *Ulmus rubra* | 361 | 42 | 21 |
| *Quercus velutina* | 333 | -- | -- |
| *Carya texana* | 250 | -- | 8 |
| *Maclura pomifera* | 139 | -- | 11 |
| *Morus alba* | 111 | 28 | -- |
| *Prunus serotina* | 83 | 14 | 61 |
| *Gleditsia triacanthos* | 28 | -- | -- |
| *Jugland nigra* | -- | -- | 4 |
| *Acer negundo* | -- | -- | 1 |
| *Morus rubra* | -- | -- | 1 |
| *Toxicodendron radicans* | 2194 | -- | -- |
| *Rubus pensilvanicus* | 1944 | -- | -- |
| *Ribes missouriense* | 1306 | -- | -- |
| *Sambus canadensis* | 389 | -- | -- |
| *Rubus occidentalis* | 278 | -- | -- |
| *Zanthoxylum americanum* | 250 | -- | -- |
| *Rubus flagellaris* | 139 | -- | -- |
| *Rosa multiflora* | 83 | -- | -- |
| *Lonicera maackii* | 28 | -- | -- |
| Totals | 18639 | 4862 | 1222 |

Table 10. Density (stems/ha), basal area ($m^2$/ha), and average diameter (cm) of the dead-standing and dead-downed tree species at Tomlin Timber Nature Preserve, Mason County, Illinois.

| | DEAD-STANDING | | | DEAD-DOWNED | | |
|---|---|---|---|---|---|---|
| Tree Species | Density (stems/ha) | Basal Area ($m^2$/ha) | Average Diameter (cm) | Density (stems/ha) | Basal Area ($m^2$/ha) | Average Diameter (cm) |
| *Quercus velutina* | 14.4 | 4.188 | 59.2 | 37.3 | 5.781 | 43.1 |
| *Sassafras albidum* | 17.1 | 0.532 | 19.2 | 3.6 | 0.158 | 23.0 |
| *Ulmus rubra* | 4.2 | 0.083 | 15.5 | 2.9 | 0.079 | 18.3 |
| *Ulmus americana* | 2.7 | 0.085 | 19.3 | 1.8 | 0.059 | 20.0 |
| *Prunus serotina* | 2.0 | 0.057 | 17.7 | 0.2 | 0.010 | 23.8 |
| *Carya tomentosa* | 0.9 | 0.055 | 26.0 | -- | -- | -- |
| *Carya texana* | 0.9 | 0.033 | 21.1 | 0.9 | 0.028 | 19.0 |
| *Asimina triloba* | 0.9 | 0.011 | 12.6 | -- | -- | -- |
| *Acer saccharinum* | 0.4 | 0.015 | 20.8 | -- | -- | -- |
| Totals | 43.5 | 5.059 | | 46.7 | 6.115 | |

APPENDIX 1. The vascular taxa encountered and collected at Sand Ridge State Forest are listed below by major groups, Pteridophytes (ferns and fern-allies) and Spermatophytes (seed plants), the latter divided into Dicots and Monocots. The families, genera, and species are alphabetically arranged within each group. Prior to the scientific name, non-native species or planted species are indicated by an asterisk (*), threatened and endangered species are indicated by a (**T**) or an (**E**), and species not previously known from the site are indicated by a (†). After the binomial and authority, the communities where the species were observed are given (1 = dry sand forest, 2 = dry-mesic sand forest, 3 = dry sand prairie, 4 = natural pond, and 5 = cultural). Following the community number(s), collecting numbers preceded by the initial of the collector's name are given (B for Dan Busemeyer, F for Mary Ann Feist, M for Paul B. Marcum, and P for Loy R. Phillippe). Voucher specimens from the current study have been deposited in the Illinois Natural History Survey herbarium (ILLS). The Illinois Natural History Survey herbarium (ILLS) and the University of Illinois herbarium (II L) were also searched for past collections at Sand Ridge State Forest. Many voucher collections were discovered including specimens collected by the following: John K. Bouseman (Bouseman), Virginius H. Chase (Chase), Irene M. Cull (Cull), F.C. Gates (Gates), Steven R. Hill (Hill), A.C. Koelling (Koelling), Chris T. Maier (Maier), Maison (Maison), Kenneth R. Robertson (Robertson), Julian A. Steyermark (Steyermark), and David Voegtlin (Voegtlin). The herbarium in which the specimen was deposited is included in parentheses after the collection number. Some species were reported occurring at Sand Ridge State Forest by C.T. Maier (1975) but we have been unable to find the voucher, those are designated as no voucher observed.

**PTERIDOPHYTA**

ASPLENIACEAE
*Asplenium platyneuron* (L.) Oakes; 2, 5; B1817; M2643

DENNSTAEDTIACEAE
*Pteridium aquilinum* (L.) Kuhn; 1; P37120

DRYOPTERIDACEAE
†*Cystopteris protrusa* (Weatherby) Blasdell; 2; B1816
†*Dryopteris carthusiana* (Villars) H.P. Fuchs; 1, 2; B1679; P37136
*Woodsia obtusa* (Spreng.) Torr.; 1; M2860

EQUISETACEAE
*Equisetum hyemale* L.; no voucher observed

ONOCLEACEAE
*Onoclea sensibilis* L.; 2; Maier s.n. 13 September 1975 (ILL)

OPHIOGLOSSACEAE
*Botrychium dissectum* Spreng.; 2; Maier s.n. 27 September 1975 (ILL)

*Botrychium virginianum* (L.) Sw.; 2; B1712, 1820; P37147

OSMUNDACEAE
†*Osmunda claytoniana* L.; 2; B1839

THELYPTERIDACEAE
*Thelypteris palustris* Schott; 2; B1838

**GYMNOSPERMAE**

CUPRESSACEAE
*Juniperus virginiana* L.; 1, 2, 3, 5; F2526; P36479

PINACEAE
**Pinus banksiana* Lamb.; 1, 5; M2673
**Pinus densiflora* Siebold & Zuccarini; no voucher observed
**Pinus echinata* Mill.; 5; M3160
**Pinus resinosa* Ait.; 1, 5; P37183
**Pinus rigida* Mill.; 1, 5; M2645
**Pinus strobus* L.; 1, 5; M2622; P37175
**Pinus sylvestris* L.; 1, 5; P36481, 37182
**Pinus thunbergii* Parlatore; no voucher observed
**Pinus virginiana* Mill.; no voucher observed
**Pseudotsuga menziesii* (Mirbel) Franco; 1, 5; Maier s.n. 11 July 1975 (ILL)

