



# Implementation of a Long-term Vegetation Monitoring Program at the Mississippi National River and Recreation Area

Natural Resource Report NPS/GLKN/NRTR—2012/616



#### **ON THE COVER**

Clockwise from top left: Obtaining the diameter of a cottonwood tree (*Populus deltoides*); groundlayer sampling on a floodplain; showy orchid (*Galearis spectabilis*) at Spring Lake Preserve; barge observed from the floodplain of the Pig's Eye Scientific and Natural Area. Photographs by GLKN field crew.



---

# **Implementation of a Long-term Vegetation Monitoring Program at the Mississippi National River and Recreation Area**

Natural Resource Report NPS/GLKN/NRTR—2012/616

Suzanne Sanders and Jessica Grochowski  
National Park Service  
Great Lakes Inventory and Monitoring Network  
2800 Lake Shore Dr. East  
Ashland, WI 54806

August 2012

U.S. Department of the Interior  
National Park Service  
Natural Resource Stewardship and Science  
Fort Collins, Colorado

The National Park Service, Natural Resource Stewardship and Science office in Fort Collins, Colorado publishes a range of reports that address natural resource topics of interest and applicability to a broad audience in the National Park Service and others in natural resource management, including scientists, conservation and environmental constituencies, and the public.

The Natural Resource Technical Report Series is used to disseminate results of scientific studies in the physical, biological, and social sciences for both the advancement of science and the achievement of the National Park Service mission. The series provides contributors with a forum for displaying comprehensive data that are often deleted from journals because of page limitations.

All manuscripts in the series receive the appropriate level of peer review to ensure that the information is scientifically credible, technically accurate, appropriately written for the intended audience, and designed and published in a professional manner.

This report received formal peer review by subject-matter experts who were not directly involved in the collection, analysis, or reporting of the data, and whose background and expertise put them on par technically and scientifically with the authors of the information.

Views, statements, findings, conclusions, recommendations, and data in this report do not necessarily reflect views and policies of the National Park Service, U.S. Department of the Interior. Mention of trade names or commercial products does not constitute endorsement or recommendation for use by the U.S. Government.

This report is available from the Great Lakes Inventory and Monitoring Network (<http://science.nature.nps.gov/im/units/glkn/index.cfm>) and the Natural Resource Publications Management website (<http://www.nature.nps.gov/publications/nrpm/>).

Please cite this publication as:

Sanders, S. and J. Grochowski. 2012. Implementation of a long-term vegetation monitoring program at the Mississippi National River and Recreation Area. Natural Resource Technical Report NPS/GLKN/NRTR—2012/616. National Park Service, Fort Collins, Colorado.

# Contents

|                                           | Page |
|-------------------------------------------|------|
| Figures .....                             | v    |
| Tables .....                              | vii  |
| Appendices .....                          | ix   |
| Executive Summary .....                   | xi   |
| Acknowledgments .....                     | xiii |
| Introduction .....                        | 1    |
| Methods .....                             | 1    |
| Field Methods.....                        | 1    |
| Basic Measurements .....                  | 1    |
| Browse Assessments .....                  | 3    |
| Tree Health.....                          | 4    |
| Assigning Forest Types.....               | 5    |
| Visual Assessment/Photo Points.....       | 5    |
| Plant Identification.....                 | 5    |
| Analysis and Classification Methods ..... | 5    |
| Cluster Analysis .....                    | 5    |
| Functional Groups.....                    | 6    |
| Coefficients of Conservatism.....         | 6    |
| Results .....                             | 7    |
| Upland Forests .....                      | 7    |
| Cottonwood-Box Elder Forests.....         | 12   |
| Green Ash-Box Elder Forests .....         | 14   |
| Silver Maple Forests .....                | 17   |

## Contents (continued)

|                                                             | Page |
|-------------------------------------------------------------|------|
| Coarse Woody Material .....                                 | 18   |
| Browse and Disease .....                                    | 19   |
| Community Indices.....                                      | 21   |
| Discussion .....                                            | 23   |
| Ecology and Interpretation .....                            | 23   |
| Management Directions.....                                  | 25   |
| Implementation: Problems, Logistics, and Future Plans ..... | 26   |
| Literature Cited .....                                      | 27   |

## Figures

|                                                                                         | Page |
|-----------------------------------------------------------------------------------------|------|
| Figure 1. The Hybrid plot. ....                                                         | 2    |
| Figure 2. Direct browse sampling circles in a plot. ....                                | 4    |
| Figure 3. MISS long-term vegetation monitoring plot locations and forest types.....     | 8    |
| Figure 4. Densities and diameter classes of tree species in upland forests.....         | 10   |
| Figure 5. Densities and diameter classes of trees in cottonwood-box elder forests. .... | 13   |
| Figure 6. Densities and diameter classes of trees in green ash-box elder forests. ....  | 15   |
| Figure 7. Densities and diameter classes of trees in silver maple forests. ....         | 17   |
| Figure 8. Mean coefficient of conservatism (COC) values for the four forest types.....  | 21   |



## Tables

|                                                                               | Page |
|-------------------------------------------------------------------------------|------|
| Table 1. Forest types at MISS and the plots classified in each.....           | 7    |
| Table 2. Basal area and density of live trees in upland forests. ....         | 9    |
| Table 3. Seedling density in upland forests. ....                             | 10   |
| Table 4. Shrub percent cover in upland forests.....                           | 11   |
| Table 5. Basal area and tree density in cottonwood-box elder forests.....     | 12   |
| Table 6. Seedling density in cottonwood-box elder forests.....                | 13   |
| Table 7. Shrub percent cover in cottonwood-box elder forests. ....            | 14   |
| Table 8. Basal area and tree density in green ash-box elder forests. ....     | 15   |
| Table 9. Seedling density in green ash-box elder forests.....                 | 16   |
| Table 10. Shrub percent cover in green ash-box elder forests.....             | 16   |
| Table 11. Basal area and tree density in silver maple forests .....           | 17   |
| Table 12. Seedling density in silver maple forests. ....                      | 18   |
| Table 13. Shrub percent cover in silver maple forests.....                    | 18   |
| Table 14. Coarse woody material volume and biomass for each forest type. .... | 18   |
| Table 15. Coarse woody material density in four diameter classes.....         | 19   |
| Table 16. Density of standing dead trees $\geq 30$ cm DBH. ....               | 19   |
| Table 17. Direct browse at the 1 m radius browse circles. ....                | 19   |
| Table 18. Summary of indirect browse documented. ....                         | 20   |
| Table 19. Plot species richness within classes of each functional group.....  | 21   |



## Appendices

|                                                   | Page |
|---------------------------------------------------|------|
| Appendix A. Field Sites Maps .....                | 31   |
| Appendix B. Complete List of Species Sampled..... | 99   |
| Appendix C. Individual Plot Data.....             | 105  |



## Executive Summary

We initiated a long-term vegetation monitoring program at the Mississippi National River and Recreation Area (MISS) in summer 2011. The goals of this monitoring program are to detect forest change and to draw inferences about forest health so that management recommendations can be provided to the park. We established 33 plots at MISS, distributed among four forest types: upland, cottonwood-box elder, green ash-box elder, and silver maple. Upland plots contained the greatest tree species diversity, with all common species regenerating. In the three riparian forest types, many species characteristic of these forests are not successfully regenerating and are now present only as large diameter individuals at very low densities. For example, in floodplain forests, we located no cottonwood individuals smaller than 15 cm in diameter at breast height (DBH), although most individuals were greater than 30 cm DBH. The lack of regeneration is a direct result of river impoundment, which moderates flooding and supplements low water flow. Floodplain species are dependent on high water events to scour surfaces and remove existing vegetation, creating germination sites.

Invasive species were evident in both upland and riparian sites. Two shrub taxa, buckthorn and exotic honeysuckles, were commonly observed in many upland plots. Both taxa were located in nine of the 10 total upland plots. In the plots where they were present, mean buckthorn cover was 14.4% and honeysuckle cover was 6.8%. In the 23 floodplain sites, garlic mustard was present at 10 of these sites and reed canarygrass at 13. Besides invasive plants, the invasive beetle, emerald ash borer, is now present in the Twin Cities metro area. This species disrupts the vascular system of all ash species, leading to tree death within about four years. In green ash-box elder forests, green ash comprised 39% of the density and 35% of the basal area. In upland plots, both green and black ash collectively represented 7% of the density and 6% of the basal area, while in cottonwood-box elder forests, ash represented 6% and 18% of the density and basal area, respectively.

Managers should make every effort to reduce the impacts of invasive plant species, particularly in areas where ash is abundant. The loss of ash trees will create gaps which can promote the establishment of buckthorn and honeysuckle. To address issues with regeneration, partial restoration of historic flow regimes, such as periodic drawdowns of water, can create suitable sites for germination and establishment of flood dependent species. Alternatively, managers may wish to consider restoration techniques that involve transplantation of two- and three-year-old saplings of these species. These plots will be revisited in 2017. Comparisons of change can be made at that time.



## **Acknowledgments**

We are grateful for the vegetation monitoring field crew of Caitlin Clarke, Chris Groebner, Brian Pauley, Jaime Thibodeaux, and Alexandra Wardwell. Without their assistance, this project would in no way be possible. We are also indebted to Bill Route for boat transportation and to Tamberlain Jacobs and Nancy Duncan for planning and logistical assistance. We also wish to convey thanks to the natural resource staff at many of our partner parks. Finally, we have also greatly appreciated the assistance of Rebecca Key of the Great Lakes I&M Network for assistance with database development and refinement.



# Introduction

Long-term forest monitoring provides an assessment of forest health by showing the status of plant communities at the time of each sampling event and elucidating how these communities change over time. Despite this value, large-scale monitoring programs for forest health with regularly scheduled return intervals are not common (for an exception, see U. S. Department of Agriculture (2005)).

In 2007, the National Park Service Great Lakes Inventory and Monitoring Network initiated a long-term forest vegetation monitoring program for nine national parks in the Great Lakes region. The general goals of this program are to monitor forest vegetation to gain a better understanding of its dynamics, and to compare, ultimately, vegetation indices to baseline conditions. The program was initiated at the Mississippi National River and Recreation Area (MISS) in the summer of 2011. As this was the first year of data collection at this park, no comparisons between time intervals can be made. Nonetheless, meaningful data were obtained to demonstrate the current status of MISS forests.

The goals of our long-term vegetation monitoring during the first sampling year at a given park focus on obtaining baseline data on the status of park forests. Here, we report on this effort at MISS. Specifically, we wanted to answer the following questions for key forest habitats: 1) What is the relationship between density and stem diameter for key tree species? 2) What is the basal area of both individual tree species and all species collectively? 3) What is the density of seedlings? 4) What is the percentage of shrub cover?

## Methods

Sampling was conducted at MISS from 31 May–27 June, 2011. Sites were selected using a generalized random-tessellation stratified design (GRTS; Stevens and Olsen 2004), ensuring that sites were both randomly located and spatially balanced throughout the park. All sites were required to have a minimum of 10% forest cover. We checked all potential sites against an aerial photography layer in GIS prior to visiting them in the field. Potential sites that did not initially meet the minimum 10% forest cover requirement were moved the shortest distance possible, to a maximum of 100 m, so that they fell within the desired amount of cover. If a potential site could not be moved  $\leq 100$  m to meet the criteria, it was not sampled. Maps of individual sites are presented in Appendix A.

### Field Methods

#### *Basic Measurements*

Sites were sampled using the Hybrid plot (Figure 1) developed specifically to meet the needs of our long-term monitoring program (Johnson et al. 2006, Johnson et al. 2008). The plot is composed of three 50 m parallel transects oriented east-west. Tree data were collected in a 6 m wide band along the length of each transect. Tree data collected included species, diameter at breast height (DBH), whether the tree was alive or dead, and any evident damage or disease. Trees were defined as having a DBH  $\geq 2.5$  cm. Groundlayer vegetation was collected in 1m<sup>2</sup> quadrats placed every 5 m along each transect (n = 30 per plot). Within each quadrat, we

recorded all herbaceous, vine, and shrub species present as well as counted seedlings. Seedlings were defined as tree species <2.5 cm DBH, but at least 15 cm in height and showing evidence of growth from the previous year. Many species we commonly encountered reproduce vegetatively (e.g., aspen, basswood). Individual sprouts (i.e., both ramets and genets) were deemed “seedlings” if no aboveground connections between them, or a parent tree, were visible. Shrub cover was assessed within each of six 2.82 m radius (25 m<sup>2</sup> area) shrub circles, located at the transect ends. Here, we visually estimated percent cover of each shrub species present. We measured coarse woody materials (CWM) along each of the three transects using the planar intercept method (Brown 1974, (Woodall and Monleon 2007)). We recorded diameters at the point of intercept, the small end, and the large end; the length; the decay class (Woodall and Williams 205); and, if possible, the species. Because we defined CWM as having a diameter  $\geq 7.5$  cm (3 in), the length of a piece was measured only along the section where the diameter exceeded this amount. Finally, we performed a half-hour time-delimited search of the entire 50 m  $\times$  100 m plot area to locate any additional species not previously recorded in any of the sampling.

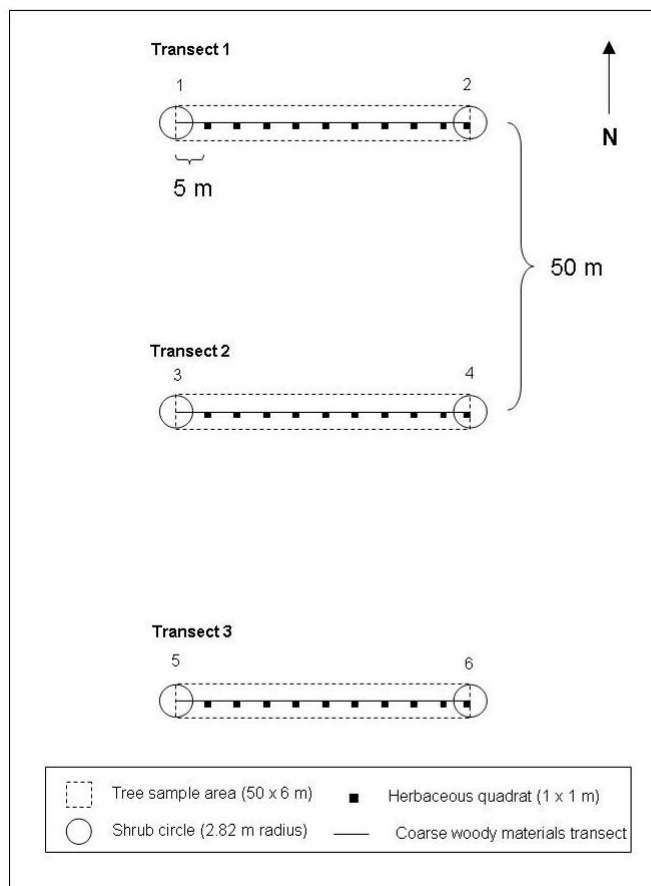


**Figure 1.** The Hybrid plot configuration consisted of three parallel transects, each 50 m long and oriented east-to-west.

### **Browse Assessments**

We examined white-tailed deer (*Odocoileus virginianus* Zimm.) winter and summer browse pressure using two distinct measures. Direct browse is an assessment of visible browse, i.e., bites, directly evident on the plant. The direct browse measure is assessed on woody species. The indirect browse assessment is conducted on herbaceous species and does not focus on obvious, visible browse, but rather changes in herbs, only indirectly observed over time. These changes are typically manifested as fewer and smaller individuals of preferred herbaceous browse species.

Direct browse was measured along each of the three 50 m transects, and along the two 100 m transects running north-south between the east-west transects at the plot (broken down into 50 meter segments for consistency) (Figure 2). Direct browse measurements were conducted in 3.14 m<sup>2</sup> (1 m radius) circular sampling areas. These browse sampling circles were centered every 5 meters along each transect, for a total of 68 for each plot. This resulted in a total sampling area of 213 m<sup>2</sup>. For each direct browse sampling circle, all woody species present in the browse zone, defined as the space between 0.20 m and 2.0 m in height, were recorded. In addition to species presence, evidence of any deer browse on that species in the sampling circle was recorded. Typically, winter browse surveys are conducted in the spring, prior to the new season's growth. Because we were not able to sample in the spring, we only considered a plant browsed when it was apparent that the browse occurred before the start of the current season's growth. This was evidenced by new growth arising from the bud immediately below the point of browse. Direct browse data were used to calculate a browse index equal to the ratio of woody species with evident browse to all woody species present (Morellet et al. 2001, Morellet et al. 2003).

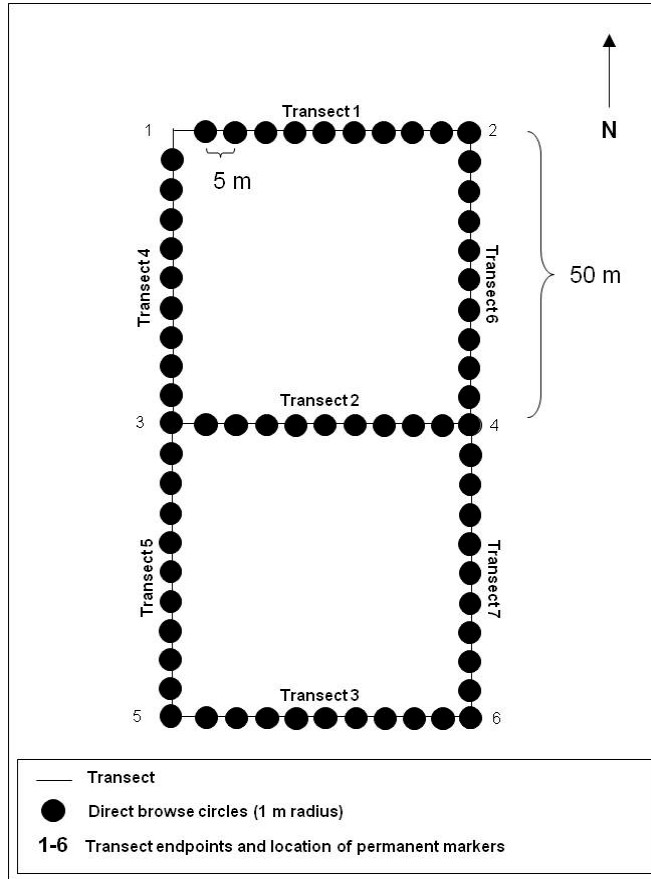


**Figure 2.** Direct browse sampling circles in a plot.

To assess the indirect impacts of summer browse on understory species, we selected three target species that are known to be browsed by white-tailed deer in the region: *Laportea canadensis* (L.) Weddell (wood nettle), *Osmorhiza* sp. Raf. (sweet cicely), and *Maianthemum racemosum* (L.) Link (false lily-of-the-valley). In each 1 m<sup>2</sup> herbaceous quadrat (see Figure 1), for each target species, we counted the number of individuals that were non-reproductive and unbrowsed, the number that were reproductive and unbrowsed, and the number that were browsed (regardless of reproductive state). We also measured the height of the tallest individual of each of the three target species, if present.

### **Tree Health**

To assess tree health, we used an evidence-based approach whereby we examined each tree for the presence of broad classes of disease, damage, or injury (U.S. Department of Agriculture 2010). These classes included dieback, epicormic sprouting, wilted foliage, defoliation, discolored foliage, insect sign, and human induced stress. If a tree exhibited symptoms of one of these primary classes, a further classification of the damage or disease was made, based on predefined characteristics within each of the primary classes. For example, if a tree was classified as having discolored foliage, we would note whether this damage was in the form of (among other choices) marginal browning of the leaves, interveinal browning of the leaves, the leaves possessing a white coating, or a general yellowing of the leaves. This symptom-based assessment of damage and disease allows us to easily classify tree health issues, from which, a

symptom-based approach is more accurate than directly assigning a root cause to problems observed when at the field site. For some symptoms, there are dozens of possible causes and a pathologist or entomologist with specialization in the region would be needed to accurately assess the problem. Large-scale or persistent symptoms noted with this method can inform the park staff of potential disease or insect outbreaks, which would require further investigation by the park to identify the exact disease or pest.

### **Assigning Forest Types**

Because we may want to stratify by forest or habitat type during later analyses (i.e., post stratification), we declared a forest type for all plots sampled. While we were present at the plot, we used the Minnesota Landcover Classification System (MLCCS, Leete and Richardson 1999) to declare a forest type.

### **Visual Assessment/Photo Points**

Finally, documenting visual assessments of site change will be as important as statistical documentation, and potentially more informative. Therefore, we took six photographs at each plot. The six photo points were located at each of the six transect endpoints, with the camera facing into the plot (i.e., due east at points 1, 3, and 5 and due west at points 2, 4, and 6; see Figure 1).

### **Plant Identification**

We attempted to identify all plants to the species level while in the field. When this was not possible, we typically collected specimens for later identification. In some instances, it was not possible to distinguish between multiple species present in a park, unless they were flowering or fruiting, which often was not the case. In these instances, we identified only to the genus level. Examples of this include *Pilea* Lindl. (false nettle), *Osmorhiza* (sweet cicely), and *Carex* L. (sedge). For *Amelanchier* sp., the genus was further subdivided into three groups of species complexes, with Group 1 containing *A. bartramiana*; Group 2 containing *A. arborea*, *A. laevis*, and *A. interior*; and Group 3 containing an uncertain number of species (Smith 2008). Finally, if a grass was not in flower or fruit, it was typically only possible to identify to the family (Poaceae) level. Finally, because we questioned the large occurrence of *Ulmus rubra* Muhl. (slippery elm) recorded in floodplain plots relative to *Ulmus americana* L. (American elm), we pooled data from these two species and are presenting it simply as *Ulmus* sp. L., or just elm.

## **Analysis and Classification Methods**

### **Cluster Analysis**

We felt that there was some degree of subjectivity required when using the MLCCS dichotomous key to assign forest types. Because multiple employees present at a site often assigned different types, we questioned the value of this data for our program. Further, the MLCCS recognizes subtle nuances in forests, such that this system tends to recognize more, rather than fewer, types. Our 33 plots were assigned to 12 different forest types. Grouping on these forest types would result in one to a few plots per type. For these reasons, we decided to use cluster analysis to place the 33 plots into groups with similar tree species composition. We limited inclusion in the cluster analysis to those species that were present in at least 8% (3 of 33) of the plots. Collectively, these plots supported 17 taxa meeting these criteria. The cluster analysis was based on the importance value, determined by the sum of the relative density and relative basal area of each species-plot

combination (Dyer 2006, Elliott and Swank 2008). We used PC-ORD software with a Sørensen distance measure and a flexible beta linkage ( $\beta = -0.25$ , McCune and Grace 2002). Forest type names were assigned based on the dominant trees in these groups.