TAXODIACEAE
**Taxodium distichum* (L.) Rich.; 2; B 1844

**ANGIOSPERMAE - DICOTYLEDONAE**

ACANTHACEAE
*Ruellia humilis* Nutt.; 1, 3; F 2719

ACERACEAE
*Acer negundo* L.; 5; B1630
*Acer saccharinum* L.; 2, 5; M2674
†*Acer saccharum* Marsh.; 1, 2, 5; M2822

AMARANTHACEAE
*Amaranthus albus* L.; 5; B2088
**Amaranthus hybridus* L.; no voucher observed
*Froelichia floridana* (Nutt.) Moq.; 3, 5; M2629, 2679
*†*Froelichia gracilis* (Hook.) Moq.; 5; M2803

ANACARDIACEAE
*Rhus aromatica* Ait.; 1, 3, 5; B1675; F2801; P36767
*Rhus glabra* L.; 1, 3, 5; F2803
*Rhus hirta* L.; 1, 3, 5; B1845; F2802
*Toxicodendron radicans* (L.) Kuntze; 1, 2, 5; B1851; P37138

APIACEAE
*Cryptotaenia canadensis* (L.) DC.; 2; Maier s.n. 1 July 1975 (ILL)
**Daucus carota* L.; 5; M2871
*Osmorhiza longistylis* (Torr.) DC. var. *villicaulis* Fern.; 1, 2; B1699
**Pastinaca sativa* L.; no voucher observed
*Sanicula canadensis* L.; 1, 2; M2655

APOCYNACEAE
*Apocynum canabinum* L.; 2, 5; P37161

ASCLEPIADACEAE
*Ampelamus albidus* (Nutt.) Britt.; no voucher observed
*Asclepias amplexicaulis* Small; 1, 3, 5; F2796, P36766
†*Asclepias hirtella* (Pennell) Woodson; 1; P36956
*Asclepias incarnata* L.; 2; Maier s.n. 23 July 1973 (ILL)
*Asclepias syriaca* L.; 1, 5; F2806
*Asclepias tuberosa* L.; 3, 5; F2790
*Asclepias verticillata* L.; 1, 3, 5; B2112, M2664
*Asclepias viridiflora* Raf.; no voucher observed

ASTERACEAE
**Achillea millefolium* L.; 3, 5; B1856; F2783
*Ageratina altissima* (L.) R. M. King. & H. Rob.; 1, 2, 5; M2659
*Ambrosia artemisiifolia* L.; 5; P 37121
*Ambrosia psilostachya* DC.; 1, 3; M2840; P37172
*Ambrosia trifida* L.; 1, 5; M2823; P37123
*Antennaria neglecta* Greene; 1; Maier s.n. 7 May 1975
*Antennaria parlinii* Fern. ssp. *fallax* (Greene) Bayer & Stebbins; 1, 2, 5; B1664, 1822
**Arctium minus* Schk.; 4, 5; M3167
*Arnoglossum atriplicifolium* (L.) H. Rob.; 1, 5; P37143
*Artemisia campestris* L.; 5; Maier s.n. 23 August 1975 (ILL)
*Aster ericoides* L.; 1, 5; M2866
*Aster lanceolatus* Willd.; 2, 5; B2117
*Aster lateriflorus* (L.) Britt.; 1, 5; B2117
*Aster ontarionis* Wieg.; 2; Maier s.n. 3 September 1975 (ILL)
*Aster oolentangiensis* Riddell; 1; M2853
*Aster pilosus* Willd.; 1, 5; M2819
*Aster sagittifolius* Willd.; no voucher observed

**Bidens bipinnata* L.; 1, 5; M2675
*Bidens frondosa* L.; 2, 5; B2095
*Brickellia eupatorioides* (L.) Shinners; 3; M2835
**Carduus nutans* L.; 5; Maier s.n. 1 July 1975 (ILL)
*Chrysopsis camporum* Greene; 1, 2, 3, 5; F2780; M2828; P36795, 37254
*†Cirsium altissimum* (L.) Spreng.; 1; M2867
*Cirsium discolor* (Muhl.) Spreng.; 1, 5; P37140
**Cirsium vulgare* (Savi) Tenore; no voucher observed
*Conyza canadensis* (L.) Cronq.; 3, 5; M2832; P37126; P37178
*Coreopsis lanceolata* L.; 3, 5; B1722
*Coreopsis palmata* Nutt.; 1, 2; Bouseman s.n. 10 July 1960 (ILL)
*Erechtites hieracifolia* (L.) Raf.; 1, 2, 5; P37160
*Erigeron annuus* (L.) Pers.; 5; Maier s.n. 4 September 1973 (ILL)
*Erigeron strigosus* Muhl.; 1, 3, 5; F2778; P36784
*†Eupatoriadelphus purpureus* (L.) R.M. King & H. Rob.; 1; M2870
*†Eupatorium altissimum* L.; 1, 5; M2868
*Eupatorium perfoliatum* L.; 2; Maier s.n. 6 August 1973 (ILL)
*Eupatorium serotinum* Michx.; 2, 5; P37139
*Euthamia graminifolia* (L.) Nutt.; 2; Maier s.n. 13 August 1973 (ILL)
**Helianthus annuus* L.; no voucher observed
*Helianthus hirsutus* Raf.; 1; M2658
*Helianthus occidentalis* Riddell; 3, 5; M2852
*Helianthus pauciflorus* Nutt.; 1, 2; Maier s.n. 13 August 1974 (ILL)
**Helianthus petiolaris* Nutt.; 1, 5; M2631
*Helianthus strumosus* L.; 1, 5; M2795; P37133
*Helianthus tuberosus* L.; 5; M2872
*Heliopsis helianthoides* (L.) Sweet; 1, 2; Maier s.n. 16 July 1974 (ILL)
*Hieracium longipilum* Torr.; 1; Maier s.n. 22 September 1974 (ILL)
*Hieracium scabrum* Michx.; 1; P37124
*Ionactis linariifolius* (L.) Greene; 1; Maier s.n. 30 August 1974 (ILL)
*Krigia virginica* (L.) Willd.; 1, 2, 5; B1667, 1673; P36741
*Lactuca canadensis* L.; 1, 3, 5; M2842; P37141, 37184
*†Lactuca floridana* (L.) Gaertn.; 1, 2; P37142
**Lactuca serriola* L.; 5; Maier s.n. 16 August 1974 (ILL)
** Leucanthemum vulgare* Lam.; no voucher observed
*Liatris aspera* Michx.; 1; Maier s.n. 25 August 1973 (ILL)
**Matricaria discoidea* DC.; 5; B1828
*Pseudognaphalium obtusifolium* (L.) Hilliard & Burtt; 3, 5; M2837; P37128, 37176
*Ratibida pinnata* (Vent.) Barnh.; 1, 5; M2858
*Rudbeckia hirta* L.; 3, 5; F2787
*Senecio plattensis* Nutt.; 1, 2, 3, 5; B1672, 1847; P36749, 36776
*†Solidago altissima* L.; 1, 5; B2090
*Solidago canadensis* L.; 1, 5; M2863
*Solidago gigantea* Ait.; no voucher observed
*Solidago juncea* Ait.; 1, 2; Maier s.n. 31 July 1974 (ILL), 1 August 1974 (ILL)

*Solidago nemoralis* Ait.; 1, 3; M2833; P37174
*Solidago speciosa* Nutt.; 1; Maier s.n. 3 September 1975 (ILL)
*Solidago ulmifolia* Muhl.; 1, 5; M2864
**Taraxacum officinale* Weber; 5; B1633
**Tragapogon dubius* Scop.; 5; B1723, 1860
**Tragapogon pratensis* L.; no voucher observed
*Vernonia missurica* Raf.; 2; Maier s.n. 6 August 1973 (ILL), 16 August 1974 (ILL)
*Xanthium strumarium* L.; 5; Maier s.n. 14 September 1975 (ILL)

BERBERIDACEAE
*Podophyllum peltatum* L.; 2; Maier s.n. 10 July 1975 (ILL)

BETULACEAE
**Alnus glutinosa* (L.) Gaertn.; 5; Maier s.n. 16 August 1974 (ILL)
**Betula nigra* L.; 2; B1840

BIGNONIACEAE
*Campsis radicans* (L.) Seem.; no voucher observed
**Catalpa speciosa* Warder; 5; B1824; P37135

BORAGINACEAE
**Buglossoides arvense* (L.) I. M. Johnston; 5; B1693
**Cynoglossum officinale* L.; 2, 5; Maier s.n. 3 July 1973 (ILL)
*Hackelia virginiana* (L.) I. M. Johnston; 1, 2, 5; M2653
*Lithospermum croceum* Fern.;1, 2, 3; P36740; 36768
*Lithospermum canescens* (Michx.) Lehm.; 1; B1660
*Lithospermum incisum* Lehm.; 1, 2, Maier s.n. 6 May 1974 (ILL)
*Mertensia virginica* (L.) Pers.; no voucher observed
†*Myosotis verna* Nutt.; B1736

BRASSICACEAE
**Alliaria petiolata* (Bieb.) Cavara & Grande; 1, 2, 5; B1676
*†*Arabidopsis thaliana* (L.) Heynh.; 2; B1726
*Arabis canadensis* L.; 1, 2; P36747
†*Arabis glabra* (L.) Bernh.; 1, 2; B1694, 1711
**Barbarea vulgaris* R. Br.; 5; M3174
**Brassica nigra* (L.) Koch; no voucher observed
**Capsella bursa-pastoris* (L.) Medic.; 5; B1666
*Descurainia pinnata* (Walt.) Britt.; 2, 5; Maier s.n. 14 May 1975 (ILL)
*Draba reptans* (Lam.) Fern.; 3, 5; B1628; F2524
*Erysimum capitatum* (Dougl.) Greene; 1, 5; B1665, 1738
**Hesperis matronalis* L.; no voucher observed
**Lepidium campestre* (L.) R. Br.; no voucher observed
*†*Lepidium densiflorum* Schrad.; 3, 5; P36746; 36770
*Lepidium virginicum* L.; 3, 5; B1730, 1832; F2792; P36769

†*Rorippa palustris* (L.) Besser var. *fernaldiana* (Butters & Abbe) Stuckey; 2; P37155
†*Rorippa sessiliflora* (Nutt.) Hitchc.; 2; B1830
**Sisymbrium altissimum* L.; 5; Maier s.n. 25 June 1975 (ILL)
**Sisymbrium loeselii* L.; 5; M3171
**Sisymbrium officinale* (L.) Scop.; no voucher observed
*†*Thlaspi arvense* L.; M3175

CACTACEAE
*Opuntia humifusa* (Raf.) Raf.; 1, 2, 3, 5; F2788, P36755

CAESALPINIACEAE
*Cercis canadensis* L.; no voucher observed
*Chamaecrista fasciculata* (Michx.) Greene; 3, 5; M2663; P37253
*Gleditsia triacanthos* L.; no voucher observed
†*Gymnocladus dioicus* (L.) K. Koch; 5; M2625
*Senna marilandica* (L.) Link; 2; Maier s.n. 17 July 1973 (ILL)

CALLITRICHACEAE
†*Callitriche heterophylla* Pursh; 5; M3180

CAMPANULACEAE
*Campanulastrum americanum* (L.) Small; 2, 5; M2687
*Triodanis perfoliata* (L.) Nieuw.; 3, 5; B1834; F2793; P36758, 36946

CANNABINACEAE
**Cannabis sativa* L.; Robertson 1301 (ILLS)

CAPPARACEAE
*Polanisia dodecandra* (L.) DC.; 5; M2635

CAPRIFOLIACEAE
*†*Lonicera* X *bella* Zabel; 2, 5; P37129
**Lonicera maackii* (Rupr.) Maxim.; 1, 2, 5; B1690
**Lonicera morrowii* Gray; 2, 5; B1659
*Sambucus canadensis* L.; 2, 5; P37130
*Symphoricarpos orbiculatus* Moench; 2; Maier s.n. 30 July 1975 (ILL)
*†*Viburnum opulus* L.; 5; M2799
*†*Viburnum recognitum* Fern.; 5; M2800

CARYOPHYLLACEAE
*†*Arenaria serpyllifolia* L.; 2, 5; B1682
**Cerastium semidecandrum* L.; 5; B1683
*†*Dianthus armeria* L.; 5; B 1859; M2620
**Holosteum umbellatum* L.; 5; B1625
*Paronychia canadensis* (L.) Wood; 1, 5; M2652; 2855b

*Paronychia fastigiata* (Raf.) Fern.; 1; M2855a
**Saponaria officinalis* L.; 5; F2813
*Silene antirrhina* L.; 5; B1829
**Silene pratensis* (Spreng.) Gordon & Gren.; 5; B1837
*Silene stellata* (L.) Ait. f.; 1, 2, 5; M2654
**Stellaria media* (L.) Cyrillo; 2, 5; B1717

CELASTRACEAE
*Celastrus scandens* L.; 2, 5; B1708; F2812
*Euonymus atropurpureus* Jacq.; 2, 5; Maier s.n. 21 June 1975 (ILL)