### **Functional Groups**

All taxa were assigned to classes within each of four functional groups. Within the *life history group*, taxa were annual, biennial, or perennial. For taxa that are known to exhibit a range of life history strategies, we assigned the shortest strategy. For example, if a taxa is known to be either biennial or perennial, we assigned it to the biennial class. Within the *growth form group*, taxa were considered to be woody (trees and shrubs), graminoid (grasses, sedges, and rushes), or forbs. This latter class included ferns and fern allies in this report. For the *pollination group*, taxa were considered to be abiotically pollinated if the flowers are non-existent (conifers) or not showy, and not known to produce any sensory attractants. These are typically wind pollinated. Otherwise, taxa were considered to be biotically pollinated. Fern and fern allies were not assigned to classes within this functional group. Within the nativity group, taxa were assigned to either native, non-native, or native/non-native. Naturalized taxa were considered non-native. In some instances taxa were identified only to the genus level and could not be assigned a nativity group as species within these genera are both native and otherwise. One example of this is *Ranunculus* sp. (buttercup).

### **Coefficients of Conservatism**

Coefficient of conservatism (COC) values describe the affinity of species to non-degraded habitats. Values range from zero (either non-native species or generalists with no faithfulness to any particular habitat) to 10 (conservative species found only in high-quality, non-degraded habitats). Since a given species may be conservative in one area of its distribution, but a generalist in the center of its range, COC values vary by region. Typically, values are assigned at the state level by experienced botanists and ecologists. For this report, we used COC values defined for the state of Wisconsin (Bernthal 2003). Although COC values have been assigned for wetland plant species in Minnesota (Milburn et al. 2007), there has been no comprehensive, statewide assignment of COC values for all plant species in Minnesota. Mean COC values were calculated for each of the four forest types.

## Results

A total of 33 plots were completed at MISS (Figure 3). Thirty-eight tree species were recorded in the sampling plots (Appendix B), as were 35 shrub species, eight species of woody vines, and 167 herbaceous species. Cluster analysis, based on the importance values of the tree species present in each plot, revealed four distinct groups. We confirmed these groups using non-metric multidimensional scaling (NMS) and designated a forest type for each (Table 1): upland, cottonwood-box elder, green ash-box elder, and silver maple.

**Table 1.** Forest types at MISS and the plots classified in each.

| Forest type          | Plots                                                      |
|----------------------|------------------------------------------------------------|
| Upland               | 5002, 5006, 5018, 5031, 5033, 5039, 5073, 5082, 5096, 5097 |
| Cottonwood-box elder | 5004, 5016, 5020, 5022, 5038, 5056, 5076, 5084, 5099, 5148 |
| Green ash-box elder  | 5010, 5021, 5034, 5042, 5052, 5104, 5140                   |
| Silver maple         | 5030, 5035, 5086, 5106, 5111, 5142                         |

### Upland Forests

The upland forest plots were near the uppermost reaches of the Riverway and between St. Paul and Hastings and exhibited a continuum of forest integrity. Plot ownership and locations include Anoka County Parks/Coon Rapids Dam Regional Park (5096), Ramsey County (5031), Macalester College/Ordway Nature Preserve (5039), Washington County/Lower Gray Cloud Island (5073), Dakota County Parks/Pine Bend Bluff State Natural Area (5082), Dakota County Parks/Spring Lake Park Reserve (5002, 5018), Dakota County Parks/Schaar's Bluff/Spring Lake Park Reserve (5097), the 3M corporation (5033), and the State of Minnesota/DNR land east of Hastings (5006).

Among the four forest types at MISS, this one had the greatest tree species richness with 24 species (Table 2). No single species was dominant in upland forests, but elm, bitternut hickory (*Carya cordiformis* (Wangenh.) K. Koch), and bur oak (*Quercus macrocarpa* Michx.) were both common and exhibited a range of size classes in this forest type (Table 2). All prominent species in upland forests appear to be regenerating, as is evidenced by greater densities in smaller size classes (Figure 4).

Seedling density varied highly by species but most of the prominent upland tree species had seedling densities greater than 800 seedlings/ha (Table 3). Exceptions to this were red oak (*Quercus rubra* L.) and basswood (*Tilia americana* L.) at 267 and 200 seedlings/ha, respectively (Table 3).

Twenty-seven shrub or woody vine species were identified (Table 4). Percent cover was less than one percent for all but three species: buckthorn (*Rhamnus cathartica* L., 12.95%), exotic honeysuckles (*Lonicera* ssp. L., 5.53%), and hairystem gooseberry (*Ribes hirtellum* Michx., 2.97%).

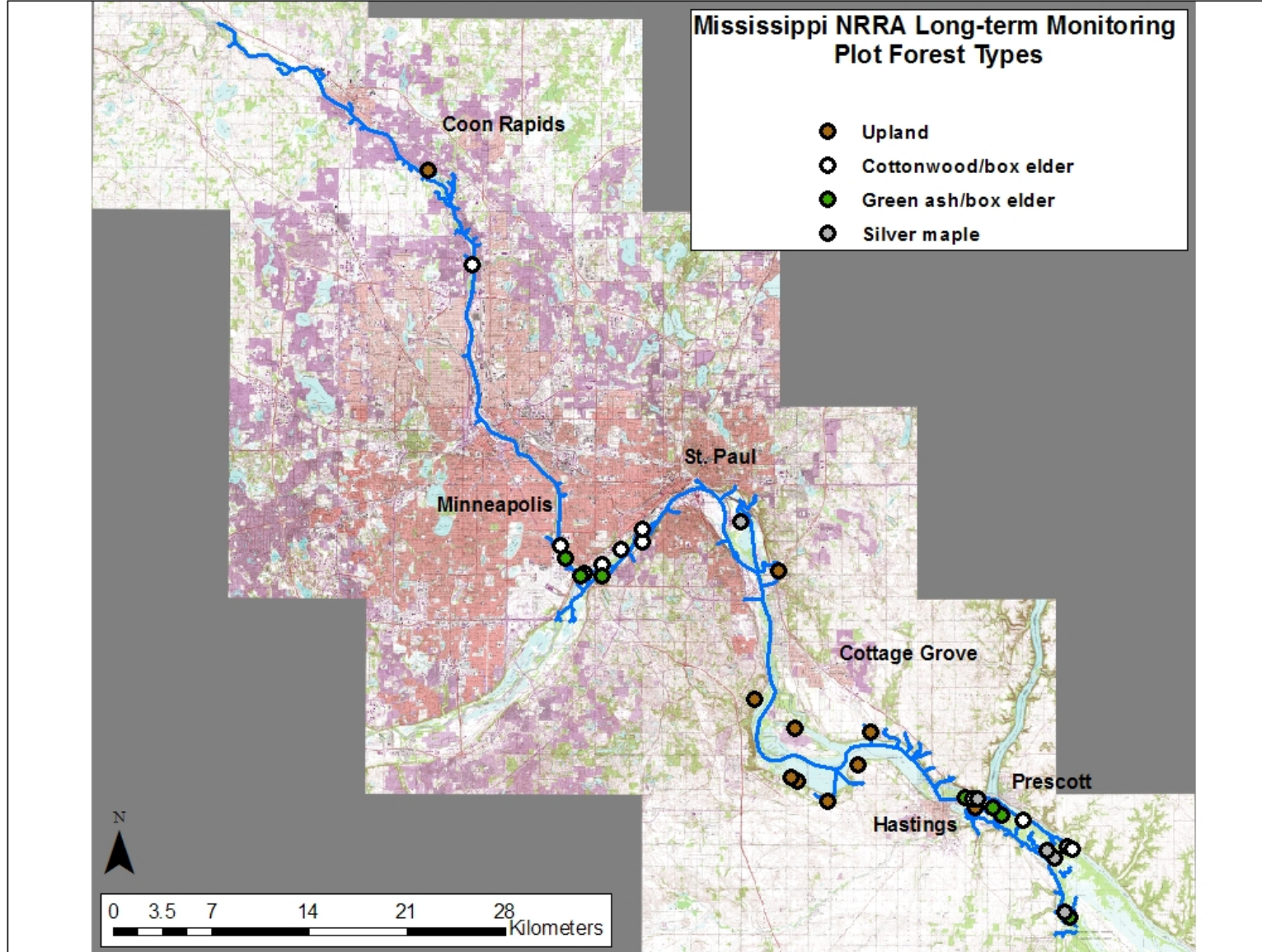


**Figure 3.** MISS long-term vegetation monitoring plot locations and forest types (in 2011).

**Table 2.** Basal area and density of live trees in upland forests at Mississippi NRRA, 2011.

| <b>Latin name</b>                               | <b>Common name</b>  | <b>Basal area<br/>(m<sup>2</sup>/ha)</b> | <b>Density<br/>(trees/ha)</b> |
|-------------------------------------------------|---------------------|------------------------------------------|-------------------------------|
| <i>Acer negundo</i>                             | box elder           | 0.72                                     | 38.89                         |
| <i>Acer nigrum</i>                              | black maple         | <0.01                                    | 1.11                          |
| <i>Acer saccharum</i>                           | sugar maple         | 0.08                                     | 6.67                          |
| <i>Betula papyrifera</i>                        | paper birch         | 0.74                                     | 30.00                         |
| <i>Carya cordiformis</i>                        | bitternut hickory   | 2.42                                     | 147.78                        |
| <i>Celtis occidentalis</i>                      | hackberry           | 1.02                                     | 104.44                        |
| <i>Crataegus</i> sp.                            | hawthorn            | <0.01                                    | 1.11                          |
| <i>Fraxinus nigra</i>                           | black ash           | 0.06                                     | 18.89                         |
| <i>Fraxinus pennsylvanica</i>                   | green ash           | 1.21                                     | 41.11                         |
| <i>Gymnocladus dioica</i>                       | Kentucky coffeetree | 0.03                                     | 3.33                          |
| <i>Juglans cinerea</i>                          | butternut           | 0.03                                     | 1.11                          |
| <i>Juniperus virginiana</i>                     | eastern red cedar   | 0.14                                     | 15.56                         |
| <i>Ostrya virginiana</i>                        | ironwood            | 0.11                                     | 17.78                         |
| <i>Populus deltoides</i> ssp. <i>monilifera</i> | cottonwood          | 1.23                                     | 7.78                          |
| <i>Populus tremuloides</i>                      | trembling aspen     | 0.18                                     | 2.22                          |
| <i>Prunus serotina</i>                          | black cherry        | 1.27                                     | 42.22                         |
| <i>Prunus virginiana</i>                        | pin cherry          | 0.02                                     | 8.89                          |
| <i>Quercus alba</i>                             | white oak           | 1.24                                     | 6.67                          |
| <i>Quercus ellipsoidalis</i>                    | northern pin oak    | 1.24                                     | 5.56                          |
| <i>Quercus macrocarpa</i>                       | bur oak             | 5.60                                     | 47.78                         |
| <i>Quercus rubra</i>                            | red oak             | 1.76                                     | 47.78                         |
| <i>Tilia americana</i>                          | basswood            | 1.72                                     | 120.00                        |
| <i>Ulmus</i> sp.                                | American elm        | 2.20                                     | 170.00                        |
| Total                                           |                     | 23.02                                    | 886.68                        |

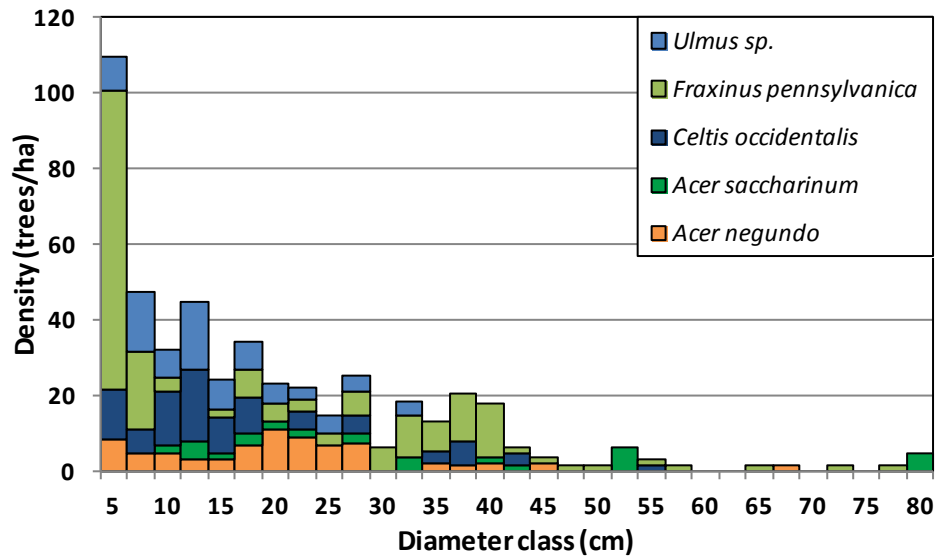


**Figure 4.** Densities and diameter classes of tree species in upland forests at Mississippi NRRA, 2011.

**Table 3.** Seedling density in upland forests at Mississippi NRRA, 2011.

| Latin name                    | Common name         | Density<br>(seedlings/ha) |
|-------------------------------|---------------------|---------------------------|
| <i>Acer negundo</i>           | box elder           | 400.00                    |
| <i>Acer saccharum</i>         | sugar maple         | 100.00                    |
| <i>Betula sp.</i>             | birch               | 66.67                     |
| <i>Carya cordiformis</i>      | bitternut hickory   | 1,366.67                  |
| <i>Celtis occidentalis</i>    | hackberry           | 2,133.33                  |
| <i>Crataegus sp.</i>          | hawthorn            | 33.33                     |
| <i>Fraxinus nigra</i>         | black ash           | 133.33                    |
| <i>Fraxinus pennsylvanica</i> | green ash           | 1,700.00                  |
| <i>Gymnocladus dioica</i>     | Kentucky coffeetree | 100.00                    |
| <i>Juniperus virginiana</i>   | eastern red cedar   | 66.67                     |
| <i>Ostrya virginiana</i>      | ironwood            | 233.33                    |
| <i>Populus tremuloides</i>    | trembling aspen     | 200.00                    |
| <i>Prunus pensylvanica</i>    | pin cherry          | 200.00                    |
| <i>Prunus serotina</i>        | black cherry        | 3,500.00                  |
| <i>Prunus sp.</i>             | cherry              | 33.33                     |
| <i>Prunus virginiana</i>      | chokecherry         | 2,333.33                  |
| <i>Quercus ellipsoidalis</i>  | northern pin oak    | 66.67                     |
| <i>Quercus rubra</i>          | red oak             | 266.67                    |
| <i>Tilia americana</i>        | basswood            | 200.00                    |
| <i>Ulmus sp.</i>              | elm                 | 900.00                    |
| Total                         |                     | 14,033.33                 |

**Table 4.** Shrub percent cover in upland forests at Mississippi NRRA, 2011.

| Latin name                                    | Common name                | % Cover |
|-----------------------------------------------|----------------------------|---------|
| <i>Berberis vulgaris</i> <sup>1</sup>         | barberry                   | 0.05    |
| <i>Cornus alternifolia</i>                    | alternate-leaved dogwood   | 0.33    |
| <i>Cornus racemosa</i>                        | gray dogwood               | 0.12    |
| <i>Corylus americana</i>                      | American hazelnut          | 0.03    |
| <i>Euonymus atropurpurea</i>                  | burningbush                | 0.08    |
| <i>Lonicera</i> sp. (exotic) <sup>1</sup>     | honeysuckle (exotic)       | 5.53    |
| <i>Lonicera morrowii</i> <sup>1</sup>         | Morrow's honeysuckle       | 0.55    |
| <i>Lonicera</i> sp. <sup>2</sup>              | honeysuckle                | 0.03    |
| <i>Menispermum canadense</i>                  | moonseed                   | 0.63    |
| <i>Parthenocissus</i> sp.                     | Virginia creeper           | 2.42    |
| <i>Physocarpus opulifolius</i>                | ninebark                   | 0.02    |
| <i>Rhamnus cathartica</i> <sup>1</sup>        | buckthorn                  | 12.95   |
| <i>Ribes cynosbati</i>                        | eastern prickly gooseberry | 0.38    |
| <i>Ribes hirtellum</i>                        | hairystem gooseberry       | 2.97    |
| <i>Ribes</i> sp.                              | current/gooseberry         | 0.05    |
| <i>Rosa carolina</i>                          | Carolina rose              | 0.02    |
| <i>Rubus idaeus</i> ssp. <i>strigosus</i>     | red raspberry              | 0.17    |
| <i>Rubus occidentalis</i>                     | black raspberry            | 0.37    |
| <i>Rubus pensilvanicus</i>                    | Pennsylvania blackberry    | 0.08    |
| <i>Rubus pubescens</i>                        | dwarf red blackberry       | 0.20    |
| <i>Rubus setosus</i>                          | setose blackberry          | 0.02    |
| <i>Sambucus nigra</i> ssp. <i>canadensis</i>  | black elderberry           | 0.03    |
| <i>Sambucus racemosa</i> var. <i>racemosa</i> | red elderberry             | 0.40    |
| <i>Sambucus</i> sp.                           | elderberry                 | 0.03    |
| <i>Solanum dulcamara</i> <sup>1</sup>         | climbing nightshade        | 0.05    |
| <i>Smilax tamnoides</i>                       | bristly greenbriar         | 0.32    |
| <i>Toxicodendron radicans</i>                 | eastern poison ivy         | 0.18    |
| <i>Toxicodendron rydbergii</i>                | western poison ivy         | 0.05    |
| <i>Viburnum rafinesqueanum</i>                | downy arrowwood            | 0.02    |
| <i>Viburnum</i> sp.                           | viburnum                   | 0.02    |
| <i>Vitis riparia</i>                          | riverbank grape            | 0.57    |
| <i>Zanthoxylum americanum</i>                 | prickly ash                | 0.35    |

<sup>1</sup>non-native<sup>2</sup>This genus contains both native and non-native species.

## Cottonwood-Box Elder Forests

The cottonwood-box elder riparian forest type is typified by large diameter cottonwoods (*Populus deltoides* Bartram ex Marsh. ssp. *monilifera* (Aiton) Eckenwalder), with significant inclusions of box elder (*Acer negundo* L.) and silver maple (*Acer saccharinum* L.). Plot ownership and locations include Anoka County/Manomin County Park (5016), St. Paul Parks and Recreation Department/Hidden Falls Regional Park (5076), St. Paul Parks and Recreation Department/Crosby Farm Regional Park (5148, 5004), State of Minnesota/land east of Hastings (5022), Minnesota DNR/Pike Island (5056), Lilydale Regional Park/ St. Paul Parks and Recreation Department (5020, 5084), Minnesota DNR/Gores Pool Wildlife Management Area (WMA) (5038, 5099). Of these ten plots, seven were located within 5 km of the confluence of the Mississippi and Minnesota Rivers, three in the Gores Pool WMA downstream from Hastings, and one at Manomin County Park in Anoka County (Figure 3). Fifteen tree species were recorded in these plots, although one species, cottonwood, represented 45.0% of the basal area. Taxa with the greatest densities include box elder, silver maple, and elm (Table 5). Despite the large basal area, no cottonwood individuals with a diameter at breast height (DBH) were recorded smaller than 15 cm, and most individuals measured had a DBH >35 cm (Figure 5).

**Table 5.** Basal area and tree density in cottonwood-box elder forests at Mississippi NRRA, 2011.

| Latin name                                      | Common name      | Basal area<br>(m <sup>2</sup> /ha) | Density<br>(trees/ha) |
|-------------------------------------------------|------------------|------------------------------------|-----------------------|
| <i>Acer negundo</i>                             | box elder        | 4.22                               | 150.00                |
| <i>Acer saccharinum</i>                         | silver maple     | 9.61                               | 133.70                |
| <i>Betula nigra</i>                             | river birch      | 0.22                               | 1.11                  |
| <i>Celtis occidentalis</i>                      | hackberry        | 0.48                               | 39.26                 |
| <i>Fraxinus nigra</i>                           | black ash        | 0.15                               | 21.11                 |
| <i>Fraxinus pennsylvanica</i>                   | green ash        | 1.84                               | 79.88                 |
| <i>Gleditsia triacanthos</i>                    | honeylocust      | 0.03                               | 1.11                  |
| <i>Juglans cinerea</i>                          | butternut        | 0.33                               | 2.22                  |
| <i>Juglans nigra</i>                            | black walnut     | 0.02                               | 4.94                  |
| <i>Morus alba</i>                               | white mulberry   | 0.03                               | 1.23                  |
| <i>Populus deltoides</i> ssp. <i>monilifera</i> | cottonwood       | 15.12                              | 51.48                 |
| <i>Prunus virginiana</i>                        | pin cherry       | <0.01                              | 1.11                  |
| <i>Salix amygdaloides</i>                       | peachleaf willow | 0.28                               | 1.11                  |
| <i>Salix nigra</i>                              | black willow     | 0.23                               | 1.11                  |
| <i>Ulmus</i> sp.                                | elm              | 1.07                               | 86.91                 |
| Total                                           |                  | 33.63                              | 576.28                |

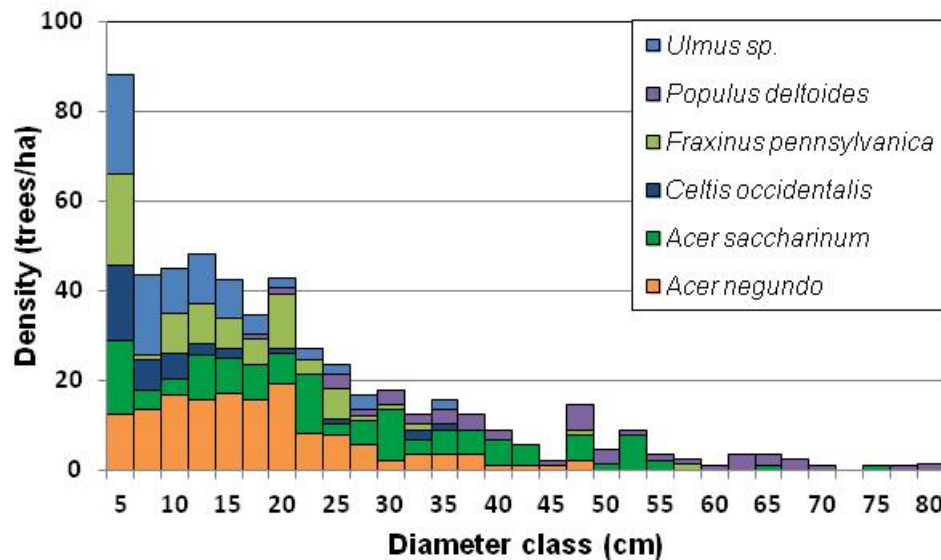


**Figure 5.** Densities and diameter classes of tree species in cottonwood-box elder forests at Mississippi NRR, 2011.

Green ash was the most abundant species of seedlings in this forest type with 3,720 (Table 6) with black ash (*Fraxinus nigra* Marsh.), hackberry, and elm having greater than 900 seedlings/ha. Seedling density of silver maple, a foundation species in floodplain forests, was only 70.3 seedlings/ha. There were no cottonwood seedlings located in the plots in this forest type (Table 6).