CERATOPYLLACEAE
†*Ceratophyllum demersum* L.; 2; B2106

CHENOPODIACEAE
**Chenopodium album* L.; Koelling 649 (ILL)
**Chenopodium ambrosioides* L.; 5; Maier s.n. 4 September 1974 (ILL)
†*Chenopodium standleyanum* Aellen; 3, 5; M2665
*Cycloloma atriplicifolium* (Spreng.) Coult.; 3, 5; M2632; P36958
**Kochia scoparia* (L.) Roth; no voucher observed

CISTACEAE
*Helianthemum bicknellii* Fern.; 3; M3158
*Helianthemum canadense* (L.) Michx.; 1, 3, 5; B1737; M2637, 2865, M3155; P36750, 36785
*Lechea tenuifolia* Michx.; 1, 3; Maier s.n. 14 June 1975 (ILL)

CONVOLVULACEAE
**Ipomoea hederacea* (L.) Jacq.; 5; M2621
*Ipomoea lacunosa* L.; 2, 5; Maier s.n. 8 August 1974 (ILL)

CORNACEAE
*Cornus drummondii* C.A. Mey.; 2, 5; P36790; 37166
*Cornus florida* L.; 1, 2; Maier s.n. 27 August 1974 (ILL)
*†*Cornus obliqua* Raf.; 5; M2798
*Cornus racemosa* Lam.; 2; B1826

CORYLACEAE
*Corylus americana* Walt.; 1, 2; P37153

CUCURBITACEAE
*Sicyos angulatus* L.; 2, 5; Maier s.n. 3 September 1975 (ILL), 14 September 1975 (ILL)

CUSCUTACEAE
*Cuscuta cuspidata* Engelm.; no voucher observed

EBENACEAE
*Diospyros virginiana* L.; 1, 5; M2824

ELAEAGNACEAE
**Elaeagnus umbellata* Thunb.; 1, 2, 5; B1669

EUPHORBIACEAE
*Acalypa rhomboidea* Raf.; no voucher observed
†*Acalypha virginica* L.; 1, 5; M2820
*Chamaesyce geyeri* (Engelm.) Small; Hill 28809 (ILLS)
*Chamaesyce maculata* (L.) Small; 5; B2086; M2801
*Chamaesyce nutans* (Lag.) Small; 5; B2089; M2812
*Croton glandulosus* L.; 1, 3, 5; F 2800; M2627,2680
*Crotonopsis linearis* Michx.; 3; M2626, 2662, 2677, 2831
*Euphorbia corollata* L.; 1, 3, 5; F2786
**Euphorbia marginata* Pursh; 1, 5; Maier s.n. 16 August 1974 (ILL)
*Poinsettia dentata* (Michx.) Kl. & Garcke; 1, 3, 5; P37165

FABACEAE
*Amorpha canescens* Pursh; 1, 3, 5; M2804
†*Amorpha fruiticosa* L.; 3; F2789
*Amphicarpaea bracteata* (L.) Fern.; 1, 2; 5; M2857
*Apios americana* Medic.; 2, 5; M3161
*Astragalus distortus* Torr. & Gray; 1; Maier s.n. 6 May 1974 (ILL)
*Baptisia bracteata* Ell.; 1, 3; M3191
*Crotalaria sagittalis* L.; 1, 3; Chase 18444, 17926 (ILL)
*Dalea candida* (Michx.) Willd.; no voucher observed
*Dalea purpurea* Vent.; no voucher observed
*Desmodium glutinosum* (Muhl.) A. Wood; 1; M2657
*Desmodium illinoense* Gray; 1, 2, 5; M2642
*Desmodium paniculatum* (L.) DC.; 1, 5; M2818
*Desmodium sessilifolium* (Torr.) Torr. & Gray; 1, 3; M2851
**Glycine max* (L.) Merr.; no voucher observed
**Kummerowia stipulacea* (Maxim.) Makino; 5; P37168
*Lespedeza capitata* Michx.; 3; M2830; P37179
*†*Lespedeza cuneata* (Dum.-Cours.) G. Don; 5; B2115
**Medicago lupulina* L.; 5; B1684, 1861
**Medicago sativa* L.; 5; P37154
**Melilotus albus* Medic.; 5; F2815
**Melilotus officinalis* (L.) Pallas; 5; F2814
**Robinia pseudoacacia* L.; 2, 5; B1733
**Securigera varia* (L.) Lassen; 5; Maier s.n. 18 June 1973 (ILL)
*Strophostyles helvula* (L.) Ell.; 5; M2634
*Strophostyles leiosperma* (Torr. & Gray) Piper; 3, 5; M2843

*Tephrosia virginiana* (L.) Pers.; 1, 3; M2841; P36947
**Trifolium hybridum* L.; no voucher observed
**Trifolium pratense* L.; 5; M3172
*†*Trifolium repens* L.: 5; M3169
**Vicia villosa* Roth; 5; B1729
**Vigna unguiculata* (L.) Walp.; Steyermark 68854 (ILL)

FAGACEAE
*Quercus marilandica* Muench.; 1, 5; M2667
*Quercus velutina* Lam.; 1, 2, 5; P37171

FUMARIACEAE
*Corydalis micrantha* (Engelm.) Gray; 3, 5; B1678; P36793
*Dicentra cucullaria* (L.) Bernh.; 1; F2528

GERANIACEAE
*Geranium carolinianum* L.; 3, 5; B1833; P36792

GROSSULARIACEAE
*Ribes missouriense* Nutt.; 1, 2, 5; B1697; F2527; P36482
**Ribes odoratum* Wendl. f.; no voucher observed

HAMAMELIDACEAE
*†*Liquidambar styraciflua* L.; 2, 5; B2116

HYDROPHYLLACEAE
*Ellisia nyctelea* L.; 2, 5; B1680, 1716

HYPERICACEAE
*Hypericum gentianoides* (L.) BSP 1, 5; Maier s.n. 24 August 1974 (ILL)
*Hypericum mutilum* L.; 2; B2102
**Hypericum perforatum* L.; 5; B1855; M2644
*Hypericum punctatum* Lam.; 1, 3, 5; M2650
*Hypericum sphaerocarpum* Michx.; ; Cull s.n. 10 July 1978 (ILLS)

JUGLANDACEAE
*Carya ovalis* (Wangenh.) Sarg.; 1, 2; B2114
*Carya texana* Buckl.; 1, 5; B1850; M2624
*Carya tomentosa* (Poir.) Nutt.; 1, 2; B1707; F2820
*Juglans nigra* L.; 2; B1721

LAMIACEAE
*Agastache nepetoides* (L.) Ktze.; 1, 5; M2671
*Hedeoma hispida* Pursh; 5; Maier s.n. 25 June 1974 (ILL)
*Hedeoma pulegioides* (L.) Pers.; 5; Maison s.n. 24 August 1974 (ILL)

**Lamium amplexicaule* L.; 5; M3170
**Leonurus cardiaca* L.; 5; M2874
*Lycopus americanus* Muhl.; 2; B2094
*†Lycopus virginicus* L.; 2; B2101
*Monarda fistulosa* L.; 1, 2; Maier s.n. 6 August 1973 (ILL)
*Monarda punctata* L.; 3, 5; F2797
**Nepeta cataria* L.; 5; Maier s.n. 9 July 1973 (ILL)
*Prunella vulgaris* L.; 5; Maier s.n. 1 August 1974 (ILL)
*Pycnanthemum pilosum* Nutt.; 1; Maier s.n. 23 July 1973 (ILL)
*Scutellaria lateriflora* L.; 2; B2092
*Scutellaria leonardii* Epling; 1, 2; M3156
*Stachys tenuifolia* Willd.; ; Cull s.n. 10 July 1978 (ILLS)
*Teucrium canadense* L.; 2, 3, 5; F2798, P37177

LAURACEAE
*Sassafras albidum* (Nutt.) Nees; 1, 2, 5; M2670

LYTHRACEAE
*Rotala ramosior* (L.) Koehne; 2; B2099

MAGNOLIACEAE
**†Liriodendron tulipifera* L.; 2, 5; B2116

MALVACEAE
*Callirhoe triangulata* (Leavenw.) A. Gray; 3, 5; M2641, 2661, 2686
**†Sida spinosa* L.; 5; P37125

MELASTOMACEAE
*Rhexia virginica* L.; 2; M2646

MENISPERMACEAE
*Menispermum canadense* L.; 2; P37137

MOLLUGINACEAE
**Mollugo verticillata* L.; 5; P36765

MORACEAE
**Maclura pomifera* (Raf.) Schneider; 2, 5; M2876
**†Morus alba* L.; 2, 5; B1711
*Morus rubra* L.; no voucher observed
**†Morus tatarica* L.; 2, 5; P36789

NYCTAGINACEAE
**Mirabilis nyctaginea* (Michx.) MacM.; 5; B1727

OLEACEAE
**Syringa vulgaris* L.; 2, 5; B1670

ONAGRACEAE
†*Circaea lutetiana* L.; 1, 2; F2811; P37146
*Gaura biennis* L.; 5; M2617
*Ludwigia alternifolia* L.; 5; M2647
*Ludwigia palustris* (L.) Elliott; 2, 5; B2098
*Oenothera biennis* L.; 2, 5; P37122
†*Oenothera clelandii* W. Dietr., Raven, & W.L. Wagner; 2, 3; F2779; P36957
*Oenothera laciniata* Hill; 3, 5; M2633

OXALIDACEAE
*Oxalis fontana* Bunge; 5; M2862
*Oxalis stricta* L.; B1718
*Oxalis violacea* L.; 1, 5; P36754

PHRYMACEAE
†*Phryma leptostachya* L.; 1; M2656

PHYTOLACCACEAE
*Phytolacca americana* L.; 2, 5; M2618

PLANTAGINACEAE
*Plantago aristata* Michx.; 5; M2813
**Plantago lanceolata* L.; 5; M3173
**Plantago patagonica* Jacq.; 3; P36751
*Plantago rugelii* Decne.; 2, 5; M2619
*Plantago virginica* L.; 5; B1687

PLATANACEAE
*Platanus occidentalis* L.; 5; M2875

POLEMONIACEAE
*Phlox bifida* Beck; 1, 2, 3; B1634; F2525; P36484

POLYGALACEAE
*Polygala polygama* Walt.; 2; Maier s.n. 18 June 1974 (ILL)
*Polygala sanguinea* L.; 1; M2649

POLYGONACEAE
*Antenoron virginianum* (L.) Roberty & Vautier; 2; P37145
**Fagopyrum esculentum* Moench; no voucher observed
**Fallopia convolvulus* (L.) A. Love (as Polygonum convolvulus); 2, 5; P37252
*Fallopia cristata* (Engelm. & Gray) Holub; 3, 5; M2640, 2666

*Fallopia scandens* (L.) Holub; 1, 2, 5; M2873
*Persicaria amphibium* (L.) S.F. Gray; 2, 5; Maier s.n. 24 August 1974 (ILL)
*†*Persicaria cespitosa* (Blume) Nakai; 2, 5; P37131
*Persicaria coccinea* (Muhl.) Greene; no voucher observed
†*Persicaria hydropiperoides* (Michx.) Small; 2, 5; B2105
*Persicaria pensylvanica* (L.) Small; 5; P37134
*Persicaria punctata* (Ell.) Small; 2, 5; P37132
*Polygonella articulata* (L.) Meisn.; 2, 5; Hill 28805 (ILLS)
**Polygonum aviculare* L.; 2, 5; Maier s.n. 3 July 1973 (ILL)
*Polygonum tenue* Michx.; 1, 3, 5; M2827; P37251
**Rumex acetosella* L.; 1, 5; B1734
**Rumex crispus* L.; 2, 5; F2819
*Tracaulon sagittatum* (L.) Small; no voucher observed

PORTULACACEAE
*Claytonia virginica* L.; 1, 2; B1698
**Portulacca oleracea* L.; 5; B2085
*Talinum rugospermum* Holz.; 1, 3; B1852; M3157; P36764

PRIMULACEAE
*Androsace occidentalis* Pursh; 3, 5; B1627; F2523; P36483
*Lysimachia lanceolata* Walt.; 2, 5; F2810

RANUNCULACEAE
*Anemone caroliniana* Walt.; 1, 2; Maier s.n. 27 April 1974 (ILL)
*Anemone cylindrica* Gray; 1, 2, 3; M3189
*Anemone virginiana* L.; 1, 2; M2854
*Aquilegia canadensis* L.; 1, 2; B1661
*Ranunculus abortivus* L.; 2, 5; B1688

RHAMNACEAE
*Ceanothus americanus* L.; 1, 2, 3; B1862
**†Rhamnus cathartica* L.; 2, 5; B2113

ROSACEAE
†*Agrimonia gryposepala* Wallr.; 2; P37148
*Agrimonia parviflora* Sol.; 2; B2103
†*Agrimonia pubescens* Wallr.; 2; P37150
*Fragaria virginiana* Duchesne; 1, 2, 5; B1663; M2814; P36743, 36777
*Geum canadense* Jacq.; 1, 2, 5; P36778, 37151
*Malus ioensis* (Wood) Britt.; 2, 5; B1841
**Potentilla norvegica* L.; 2, 5; M3186
**Potentilla recta* L.; 5; B1857
*Potentilla simplex* Michx.; 2, 5; B1701
*Prunus americana* Marsh.; no voucher observed