**Table 6.** Seedling density in cottonwood-box elder forests at Mississippi NRR, 2011.

| Latin name                    | Common name  | Density<br>(seedlings/ha) |
|-------------------------------|--------------|---------------------------|
| <i>Acer negundo</i>           | box elder    | 566.67                    |
| <i>Acer saccharinum</i>       | silver maple | 70.37                     |
| <i>Celtis occidentalis</i>    | hackberry    | 1,329.63                  |
| <i>Fraxinus nigra</i>         | black ash    | 1,533.33                  |
| <i>Fraxinus pennsylvanica</i> | green ash    | 3,719.98                  |
| <i>Prunus serotina</i>        | black cherry | 33.33                     |
| <i>Prunus virginiana</i>      | choke cherry | 433.33                    |
| <i>Tilia americana</i>        | basswood     | 66.67                     |
| <i>Ulmus sp.</i>              | elm          | 966.67                    |
| Total                         |              | 8,719.98                  |

Shrub and woody vine occurrence in cottonwood-box elder forests was generally low and only four species showed greater than 1% cover: buckthorn (3.13%), Virginia creeper (*Parthenocissus* sp. Planch., 2.03%), riverbank grape *Vitis riparia* Michx. (a woody vine with 1.55% cover), and

hairystem gooseberry (1.15%, Table 7). Including buckthorn, four non-native shrub taxa were recorded.

**Table 7.** Shrub percent cover in cottonwood-box elder forests at Mississippi NRRA, 2011.

| Latin name                                    | Common name            | % Cover |
|-----------------------------------------------|------------------------|---------|
| <i>Acer ginnala</i> <sup>1</sup>              | Amur maple             | 0.03    |
| <i>Cornus sericea</i>                         | redosier dogwood       | 0.48    |
| <i>Euonymus atropurpurea</i>                  | burning bush           | 0.03    |
| <i>Humulus lupulus</i>                        | common hops            | 0.02    |
| <i>Lonicera</i> sp. (exotic) <sup>1</sup>     | honeysuckle (exotic)   | 0.15    |
| <i>Menispermum canadense</i>                  | moonseed               | 0.12    |
| <i>Parthenocissus</i> sp.                     | Virginia creeper       | 2.03    |
| <i>Physocarpus opulifolius</i>                | ninebark               | 0.02    |
| <i>Rhamnus cathartica</i> <sup>1</sup>        | buckthorn              | 3.13    |
| <i>Ribes americanum</i>                       | American black current | 0.42    |
| <i>Ribes hirtellum</i>                        | hairystem gooseberry   | 1.15    |
| <i>Rubus idaeus</i> ssp. <i>strigosus</i>     | red raspberry          | 0.02    |
| <i>Rubus occidentalis</i>                     | black raspberry        | 0.75    |
| <i>Rubus pubescens</i>                        | dward red blackberry   | 0.05    |
| <i>Sambucus nigra</i> ssp. <i>canadensis</i>  | black elderberry       | 0.08    |
| <i>Smilax tamnoides</i>                       | bristly greenbriar     | 0.07    |
| <i>Solanum dulcamara</i> <sup>1</sup>         | climbing nightshade    | 0.12    |
| <i>Viburnum opulus</i> var. <i>americanum</i> | cranberrybush          | 0.03    |
| <i>Viburnum rafinesqueanum</i>                | downy arrowwood        | 0.02    |
| <i>Vitis riparia</i>                          | riverbank grape        | 1.55    |
| <i>Zanthoxylum americanum</i>                 | prickly ash            | 0.32    |

<sup>1</sup>non-native

### Green Ash-Box Elder Forests

The green ash-box elder forest type was dominated primarily by green ash (*Fraxinus pennsylvanica* Marsh.) but with abundant box elder and hackberry (*Celtis occidentalis* L.). Plot ownership and locations include Ft. Snelling State Park/National Cemetery (5140), Minnesota DNR/Ft. Snelling State Park (5052, 5104), Minnesota DNR/land east of Hastings (5021), Minnesota DNR/Gores Pool WMA (5010, 5034, 5042). Geographically, of these seven plots, three were within 2 km of the confluence of the Minnesota and Mississippi Rivers and four were downstream from Hastings. Green ash was the most abundant species comprising 39% of the total individuals, although the basal area of silver maple was greatest at 10.79 m<sup>2</sup>/ha (Table 8).

The density-diameter graph of green ash-box elder forests shows increased density of green ash in smaller size classes suggesting this species is successfully regenerating. In contrast, the density of other prominent taxa in this forest type (elm, hackberry, box elder) are generally consistent across the small and mid-size classes (Figure 6).

**Table 8.** Basal area and tree density in green ash-box elder forests at Mississippi NRRA, 2011.

| Latin name                    | Common name    | Basal area<br>(m <sup>2</sup> /ha) | Density<br>(trees/ha) |
|-------------------------------|----------------|------------------------------------|-----------------------|
| <i>Acer negundo</i>           | box elder      | 3.04                               | 75.12                 |
| <i>Acer nigrum</i>            | black maple    | 0.01                               | 3.17                  |
| <i>Acer saccharinum</i>       | silver maple   | 10.79                              | 43.78                 |
| <i>Celtis occidentalis</i>    | hackberry      | 2.78                               | 96.12                 |
| <i>Fraxinus pennsylvanica</i> | green ash      | 9.70                               | 196.21                |
| <i>Morus alba</i>             | white mulberry | 0.00                               | 1.76                  |
| <i>Ulmus</i> sp.              | elm            | 1.54                               | 86.27                 |
| Total                         |                | 27.86                              | 502.43                |

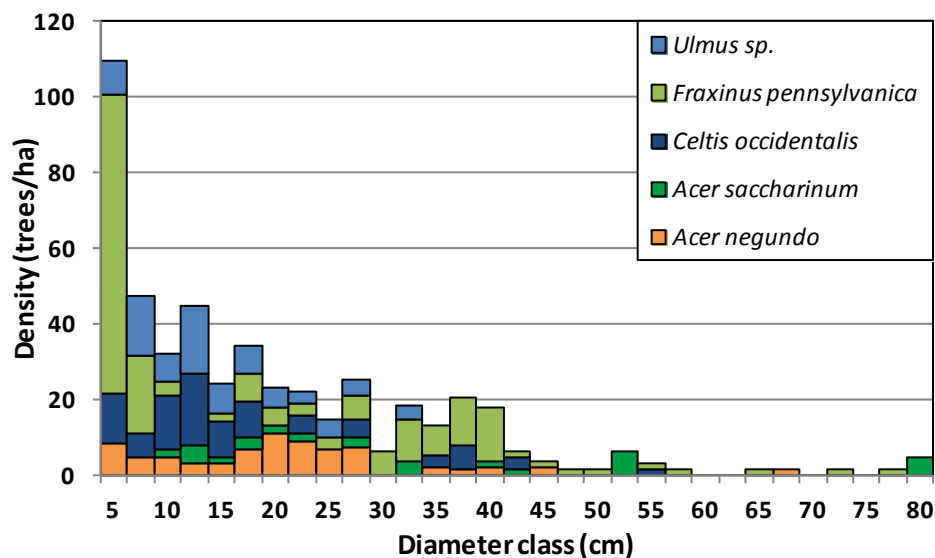


**Figure 6.** Densities and diameter classes of tree species in green ash-box elder forests at Mississippi NRRA, 2011.

Of the four forest types sampled, seedling density was the lowest in green ash-box elder forests (1,312 seedlings/ha, Table 9). Green ash seedlings represented 47% of the total, with the remaining five species having densities less than 250 seedlings/ha (Table 9).

**Table 9.** Seedling density in green ash-box elder forests at Mississippi NRR, 2011.

| Latin name                    | Common name  | Density<br>(seedlings/ha) |
|-------------------------------|--------------|---------------------------|
| <i>Acer negundo</i>           | box elder    | 153.44                    |
| <i>Acer saccharinum</i>       | silver maple | 142.86                    |
| <i>Celtis occidentalis</i>    | hackberry    | 158.73                    |
| <i>Fraxinus pennsylvanica</i> | green ash    | 619.05                    |
| <i>Ulmus</i> sp.              | elm          | 238.10                    |
| Total                         |              | 1,312.17                  |

Fourteen shrub and woody vine species were recorded in green ash-box elder plots with all of these having <1% cover (Table 10). There were three non-native shrub taxa located in these plots.

**Table 10.** Shrub percent cover in green ash-box elder forests at Mississippi NRR, 2011.

| Latin name                                   | Common name              | % Cover |
|----------------------------------------------|--------------------------|---------|
| <i>Cornus alternifolia</i>                   | alternate-leaved dogwood | 0.31    |
| <i>Euonymus atropurpurea</i>                 | burningbush              | 0.05    |
| <i>Menispermum canadense</i>                 | moonseed                 | 0.17    |
| <i>Parthenocissus</i> sp.                    | virginia creeper         | 0.33    |
| <i>Rhamnus cathartica</i> <sup>1</sup>       | buckthorn                | 0.71    |
| <i>Ribes hirtellum</i>                       | hairystem gooseberry     | 0.14    |
| <i>Sambucus nigra</i> ssp. <i>canadensis</i> | black elderberry         | 0.24    |
| <i>Smilax tamnoides</i>                      | bristly greenbriar       | 0.23    |
| <i>Solanum dulcamara</i> <sup>1</sup>        | climbing nightshade      | 0.02    |
| <i>Toxicodendron radicans</i>                | poison ivy               | 0.07    |
| <i>Viburnum lantana</i> <sup>1</sup>         | wayfaring tree           | 0.12    |
| <i>Viburnum lentago</i>                      | nannyberry               | 0.24    |
| <i>Vitis riparia</i>                         | riverbank grape          | 0.48    |
| <i>Zanthoxylum americanum</i>                | prickly ash              | 0.17    |

<sup>1</sup>non-native

## Silver Maple Forests

The silver maple forest type is riparian and characterized by large diameter silver maples. Six plots were classified in this type and plot ownership and locations include Ramsey County Parks/Battle Creek Regional Park (5111), Minnesota DNR/land east of Hastings (5086), and the Minnesota DNR/Gores Pool WMA (5030, 5035, 5106, 5142). Geographically, one of these was adjacent to Pig's Eye Lake and five were within or adjacent to the Gores Pool WMA. Silver maple comprised 76% of the individuals and represented 86% of the basal area (Table 11). Silver maple density decreased in the smallest size classes with only two individuals in the 2.5-5 cm DBH size class (Figure 7). There was a low density of silver maple seedlings detected in the plots (Table 12). Nine shrub and woody vine taxa were recorded in silver maple forests and cover was <1% for all of these (Table 13).

**Table 11.** Basal area and tree density in silver maple forests at Mississippi NRRA, 2011.

| Latin name                                      | Common name  | Basal area<br>(m <sup>2</sup> /ha) | Density<br>(trees/ha) |
|-------------------------------------------------|--------------|------------------------------------|-----------------------|
| <i>Acer negundo</i>                             | box elder    | 1.27                               | 22.22                 |
| <i>Acer saccharinum</i>                         | silver maple | 35.27                              | 237.96                |
| <i>Celtis occidentalis</i>                      | hackberry    | 0.02                               | 1.85                  |
| <i>Fraxinus nigra</i>                           | black ash    | 0.52                               | 3.70                  |
| <i>Fraxinus pennsylvanica</i>                   | green ash    | 0.03                               | 3.70                  |
| <i>Populus deltoides</i> ssp. <i>monilifera</i> | cottonwood   | 3.41                               | 11.11                 |
| <i>Ulmus</i> sp.                                | elm          | 0.62                               | 29.63                 |
| Total                                           |              | 41.14                              | 310.17                |

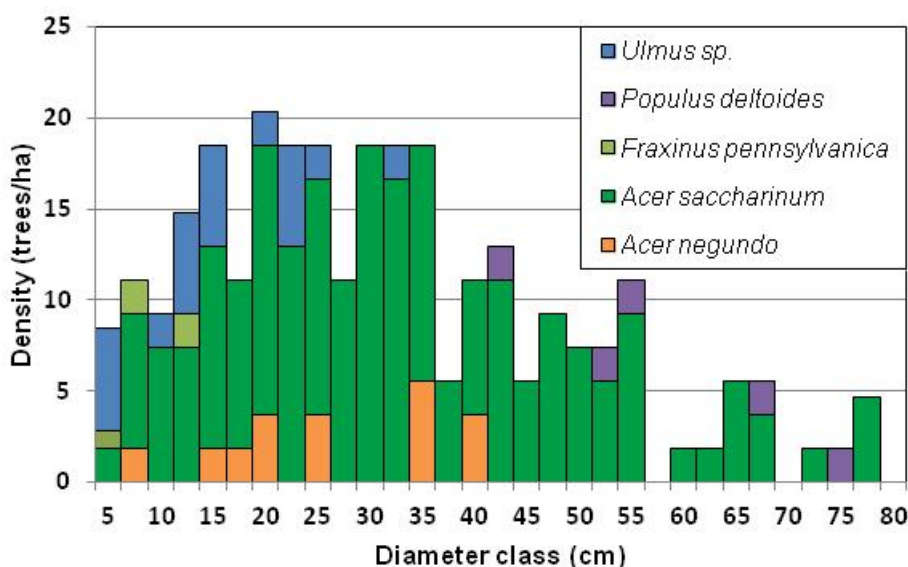


**Figure 7.** Densities and diameter classes of tree species in silver maple forests at Mississippi NRRA, 2011.

**Table 12.** Seedling density in silver maple forests at Mississippi NRRA, 2011.

| Latin name                    | Common name  | Density<br>seedlings/ha |
|-------------------------------|--------------|-------------------------|
| <i>Acer negundo</i>           | box elder    | 555.56                  |
| <i>Acer saccharinum</i>       | silver maple | 55.56                   |
| <i>Celtis occidentalis</i>    | hackberry    | 166.67                  |
| <i>Fraxinus nigra</i>         | black ash    | 166.67                  |
| <i>Fraxinus pennsylvanica</i> | green ash    | 1,166.67                |
| <i>Ulmus</i> sp.              | elm          | 111.11                  |
| Total                         |              | 2,222.22                |

**Table 13.** Shrub percent cover in silver maple forests at Mississippi NRRA, 2011.

| Latin name                                   | Common name                | % Cover |
|----------------------------------------------|----------------------------|---------|
| <i>Menispermum canadense</i>                 | moonseed                   | 0.17    |
| <i>Parthenocissus</i> sp.                    | Virginia creeper           | 0.14    |
| <i>Rhamnus cathartica</i> <sup>1</sup>       | buckthorn                  | 0.06    |
| <i>Ribes americanum</i>                      | American black current     | 0.03    |
| <i>Ribes cynosbati</i>                       | eastern prickly gooseberry | 0.03    |
| <i>Sambucus nigra</i> ssp. <i>canadensis</i> | black elderberry           | 0.11    |
| <i>Sambucus</i> sp.                          | elderberry                 | 0.03    |
| <i>Smilax tamnoides</i>                      | bristly greenbriar         | 0.28    |
| <i>Solanum dulcamara</i> <sup>1</sup>        | climbing nightshade        | 0.03    |
| <i>Vitis riparia</i>                         | riverbank grape            | 0.72    |

<sup>1</sup>non-native

### Coarse Woody Material

Coarse woody material (CWM) varied somewhat between habitats with upland sites having the least volume (36.87 m<sup>3</sup>/ha) and biomass (13,509 kg/ha, Table 14). The density of CWM pieces did not vary greatly between habitats (Table 15). The density of standing dead trees of  $\geq 30$  DBH ranged from 7.77 – 11.10/ha (Table 16).

**Table 14.** Coarse woody material volume and biomass for each forest type at Mississippi NRRA, 2011.

| Forest type          | Number of plots<br>in forest type | Volume<br>(m <sup>3</sup> /ha) | Biomass<br>(kg/ha) | Biomass<br>(tons/ac) |
|----------------------|-----------------------------------|--------------------------------|--------------------|----------------------|
| Upland               | 10                                | 36.87                          | 13,509.08          | 6.03                 |
| Cottonwood-box elder | 10                                | 68.15                          | 22,919.32          | 10.22                |
| Green ash-box elder  | 7                                 | 50.33                          | 18,233.19          | 8.13                 |
| Silver maple         | 6                                 | 39.52                          | 14,595.02          | 6.51                 |
| Mean                 |                                   | 49.77                          | 17,570.16          | 7.84                 |

**Table 15.** Coarse woody material density in four diameter classes at Mississippi NRR, 2011.

| Forest type          | Density (pieces/ha) in diameter classes (cm) |         |         |      | Total pieces/ha |
|----------------------|----------------------------------------------|---------|---------|------|-----------------|
|                      | 7.5-19.9                                     | 20-32.9 | 33-45.9 | ≥46  |                 |
| Upland               | 332.86                                       | 51.68   | 3.75    | 1.56 | 389.85          |
| Cottonwood-box elder | 254.18                                       | 33.32   | 4.30    | 9.25 | 301.05          |
| Green ash-box elder  | 250.80                                       | 63.67   | 19.51   | 2.76 | 336.74          |
| Silver maple         | 357.21                                       | 37.80   | 5.13    | 5.60 | 405.75          |
| Mean                 | 296.82                                       | 45.67   | 7.16    | 4.94 | 354.59          |

**Table 16.** Density of standing dead trees ≥30 cm DBH at Mississippi NRR, 2011.

| Forest type          | Density (trees/ha) |
|----------------------|--------------------|
| Upland               | 11.10              |
| Cottonwood-box elder | 7.77               |
| Green ash-box elder  | 9.08               |
| Silver maple         | 11.10              |

### Browse and Disease

Browse pressure at MISS was high in 2011, especially in upland plots, where 55% of browse circles showed evidence of browse (Table 17). In the riparian habitats, 21-36% of browse circles had browsed individuals (Table 17).

**Table 17.** Direct browse at the 1 m radius browse circles, by forest type and for the whole park.

| Forest type          | Number of plots | Browse circles with evident browse | Browse circles with species present | Browse index* |
|----------------------|-----------------|------------------------------------|-------------------------------------|---------------|
| Upland               | 10              | 367                                | 665                                 | 0.5517        |
| Cottonwood-box elder | 10              | 166                                | 461                                 | 0.3607        |
| Green ash-box elder  | 7               | 49                                 | 235                                 | 0.2110        |
| Silver maple         | 6               | 35                                 | 112                                 | 0.3158        |
| Whole park           | 33              | 617                                | 1,473                               | 0.4190        |

\*The browse index is the ratio of the number of circles with any woody species browsed within the molar zone to the number of circles with any woody species present.

In the indirect browse assessment, we only detected browse on one of the three target herbaceous species, wood nettle, and the extent of browse was low. In upland forests, 5.1% of individuals exhibited browse, while browse extent ranged from 1.3-2.5% of individuals in riparian forests (Table 18).

We did not note the presence of any severe sign of damage or disease. Further, we did not note any D-shaped exit holes on trees which would indicate the presence of emerald ash borer.

**Table 18.** Summary of indirect browse documented at Mississippi NRRA in 2011.

| Forest type          | Species                      | Number of quadrats where present | Mean maximum height per quadrat | Abundance | Number of unbrowsed and non-reproductive individuals | Number of unbrowsed and reproductive individuals | Number of browsed individuals |
|----------------------|------------------------------|----------------------------------|---------------------------------|-----------|------------------------------------------------------|--------------------------------------------------|-------------------------------|
| Upland               | <i>Osmorhiza</i> sp.         | 8                                | 11.9                            | 13        | 12                                                   | 1                                                | 0                             |
|                      | <i>Maianthemum racemosum</i> | 7                                | 20.1                            | 16        | 15                                                   | 1                                                | 0                             |
|                      | <i>Laportea canadensis</i>   | 21                               | 49.5                            | 156       | 148                                                  | 0                                                | 8                             |
| Cottonwood-box elder | <i>Maianthemum racemosum</i> | 2                                | 29.5                            | 2         | 2                                                    | 0                                                | 0                             |
|                      | <i>Laportea canadensis</i>   | 159                              | 54.1                            | 3188      | 3,052                                                | 94                                               | 42                            |
| Green ash-box elder  | <i>Maianthemum racemosum</i> | 2                                | 22                              | 3         | 3                                                    | □                                                | 0                             |
|                      | <i>Laportea canadensis</i>   | 99                               | 47.4                            | 2,219     | 2,139                                                | 25                                               | 55                            |
| Silver maple         | <i>Laportea canadensis</i>   | 73                               | 36.8                            | 1,263     | 1,166                                                | 68                                               | 29                            |

## Community Indices

There were 248 species, collectively, in the 33 plots, with a mean of 42.85 species/plot. Across all forest types, the overwhelming majority were perennial and native (Table 19). Herbaceous species (forb and graminoid) represented 55% of the total and, of those that are pollinated, 65.1% are done so via biotic means.

**Table 19.** Plot species richness within classes of each functional group.

| Functional group | Class             | Mean richness 2011 |
|------------------|-------------------|--------------------|
| Live history     | annual            | 4.42               |
|                  | biennial          | 1.95               |
|                  | perennial         | 36.48              |
| Growth form      | forb              | 20.28              |
|                  | graminoid         | 3.30               |
|                  | woody             | 19.27              |
| Pollination      | abiotic           | 14.33              |
|                  | biotic            | 27.91              |
|                  | N/A               | 0.61               |
| Nativity         | native            | 35.97              |
|                  | non-native        | 6.27               |
|                  | native/non-native | 0.61               |

Coefficient of conservatism (COC) values ranged from 3.09-3.47 for the four forest types (Figure 8), with a mean for the entire park of 3.35. Mean plot species richness ranged from 20 – 64 across the five forest types (Figure 8).