†*Prunus hortulana* Bailey; 2, 5; B1629
**Prunus persica* (L.) Batsch; no voucher observed
*Prunus serotina* Ehrh.; 1, 2, 3, 5; B1685; F2804; P36783
*Prunus virginiana* L.; 1, 2; B1636, 1658, 1691
**Pyrus communis* L.; no voucher observed
*Rosa carolina* L.; 1, 3; P36786
**Rosa multiflora* Thunb.; 1, 2, 5; M2805
*Rosa palustris* Marshall; 5; F2808
*Rubus allegheniensis* Porter; 1, 2, 5; B1706; M3164; P36788
*Rubus flagellaris* Willd.; no voucher observed
*Rubus hispidus* L.; 2, 5; B 1705; F2809
*Rubus occidentalis* L.; 2, 5; B1689; P36779
†*Rubus pensilvanicus* Poir.; 2, 5; M3163

RUBIACEAE
*Cephalanthus occidentalis* L.; 2, 5; Maier s.n. 23 July 1973 (ILL)
*Diodia teres* Walt.; 5; M2636, 2681
*Galium aparine* L.; 2, 5; B1686; P36733, 36771
*Galium circaezans* Michx.; 1, 2; F2807
*†*Galium pedemontanum* (Bellardi) All.; 5; B1858
*Galium pilosum* Ait.; 1, 2, 5; M2651

RUTACEAE
*Ptelea trifoliata* L.; 1, 2, 5; B1728; P36744
*Zanthoxylum americanum* Mill.; 1, 2; B1631

SALICACEAE
*Populus deltoides* Marsh.; 2, 5; B1732
†*Salix amygdaloides* Anderss.; 2, 5; B1731, 2108
*Salix eriocephala* Michx.; no voucher observed
*Salix humilis* Marsh. var. *microphylla* (Anderss.) Fern.; 1, 3; B1632
*Salix interior* Rowlee; ; Voegtlin 82-69 (ILLS)
*Salix nigra* Marsh.; 2, 5; B2107

SANTALACEAE
*Comandra umbellata* (L.) Nutt.; 1, 3; M 2669, 3188

SCROPHULARIACEAE
*Aureolaria grandiflora* (Benth.) Pennell; 1, 2; Maier s.n. 25 June 1974 (ILL), 13 August 1975 (ILL)
**Linaria genistifolia* (L.) Mill.; no voucher observed
*Lindernia anagallidea* (Michx.) Pennell; 5; M2678
*Nuttallanthus canadensis* (L.) D. Sutton; 1, 2, 3; B1668, 1674; P36734
*Penstemon pallidus* Small; 1, 2; B1692; P36748
*Scrophularia lanceolata* Pursh; 1, 2; B1696, 1819

**Verbascum thapsus* L.; 5; M3166
**Veronica arvensis* L.; 5; B1671
*Veronica peregrina* L. var. *xalapensis* (HBK) St. John; 5; B1836

SOLANACEAE
**Datura stramonium* L.; 5; Maier s.n. 24 August 1974 (ILL)
*Physalis heterophylla* Nees; 3, 5; F 2795; M2668; P37181
*Physalis virginiana* Mill.; 2, 5; B1827; P36752
*Solanum carolinense* L.; 5; P36791
**Solanum dulcamara* L.; 5; M3177
*Solanum ptychanthum* Dunal; 2, 5; P36787

TILIACEAE
Tilia americana L.; 1; M3165

ULMACEAE
*Celtis occidentalis* L.; 2, 5; B1635
*Ulmus americana* L.; 1, 2, 5; M2672
*Ulmus rubra* Muhl.; 1, 2, 5; M2794

URTICACEAE
*Boehmeria cylindrica* (L.) Sw.; 2; B2110
*Parietaria pensylvanica* Muhl.; 2; B1818; P36745

VERBENACEAE
*Phyla lanceolata* (Michx.) Greene; 2, 5; Maier s.n. 7 July 1973 (ILL), 1 August 1974 (ILL)
*Verbena hastata* L.; ; Cull s.n. 10 July 1978 (ILLS)
*Verbena stricta* Vent.; 5; F2816
*Verbena urticifolia* L.; 1, 5; M2690

VIOLACEAE
*Viola fimbriatula* Smith; no voucher observed
*Viola lanceolata* L.; 2; B1843; M3162
†*Viola palmata* L.; 1; M2856
*Viola pedata* L.; 1, 2; P36753
*Viola pratincola* Greene; 2, 5; B1702
**Viola rafinesquei* Greene; 2, 5; B1626; P36480, 36742
†*Viola sagittata* L.; 2; B1842

VITACEAE
*Parthenocissus quinquefolia* (L.) Planch.; 1, 2, 5; M2796
*Vitis aestivalis* Michx.; 2; Maier s.n. 21 June 1975 (ILL)
†*Vitis riparia* L.; 1, 2, 5; B1714, 1854; M2797
*Vitis vulpina* L.; 1, 2, 5; M2861

ZYGOPHYLLACEAE
*†*Tribulus terrestris* L.; 5; P36794

**ANGIOSPERMAE – MONOCOTYLEDONAE**

COMMELINACEAE
*Commelina erecta* L.; 1, 2, 3, 5; F2781; M2846; P36950
*Tradescantia ohiensis* Raf.; 2, 3, 5; P3675, 36780