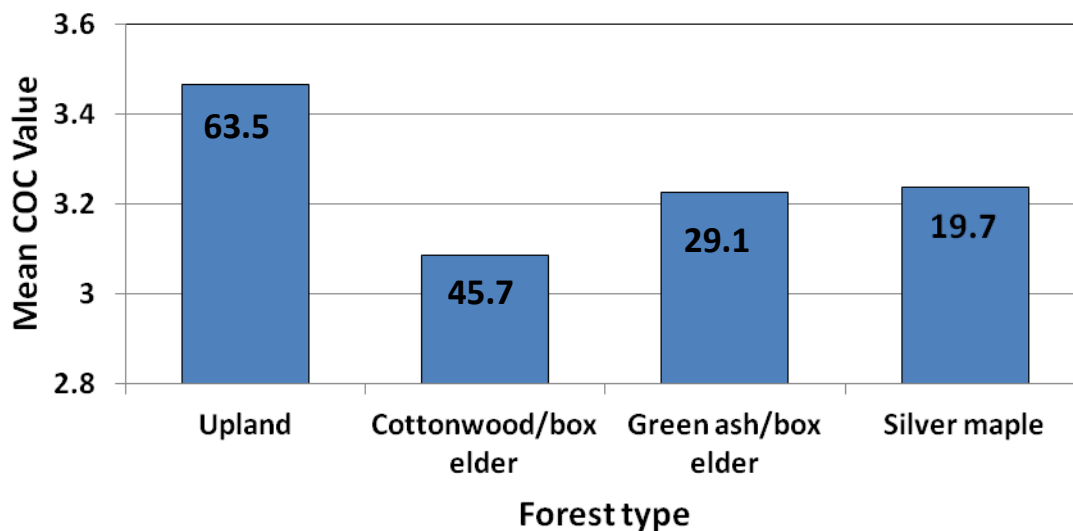


**Figure 8.** Mean coefficient of conservatism (COC) values for the four forest types. Numbers on the blue bars are the mean plot species richness in those forest types.



## Discussion

### Ecology and Interpretation

This work demonstrates two serious forest health issues at the Mississippi National River and Recreation Area. Floodplain forests in riparian habitats are diverging from their pre-impoundment species composition and structure, due largely to flow regulation, while upland habitats are impacted by non-native shrub taxa.

In an unimpounded stretch of river, the age structure and spatial distribution of overstory species in floodplains are controlled largely by pulses in stream flow (Hupp 1983, Streng et al. 1989, Nilsson et al. 1991, Johnson 1994, Friedman et al. 1998). Moderate to high flow events scour banks, sandbars, islands, and point bars, creating nursery sites on which seedlings of pioneer species, such as cottonwood and willows, can establish free of competing vegetation. Following germination, these species require a large flow event followed by a gradual decline in flow over the remainder of the initial growing season to survive through that period. In drier climates, such as the North American west, it is critical for survival that the drop in water level is slow enough that root elongation can keep pace; otherwise, dessication of the newly germinated seedlings will occur (Mahoney and Rood 1992). While this is still true in mesic areas, such as the upper Midwest, the availability of summer rainfall can buffer fast drops in water levels, providing some protection against mid- and late-summer dessication (Stewart Rood, University of Lethbridge, personal communication). Establishment can then occur if ice scour is low in the first two springs following germination and flow levels are such that anoxia of growing seedlings does not occur during this time. Because this specific set of conditions occurs only periodically, cohorts of these species develop, with the time between cohorts ranging between approximately 5-10 years (Mahoney and Rood 1998). We did not observe any cottonwood seedling at any site in the 2011 sampling at MISS. Our criteria for recognizing seedlings is that they be at least 15 cm in height and show evidence of previous year's growth. As such, any seedlings identified would be in at least their second growing season. The current year's cottonwood seeds were releasing throughout most of the time we sampled. In addition to not detecting seedlings, we did not observe any of the current year's germinants.

Channelizing the river also hinders regeneration. In a non-channelized river, the streambed meanders over time so that, where the river bends, the outside banks are constantly eroding away while deposition is constantly occurring on the inside banks. This newly created habitat is easily cleared by floods, and is ideal for seedling growth of pioneer floodplain species such as cottonwoods. Levees and other reinforcing structures throughout much of the upper Mississippi River prevent the river from meandering, a natural, healthy process as rivers age.

Dams, as well as levees (Gergel et al. 2002) eliminate the annual pulse-low flow cycle of rivers, moderating heavy flow events and supplementing natural flow during typical low flow periods of mid- to late-summer. They also influence physiographical processes, particularly downstream of the dam. Collectively, these changes can reduce the abundance of disturbance-dependent species, such as cottonwoods and willows, and cause a transition to later successional plant communities (Junk et al. 1989).

Lock and Dams #1, #2, and #3 on the Mississippi River are in Minneapolis/St. Paul, Hastings, and Red Wing, Minnesota and were erected in 1917, 1907, and 1938 respectively. These impoundments have influenced the riparian vegetation in, and downstream of, the Twin Cities metro area. We did not observe any cottonwood trees smaller than 15 cm, although most were greater than 30 cm (Figures 5, 7). Scott et al. (1997) regressed *Populus deltoides* age on diameters at breast height for a population along the Missouri River in central Montana. Numerous environmental factors affect annual ring widths, and ultimately stem diameter, so age-diameter relationships cannot be assumed to be similar between sites. Nonetheless, their results can serve as a general reference of the size-to-age relationship of cottonwoods. They found a 30 cm DBH individual was predicted to be between 50 and 60 years old, while a 70 cm tree was predicted to be roughly 110 years old. This relationship, combined with our results, suggests that it is possible that there has been minimal cottonwood recruitment on the upper Mississippi River since the establishment of the these dams.

In the absence of flooding disturbance, succession is occurring along the MISS floodplains. Later successional floodplain species such as box elder and elm, in addition to colonizing cottonwoods, are not being replaced in the small diameter size classes, while green ash and hackberry density are increasing. Similar results have been observed by others, including Johnson et al. (2012), who resampled plots along the upper Missouri River in 2008. These plots had initially been sampled in 1969 and 1970, and changes over the ensuing 39-year time period were substantial. They observed marked reductions in both American elm and box elder with only slight decreases in green ash composition.

The altered flooding may be affecting the herbaceous layer, in addition to trees. While we observed numerous non-native species in the understories of riparian plots, two species are particularly invasive and pose a threat to forest integrity. In the 23 plots in floodplain forests, garlic mustard (*Alliaria petiolata* [M. Bieb.] Carava and Grande) was present in 10 (43%) and reed canarygrass (*Phalaris arundinaceae* L.) was present in 13 (57%). Within only those plots where they were present, garlic mustard and reed canarygrass were located in 27% and 22% of the quadrats, respectively. Garlic mustard spreads via prolific seed production, with dispersal aided by stream transport. This seed production, along with its allelopathic properties, early spring growth, and tolerance of moderate flooding, allow garlic mustard to outcompete many native species. Reed canarygrass is indeed a grass, and spreads primarily by a dense network of underground rhizomes, but also via a large number of seeds which, like garlic mustard, are carried downstream. Efforts to control these species are ongoing, and vary by level of effort, control method, and ownership. Garlic mustard has been the focus of many efforts, by both volunteers and paid employees, including both hand pulling and herbicide treatments.

The upland community was much more diverse and varied than the riparian communities. Not only were there more tree and shrub species present, the habitats themselves varied greatly. For example, in sites at Coon Rapids Dam Regional Park, the plots were in mesic, mid-successional stands with large amounts of red maple (*Acer rubrum* L.). In contrast, the plot at Grey Cloud Dunes Scientific and Natural Area was open with high light and species adapted to coarse textured soils. The density-diameter graph (Figure 4) for all plots in the habitat indicates increasing density with decreasing diameter, suggesting the common species are regenerating. In addition to trees, the upland plots had high shrub diversity with a total of 27 species observed within that habitat (Table 4). Two shrub taxa, buckthorn and exotic honeysuckles, are highly

invasive and were commonly observed in many upland plots. Both taxa were located in nine of the 10 total upland plots. In the plots where they were present, mean buckthorn cover was 14.4% and honeysuckle cover was 6.8%.

Although characteristics between the upland and the riparian forests vary greatly, all MISS forests face the immediate threat of emerald ash borer (*Agrilus planipennis* Fairmaire). This insect was first discovered in the Twin Cities metro area in 2009 and has been documented in both Hennepin and Ramsey Counties. This species feeds on the phloem layer, disrupting the flow of nutrients within the tree. It is lethal to the tree and there are no known effective control measures.

Ash was present in all forest types at MISS, although in silver maple forests, it only comprised a small fraction of the total component. In contrast, in green ash-box elder forests, green ash comprised 39% of the density and 35% of the basal area. The other two forest types had less ash, although still a significant amount. In upland plots, both green and black ash collectively represented 7% of the density and 6% of the basal area. In cottonwood-box elder forests, ash represented 6% and 18% of the density and basal area, respectively.

The loss of ash in all forest types could be devastating, although particularly so in the uplands. Ash death will result in gaps within which opportunistic species, namely buckthorn and honeysuckle, can more easily gain a foothold over native species. It is unclear how the loss of ash will impact riparian forests. The successional trajectories are already disrupted with altered hydrology. Green ash is now occupying the niche vacated by species requiring flooding. The impending loss of green ash will reopen this niche.

### **Management Directions**

Because the upper Mississippi River is managed for navigation, industry, and recreation, large-scale management for forest composition and structure is not likely. Nonetheless, some smaller-scale efforts are being made. A Water Level Management Task Force has been assembled to assess the impacts of, and carry out, pool drawdowns on the upper Mississippi River. To date, all drawdowns have occurred downstream from MISS. Pool 8 was drawn down in 2001 and 2002, Pool 5 in 2005 and 2006, and Pool 6 in 2010. Efforts are underway to initiate a drawdown of Pool 3, which is between Hastings and Red Wing, Minnesota. A large amount of MISS land is within the Pool 3 basin, as are 12 long-term monitoring plots. This land includes the Gores Pool Wildlife Management Area, downstream from Hastings, Minnesota.

This effort may allow a new cohort of cottonwoods to become established. Cottonwoods are a foundation species (Dayton 1972) in pioneer riparian and later successional secondary floodplain habitats. As such, they provide habitat for other species. Steenhof et al. (1980) studied habitat use by overwintering eagles on the Missouri River in southern South Dakota. They found the proportion of cottonwoods among the trees used by eagles was greater than the overall proportion of cottonwoods in the study area. Moreover, box elder, American elm, and green ash were present in greater proportions in the study area than the proportion of trees used by eagles. The continued loss of cottonwoods at MISS could limit eagle nests and require eagles to fly farther for food. The consequences of this altered habitat could result in further stresses on eagles and contribute to reductions in reproductive rates.

Invasive species are a huge issue for park managers in the various units that comprise the park. Continued, or increased, control of garlic mustard, reed canarygrass, buckthorn, and honeysuckle are essential. Nonetheless, there are numerous areas within the riverway with little to no impacts by invasives. Maintaining or improving habitat will promote forest integrity as a whole. This is especially relevant with the impending arrival of the emerald ash borer.

### **Implementation: Problems, Logistics, and Future Plans**

Sampling in 2011 at MISS was somewhat problematic due to the high water levels in June. We had a target to complete at least 45 plots, although only 32 were completed. We postponed sampling all plots in the Gores Pool WMA until the last scheduled work there, and during this time additional flooding occurred. In the future, we would like to sample additional plots in this area. Unfortunately, our sampling schedule does not permit us to spend an entire summer there.

.

## Literature Cited

- Bernthal, T. W. 2003. Development of a Floristic Quality Assessment Methodology for Wisconsin. CD975115-01-0, Wisconsin Department of Natural Resources.
- Brown, J. K. 1974. Handbook for Inventorying Downed Woody Material. USDA Forest Service General Technical Report INT-16. Intermountain Forest & Range Experiment Station, Ogden, Utah.
- Dayton, P. K. 1972. Toward an understanding of community resilience and the potential effects of enrichments to the benthos at McMurdo Sound, Antarctica. *in* B. C. Parker, editor. Proceedings of the colloquium on conservation problems in Antarctica. Lawrence, KS: Allen Press.
- Dyer, J. M. 2006. Revisiting the deciduous forests of eastern North America. *BioScience* 56:341-352.
- Elliott, K. J., and W. T. Swank. 2008. Long-term changes in forest composition and diversity following early logging (1919-1923) and the decline of American chestnut (*Castanea dentata*). *Plant Ecology* 197:155-172.
- Friedman, J. M., W. R. Osterkamp, M. L. Scott, and G. T. Auble. 1998. Downstream effects of dams on channel geometry and bottomland vegetation: regional patterns in the Great Plains. *Wetlands* 18:619-633.
- Gergel, S. E., M. D. Dixon, and M. G. Turner. 2002. Consequences of human-altered floods: levees, floods, and floodplain forests along the Wisconsin River. *Ecological Applications* 12:1755-1770.
- Hupp, C. R. 1983. Vegetation pattern on channel features in the Passage Creek Gorge, Virginia. *Castanea* 48:62-72.
- Johnson, S. E., E. L. Mudrak, E. A. Beever, S. Sanders, and D. M. Waller. 2008. Comparing power among three sampling methods for monitoring forest vegetation. *Canadian Journal of Forest Research* 38:143-156.
- Johnson, S. E., E. L. Mudrak, and D. M. Waller. 2006. A comparison of sampling methodologies for long-term monitoring of forest vegetation in the Great Lakes Network National Parks. National Park Service, Great Lakes Network Office, Ashland, Wisconsin.
- Johnson, W. C. 1994. Woodland expansion in the Platte River, Nebraska: patterns and causes. *Ecological Monographs* 64:45-84.
- Johnson, W. C., M. D. Dixon, M. L. Scott, L. Rabbe, G. Larson, M. Volke, and B. Werner. 2012. Forty years of vegetation change on the Missouri River floodplain. *BioScience* 62:123-135.

- Junk, W., J., P. B. Bayley, and R. E. Sparks. 1989. The flood pulse concept in river-floodplain systems. Pages 110-127 in D. P. Dodge, editor. Proceedings of the International Large River Symposium. Canadian Special Publication Fisheries Aquatic Sciences.
- Leete, P., and B. Richardson. 1999. Minnesota Land Cover Classification System. Minnesota Department of Natural Resources, St. Paul.
- Mahoney, J. M., and S. B. Rood. 1992. Response of a hybrid poplar to water table decline in different substrates. *Forest Ecology and Management* 54:141-156.
- Mahoney, J. M., and S. B. Rood. 1998. Streamflow requirements for cottonwood seedling recruitment-an integrative model. *Wetlands* 18:334-345.
- Milburn, S. A., M. Bourdaghs, and J. J. Husveth. 2007. Floristic Quality Assessment for Minnesota Wetlands. Minnesota Pollution Control Agency, St. Paul, Minnesota.
- Morellet, N., P. Ballon, Y. Boscardin, and S. Champely. 2003. A new index to measure roe deer (*Capreolus capreolus*) browsing pressure on woody flora. *Game and Wildlife Science* 20:155-173.
- Morellet, N., S. Champely, J.-M. Gaillard, P. Ballon, and Y. Boscardin. 2001. The browsing index: new tool uses browsing pressure to monitor deer populations. *Wildlife Society Bulletin* 29:1243-1252.
- Nilsson, C., A. Ekblad, M. Gardfjell, and B. Carlberg. 1991. Long-term effects of river regulation on river margin vegetation. *Journal of Applied Ecology* 28:963-987.
- Scott, M. L., G. T. Auble, and J. M. Friedman. 1997. Flood dependency of cottonwood establishment along the Missouri River, Montana, USA. *Ecological Applications* 7:677-690.
- Smith, W. R. 2008. *Trees and Shrubs of Minnesota*. University of Minnesota Press, Minneapolis.
- Steenhof, K., S. S. Berlinger, and L. H. Fredrickson. 1980. Habitat use by wintering bald eagles in South Dakota. *Journal of Wildlife Management* 44:798-805.
- Streng, D. R., J. S. Glitzenstein, and P. A. Harcombe. 1989. Woody seedling dynamics in an east Texas floodplain forest. *Ecological Monographs* 59:177-204.
- Stevens, D. L., and A. R. Olsen. 2004. Spatially balanced sampling of natural resources. *Journal of the American Statistical Association* 99:262-278.
- U.S. Department of Agriculture. 2010. IPED Field Guide Pest Evaluation and Detection. Northeastern Areas State and Private Forestry. Newtown Square, PA.
- U.S. Department of Agriculture. 2005. *Forest Inventory and Analysis National Core Field Guide*. U.S. Department of Agriculture, Forest Service, Arlington, Virginia.

Woodall, C. W., and V. J. Monleon. 2007. Sampling Protocol, Estimation, and Analysis Procedures for the Down Woody Materials Indicator of the FIA program., U.S. Forest Service, Newtown Square.



## **Appendix A. Field Site Maps**

**Note: The field site maps are not included in electronic versions of this report in order to minimize file size. If you would like copies of these, either electronically or in print, please contact the Great Lakes Inventory and Monitoring Network office.**



## **Appendix B. Complete List of Species Sampled**



# Species Encountered during Site Visits - by Park

---

## Park: MISS Year: 2011

This information is from certified and uncertified data from standard sampling of active alternating plots at this park.

### Species

#### HERBACEOUS - Fern / Fern Allies

##### **Dryopteridaceae**

Athyrium filix-femina ssp. angustum  
Cystopteris fragilis  
Matteuccia struthiopteris  
Onoclea sensibilis

##### **Equisetaceae**

Equisetum arvense  
Equisetum hyemale  
Equisetum pratense

##### **Ophioglossaceae**

Botrychium sp.  
Botrychium virginianum

##### **Osmundaceae**

Osmunda cinnamomea

##### **Pteridaceae**

Adiantum pedatum

#### HERBACEOUS - Forb

##### **Alismataceae**

Sagittaria latifolia

##### **Amaranthaceae**

Amaranthus retroflexus  
Chenopodium album  
Chenopodium simplex

##### **Apiaceae**

Angelica atropurpurea  
Cicuta maculata  
Cryptotaenia canadensis  
Daucus carota  
Heracleum sphondylium ssp. montanum  
Osmorhiza claytonii  
Osmorhiza sp.  
Sanicula marilandica  
Sanicula odorata  
Sanicula sp.

##### **Araceae**

Arisaema dracontium  
Arisaema triphyllum  
Lemna minor

##### **Araliaceae**

Hydrocotyle americana

##### **Aristolochiaceae**

Asarum canadense

##### **Asparagaceae**

Polygonatum biflorum  
Polygonatum pubescens

##### **Asparagaceae**

Maianthemum canadense  
Maianthemum racemosum

##### **Asparagaceae**

Maianthemum stellatum

##### **Asteraceae**

Ambrosia trifida  
Arctium minus  
Asteraceae fam.  
Bidens cernua  
Bidens connata  
Bidens frondosa  
Bidens sp.  
Cirsium altissimum  
Cirsium arvense  
Cirsium discolor  
Cirsium sp.  
Erigeron annuus  
Erigeron philadelphicus  
Erigeron sp.  
Eurybia macrophylla  
Lactuca canadensis  
Prenanthes alba  
Rudbeckia laciniata  
Solidago flexicaulis  
Solidago sp.  
Taraxacum officinale

##### **Balsaminaceae**

Impatiens capensis  
Impatiens sp.

##### **Berberidaceae**

Caulophyllum thalictroides

##### **Boraginaceae**

Hackelia virginiana  
Hydrophyllum virginianum

##### **Brassicaceae**

Alliaria petiolata  
Cardamine impatiens  
Cardamine pensylvanica  
Hesperis matronalis

##### **Cannabaceae**

Cannabis sativa

##### **Caprifoliaceae**

Triosteum perfoliatum

##### **Caryophyllaceae**

Cerastium fontanum ssp. vulgare  
Cerastium sp.  
Moehringia lateriflora  
Myosoton aquaticum  
Stellaria media

##### **Ceratophyllaceae**

Ceratophyllum demersum

##### **Colchicaceae**

Uvularia grandiflora  
Uvularia sessilifolia

##### **Euphorbiaceae**

Acalypha rhomboidea

# Species Encountered during Site Visits - by Park

---

## Fabaceae

Desmodium canadense  
Desmodium glutinosum  
Desmodium sp.  
Medicago lupulina  
Trifolium pratense  
Trifolium repens

## Geraniaceae

Geranium maculatum

## Iridaceae

Iris pseudacorus  
Iris versicolor

## Lamiaceae

Glechoma hederacea  
Lamiaceae fam.  
Leonurus cardiaca  
Lycopus americanus  
Lycopus sp.  
Lycopus uniflorus  
Nepeta cataria  
Scutellaria sp.  
Stachys palustris  
Stachys sp.  
Stachys tenuifolia  
Teucrium canadense

## Liliaceae

Streptopus lanceolatus var. roseus

## Melanthiaceae

Trillium sp.

## Onagraceae

Circaea lutetiana ssp. canadensis

## Orchidaceae

Galearis spectabilis  
Orchidaceae fam.

## Oxalidaceae

Oxalis sp.  
Oxalis stricta

## Papaveraceae

Chelidonium majus  
Sanguinaria canadensis

## Plantaginaceae

Plantago major  
Plantago rugelii

## Plantaginaceae

Veronica sp.

## Polemoniaceae

Phlox divaricata

## Polygonaceae

Fallopia convolvulus  
Persicaria virginiana  
Rumex crispus  
Rumex obtusifolius  
Rumex sp.

## Primulaceae

Lysimachia ciliata

## Primulaceae

Lysimachia nummularia

## Pyrolaceae

Pyrola elliptica  
Pyrola sp.

## Ranunculaceae

Actaea rubra  
Actaea sp.  
Anemone canadensis  
Anemone quinquefolia  
Anemone virginiana  
Aquilegia canadensis  
Caltha palustris  
Clematis virginiana  
Ranunculus abortivus  
Ranunculus fascicularis  
Ranunculus hispidus  
Ranunculus sceleratus  
Ranunculus sp.  
Thalictrum dasycarpum  
Thalictrum dioicum  
Thalictrum thalictroides

## Rosaceae

Agrimonia striata  
Fragaria vesca  
Fragaria virginiana  
Geum aleppicum  
Geum laciniatum  
Geum sp.  
Potentilla anserina ssp. anserina  
Potentilla simplex

## Rubiaceae

Galium aparine  
Galium asprellum  
Galium boreale  
Galium sp.  
Galium trifidum  
Galium triflorum

## Scrophulariaceae

Scrophularia lanceolata  
Verbascum thapsus

## Solanaceae

Solanum ptychanthum

## Typhaceae

Sparganium sp.