CYPERACEAE
*Bulbostylis capillaris* (L.) C. B. Clarke; 2; P36952
*Carex albicans* Willd.; 1; M3183
*Carex blanda* Dewey; 2; B1709
*Carex brevior* (Dewey) Mack.; 5; B1849; M3159
†*Carex cephalophora* Muhl.; 2; B1821, 1846
*Carex davisii* Schwein. & Torr.; 2; Maier s.n. 26 May 1975 (ILL)
†*Carex festucacea* Schk.; 2; B1823
†*Carex grayi* Carey; 5; M3176
*Carex pellita* Willd.; 1, 2; Maier s.n. 20 May 1975 (ILL)
*Carex meadii* Dewey; 1, 2, 3; M3190; P36737, 36782
*Carex muhlenbergii* Schk.; 1, 3; P36736, 36757
*Carex pensylvanica* L.; 1, 2; B1713
†*Carex rosea* Schk.; 1, 2; B1719
*Carex scoparia* Schkuhr; 5; M3181
*Carex tonsa* (Fern.) Bickn.; 1, 3; B1677, F2522; M3154; P36478
*Carx vulpinioidea* Michx.; 2; M3184
*Cyperus erythrorhizos* Muhl.; no voucher observed
*Cyperus esculentus* L.; 2, 5; Maier s.n. 23 August 1975 (ILL)
**T***Cyperus grayoides* Mohlenbr.; 3, 5; M2684; P36948
*Cyperus lupulinus* (Spreng.) Marcks; 1, 3, 5; F2784; P36949
*Cyperus schweinitzii* Torr.; 1, 3, 5; F2794, M2628; P36945
†*Cyperus strigosus* L.; 5; B2100; P37162
*Eleocharis acicularis* (L.) Roem. & Schultes; 2; Maier s.n. 13 August 1975 (ILL), 23 August 1975 (ILL)
†*Eleocharis erythropoda* Steud.; 2, 5; P36955
*Eleocharis ovata* (Roth) Roem. & Schultes; 2, 5; P36953
*Fimbristylis autumnalis* (L.) Roem. & Schultes; 2; B2096
*Hemicarpha micrantha* (Vahl) Pax; 2; Maier s.n. 23 August 1975 (ILL)
†*Schoenoplectus pungens* (Vahl) Palla; 2; B2093

DIOSCOREACEAE
†*Dioscorea villosa* L.: 1, 2; M3187

IRIDACEAE
**Iris* X *germanica* L.; 5; Maier s.n. 23 May 1974 (ILL)
*Sisyrinchium campestre* Bickn.; 2; Maier s.n. 8 May 1975 (ILL)

JUNCACEAE
*Juncus acuminatus* Michx.; 2; P36951
*Juncus interior* Wieg.; 2, 5; P36763
*Juncus tenuis* Willd.; 5; M2821

LEMNACEAE
*Lemna minor* L.; 2, 5; B2111
*Spirodela polyrhiza* (L.) Schleiden; no voucher observed
*Wolffia brasiliensis* Weddell; 2, 5; B2109

LILIACEAE
**Allium vineale* L.; 5; B1835
**Asparagus officinalis* L.; no voucher observed
*Polygonatum commutatum* (Schult.) A. Dietr.; 2; B1700
*Smilacina racemosa* (L.) Desf.; 2; B1703

ORCHIDACEAE
†*Cypripedium pubescens* Willd. var. *pubescens*; 2; B1825
*Spiranthes cernua* (L.) Rich.; 2; Maier s.n. 13 September 1975 (ILL)

POACEAE
*Agrostis gigantea* Roth; 5; Maier s.n. 25 June 1975
*Agrostis hyemalis* (Walt.) BSP; 3, 5; B1831, 1848; F2785; P36759
*Andropogon gerardii* Vitman; 3, 5; M2638; P37173
*Andropogon virginicus* L.; 3, 5; Maier s.n. 14 September 1975 (ILL)
*Aristida desmantha* Trin. & Rupr.; 5; M2811
*Aristida purpurascens* Poir.; 3; Maier s.n. 3 September 1975 (ILL)
*Aristida tuberculosa* Nutt.; 3, 5; M2848, 2850; P37169
**Avena sativa* L.; 5; Maier s.n. 25 June 1974 (ILL)
†*Bouteloua curtipendula* (Michx.) Torr.; 3; M2826
*Bouteloua hirsuta* Lag.; 3; M2660
*Bromus ciliatus* L.; 5; Maier s.n. 1 July 1975 (ILL)
**Bromus inermis* Leyss.; 5; P37163
**Bromus japonicus* Thunb.; 5; Maier s.n. 12 June 1975 (ILL)
**†Bromus racemosus* L.; 5; F2817
**Bromus tectorum* L.; 5; B1662; P36775
**†Buchloe dactyloides* (Nutt.) Engelm.; 1, 5; M2808
*Calamovilfa longifolia* (Hook.) Scribn.; 3, 5; M2685
*Cenchrus longispinus* (Hack.) Fern.; 3, 5; M2676
†*Cinna arundinacea* L.; 1, 2, 5; M2859
**Dactylis glomerata* L.; 5; B1720

*Danthonia spicata* (L.) Roem. & Schultes; 1, 3; B1853
*Dichanthelium acuminatum* (Sw.) Gould & Clark var. *implicatum* (Scribn.) Gould & Clark; 1, 5; M2825
*Dichanthelium depauperatum* (Muhl.) Gould;3, 5; B1735; M2844
*Dichanthelium oligosanthes* (Schult.) Gould; 1, 3, 5; B1725; M3182; P36738, 36772
†*Dichanthelium perlongum* (Nash) Freckm.; 3; P36735; 36760
*Dichanthelium praecocius* (Hitchc. & Chase) Mohlenb.; no voucher observed
*Dichanthelium villosissimum* (Nash) Freckm.; 3; P36739, 36756
*†*Digitaria ciliaris* (Retz.) Koeler; 5; P37159
*Digitaria filiformis* (L.) Koeler; 5; M2869
**Digitaria ischaemum* (Schreb.) Schreb.; 5; M2806, 2807
**Digitaria sanguinalis* (L.) Scop.; Maier s.n. 1 July 1975
**Echinochloa crus-galli* (L.) Beauv.; 5; P36954
†*Echinochloa muricata* (Michx.) Fern. var. *wiegandii* (Fassett) Mohlenb.; 5; P37157
**Eleusine indica* (L.) Gaertn.; 5; B2082
*Elymus canadensis* L.; 1, 5; M2688, 2689, 2817
†*Elymus hystrix* L.; 2; M2816
**Elytrigia repens* (L.) Desvaux; Maier s.n. 21 June 1975 (ILL)
**Eragrostis cilianensis* (All.) Vign.; 5; M2810
*Eragrostis hypnoides* (Lam.) BSP; no voucher observed
*Eragrostis pectinacea* (Michx.) Nees; 5; B2084
*Eragrostis spectabilis* (Pursh) Steud.; 3, 5; M2839; P37170
*Eragrostis trichodes* (Nutt.) Wood; 3, 5; M2845; P37144
**Festuca arundinacea* Schreb.; 5; M3168
*Heterostipa spartea* (Trin.) Barkworth; 3; B1724; F2805; P36781
*Hordeum pusillum* Nutt.; 5; B1681; P36774
*Koeleria macrantha* (Ledeb.) Spreng.; no voucher observed
*Leersia oryzoides* (L.) Swartz; 2, 5; B2091
†*Leersia virginica* Willd.; 2; P37152
*Leptoloma cognatum* (Schult.) Chase; 3; M2683; M2836
*Muhlenbergia frondosa* (Poir.) Fern.; no voucher observed
*Muhlenbergia racemosa* (Michx.) BSP; Maier s.n. 23 August 1975, 28 September 1975
*Muhlenbergia schreberi* J. F. Gmel.; 5; P37127
*Panicum capillare* L.; 2, 5; B2083
*Panicum dichotomiflorum* Michx.; 3, 5; P37158
*Panicum virgatum* L.; 3, 5; M2639
†*Paspalum bushii* Nash; 3, 5; M2630, 2682
*Paspalum setaceum* Michx.; no voucher observed
**Phalaris arundinacea* L.; 5; M3185
**Phleum pratense* L.; 5; F2818; P37164
**Poa annua* L.; 5; B1715
**Poa compressa* L.; 1, 2, 3, 5; M2815
*†*Poa nemoralis* L.; 1, 2; B1695
**Poa pratensis* L.; 1, 2, 3, 5; F2799
*Poa sylvestris* Gray; no voucher observed