## Urticaceae

Boehmeria cylindrica  
Laportea canadensis  
Pilea pumila  
Pilea sp.  
Urtica dioica ssp. gracilis

## Violaceae

Viola pubescens  
Viola sp.

## Xanthorrhoeaceae

Hemerocallis fulva

# Species Encountered during Site Visits - by Park

---

## **HERBACEOUS - Forb (vine)**

### **Convolvulaceae**

Calystegia sepium

### **Cucurbitaceae**

Cucurbitaceae fam.

Echinocystis lobata

Sicyos angulatus

### **Dioscoreaceae**

Dioscorea villosa

### **Fabaceae**

Amphicarpaea bracteata

### **Smilacaceae**

Smilax ecirrata

Smilax sp.

## **HERBACEOUS - Graminoid**

### **Cyperaceae**

Carex assiniboinensis

Carex bebbii

Carex blanda

Carex deweyana

Carex gracillima

Carex grisea

Carex pedunculata

Carex pennsylvanica

Carex projecta

Carex radiata

Carex rosea

Carex sp.

Carex sprengei

Carex stipata

Scirpus sp.

### **Poaceae**

Brachyelytrum erectum

Bromus inermis

Calamagrostis canadensis

Cinna arundinacea

Elymus sp.

Elymus virginicus

Leersia oryzoides

Phalaris arundinacea

Poa compressa

Poa pratensis

Poa sp.

Poaceae fam.

## **SHRUB**

### **Adoxaceae**

Sambucus nigra ssp. canadensis

Sambucus racemosa var. racemosa

Sambucus sp.

Viburnum lantana

Viburnum lentago

Viburnum opulus var. americanum

Viburnum rafinesqueanum

Viburnum sp.

### **Berberidaceae**

Berberis thunbergii

Berberis vulgaris

### **Betulaceae**

Corylus americana

### **Caprifoliaceae**

Lonicera (exotic) sp.

Lonicera morrowii

Lonicera sp.

Lonicera xylosteum

Symphoricarpos occidentalis

### **Celastraceae**

Euonymus atropurpurea

### **Cornaceae**

Cornus alternifolia

Cornus amomum

Cornus racemosa

Cornus sericea

Cornus sp.

### **Grossulariaceae**

Ribes americanum

Ribes cynosbati

Ribes hirtellum

Ribes sp.

### **Rhamnaceae**

Rhamnus cathartica

Rhamnus frangula

### **Rosaceae**

Amelanchier Group 2 sp.

Amelanchier Group 3 sp.

Physocarpus opulifolius

Rosa carolina

Rubus idaeus ssp. strigosus

Rubus occidentalis

Rubus pensilvanicus

Rubus pubescens

Rubus semisetosus

Rubus setosus

### **Rutaceae**

Zanthoxylum americanum

### **Salicaceae**

Salix sp.

### **Sapindaceae**

Acer ginnala

### **Staphyleaceae**

Staphylea trifolia

## **SHRUB - Woody Vine**

### **Anacardiaceae**

Toxicodendron radicans

Toxicodendron rydbergii

### **Cannabaceae**

Humulus lupulus

### **Menispermaceae**

Menispermum canadense

# ***Species Encountered during Site Visits - by Park***

---

## **Smilacaceae**

Smilax tamnoides

## **Solanaceae**

Solanum dulcamara

## **Vitaceae**

Parthenocissus quinquefolia

Parthenocissus sp.

Vitis riparia

## **TREE**

## **Betulaceae**

Betula nigra

Betula papyrifera

Betula sp.

Ostrya virginiana

## **Cupressaceae**

Juniperus virginiana

## **Fabaceae**

Gleditsia triacanthos

Gymnocladus dioicus

## **Fagaceae**

Quercus alba

Quercus ellipsoidalis

Quercus macrocarpa

Quercus rubra

Quercus sp.

## **Juglandaceae**

Carya cordiformis

Juglans cinerea

Juglans nigra

Juglans sp.

## **Malvaceae**

Tilia americana

## **Moraceae**

Morus alba

Morus rubra

## **Oleaceae**

Fraxinus nigra

Fraxinus pennsylvanica

Fraxinus sp.

## **Pinaceae**

Abies balsamea

## **Rosaceae**

Crataegus sp.

Prunus pensylvanica

Prunus serotina

Prunus sp.

Prunus virginiana

## **Salicaceae**

Populus deltoides ssp. monilifera

Populus grandidentata

Populus tremuloides

Salix amygdaloides

Salix nigra

## **Sapindaceae**

Acer negundo

Acer nigrum

Acer rubrum

Acer saccharinum

Acer saccharum

Aesculus glabra

## **Ulmaceae**

Celtis occidentalis

Ulmus americana

Ulmus pumila

Ulmus rubra

Ulmus sp.

## Appendix C. Individual Plot Data



# Density and Basal Area of Tree Species (Live trees)

| <b>Plot: 5002</b>             | Density<br>(individuals<br>/ ha) | Basal<br>Area<br>(m <sup>2</sup> / ha) |
|-------------------------------|----------------------------------|----------------------------------------|
| Species                       |                                  |                                        |
| hardwood                      |                                  |                                        |
| <i>Acer negundo</i>           | 77.8                             | 0.7                                    |
| <i>Betula papyrifera</i>      | 11.1                             | 1.0                                    |
| <i>Carya cordiformis</i>      | 388.9                            | 6.4                                    |
| <i>Celtis occidentalis</i>    | 511.1                            | 2.0                                    |
| <i>Fraxinus pennsylvanica</i> | 66.7                             | 4.9                                    |
| <i>Ostrya virginiana</i>      | 33.3                             | 0.4                                    |
| <i>Prunus serotina</i>        | 66.7                             | 5.4                                    |
| <i>Prunus virginiana</i>      | 11.1                             | 0.0                                    |
| <i>Quercus rubra</i>          | 11.1                             | 1.8                                    |
| <i>Tilia americana</i>        | 22.2                             | 0.0                                    |
| <i>Ulmus americana</i>        | 11.1                             | 0.0                                    |
| <i>Ulmus rubra</i>            | 44.4                             | 1.0                                    |
| <b>TOTAL</b>                  | <b>1,255.6</b>                   | <b>23.8</b>                            |

| <b>Plot: 5004</b>                        | Density<br>(individuals<br>/ ha) | Basal<br>Area<br>(m <sup>2</sup> / ha) |
|------------------------------------------|----------------------------------|----------------------------------------|
| Species                                  |                                  |                                        |
| hardwood                                 |                                  |                                        |
| <i>Acer negundo</i>                      | 177.8                            | 6.0                                    |
| <i>Acer saccharinum</i>                  | 88.9                             | 4.1                                    |
| <i>Fraxinus pennsylvanica</i>            | 33.3                             | 1.3                                    |
| <i>Gleditsia triacanthos</i>             | 11.1                             | 0.3                                    |
| <i>Populus deltoides ssp. monilifera</i> | 55.6                             | 3.1                                    |
| <i>Ulmus rubra</i>                       | 233.3                            | 1.2                                    |
| <b>TOTAL</b>                             | <b>600.0</b>                     | <b>16.0</b>                            |

| <b>Plot: 5006</b>             | Density<br>(individuals<br>/ ha) | Basal<br>Area<br>(m <sup>2</sup> / ha) |
|-------------------------------|----------------------------------|----------------------------------------|
| Species                       |                                  |                                        |
| hardwood                      |                                  |                                        |
| <i>Acer nigrum</i>            | 11.1                             | 0.0                                    |
| <i>Carya cordiformis</i>      | 188.9                            | 2.4                                    |
| <i>Celtis occidentalis</i>    | 77.8                             | 0.9                                    |
| <i>Fraxinus nigra</i>         | 33.3                             | 0.1                                    |
| <i>Fraxinus pennsylvanica</i> | 88.9                             | 0.8                                    |
| <i>Ostrya virginiana</i>      | 111.1                            | 0.5                                    |
| <i>Prunus serotina</i>        | 22.2                             | 0.1                                    |
| <i>Quercus macrocarpa</i>     | 11.1                             | 0.0                                    |
| <i>Tilia americana</i>        | 66.7                             | 0.4                                    |
| <i>Ulmus americana</i>        | 33.3                             | 0.2                                    |
| <i>Ulmus rubra</i>            | 77.8                             | 0.6                                    |
| softwood                      |                                  |                                        |
| <i>Juniperus virginiana</i>   | 155.6                            | 1.4                                    |
| <b>TOTAL</b>                  | <b>877.8</b>                     | <b>7.4</b>                             |

| <b>Plot: 5010</b>             | Density<br>(individuals<br>/ ha) | Basal<br>Area<br>(m <sup>2</sup> / ha) |
|-------------------------------|----------------------------------|----------------------------------------|
| Species                       |                                  |                                        |
| hardwood                      |                                  |                                        |
| <i>Acer negundo</i>           | 11.1                             | 0.0                                    |
| <i>Acer saccharinum</i>       | 22.2                             | 26.4                                   |
| <i>Fraxinus pennsylvanica</i> | 77.8                             | 20.1                                   |
| <i>Ulmus rubra</i>            | 33.3                             | 0.6                                    |
| <b>TOTAL</b>                  | <b>144.4</b>                     | <b>47.0</b>                            |

| <b>Plot: 5016</b>                        | Density<br>(individuals<br>/ ha) | Basal<br>Area<br>(m <sup>2</sup> / ha) |
|------------------------------------------|----------------------------------|----------------------------------------|
| Species                                  |                                  |                                        |
| hardwood                                 |                                  |                                        |
| <i>Acer negundo</i>                      | 222.2                            | 5.7                                    |
| <i>Acer saccharinum</i>                  | 148.1                            | 6.8                                    |
| <i>Celtis occidentalis</i>               | 37.0                             | 1.2                                    |
| <i>Fraxinus pennsylvanica</i>            | 98.8                             | 4.4                                    |
| <i>Juglans nigra</i>                     | 49.4                             | 0.2                                    |
| <i>Morus alba</i>                        | 12.3                             | 0.3                                    |
| <i>Populus deltoides ssp. monilifera</i> | 37.0                             | 14.3                                   |
| <i>Ulmus rubra</i>                       | 24.7                             | 0.4                                    |
| <b>TOTAL</b>                             | <b>629.6</b>                     | <b>33.5</b>                            |

| <b>Plot: 5018</b>                        | Density<br>(individuals<br>/ ha) | Basal<br>Area<br>(m <sup>2</sup> / ha) |
|------------------------------------------|----------------------------------|----------------------------------------|
| Species                                  |                                  |                                        |
| hardwood                                 |                                  |                                        |
| <i>Betula papyrifera</i>                 | 266.7                            | 5.2                                    |
| <i>Carya cordiformis</i>                 | 77.8                             | 0.1                                    |
| <i>Celtis occidentalis</i>               | 11.1                             | 0.0                                    |
| <i>Fraxinus pennsylvanica</i>            | 100.0                            | 1.7                                    |
| <i>Ostrya virginiana</i>                 | 33.3                             | 0.2                                    |
| <i>Populus deltoides ssp. monilifera</i> | 44.4                             | 5.0                                    |
| <i>Prunus serotina</i>                   | 11.1                             | 0.0                                    |
| <i>Prunus virginiana</i>                 | 11.1                             | 0.0                                    |
| <i>Quercus macrocarpa</i>                | 11.1                             | 0.1                                    |
| <i>Quercus rubra</i>                     | 233.3                            | 2.4                                    |
| <i>Tilia americana</i>                   | 411.1                            | 1.6                                    |
| <i>Ulmus americana</i>                   | 155.6                            | 0.4                                    |
| <i>Ulmus rubra</i>                       | 200.0                            | 1.4                                    |
| <b>TOTAL</b>                             | <b>1,566.7</b>                   | <b>18.0</b>                            |

| <b>Plot: 5020</b>                        | Density<br>(individuals<br>/ ha) | Basal<br>Area<br>(m <sup>2</sup> / ha) |
|------------------------------------------|----------------------------------|----------------------------------------|
| Species                                  |                                  |                                        |
| hardwood                                 |                                  |                                        |
| <i>Acer negundo</i>                      | 122.2                            | 4.2                                    |
| <i>Acer saccharinum</i>                  | 133.3                            | 7.9                                    |
| <i>Celtis occidentalis</i>               | 11.1                             | 0.1                                    |
| <i>Fraxinus nigra</i>                    | 211.1                            | 1.5                                    |
| <i>Fraxinus pennsylvanica</i>            | 155.6                            | 2.9                                    |
| <i>Populus deltoides ssp. monilifera</i> | 55.6                             | 8.3                                    |
| <i>Prunus virginiana</i>                 | 11.1                             | 0.0                                    |
| <i>Salix nigra</i>                       | 11.1                             | 2.3                                    |
| <b>TOTAL</b>                             | <b>711.1</b>                     | <b>27.3</b>                            |

| <b>Plot: 5021</b>             | Density<br>(individuals<br>/ ha) | Basal<br>Area<br>(m <sup>2</sup> / ha) |
|-------------------------------|----------------------------------|----------------------------------------|
| Species                       |                                  |                                        |
| hardwood                      |                                  |                                        |
| <i>Acer negundo</i>           | 22.2                             | 0.6                                    |
| <i>Acer saccharinum</i>       | 55.6                             | 0.8                                    |
| <i>Fraxinus pennsylvanica</i> | 288.9                            | 25.4                                   |
| <i>Ulmus rubra</i>            | 144.4                            | 3.0                                    |
| <b>TOTAL</b>                  | <b>511.1</b>                     | <b>29.9</b>                            |

| <b>Plot: 5022</b>                        | Density<br>(individuals<br>/ ha) | Basal<br>Area<br>(m <sup>2</sup> / ha) |
|------------------------------------------|----------------------------------|----------------------------------------|
| Species                                  |                                  |                                        |
| hardwood                                 |                                  |                                        |
| <i>Acer negundo</i>                      | 111.1                            | 2.8                                    |
| <i>Acer saccharinum</i>                  | 211.1                            | 24.4                                   |
| <i>Fraxinus pennsylvanica</i>            | 44.4                             | 1.0                                    |
| <i>Populus deltoides ssp. monilifera</i> | 88.9                             | 20.3                                   |
| <i>Ulmus rubra</i>                       | 33.3                             | 0.7                                    |
| <b>TOTAL</b>                             | <b>488.9</b>                     | <b>49.2</b>                            |

| <b>Plot: 5030</b>       | Density<br>(individuals<br>/ ha) | Basal<br>Area<br>(m <sup>2</sup> / ha) |
|-------------------------|----------------------------------|----------------------------------------|
| Species                 |                                  |                                        |
| hardwood                |                                  |                                        |
| <i>Acer saccharinum</i> | 16.7                             | 7.4                                    |
| <b>TOTAL</b>            | <b>16.7</b>                      | <b>7.4</b>                             |

| <b>Plot: 5031</b>                        | Density<br>(individuals<br>/ ha) | Basal<br>Area<br>(m <sup>2</sup> / ha) |
|------------------------------------------|----------------------------------|----------------------------------------|
| Species                                  |                                  |                                        |
| hardwood                                 |                                  |                                        |
| <i>Acer negundo</i>                      | 155.6                            | 3.6                                    |
| <i>Betula papyrifera</i>                 | 22.2                             | 1.2                                    |
| <i>Populus deltoides ssp. monilifera</i> | 33.3                             | 7.3                                    |
| <i>Prunus serotina</i>                   | 22.2                             | 0.7                                    |
| <i>Prunus virginiana</i>                 | 11.1                             | 0.0                                    |
| <i>Quercus macrocarpa</i>                | 11.1                             | 0.1                                    |
| <i>Quercus rubra</i>                     | 144.4                            | 5.5                                    |
| <i>Ulmus rubra</i>                       | 88.9                             | 2.5                                    |
| <b>TOTAL</b>                             | <b>488.9</b>                     | <b>20.8</b>                            |

| <b>Plot: 5033</b>          | Density<br>(individuals<br>/ ha) | Basal<br>Area<br>(m <sup>2</sup> / ha) |
|----------------------------|----------------------------------|----------------------------------------|
| Species                    |                                  |                                        |
| hardwood                   |                                  |                                        |
| <i>Acer negundo</i>        | 11.1                             | 0.2                                    |
| <i>Celtis occidentalis</i> | 44.4                             | 1.5                                    |
| <i>Prunus serotina</i>     | 11.1                             | 0.5                                    |
| <i>Quercus macrocarpa</i>  | 144.4                            | 15.0                                   |
| <i>Tilia americana</i>     | 33.3                             | 2.2                                    |
| <i>Ulmus rubra</i>         | 244.4                            | 3.4                                    |
| <b>TOTAL</b>               | <b>488.9</b>                     | <b>22.8</b>                            |

| <b>Plot: 5034</b>       | Density<br>(individuals<br>/ ha) | Basal<br>Area<br>(m <sup>2</sup> / ha) |
|-------------------------|----------------------------------|----------------------------------------|
| Species                 |                                  |                                        |
| hardwood                |                                  |                                        |
| <i>Acer negundo</i>     | 87.0                             | 6.7                                    |
| <i>Acer saccharinum</i> | 43.5                             | 1.6                                    |
| <i>Ulmus rubra</i>      | 101.4                            | 3.2                                    |
| <b>TOTAL</b>            | <b>231.9</b>                     | <b>11.5</b>                            |

| <b>Plot: 5035</b>          | Density<br>(individuals<br>/ ha) | Basal<br>Area<br>(m <sup>2</sup> / ha) |
|----------------------------|----------------------------------|----------------------------------------|
| Species                    |                                  |                                        |
| hardwood                   |                                  |                                        |
| <i>Acer negundo</i>        | 44.4                             | 2.5                                    |
| <i>Acer saccharinum</i>    | 211.1                            | 53.2                                   |
| <i>Celtis occidentalis</i> | 11.1                             | 0.1                                    |
| <i>Fraxinus nigra</i>      | 22.2                             | 3.1                                    |
| <i>Ulmus rubra</i>         | 55.6                             | 2.2                                    |
| <b>TOTAL</b>               | <b>344.4</b>                     | <b>61.2</b>                            |

| <b>Plot: 5038</b>                        | Density<br>(individuals<br>/ ha) | Basal<br>Area<br>(m <sup>2</sup> / ha) |
|------------------------------------------|----------------------------------|----------------------------------------|
| Species                                  |                                  |                                        |
| hardwood                                 |                                  |                                        |
| <i>Acer saccharinum</i>                  | 177.8                            | 19.0                                   |
| <i>Celtis occidentalis</i>               | 11.1                             | 0.3                                    |
| <i>Fraxinus pennsylvanica</i>            | 44.4                             | 0.9                                    |
| <i>Juglans cinerea</i>                   | 11.1                             | 3.3                                    |
| <i>Populus deltoides ssp. monilifera</i> | 11.1                             | 28.8                                   |
| <i>Ulmus rubra</i>                       | 88.9                             | 1.7                                    |
| <b>TOTAL</b>                             | <b>344.4</b>                     | <b>53.9</b>                            |

| <b>Plot: 5039</b>             | Density<br>(individuals<br>/ ha) | Basal<br>Area<br>(m <sup>2</sup> / ha) |
|-------------------------------|----------------------------------|----------------------------------------|
| Species                       |                                  |                                        |
| hardwood                      |                                  |                                        |
| <i>Acer negundo</i>           | 11.1                             | 0.0                                    |
| <i>Fraxinus nigra</i>         | 155.6                            | 0.5                                    |
| <i>Fraxinus pennsylvanica</i> | 33.3                             | 0.1                                    |
| <i>Populus tremuloides</i>    | 22.2                             | 1.7                                    |
| <i>Prunus serotina</i>        | 133.3                            | 0.7                                    |
| <i>Quercus alba</i>           | 66.7                             | 12.4                                   |
| <i>Quercus macrocarpa</i>     | 44.4                             | 6.5                                    |
| <i>Quercus rubra</i>          | 33.3                             | 0.5                                    |
| <i>Tilia americana</i>        | 111.1                            | 0.8                                    |
| <i>Ulmus rubra</i>            | 300.0                            | 2.0                                    |
| <b>TOTAL</b>                  | <b>911.1</b>                     | <b>25.3</b>                            |

| <b>Plot: 5042</b>             | Density<br>(individuals<br>/ ha) | Basal<br>Area<br>(m <sup>2</sup> / ha) |
|-------------------------------|----------------------------------|----------------------------------------|
| Species                       |                                  |                                        |
| hardwood                      |                                  |                                        |
| <i>Acer negundo</i>           | 33.3                             | 0.8                                    |
| <i>Acer saccharinum</i>       | 33.3                             | 7.1                                    |
| <i>Celtis occidentalis</i>    | 466.7                            | 10.4                                   |
| <i>Fraxinus pennsylvanica</i> | 200.0                            | 18.1                                   |
| <i>Ulmus rubra</i>            | 33.3                             | 1.5                                    |
| <b>TOTAL</b>                  | <b>766.7</b>                     | <b>37.8</b>                            |

| <b>Plot: 5052</b>             | Density<br>(individuals<br>/ ha) | Basal<br>Area<br>(m <sup>2</sup> / ha) |
|-------------------------------|----------------------------------|----------------------------------------|
| Species                       |                                  |                                        |
| hardwood                      |                                  |                                        |
| <i>Acer negundo</i>           | 16.7                             | 0.9                                    |
| <i>Acer saccharinum</i>       | 66.7                             | 17.7                                   |
| <i>Fraxinus pennsylvanica</i> | 250.0                            | 0.7                                    |
| <i>Ulmus rubra</i>            | 200.0                            | 2.0                                    |
| <b>TOTAL</b>                  | <b>533.3</b>                     | <b>21.3</b>                            |

| <b>Plot: 5056</b>                        | Density<br>(individuals<br>/ ha) | Basal<br>Area<br>(m <sup>2</sup> / ha) |
|------------------------------------------|----------------------------------|----------------------------------------|
| Species                                  |                                  |                                        |
| hardwood                                 |                                  |                                        |
| <i>Acer negundo</i>                      | 222.2                            | 3.7                                    |
| <i>Acer saccharinum</i>                  | 55.6                             | 10.1                                   |
| <i>Celtis occidentalis</i>               | 88.9                             | 1.5                                    |
| <i>Fraxinus pennsylvanica</i>            | 233.3                            | 4.0                                    |
| <i>Populus deltoides ssp. monilifera</i> | 44.4                             | 35.3                                   |
| <i>Ulmus rubra</i>                       | 233.3                            | 1.5                                    |
| <b>TOTAL</b>                             | <b>877.8</b>                     | <b>56.0</b>                            |

| <b>Plot: 5073</b>          | Density<br>(individuals<br>/ ha) | Basal<br>Area<br>(m <sup>2</sup> / ha) |
|----------------------------|----------------------------------|----------------------------------------|
| Species                    |                                  |                                        |
| hardwood                   |                                  |                                        |
| <i>Carya cordiformis</i>   | 755.6                            | 14.8                                   |
| <i>Gymnocladus dioicus</i> | 33.3                             | 0.3                                    |
| <i>Prunus serotina</i>     | 22.2                             | 0.4                                    |
| <i>Prunus virginiana</i>   | 11.1                             | 0.1                                    |
| <i>Quercus macrocarpa</i>  | 22.2                             | 6.0                                    |
| <i>Quercus rubra</i>       | 11.1                             | 0.2                                    |
| <i>Ulmus rubra</i>         | 133.3                            | 4.1                                    |
| <b>TOTAL</b>               | <b>988.9</b>                     | <b>26.0</b>                            |

| <b>Plot: 5076</b>                        | Density<br>(individuals<br>/ ha) | Basal<br>Area<br>(m <sup>2</sup> / ha) |
|------------------------------------------|----------------------------------|----------------------------------------|
| Species                                  |                                  |                                        |
| hardwood                                 |                                  |                                        |
| <i>Acer negundo</i>                      | 122.2                            | 1.8                                    |
| <i>Acer saccharinum</i>                  | 177.8                            | 6.5                                    |
| <i>Celtis occidentalis</i>               | 222.2                            | 0.8                                    |
| <i>Fraxinus pennsylvanica</i>            | 33.3                             | 0.5                                    |
| <i>Juglans cinerea</i>                   | 11.1                             | 0.0                                    |
| <i>Populus deltoides ssp. monilifera</i> | 77.8                             | 18.0                                   |
| <i>Ulmus rubra</i>                       | 33.3                             | 0.1                                    |
| <b>TOTAL</b>                             | <b>677.8</b>                     | <b>27.7</b>                            |

| <b>Plot: 5082</b>             | Density<br>(individuals<br>/ ha) | Basal<br>Area<br>(m <sup>2</sup> / ha) |
|-------------------------------|----------------------------------|----------------------------------------|
| Species                       |                                  |                                        |
| hardwood                      |                                  |                                        |
| <i>Carya cordiformis</i>      | 33.3                             | 0.3                                    |
| <i>Celtis occidentalis</i>    | 88.9                             | 0.6                                    |
| <i>Crataegus sp.</i>          | 11.1                             | 0.0                                    |
| <i>Fraxinus pennsylvanica</i> | 55.6                             | 3.2                                    |
| <i>Juglans cinerea</i>        | 11.1                             | 0.3                                    |
| <i>Prunus serotina</i>        | 33.3                             | 0.6                                    |
| <i>Prunus virginiana</i>      | 22.2                             | 0.0                                    |
| <i>Quercus macrocarpa</i>     | 88.9                             | 7.2                                    |
| <i>Quercus rubra</i>          | 33.3                             | 4.1                                    |
| <i>Tilia americana</i>        | 444.4                            | 8.1                                    |
| <i>Ulmus rubra</i>            | 55.6                             | 0.3                                    |
| <b>TOTAL</b>                  | <b>877.8</b>                     | <b>24.7</b>                            |

| <b>Plot: 5084</b>                        | Density<br>(individuals<br>/ ha) | Basal<br>Area<br>(m <sup>2</sup> / ha) |
|------------------------------------------|----------------------------------|----------------------------------------|
| Species                                  |                                  |                                        |
| hardwood                                 |                                  |                                        |
| <i>Acer negundo</i>                      | 311.1                            | 4.9                                    |
| <i>Acer saccharinum</i>                  | 211.1                            | 3.3                                    |
| <i>Fraxinus pennsylvanica</i>            | 66.7                             | 1.3                                    |
| <i>Populus deltoides ssp. monilifera</i> | 111.1                            | 9.6                                    |
| <i>Salix amygdaloides</i>                | 11.1                             | 2.8                                    |
| <i>Ulmus rubra</i>                       | 22.2                             | 1.1                                    |
| <b>TOTAL</b>                             | <b>733.3</b>                     | <b>23.1</b>                            |

| <b>Plot: 5086</b>                        | Density<br>(individuals<br>/ ha) | Basal<br>Area<br>(m <sup>2</sup> / ha) |
|------------------------------------------|----------------------------------|----------------------------------------|
| Species                                  |                                  |                                        |
| hardwood                                 |                                  |                                        |
| <i>Acer negundo</i>                      | 55.6                             | 3.1                                    |
| <i>Acer saccharinum</i>                  | 355.6                            | 36.8                                   |
| <i>Populus deltoides ssp. monilifera</i> | 55.6                             | 14.6                                   |
| <i>Ulmus americana</i>                   | 55.6                             | 0.9                                    |
| <i>Ulmus rubra</i>                       | 11.1                             | 0.3                                    |
| <b>TOTAL</b>                             | <b>533.3</b>                     | <b>55.6</b>                            |

| <b>Plot: 5096</b>            | Density<br>(individuals<br>/ ha) | Basal<br>Area<br>(m <sup>2</sup> / ha) |
|------------------------------|----------------------------------|----------------------------------------|
| Species                      |                                  |                                        |
| hardwood                     |                                  |                                        |
| <i>Acer negundo</i>          | 111.1                            | 2.7                                    |
| <i>Celtis occidentalis</i>   | 11.1                             | 0.2                                    |
| <i>Prunus serotina</i>       | 55.6                             | 1.4                                    |
| <i>Quercus ellipsoidalis</i> | 55.6                             | 12.4                                   |
| <i>Quercus macrocarpa</i>    | 144.4                            | 21.1                                   |
| <i>Ulmus rubra</i>           | 55.6                             | 2.8                                    |
| <b>TOTAL</b>                 | <b>433.3</b>                     | <b>40.7</b>                            |

| <b>Plot: 5097</b>             | Density<br>(individuals<br>/ ha) | Basal<br>Area<br>(m <sup>2</sup> / ha) |
|-------------------------------|----------------------------------|----------------------------------------|
| Species                       |                                  |                                        |
| hardwood                      |                                  |                                        |
| <i>Acer negundo</i>           | 22.2                             | 0.1                                    |
| <i>Acer saccharum</i>         | 66.7                             | 0.8                                    |
| <i>Carya cordiformis</i>      | 33.3                             | 0.1                                    |
| <i>Celtis occidentalis</i>    | 300.0                            | 5.1                                    |
| <i>Fraxinus pennsylvanica</i> | 66.7                             | 1.4                                    |
| <i>Prunus serotina</i>        | 44.4                             | 2.9                                    |
| <i>Prunus virginiana</i>      | 22.2                             | 0.0                                    |
| <i>Quercus rubra</i>          | 11.1                             | 3.0                                    |
| <i>Tilia americana</i>        | 111.1                            | 4.1                                    |
| <i>Ulmus rubra</i>            | 300.0                            | 3.4                                    |
| <b>TOTAL</b>                  | <b>977.8</b>                     | <b>20.8</b>                            |

| <b>Plot: 5099</b>                        | Density<br>(individuals<br>/ ha) | Basal<br>Area<br>(m <sup>2</sup> / ha) |
|------------------------------------------|----------------------------------|----------------------------------------|
| Species                                  |                                  |                                        |
| hardwood                                 |                                  |                                        |
| <i>Acer negundo</i>                      | 77.8                             | 6.4                                    |
| <i>Acer saccharinum</i>                  | 77.8                             | 7.5                                    |
| <i>Betula nigra</i>                      | 11.1                             | 2.2                                    |
| <i>Celtis occidentalis</i>               | 11.1                             | 0.9                                    |
| <i>Populus deltoides ssp. monilifera</i> | 22.2                             | 7.3                                    |
| <i>Ulmus rubra</i>                       | 111.1                            | 3.1                                    |
| <b>TOTAL</b>                             | <b>311.1</b>                     | <b>27.3</b>                            |

| <b>Plot: 5104</b>             | Density<br>(individuals<br>/ ha) | Basal<br>Area<br>(m <sup>2</sup> / ha) |
|-------------------------------|----------------------------------|----------------------------------------|
| Species                       |                                  |                                        |
| hardwood                      |                                  |                                        |
| <i>Acer negundo</i>           | 111.1                            | 2.2                                    |
| <i>Acer saccharinum</i>       | 74.1                             | 21.8                                   |
| <i>Celtis occidentalis</i>    | 61.7                             | 0.1                                    |
| <i>Fraxinus pennsylvanica</i> | 456.8                            | 2.4                                    |
| <i>Morus alba</i>             | 12.3                             | 0.0                                    |
| <i>Ulmus rubra</i>            | 24.7                             | 0.1                                    |
| <b>TOTAL</b>                  | <b>740.7</b>                     | <b>26.6</b>                            |

| <b>Plot: 5106</b>                        | Density<br>(individuals<br>/ ha) | Basal<br>Area<br>(m <sup>2</sup> / ha) |
|------------------------------------------|----------------------------------|----------------------------------------|
| Species                                  |                                  |                                        |
| hardwood                                 |                                  |                                        |
| <i>Acer saccharinum</i>                  | 188.9                            | 20.2                                   |
| <i>Fraxinus pennsylvanica</i>            | 22.2                             | 0.2                                    |
| <i>Populus deltoides ssp. monilifera</i> | 11.1                             | 5.9                                    |
| <i>Ulmus rubra</i>                       | 22.2                             | 0.3                                    |
| <b>TOTAL</b>                             | <b>244.4</b>                     | <b>26.5</b>                            |

| <b>Plot: 5111</b>       | Density<br>(individuals<br>/ ha) | Basal<br>Area<br>(m <sup>2</sup> / ha) |
|-------------------------|----------------------------------|----------------------------------------|
| Species                 |                                  |                                        |
| hardwood                |                                  |                                        |
| <i>Acer negundo</i>     | 33.3                             | 2.0                                    |
| <i>Acer saccharinum</i> | 477.8                            | 44.4                                   |
| <b>TOTAL</b>            | <b>511.1</b>                     | <b>46.5</b>                            |

| <b>Plot: 5140</b>             | Density<br>(individuals<br>/ ha) | Basal<br>Area<br>(m <sup>2</sup> / ha) |
|-------------------------------|----------------------------------|----------------------------------------|
| Species                       |                                  |                                        |
| hardwood                      |                                  |                                        |
| <i>Acer negundo</i>           | 244.4                            | 9.9                                    |
| <i>Acer nigrum</i>            | 22.2                             | 0.0                                    |
| <i>Acer saccharinum</i>       | 11.1                             | 0.1                                    |
| <i>Celtis occidentalis</i>    | 144.4                            | 9.0                                    |
| <i>Fraxinus pennsylvanica</i> | 100.0                            | 1.3                                    |
| <i>Ulmus rubra</i>            | 66.7                             | 0.4                                    |
| <b>TOTAL</b>                  | <b>588.9</b>                     | <b>20.8</b>                            |

| <b>Plot: 5142</b>       | Density<br>(individuals<br>/ ha) | Basal<br>Area<br>(m <sup>2</sup> / ha) |
|-------------------------|----------------------------------|----------------------------------------|
| Species                 |                                  |                                        |
| hardwood                |                                  |                                        |
| <i>Acer saccharinum</i> | 177.8                            | 49.6                                   |
| <i>Ulmus rubra</i>      | 33.3                             | 0.0                                    |
| <b>TOTAL</b>            | <b>211.1</b>                     | <b>49.6</b>                            |

| <b>Plot: 5148</b>                        | Density<br>(individuals<br>/ ha) | Basal<br>Area<br>(m <sup>2</sup> / ha) |
|------------------------------------------|----------------------------------|----------------------------------------|
| Species                                  |                                  |                                        |
| hardwood                                 |                                  |                                        |
| <i>Acer negundo</i>                      | 133.3                            | 6.6                                    |
| <i>Acer saccharinum</i>                  | 55.6                             | 6.5                                    |
| <i>Celtis occidentalis</i>               | 11.1                             | 0.0                                    |
| <i>Fraxinus pennsylvanica</i>            | 88.9                             | 2.0                                    |
| <i>Populus deltoides ssp. monilifera</i> | 11.1                             | 6.2                                    |
| <i>Ulmus rubra</i>                       | 88.9                             | 1.1                                    |
| <b>TOTAL</b>                             | <b>388.9</b>                     | <b>22.3</b>                            |

# Density and Basal Area of Tree Species (Dead trees)

| <b>Plot: 5002</b>          | Density<br>(individuals<br>/ ha) | Basal<br>Area<br>(m <sup>2</sup> / ha) |
|----------------------------|----------------------------------|----------------------------------------|
| Species                    |                                  |                                        |
| hardwood                   |                                  |                                        |
| <i>Celtis occidentalis</i> | 22.2                             | 0.1                                    |
| <i>Prunus serotina</i>     | 11.1                             | 0.5                                    |
| unknown tree - hardwood    | 33.3                             | 0.0                                    |
| softwood / hardwood        |                                  |                                        |
| unknown tree               | 55.6                             | 1.6                                    |
| <b>TOTAL</b>               | <b>122.2</b>                     | <b>2.2</b>                             |

| <b>Plot: 5004</b>                        | Density<br>(individuals<br>/ ha) | Basal<br>Area<br>(m <sup>2</sup> / ha) |
|------------------------------------------|----------------------------------|----------------------------------------|
| Species                                  |                                  |                                        |
| hardwood                                 |                                  |                                        |
| <i>Populus deltoides ssp. monilifera</i> | 11.1                             | 0.5                                    |
| unknown tree - hardwood                  | 55.6                             | 0.9                                    |
| <b>TOTAL</b>                             | <b>66.7</b>                      | <b>1.4</b>                             |

| <b>Plot: 5006</b>           | Density<br>(individuals<br>/ ha) | Basal<br>Area<br>(m <sup>2</sup> / ha) |
|-----------------------------|----------------------------------|----------------------------------------|
| Species                     |                                  |                                        |
| hardwood                    |                                  |                                        |
| <i>Fraxinus nigra</i>       | 11.1                             | 0.0                                    |
| unknown tree - hardwood     | 44.4                             | 1.0                                    |
| softwood                    |                                  |                                        |
| <i>Juniperus virginiana</i> | 44.4                             | 0.3                                    |
| softwood / hardwood         |                                  |                                        |
| unknown tree                | 11.1                             | 0.2                                    |
| <b>TOTAL</b>                | <b>111.1</b>                     | <b>1.5</b>                             |

| <b>Plot: 5010</b>       | Density<br>(individuals<br>/ ha) | Basal<br>Area<br>(m <sup>2</sup> / ha) |
|-------------------------|----------------------------------|----------------------------------------|
| Species                 |                                  |                                        |
| hardwood                |                                  |                                        |
| unknown tree - hardwood | 22.2                             | 2.3                                    |
| <b>TOTAL</b>            | <b>22.2</b>                      | <b>2.3</b>                             |

| <b>Plot: 5016</b>   | Density<br>(individuals<br>/ ha) | Basal<br>Area<br>(m <sup>2</sup> / ha) |
|---------------------|----------------------------------|----------------------------------------|
| Species             |                                  |                                        |
| hardwood            |                                  |                                        |
| <i>Acer negundo</i> | 24.7                             | 0.1                                    |
| <b>TOTAL</b>        | <b>24.7</b>                      | <b>0.1</b>                             |

| <b>Plot: 5018</b>                        | Density<br>(individuals<br>/ ha) | Basal<br>Area<br>(m <sup>2</sup> / ha) |
|------------------------------------------|----------------------------------|----------------------------------------|
| Species                                  |                                  |                                        |
| hardwood                                 |                                  |                                        |
| <i>Betula papyrifera</i>                 | 22.2                             | 0.4                                    |
| <i>Fraxinus pennsylvanica</i>            | 11.1                             | 0.0                                    |
| <i>Populus deltoides ssp. monilifera</i> | 22.2                             | 2.6                                    |
| <i>Tilia americana</i>                   | 33.3                             | 0.1                                    |
| <i>Ulmus americana</i>                   | 11.1                             | 0.0                                    |
| <i>Ulmus rubra</i>                       | 11.1                             | 0.0                                    |
| unknown tree - hardwood                  | 33.3                             | 0.1                                    |
| <b>TOTAL</b>                             | <b>144.4</b>                     | <b>3.2</b>                             |

| <b>Plot: 5020</b>       | Density<br>(individuals<br>/ ha) | Basal<br>Area<br>(m <sup>2</sup> / ha) |
|-------------------------|----------------------------------|----------------------------------------|
| Species                 |                                  |                                        |
| hardwood                |                                  |                                        |
| <i>Fraxinus nigra</i>   | 11.1                             | 0.0                                    |
| unknown tree - hardwood | 22.2                             | 0.4                                    |
| <b>TOTAL</b>            | <b>33.3</b>                      | <b>0.4</b>                             |

| <b>Plot: 5021</b>       | Density<br>(individuals<br>/ ha) | Basal<br>Area<br>(m <sup>2</sup> / ha) |
|-------------------------|----------------------------------|----------------------------------------|
| Species                 |                                  |                                        |
| hardwood                |                                  |                                        |
| <i>Ulmus rubra</i>      | 11.1                             | 0.3                                    |
| unknown tree - hardwood | 55.6                             | 1.2                                    |
| <b>TOTAL</b>            | <b>66.7</b>                      | <b>1.5</b>                             |

| <b>Plot: 5022</b>       | Density<br>(individuals<br>/ ha) | Basal<br>Area<br>(m <sup>2</sup> / ha) |
|-------------------------|----------------------------------|----------------------------------------|
| Species                 |                                  |                                        |
| hardwood                |                                  |                                        |
| unknown tree - hardwood | 11.1                             | 0.3                                    |
| <b>TOTAL</b>            | <b>11.1</b>                      | <b>0.3</b>                             |

| <b>Plot: 5031</b>                        | Density<br>(individuals<br>/ ha) | Basal<br>Area<br>(m <sup>2</sup> / ha) |
|------------------------------------------|----------------------------------|----------------------------------------|
| Species                                  |                                  |                                        |
| hardwood                                 |                                  |                                        |
| <i>Acer negundo</i>                      | 11.1                             | 0.1                                    |
| <i>Betula papyrifera</i>                 | 44.4                             | 2.0                                    |
| <i>Populus deltoides ssp. monilifera</i> | 11.1                             | 0.7                                    |
| <i>Prunus serotina</i>                   | 11.1                             | 0.1                                    |
| <i>Quercus rubra</i>                     | 144.4                            | 6.8                                    |
| <i>Ulmus rubra</i>                       | 11.1                             | 0.2                                    |
| unknown tree - hardwood                  | 77.8                             | 0.4                                    |
| <b>TOTAL</b>                             | <b>311.1</b>                     | <b>10.1</b>                            |

| <b>Plot: 5033</b>         | Density<br>(individuals<br>/ ha) | Basal<br>Area<br>(m <sup>2</sup> / ha) |
|---------------------------|----------------------------------|----------------------------------------|
| Species                   |                                  |                                        |
| hardwood                  |                                  |                                        |
| <i>Quercus macrocarpa</i> | 22.2                             | 0.9                                    |
| <i>Ulmus rubra</i>        | 66.7                             | 0.7                                    |
| unknown tree - hardwood   | 188.9                            | 3.6                                    |
| <b>TOTAL</b>              | <b>277.8</b>                     | <b>5.2</b>                             |

| <b>Plot: 5034</b>       | Density<br>(individuals<br>/ ha) | Basal<br>Area<br>(m <sup>2</sup> / ha) |
|-------------------------|----------------------------------|----------------------------------------|
| Species                 |                                  |                                        |
| hardwood                |                                  |                                        |
| <i>Acer negundo</i>     | 14.5                             | 1.8                                    |
| <i>Acer saccharinum</i> | 14.5                             | 0.7                                    |
| <i>Ulmus rubra</i>      | 29.0                             | 0.8                                    |
| unknown tree - hardwood | 58.0                             | 3.0                                    |
| <b>TOTAL</b>            | <b>115.9</b>                     | <b>6.3</b>                             |

| <b>Plot: 5035</b>              | Density<br>(individuals<br>/ ha) | Basal<br>Area<br>(m <sup>2</sup> / ha) |
|--------------------------------|----------------------------------|----------------------------------------|
| Species                        |                                  |                                        |
| hardwood                       |                                  |                                        |
| <i>Ulmus rubra</i>             | 11.1                             | 0.0                                    |
| <i>unknown tree - hardwood</i> | 144.4                            | 10.7                                   |
| <b>TOTAL</b>                   | <b>155.6</b>                     | <b>10.7</b>                            |

| <b>Plot: 5038</b>                        | Density<br>(individuals<br>/ ha) | Basal<br>Area<br>(m <sup>2</sup> / ha) |
|------------------------------------------|----------------------------------|----------------------------------------|
| Species                                  |                                  |                                        |
| hardwood                                 |                                  |                                        |
| <i>Acer saccharinum</i>                  | 11.1                             | 0.3                                    |
| <i>Populus deltoides ssp. monilifera</i> | 11.1                             | 1.8                                    |
| <i>Ulmus rubra</i>                       | 11.1                             | 0.0                                    |
| <i>unknown tree - hardwood</i>           | 11.1                             | 1.1                                    |
| <b>TOTAL</b>                             | <b>44.4</b>                      | <b>3.2</b>                             |

| <b>Plot: 5039</b>              | Density<br>(individuals<br>/ ha) | Basal<br>Area<br>(m <sup>2</sup> / ha) |
|--------------------------------|----------------------------------|----------------------------------------|
| Species                        |                                  |                                        |
| hardwood                       |                                  |                                        |
| <i>Prunus serotina</i>         | 11.1                             | 0.0                                    |
| <i>Ulmus rubra</i>             | 22.2                             | 0.7                                    |
| <i>unknown tree - hardwood</i> | 22.2                             | 0.4                                    |
| <b>TOTAL</b>                   | <b>55.6</b>                      | <b>1.0</b>                             |

| <b>Plot: 5052</b>              | Density<br>(individuals<br>/ ha) | Basal<br>Area<br>(m <sup>2</sup> / ha) |
|--------------------------------|----------------------------------|----------------------------------------|
| Species                        |                                  |                                        |
| hardwood                       |                                  |                                        |
| <i>unknown tree - hardwood</i> | 33.3                             | 0.1                                    |
| <b>TOTAL</b>                   | <b>33.3</b>                      | <b>0.1</b>                             |