*Schizachyrium scoparium* (Michx.) Nash; 1, 3, 5; M2829
**Setaria faberi* R.A.W. Herrm.; Maier s.n. 30 July 1975
**Setaris glauca* (L.) P. Beauv.; 5; M2809; P37156
**Setaria viridis* (L.) Beauv. var. *viridis*; 5; B2087
*Sorghastrum nutans* (L.) Nash; 3, 5; M2834; P37180
*Sphenopholis obtusata* (Michx.) Scribn.; 3; B1863
*Sporobolus clandestinus* (Biehler) Hitchc.; 3; M2838
†*Sporobolus cryptandrus* (Torr.) Gray; 5; M2802
*Sporobolus vaginiflorus* (Torr.) A. Wood; 3; Maier s.n. 3 September 1975
*Tridens flavus* (L.) Hitchc.; 5; M2623
*Triplasis purpurea* (Walt.) Chapm.; 3; M2847; M2849; P37167
**Triticum aestivum* L.; 5; Maier s.n. 12 May 1975
*Vulpia octoflora* (Walt.) Rydb.; 3, 5; P36751; P36773
**Zea mays* L.; no voucher observed

POTAMOGETONACEAE
*†*Potamogeton crispus* L.: 5; M3179
*Potamogeton diversifolius* Raf.; 2; Maier s.n. 3 September 1975 (ILL)

SMILACACEAE
†*Smilax lasioneuron* Hook.; 2; P37149
*Smilax tamnoides* L.; 2, 5; B1704

TYPHACEAE
†*Typha angustifolia* L.; 5; B2097; M3178

XYRIDACEAE
*Xyris torta* Sm.; 2; M2648

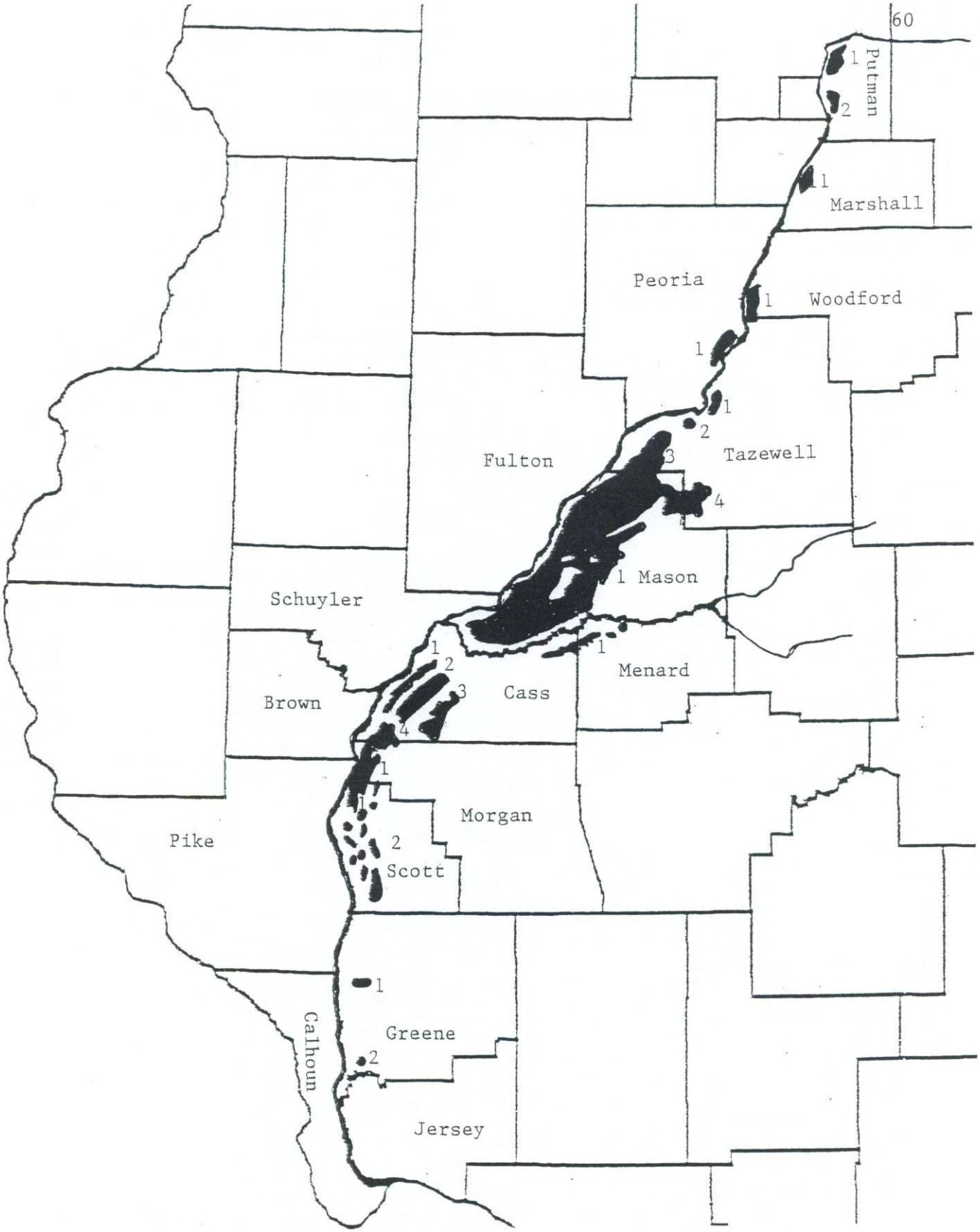


Figure 1. Map of the Illinois River valley from the "Big Bend" in Putnam County south to the Mississippi River with the distribution of the Illinois River sand deposits.