| <b>Plot: 5056</b>                        | Density<br>(individuals<br>/ ha) | Basal<br>Area<br>(m <sup>2</sup> / ha) |
|------------------------------------------|----------------------------------|----------------------------------------|
| Species                                  |                                  |                                        |
| hardwood                                 |                                  |                                        |
| <i>Celtis occidentalis</i>               | 11.1                             | 0.0                                    |
| <i>Populus deltoides ssp. monilifera</i> | 11.1                             | 0.4                                    |
| <i>unknown tree - hardwood</i>           | 66.7                             | 0.8                                    |
| <b>TOTAL</b>                             | <b>88.9</b>                      | <b>1.2</b>                             |

| <b>Plot: 5073</b>              | Density<br>(individuals<br>/ ha) | Basal<br>Area<br>(m <sup>2</sup> / ha) |
|--------------------------------|----------------------------------|----------------------------------------|
| Species                        |                                  |                                        |
| hardwood                       |                                  |                                        |
| <i>Carya cordiformis</i>       | 66.7                             | 0.4                                    |
| <i>Celtis occidentalis</i>     | 11.1                             | 0.0                                    |
| <i>Ulmus rubra</i>             | 11.1                             | 0.0                                    |
| <i>unknown tree - hardwood</i> | 44.4                             | 3.4                                    |
| <b>TOTAL</b>                   | <b>133.3</b>                     | <b>3.8</b>                             |

| <b>Plot: 5076</b>              | Density<br>(individuals<br>/ ha) | Basal<br>Area<br>(m <sup>2</sup> / ha) |
|--------------------------------|----------------------------------|----------------------------------------|
| Species                        |                                  |                                        |
| hardwood                       |                                  |                                        |
| <i>Acer saccharinum</i>        | 22.2                             | 1.0                                    |
| <i>unknown tree - hardwood</i> | 55.6                             | 0.8                                    |
| <b>TOTAL</b>                   | <b>77.8</b>                      | <b>1.8</b>                             |

| <b>Plot: 5082</b>              | Density<br>(individuals<br>/ ha) | Basal<br>Area<br>(m <sup>2</sup> / ha) |
|--------------------------------|----------------------------------|----------------------------------------|
| Species                        |                                  |                                        |
| hardwood                       |                                  |                                        |
| <i>Prunus serotina</i>         | 11.1                             | 0.3                                    |
| <i>Quercus macrocarpa</i>      | 33.3                             | 2.5                                    |
| <i>Tilia americana</i>         | 11.1                             | 0.1                                    |
| <i>unknown tree - hardwood</i> | 11.1                             | 0.6                                    |
| <b>TOTAL</b>                   | <b>66.7</b>                      | <b>3.5</b>                             |

| <b>Plot: 5084</b>                        | Density<br>(individuals<br>/ ha) | Basal<br>Area<br>(m <sup>2</sup> / ha) |
|------------------------------------------|----------------------------------|----------------------------------------|
| Species                                  |                                  |                                        |
| hardwood                                 |                                  |                                        |
| <i>Acer negundo</i>                      | 77.8                             | 0.3                                    |
| <i>Acer saccharinum</i>                  | 44.4                             | 0.1                                    |
| <i>Fraxinus pennsylvanica</i>            | 11.1                             | 0.0                                    |
| <i>Populus deltoides ssp. monilifera</i> | 11.1                             | 0.2                                    |
| <i>unknown tree - hardwood</i>           | 22.2                             | 0.1                                    |
| <b>TOTAL</b>                             | <b>166.7</b>                     | <b>0.7</b>                             |

| <b>Plot: 5086</b>                        | Density<br>(individuals<br>/ ha) | Basal<br>Area<br>(m <sup>2</sup> / ha) |
|------------------------------------------|----------------------------------|----------------------------------------|
| Species                                  |                                  |                                        |
| hardwood                                 |                                  |                                        |
| <i>Acer saccharinum</i>                  | 22.2                             | 0.3                                    |
| <i>Populus deltoides ssp. monilifera</i> | 11.1                             | 0.9                                    |
| <i>unknown tree - hardwood</i>           | 44.4                             | 3.5                                    |
| <b>TOTAL</b>                             | <b>77.8</b>                      | <b>4.7</b>                             |

| <b>Plot: 5096</b>      | Density<br>(individuals<br>/ ha) | Basal<br>Area<br>(m <sup>2</sup> / ha) |
|------------------------|----------------------------------|----------------------------------------|
| Species                |                                  |                                        |
| hardwood               |                                  |                                        |
| <i>Prunus serotina</i> | 11.1                             | 0.1                                    |
| <b>TOTAL</b>           | <b>11.1</b>                      | <b>0.1</b>                             |

| <b>Plot: 5097</b>              | Density<br>(individuals<br>/ ha) | Basal<br>Area<br>(m <sup>2</sup> / ha) |
|--------------------------------|----------------------------------|----------------------------------------|
| Species                        |                                  |                                        |
| hardwood                       |                                  |                                        |
| <i>Acer negundo</i>            | 11.1                             | 0.0                                    |
| <i>Fraxinus pennsylvanica</i>  | 11.1                             | 0.5                                    |
| <i>Tilia americana</i>         | 11.1                             | 0.0                                    |
| <i>unknown tree - hardwood</i> | 200.0                            | 3.9                                    |
| <b>TOTAL</b>                   | <b>233.3</b>                     | <b>4.4</b>                             |

| <b>Plot: 5099</b>                        | Density<br>(individuals<br>/ ha) | Basal<br>Area<br>(m <sup>2</sup> / ha) |
|------------------------------------------|----------------------------------|----------------------------------------|
| Species                                  |                                  |                                        |
| hardwood                                 |                                  |                                        |
| <i>Acer saccharinum</i>                  | 11.1                             | 1.9                                    |
| <i>Populus deltoides ssp. monilifera</i> | 11.1                             | 3.5                                    |
| <i>unknown tree - hardwood</i>           | 22.2                             | 1.4                                    |
| <b>TOTAL</b>                             | <b>44.4</b>                      | <b>6.8</b>                             |

|                                          |                                  |                                        |
|------------------------------------------|----------------------------------|----------------------------------------|
| <b>Plot: 5104</b>                        | Density<br>(individuals<br>/ ha) | Basal<br>Area<br>(m <sup>2</sup> / ha) |
| Species                                  |                                  |                                        |
| hardwood                                 |                                  |                                        |
| <i>Fraxinus pennsylvanica</i>            | 24.7                             | 0.0                                    |
| <i>Populus deltoides ssp. monilifera</i> | 12.3                             | 6.4                                    |
| <i>unknown tree - hardwood</i>           | 12.3                             | 0.6                                    |
| <b>TOTAL</b>                             | <b>49.4</b>                      | <b>7.0</b>                             |

|                         |                                  |                                        |
|-------------------------|----------------------------------|----------------------------------------|
| <b>Plot: 5106</b>       | Density<br>(individuals<br>/ ha) | Basal<br>Area<br>(m <sup>2</sup> / ha) |
| Species                 |                                  |                                        |
| hardwood                |                                  |                                        |
| <i>Acer saccharinum</i> | 22.2                             | 1.2                                    |
| <i>Ulmus rubra</i>      | 11.1                             | 0.6                                    |
| <b>TOTAL</b>            | <b>33.3</b>                      | <b>1.8</b>                             |

|                         |                                  |                                        |
|-------------------------|----------------------------------|----------------------------------------|
| <b>Plot: 5111</b>       | Density<br>(individuals<br>/ ha) | Basal<br>Area<br>(m <sup>2</sup> / ha) |
| Species                 |                                  |                                        |
| hardwood                |                                  |                                        |
| <i>Acer negundo</i>     | 11.1                             | 0.3                                    |
| <i>Acer saccharinum</i> | 22.2                             | 0.5                                    |
| <b>TOTAL</b>            | <b>33.3</b>                      | <b>0.9</b>                             |

|                                |                                  |                                        |
|--------------------------------|----------------------------------|----------------------------------------|
| <b>Plot: 5140</b>              | Density<br>(individuals<br>/ ha) | Basal<br>Area<br>(m <sup>2</sup> / ha) |
| Species                        |                                  |                                        |
| hardwood                       |                                  |                                        |
| <i>Acer negundo</i>            | 11.1                             | 0.0                                    |
| <i>Fraxinus pennsylvanica</i>  | 55.6                             | 0.3                                    |
| <i>unknown tree - hardwood</i> | 55.6                             | 0.4                                    |
| <b>TOTAL</b>                   | <b>122.2</b>                     | <b>0.8</b>                             |

|                         |                                  |                                        |
|-------------------------|----------------------------------|----------------------------------------|
| <b>Plot: 5142</b>       | Density<br>(individuals<br>/ ha) | Basal<br>Area<br>(m <sup>2</sup> / ha) |
| Species                 |                                  |                                        |
| hardwood                |                                  |                                        |
| <i>Acer saccharinum</i> | 22.2                             | 0.8                                    |
| <b>TOTAL</b>            | <b>22.2</b>                      | <b>0.8</b>                             |

|                                |                                  |                                        |
|--------------------------------|----------------------------------|----------------------------------------|
| <b>Plot: 5148</b>              | Density<br>(individuals<br>/ ha) | Basal<br>Area<br>(m <sup>2</sup> / ha) |
| Species                        |                                  |                                        |
| hardwood                       |                                  |                                        |
| <i>Acer negundo</i>            | 11.1                             | 1.2                                    |
| <i>unknown tree - hardwood</i> | 33.3                             | 0.5                                    |
| <b>TOTAL</b>                   | <b>44.4</b>                      | <b>1.7</b>                             |

# Percent Cover of Shrub Species

## Plot: 5002

| Species                         | Percent cover in shrub circles |    |   |   |   |   | mean percent cover |
|---------------------------------|--------------------------------|----|---|---|---|---|--------------------|
|                                 | 1                              | 2  | 3 | 4 | 5 | 6 |                    |
| Cornus alternifolia             | 1                              | 1  | 1 |   | 1 | 1 | 0.83               |
| Lonicera morrowii               | 30                             |    |   | 1 | 2 |   | 5.50               |
| Menispermum canadense           | 1                              |    |   | 4 | 1 |   | 1.00               |
| Parthenocissus sp.              | 1                              | 1  | 1 | 4 | 1 | 1 | 1.50               |
| Rhamnus cathartica              | 4                              | 4  | 4 | 4 | 2 | 2 | 3.33               |
| Ribes hirtellum                 | 20                             | 10 | 4 | 8 | 2 | 2 | 7.67               |
| Rubus occidentalis              | 1                              |    |   |   |   |   | 0.17               |
| Rubus pensilvanicus             | 1                              |    |   |   | 1 | 1 | 0.50               |
| Rubus pubescens                 |                                | 1  | 1 | 1 |   |   | 0.50               |
| Sambucus racemosa var. racemosa | 10                             | 4  | 4 |   | 3 | 2 | 3.83               |
| Smilax tamnoides                | 4                              | 1  | 1 | 1 | 1 | 1 | 1.50               |

Number of Shrub Circles Not Sampled in Plot 5002: 0

## Plot: 5004

| Species            | Percent cover in shrub circles |   |   |    |   |   | mean percent cover |
|--------------------|--------------------------------|---|---|----|---|---|--------------------|
|                    | 1                              | 2 | 3 | 4  | 5 | 6 |                    |
| Parthenocissus sp. | 25                             | 2 |   | 1  |   |   | 4.67               |
| Rhamnus cathartica | 10                             | 5 |   | 5  |   |   | 3.33               |
| Ribes hirtellum    | 5                              | 1 |   |    |   |   | 1.00               |
| Rubus occidentalis |                                |   |   | 15 |   |   | 2.50               |
| Vitis riparia      | 1                              | 1 |   | 1  |   |   | 0.50               |

Number of Shrub Circles Not Sampled in Plot 5004: 0

## Plot: 5006

| Species                     | Percent cover in shrub circles |   |    |    |    |    | mean percent cover |
|-----------------------------|--------------------------------|---|----|----|----|----|--------------------|
|                             | 1                              | 2 | 3  | 4  | 5  | 6  |                    |
| Euonymus atropurpurea       | 1                              | 1 |    |    |    |    | 0.33               |
| Lonicera (exotic) sp.       | 1                              |   |    |    | 1  | 1  | 0.50               |
| Lonicera sp.                |                                |   | 1  | 1  |    |    | 0.33               |
| Menispermum canadense       |                                | 1 | 4  |    |    | 1  | 1.00               |
| Parthenocissus sp.          | 1                              | 1 | 30 | 40 | 1  | 1  | 12.33              |
| Rhamnus cathartica          | 2                              | 1 | 10 | 15 | 50 | 30 | 18.00              |
| Ribes cynosbati             |                                |   |    |    | 1  | 1  | 0.33               |
| Ribes hirtellum             | 2                              |   | 1  | 1  | 1  |    | 0.83               |
| Rubus idaeus ssp. strigosus |                                |   |    |    | 1  |    | 0.17               |
| Rubus occidentalis          |                                |   |    | 1  |    |    | 0.17               |
| Rubus pubescens             |                                |   |    |    |    | 1  | 0.17               |
| Smilax tamnoides            |                                |   |    | 1  |    |    | 0.17               |
| Solanum dulcamara           | 1                              | 1 |    |    |    |    | 0.33               |
| Vitis riparia               | 1                              | 2 |    |    | 1  |    | 0.67               |
| Zanthoxylum americanum      |                                |   |    |    | 1  | 1  | 0.33               |

Number of Shrub Circles Not Sampled in Plot 5006: 0

| <b>Plot: 5010</b>                                   |                                       |          |          |          |          |          |                           |
|-----------------------------------------------------|---------------------------------------|----------|----------|----------|----------|----------|---------------------------|
| <b>Species</b>                                      | <b>Percent cover in shrub circles</b> |          |          |          |          |          | <b>mean percent cover</b> |
|                                                     | <b>1</b>                              | <b>2</b> | <b>3</b> | <b>4</b> | <b>5</b> | <b>6</b> |                           |
| Menispermum canadense                               | 1                                     | 1        | 1        |          | 1        | 1        | 0.83                      |
| Sambucus nigra ssp. canadensis                      |                                       |          |          | 4        |          | 1        | 0.83                      |
| Smilax tamnoides                                    |                                       |          | 1        |          |          |          | 0.17                      |
| Number of Shrub Circles Not Sampled in Plot 5010: 0 |                                       |          |          |          |          |          |                           |

| <b>Plot: 5016</b>                                   |                                       |          |          |          |          |          |                           |
|-----------------------------------------------------|---------------------------------------|----------|----------|----------|----------|----------|---------------------------|
| <b>Species</b>                                      | <b>Percent cover in shrub circles</b> |          |          |          |          |          | <b>mean percent cover</b> |
|                                                     | <b>1</b>                              | <b>2</b> | <b>3</b> | <b>4</b> | <b>5</b> | <b>6</b> |                           |
| Euonymus atropurpurea                               |                                       |          |          |          | 2        |          | 0.33                      |
| Parthenocissus sp.                                  | 3                                     | 1        | 5        | 5        | 3        | 1        | 3.00                      |
| Rhamnus cathartica                                  | 2                                     | 10       | 5        | 1        | 1        | 1        | 3.33                      |
| Ribes hirtellum                                     | 5                                     | 15       | 1        | 5        | 2        |          | 4.67                      |
| Rubus occidentalis                                  |                                       | 1        |          | 5        | 5        | 1        | 2.00                      |
| Smilax tamnoides                                    | 1                                     | 1        |          |          |          | 1        | 0.50                      |
| Solanum dulcamara                                   | 1                                     |          |          |          |          |          | 0.17                      |
| Viburnum opulus var. americanum                     |                                       | 1        | 1        |          |          |          | 0.33                      |
| Vitis riparia                                       | 1                                     | 1        | 15       | 15       | 15       | 1        | 8.00                      |
| Zanthoxylum americanum                              | 1                                     | 5        | 3        |          | 10       |          | 3.17                      |
| Number of Shrub Circles Not Sampled in Plot 5016: 0 |                                       |          |          |          |          |          |                           |

| <b>Plot: 5018</b>                                   |                                       |          |          |          |          |          |                           |
|-----------------------------------------------------|---------------------------------------|----------|----------|----------|----------|----------|---------------------------|
| <b>Species</b>                                      | <b>Percent cover in shrub circles</b> |          |          |          |          |          | <b>mean percent cover</b> |
|                                                     | <b>1</b>                              | <b>2</b> | <b>3</b> | <b>4</b> | <b>5</b> | <b>6</b> |                           |
| Cornus alternifolia                                 | 1                                     |          | 1        | 1        | 1        | 1        | 0.83                      |
| Cornus racemosa                                     | 1                                     | 1        |          |          | 1        | 2        | 0.83                      |
| Corylus americana                                   |                                       |          |          |          | 1        | 1        | 0.33                      |
| Lonicera (exotic) sp.                               | 40                                    | 30       | 10       | 25       | 20       | 15       | 23.33                     |
| Parthenocissus sp.                                  | 5                                     | 1        | 1        | 1        | 1        | 1        | 1.67                      |
| Rhamnus cathartica                                  | 10                                    | 5        | 1        |          | 1        | 1        | 3.00                      |
| Ribes cynosbati                                     |                                       | 5        |          |          |          |          | 0.83                      |
| Ribes hirtellum                                     |                                       | 5        | 1        | 1        | 1        | 1        | 1.50                      |
| Rosa carolina                                       | 1                                     |          |          |          |          |          | 0.17                      |
| Rubus idaeus ssp. strigosus                         | 1                                     | 5        |          |          |          |          | 1.00                      |
| Rubus occidentalis                                  |                                       |          | 1        |          |          |          | 0.17                      |
| Rubus setosus                                       | 1                                     |          |          |          |          |          | 0.17                      |
| Smilax tamnoides                                    | 1                                     |          | 1        |          |          |          | 0.33                      |
| Toxicodendron radicans                              | 5                                     |          |          |          |          | 1        | 1.00                      |
| Viburnum rafinesqueanum                             |                                       | 1        |          |          |          |          | 0.17                      |
| Vitis riparia                                       | 1                                     | 1        |          |          |          | 1        | 0.50                      |
| Zanthoxylum americanum                              | 10                                    |          |          |          |          | 1        | 1.83                      |
| Number of Shrub Circles Not Sampled in Plot 5018: 0 |                                       |          |          |          |          |          |                           |

| <b>Plot: 5020</b>           |                                       |          |          |          |          |          |                           |
|-----------------------------|---------------------------------------|----------|----------|----------|----------|----------|---------------------------|
| <b>Species</b>              | <b>Percent cover in shrub circles</b> |          |          |          |          |          | <b>mean percent cover</b> |
|                             | <b>1</b>                              | <b>2</b> | <b>3</b> | <b>4</b> | <b>5</b> | <b>6</b> |                           |
| Acer ginnala                | 1                                     |          |          |          |          | 1        | 0.33                      |
| Cornus sericea              | 2                                     | 5        | 4        | 4        | 2        | 12       | 4.83                      |
| Lonicera (exotic) sp.       |                                       |          | 1        | 4        |          | 4        | 1.50                      |
| Menispermum canadense       |                                       |          | 1        |          |          |          | 0.17                      |
| Parthenocissus sp.          | 2                                     | 3        | 10       | 5        | 10       | 4        | 5.67                      |
| Physocarpus opulifolius     |                                       |          |          |          |          | 1        | 0.17                      |
| Rhamnus cathartica          | 1                                     | 1        | 10       | 20       | 1        | 50       | 13.83                     |
| Ribes americanum            |                                       |          |          | 12       | 1        | 5        | 3.00                      |
| Ribes hirtellum             |                                       |          |          |          | 4        |          | 0.67                      |
| Rubus idaeus ssp. strigosus | 1                                     |          |          |          |          |          | 0.17                      |
| Rubus occidentalis          |                                       |          | 4        |          | 4        | 4        | 2.00                      |
| Rubus pubescens             |                                       |          |          |          |          | 1        | 0.17                      |
| Solanum dulcamara           | 1                                     |          | 1        | 1        |          | 1        | 0.67                      |
| Viburnum rafinesqueanum     |                                       |          |          | 1        |          |          | 0.17                      |
| Vitis riparia               | 1                                     | 2        | 5        | 5        | 1        | 1        | 2.50                      |

Number of Shrub Circles Not Sampled in Plot 5020: 0

| <b>Plot: 5021</b>     |                                       |          |          |          |          |          |                           |
|-----------------------|---------------------------------------|----------|----------|----------|----------|----------|---------------------------|
| <b>Species</b>        | <b>Percent cover in shrub circles</b> |          |          |          |          |          | <b>mean percent cover</b> |
|                       | <b>1</b>                              | <b>2</b> | <b>3</b> | <b>4</b> | <b>5</b> | <b>6</b> |                           |
| Menispermum canadense | 1                                     |          |          |          |          |          | 0.17                      |
| Rhamnus cathartica    | 1                                     |          |          |          |          |          | 0.17                      |
| Vitis riparia         |                                       |          | 1        |          |          |          | 0.17                      |

Number of Shrub Circles Not Sampled in Plot 5021: 0

| <b>Plot: 5022</b>  |                                       |          |          |          |          |          |                           |
|--------------------|---------------------------------------|----------|----------|----------|----------|----------|---------------------------|
| <b>Species</b>     | <b>Percent cover in shrub circles</b> |          |          |          |          |          | <b>mean percent cover</b> |
|                    | <b>1</b>                              | <b>2</b> | <b>3</b> | <b>4</b> | <b>5</b> | <b>6</b> |                           |
| Rhamnus cathartica | 1                                     |          |          | 1        | 1        | 1        | 0.67                      |
| Vitis riparia      | 1                                     | 1        |          | 1        | 1        | 1        | 0.83                      |

Number of Shrub Circles Not Sampled in Plot 5022: 0

| <b>Plot: 5031</b>      |                                       |          |          |          |          |          |                           |
|------------------------|---------------------------------------|----------|----------|----------|----------|----------|---------------------------|
| <b>Species</b>         | <b>Percent cover in shrub circles</b> |          |          |          |          |          | <b>mean percent cover</b> |
|                        | <b>1</b>                              | <b>2</b> | <b>3</b> | <b>4</b> | <b>5</b> | <b>6</b> |                           |
| Cornus racemosa        |                                       |          |          | 1        |          |          | 0.17                      |
| Lonicera (exotic) sp.  | 1                                     |          |          | 1        |          |          | 0.33                      |
| Parthenocissus sp.     | 2                                     | 1        | 1        | 1        | 2        | 1        | 1.33                      |
| Rhamnus cathartica     | 50                                    | 50       | 50       | 15       | 45       | 30       | 40.00                     |
| Ribes hirtellum        | 1                                     | 1        | 1        | 1        | 1        | 1        | 1.00                      |
| Rubus occidentalis     |                                       | 1        |          | 1        | 1        |          | 0.50                      |
| Vitis riparia          |                                       | 1        | 1        |          | 1        | 1        | 0.67                      |
| Zanthoxylum americanum | 1                                     | 1        | 1        |          |          |          | 0.50                      |

Number of Shrub Circles Not Sampled in Plot 5031: 0

| <b>Plot: 5033</b>       |                                       |          |          |          |          |          |                           |
|-------------------------|---------------------------------------|----------|----------|----------|----------|----------|---------------------------|
| <b>Species</b>          | <b>Percent cover in shrub circles</b> |          |          |          |          |          | <b>mean percent cover</b> |
|                         | <b>1</b>                              | <b>2</b> | <b>3</b> | <b>4</b> | <b>5</b> | <b>6</b> |                           |
| Lonicera (exotic) sp.   | 8                                     |          | 1        | 15       | 1        | 1        | 4.33                      |
| Menispermum canadense   |                                       |          | 1        |          |          |          | 0.17                      |
| Parthenocissus sp.      | 1                                     | 4        | 1        | 1        | 1        |          | 1.33                      |
| Rhamnus cathartica      | 10                                    | 8        | 30       |          | 20       | 25       | 15.50                     |
| Ribes hirtellum         | 4                                     | 12       | 1        | 1        |          | 1        | 3.17                      |
| Rubus occidentalis      | 1                                     | 4        |          | 1        |          |          | 1.00                      |
| Rubus pubescens         | 1                                     |          |          |          |          |          | 0.17                      |
| Toxicodendron rydbergii | 1                                     |          |          |          |          |          | 0.17                      |
| Vitis riparia           | 1                                     | 1        | 1        | 2        |          | 1        | 1.00                      |
| Zanthoxylum americanum  | 1                                     |          |          |          |          |          | 0.17                      |

Number of Shrub Circles Not Sampled in Plot 5033: 0

| <b>Plot: 5034</b>              |                                       |          |          |          |          |          |                           |
|--------------------------------|---------------------------------------|----------|----------|----------|----------|----------|---------------------------|
| <b>Species</b>                 | <b>Percent cover in shrub circles</b> |          |          |          |          |          | <b>mean percent cover</b> |
|                                | <b>1</b>                              | <b>2</b> | <b>3</b> | <b>4</b> | <b>5</b> | <b>6</b> |                           |
| Rhamnus cathartica             |                                       | 1        |          |          |          |          | 0.17                      |
| Sambucus nigra ssp. canadensis | 3                                     |          | 1        |          |          |          | 0.67                      |
| Vitis riparia                  | 1                                     | 2        | 1        |          | 1        |          | 0.83                      |
| Zanthoxylum americanum         | 3                                     | 4        |          |          |          |          | 1.17                      |

Number of Shrub Circles Not Sampled in Plot 5034: 0

| <b>Plot: 5035</b>     |                                       |          |          |          |          |          |                           |
|-----------------------|---------------------------------------|----------|----------|----------|----------|----------|---------------------------|
| <b>Species</b>        | <b>Percent cover in shrub circles</b> |          |          |          |          |          | <b>mean percent cover</b> |
|                       | <b>1</b>                              | <b>2</b> | <b>3</b> | <b>4</b> | <b>5</b> | <b>6</b> |                           |
| Menispermum canadense |                                       | 5        |          |          |          |          | 0.83                      |
| Parthenocissus sp.    | 1                                     | 4        |          |          |          |          | 0.83                      |
| Rhamnus cathartica    |                                       | 1        |          |          |          |          | 0.17                      |
| Ribes cynosbati       |                                       | 1        |          |          |          |          | 0.17                      |
| Sambucus sp.          |                                       | 1        |          |          |          |          | 0.17                      |
| Smilax tamnoides      | 4                                     | 5        |          |          |          |          | 1.50                      |
| Vitis riparia         | 1                                     |          |          |          |          | 1        | 0.33                      |

Number of Shrub Circles Not Sampled in Plot 5035: 0

| <b>Plot: 5038</b>              |                                       |          |          |          |          |          |                           |
|--------------------------------|---------------------------------------|----------|----------|----------|----------|----------|---------------------------|
| <b>Species</b>                 | <b>Percent cover in shrub circles</b> |          |          |          |          |          | <b>mean percent cover</b> |
|                                | <b>1</b>                              | <b>2</b> | <b>3</b> | <b>4</b> | <b>5</b> | <b>6</b> |                           |
| Rhamnus cathartica             |                                       | 1        |          |          |          |          | 0.17                      |
| Sambucus nigra ssp. canadensis |                                       |          |          |          | 2        |          | 0.33                      |
| Vitis riparia                  |                                       | 1        |          |          |          |          | 0.17                      |

Number of Shrub Circles Not Sampled in Plot 5038: 0

**Plot: 5039**

| Species                     | Percent cover in shrub circles |   |   |   |   |   | mean percent cover |
|-----------------------------|--------------------------------|---|---|---|---|---|--------------------|
|                             | 1                              | 2 | 3 | 4 | 5 | 6 |                    |
| Cornus alternifolia         | 1                              | 1 |   |   |   | 1 | 0.50               |
| Cornus racemosa             |                                |   |   |   |   | 1 | 0.17               |
| Lonicera (exotic) sp.       | 2                              | 1 |   |   |   |   | 0.50               |
| Parthenocissus quinquefolia | 1                              | 1 | 1 |   |   |   | 0.50               |
| Parthenocissus sp.          |                                |   |   | 2 | 1 | 1 | 0.67               |
| Rhamnus cathartica          | 2                              | 1 | 1 | 2 |   | 1 | 1.17               |
| Ribes hirtellum             | 2                              |   | 2 | 2 | 1 | 1 | 1.33               |
| Ribes sp.                   |                                | 3 |   |   |   |   | 0.50               |
| Rubus occidentalis          | 2                              | 2 | 1 | 2 |   |   | 1.17               |
| Smilax tamnoides            | 1                              | 1 |   |   |   |   | 0.33               |
| Toxicodendron radicans      | 1                              | 1 |   |   |   |   | 0.33               |
| Vitis riparia               | 1                              | 1 | 1 | 1 | 1 |   | 0.83               |

Number of Shrub Circles Not Sampled in Plot 5039: 0

**Plot: 5042**

| Species                        | Percent cover in shrub circles |   |   |   |   |   | mean percent cover |
|--------------------------------|--------------------------------|---|---|---|---|---|--------------------|
|                                | 1                              | 2 | 3 | 4 | 5 | 6 |                    |
| Menispermum canadense          |                                |   |   |   | 1 |   | 0.17               |
| Sambucus nigra ssp. canadensis |                                | 1 |   |   |   |   | 0.17               |
| Smilax tamnoides               | 2                              |   |   |   |   |   | 0.33               |
| Toxicodendron radicans         | 2                              |   |   |   |   |   | 0.33               |

Number of Shrub Circles Not Sampled in Plot 5042: 0

**Plot: 5052**

| Species            | Percent cover in shrub circles |   |   |   |   |   | mean percent cover |
|--------------------|--------------------------------|---|---|---|---|---|--------------------|
|                    | 1                              | 2 | 3 | 4 | 5 | 6 |                    |
| Rhamnus cathartica | 1                              | 1 |   |   |   |   | 0.50               |
| Smilax tamnoides   | 1                              |   |   |   |   |   | 0.25               |
| Vitis riparia      |                                | 1 |   | 1 |   |   | 0.50               |

Number of Shrub Circles Not Sampled in Plot 5052: 2

**Plot: 5056**

| Species            | Percent cover in shrub circles |   |   |   |   |   | mean percent cover |
|--------------------|--------------------------------|---|---|---|---|---|--------------------|
|                    | 1                              | 2 | 3 | 4 | 5 | 6 |                    |
| Parthenocissus sp. | 1                              | 1 | 1 |   |   | 1 | 0.67               |
| Rhamnus cathartica | 1                              | 1 | 4 | 1 |   | 1 | 1.33               |
| Rubus occidentalis | 1                              | 4 |   |   |   |   | 0.83               |
| Rubus pubescens    |                                |   |   | 1 |   | 1 | 0.33               |
| Vitis riparia      | 3                              | 1 | 2 |   | 5 | 1 | 2.00               |

Number of Shrub Circles Not Sampled in Plot 5056: 0

| <b>Plot: 5073</b>                                   |                                       |          |          |          |          |          |                           |
|-----------------------------------------------------|---------------------------------------|----------|----------|----------|----------|----------|---------------------------|
| <b>Species</b>                                      | <b>Percent cover in shrub circles</b> |          |          |          |          |          | <b>mean percent cover</b> |
|                                                     | <b>1</b>                              | <b>2</b> | <b>3</b> | <b>4</b> | <b>5</b> | <b>6</b> |                           |
| Lonicera (exotic) sp.                               | 25                                    |          | 3        | 5        | 10       |          | 7.17                      |
| Menispermum canadense                               |                                       | 1        |          |          |          |          | 0.17                      |
| Parthenocissus sp.                                  | 1                                     | 1        | 2        | 1        | 2        | 1        | 1.33                      |
| Rhamnus cathartica                                  | 1                                     | 1        | 1        | 1        | 1        | 1        | 1.00                      |
| Ribes hirtellum                                     | 1                                     | 1        | 1        | 1        | 1        |          | 0.83                      |
| Rubus occidentalis                                  | 1                                     |          |          |          |          |          | 0.17                      |
| Rubus pensilvanicus                                 |                                       | 1        |          |          |          | 1        | 0.33                      |
| Rubus pubescens                                     |                                       |          |          | 1        |          |          | 0.17                      |
| Smilax tamnoides                                    | 1                                     | 1        | 1        |          |          | 1        | 0.67                      |
| Vitis riparia                                       | 1                                     | 1        | 1        | 1        | 1        |          | 0.83                      |
| Zanthoxylum americanum                              |                                       |          |          | 1        |          |          | 0.17                      |
| Number of Shrub Circles Not Sampled in Plot 5073: 0 |                                       |          |          |          |          |          |                           |

| <b>Plot: 5076</b>                                   |                                       |          |          |          |          |          |                           |
|-----------------------------------------------------|---------------------------------------|----------|----------|----------|----------|----------|---------------------------|
| <b>Species</b>                                      | <b>Percent cover in shrub circles</b> |          |          |          |          |          | <b>mean percent cover</b> |
|                                                     | <b>1</b>                              | <b>2</b> | <b>3</b> | <b>4</b> | <b>5</b> | <b>6</b> |                           |
| Humulus lupulus                                     | 1                                     |          |          |          |          |          | 0.17                      |
| Menispermum canadense                               | 1                                     |          |          | 4        |          |          | 0.83                      |
| Parthenocissus sp.                                  | 1                                     |          | 20       | 4        |          | 1        | 4.33                      |
| Rhamnus cathartica                                  | 1                                     |          | 1        | 1        | 1        | 1        | 0.83                      |
| Ribes americanum                                    |                                       |          | 1        | 4        |          |          | 0.83                      |
| Vitis riparia                                       | 1                                     |          |          | 1        | 1        |          | 0.50                      |
| Number of Shrub Circles Not Sampled in Plot 5076: 0 |                                       |          |          |          |          |          |                           |

| <b>Plot: 5082</b>                                   |                                       |          |          |          |          |          |                           |
|-----------------------------------------------------|---------------------------------------|----------|----------|----------|----------|----------|---------------------------|
| <b>Species</b>                                      | <b>Percent cover in shrub circles</b> |          |          |          |          |          | <b>mean percent cover</b> |
|                                                     | <b>1</b>                              | <b>2</b> | <b>3</b> | <b>4</b> | <b>5</b> | <b>6</b> |                           |
| Berberis vulgaris                                   |                                       |          | 3        |          |          |          | 0.50                      |
| Cornus alternifolia                                 |                                       |          |          |          | 1        |          | 0.17                      |
| Lonicera (exotic) sp.                               | 30                                    |          | 25       | 25       | 20       | 5        | 17.50                     |
| Menispermum canadense                               |                                       | 1        |          |          |          |          | 0.17                      |
| Parthenocissus sp.                                  | 1                                     | 5        | 1        |          | 1        | 1        | 1.50                      |
| Rhamnus cathartica                                  | 20                                    | 25       | 20       | 10       | 15       | 50       | 23.33                     |
| Ribes cynosbati                                     | 1                                     | 1        | 1        |          | 1        | 1        | 0.83                      |
| Ribes hirtellum                                     | 1                                     | 1        |          |          | 1        | 1        | 0.67                      |
| Rubus idaeus ssp. strigosus                         |                                       | 2        |          |          |          |          | 0.33                      |
| Sambucus nigra ssp. canadensis                      |                                       | 2        |          |          |          |          | 0.33                      |
| Solanum dulcamara                                   |                                       | 1        |          |          |          |          | 0.17                      |
| Toxicodendron radicans                              |                                       |          | 1        |          |          |          | 0.17                      |
| Viburnum sp.                                        |                                       |          |          | 1        |          |          | 0.17                      |
| Vitis riparia                                       | 1                                     | 1        | 1        |          |          |          | 0.50                      |
| Zanthoxylum americanum                              |                                       |          | 1        |          |          |          | 0.17                      |
| Number of Shrub Circles Not Sampled in Plot 5082: 0 |                                       |          |          |          |          |          |                           |

| <b>Plot: 5084</b>                                   |                                       |          |          |          |          |          |                           |
|-----------------------------------------------------|---------------------------------------|----------|----------|----------|----------|----------|---------------------------|
| <b>Species</b>                                      | <b>Percent cover in shrub circles</b> |          |          |          |          |          | <b>mean percent cover</b> |
|                                                     | <b>1</b>                              | <b>2</b> | <b>3</b> | <b>4</b> | <b>5</b> | <b>6</b> |                           |
| Parthenocissus sp.                                  |                                       |          |          | 1        |          | 1        | 0.33                      |
| Vitis riparia                                       | 1                                     |          | 1        | 1        | 1        |          | 0.67                      |
| Number of Shrub Circles Not Sampled in Plot 5084: 0 |                                       |          |          |          |          |          |                           |

| <b>Plot: 5086</b>                                   |                                       |          |          |          |          |          |                           |
|-----------------------------------------------------|---------------------------------------|----------|----------|----------|----------|----------|---------------------------|
| <b>Species</b>                                      | <b>Percent cover in shrub circles</b> |          |          |          |          |          | <b>mean percent cover</b> |
|                                                     | <b>1</b>                              | <b>2</b> | <b>3</b> | <b>4</b> | <b>5</b> | <b>6</b> |                           |
| Ribes americanum                                    |                                       |          |          | 1        |          |          | 0.17                      |
| Sambucus nigra ssp. canadensis                      |                                       |          | 1        |          |          |          | 0.17                      |
| Solanum dulcamara                                   |                                       | 1        |          |          |          |          | 0.17                      |
| Vitis riparia                                       | 1                                     | 1        | 1        | 1        | 1        |          | 0.83                      |
| Number of Shrub Circles Not Sampled in Plot 5086: 0 |                                       |          |          |          |          |          |                           |

| <b>Plot: 5096</b>                                   |                                       |          |          |          |          |          |                           |
|-----------------------------------------------------|---------------------------------------|----------|----------|----------|----------|----------|---------------------------|
| <b>Species</b>                                      | <b>Percent cover in shrub circles</b> |          |          |          |          |          | <b>mean percent cover</b> |
|                                                     | <b>1</b>                              | <b>2</b> | <b>3</b> | <b>4</b> | <b>5</b> | <b>6</b> |                           |
| Menispermum canadense                               |                                       | 1        |          |          |          |          | 0.17                      |
| Parthenocissus sp.                                  | 1                                     | 1        | 1        | 1        | 4        | 1        | 1.50                      |
| Physocarpus opulifolius                             |                                       | 1        |          |          |          |          | 0.17                      |
| Rhamnus cathartica                                  | 10                                    | 20       | 40       | 20       | 35       | 20       | 24.17                     |
| Ribes hirtellum                                     | 5                                     | 5        | 8        | 1        | 5        | 4        | 4.67                      |
| Rubus idaeus ssp. strigosus                         | 1                                     |          |          |          |          |          | 0.17                      |
| Rubus occidentalis                                  |                                       |          |          |          | 1        | 1        | 0.33                      |
| Rubus pubescens                                     | 1                                     | 1        | 1        | 1        | 1        | 1        | 1.00                      |
| Sambucus sp.                                        |                                       |          | 1        | 1        |          |          | 0.33                      |
| Toxicodendron rydbergii                             | 1                                     |          | 1        |          |          |          | 0.33                      |
| Vitis riparia                                       | 1                                     | 1        |          |          |          |          | 0.33                      |
| Zanthoxylum americanum                              | 1                                     |          |          |          | 1        |          | 0.33                      |
| Number of Shrub Circles Not Sampled in Plot 5096: 0 |                                       |          |          |          |          |          |                           |

| <b>Plot: 5097</b>                                   |                                       |          |          |          |          |          |                           |
|-----------------------------------------------------|---------------------------------------|----------|----------|----------|----------|----------|---------------------------|
| <b>Species</b>                                      | <b>Percent cover in shrub circles</b> |          |          |          |          |          | <b>mean percent cover</b> |
|                                                     | <b>1</b>                              | <b>2</b> | <b>3</b> | <b>4</b> | <b>5</b> | <b>6</b> |                           |
| Cornus alternifolia                                 |                                       | 5        |          |          | 1        |          | 1.00                      |
| Euonymus atropurpurea                               |                                       |          |          |          | 3        |          | 0.50                      |
| Lonicera (exotic) sp.                               |                                       |          |          |          |          | 10       | 1.67                      |
| Menispermum canadense                               |                                       | 5        | 1        | 1        | 10       | 5        | 3.67                      |
| Parthenocissus sp.                                  | 1                                     |          |          | 1        |          | 1        | 0.50                      |
| Ribes cynosbati                                     |                                       |          |          |          | 1        | 10       | 1.83                      |
| Ribes hirtellum                                     |                                       | 5        | 4        | 4        | 10       | 25       | 8.00                      |
| Sambucus racemosa var. racemosa                     |                                       |          |          | 1        |          |          | 0.17                      |
| Smilax tamnoides                                    |                                       |          | 1        |          |          |          | 0.17                      |
| Toxicodendron radicans                              |                                       | 1        |          |          |          | 1        | 0.33                      |
| Vitis riparia                                       | 1                                     |          |          |          |          | 1        | 0.33                      |
| Number of Shrub Circles Not Sampled in Plot 5097: 0 |                                       |          |          |          |          |          |                           |

| <b>Plot: 5099</b>                                   |                                       |          |          |          |          |          |                           |
|-----------------------------------------------------|---------------------------------------|----------|----------|----------|----------|----------|---------------------------|
| <b>Species</b>                                      | <b>Percent cover in shrub circles</b> |          |          |          |          |          | <b>mean percent cover</b> |
|                                                     | <b>1</b>                              | <b>2</b> | <b>3</b> | <b>4</b> | <b>5</b> | <b>6</b> |                           |
| Menispermum canadense                               | 1                                     |          |          |          |          |          | 0.17                      |
| Parthenocissus sp.                                  | 1                                     |          | 1        |          |          |          | 0.33                      |
| Sambucus nigra ssp. canadensis                      | 1                                     |          | 1        |          |          |          | 0.33                      |
| Smilax tamnoides                                    | 1                                     |          |          |          |          |          | 0.17                      |
| Solanum dulcamara                                   |                                       | 1        |          |          |          |          | 0.17                      |
| Number of Shrub Circles Not Sampled in Plot 5099: 0 |                                       |          |          |          |          |          |                           |

| <b>Plot: 5104</b>                                   |                                       |          |          |          |          |          |                           |
|-----------------------------------------------------|---------------------------------------|----------|----------|----------|----------|----------|---------------------------|
| <b>Species</b>                                      | <b>Percent cover in shrub circles</b> |          |          |          |          |          | <b>mean percent cover</b> |
|                                                     | <b>1</b>                              | <b>2</b> | <b>3</b> | <b>4</b> | <b>5</b> | <b>6</b> |                           |
| Parthenocissus sp.                                  | 1                                     | 2        |          |          | 1        |          | 0.67                      |
| Rhamnus cathartica                                  | 2                                     | 5        |          | 1        | 1        |          | 1.50                      |
| Ribes hirtellum                                     |                                       | 1        |          |          |          |          | 0.17                      |
| Solanum dulcamara                                   |                                       |          |          |          | 1        |          | 0.17                      |
| Toxicodendron radicans                              |                                       | 1        |          |          |          |          | 0.17                      |
| Vitis riparia                                       | 1                                     | 1        |          | 1        | 1        | 5        | 1.50                      |
| Number of Shrub Circles Not Sampled in Plot 5104: 0 |                                       |          |          |          |          |          |                           |

| <b>Plot: 5106</b>                                   |                                       |          |          |          |          |          |                           |
|-----------------------------------------------------|---------------------------------------|----------|----------|----------|----------|----------|---------------------------|
| <b>Species</b>                                      | <b>Percent cover in shrub circles</b> |          |          |          |          |          | <b>mean percent cover</b> |
|                                                     | <b>1</b>                              | <b>2</b> | <b>3</b> | <b>4</b> | <b>5</b> | <b>6</b> |                           |
| Smilax tamnoides                                    | 1                                     |          |          |          |          |          | 0.17                      |
| Vitis riparia                                       |                                       |          |          |          | 2        |          | 0.33                      |
| Number of Shrub Circles Not Sampled in Plot 5106: 0 |                                       |          |          |          |          |          |                           |

| <b>Plot: 5111</b>                                   |                                       |          |          |          |          |          |                           |
|-----------------------------------------------------|---------------------------------------|----------|----------|----------|----------|----------|---------------------------|
| <b>Species</b>                                      | <b>Percent cover in shrub circles</b> |          |          |          |          |          | <b>mean percent cover</b> |
|                                                     | <b>1</b>                              | <b>2</b> | <b>3</b> | <b>4</b> | <b>5</b> | <b>6</b> |                           |
| Rhamnus cathartica                                  |                                       |          |          |          | 1        |          | 0.17                      |
| Vitis riparia                                       |                                       |          | 1        |          | 15       |          | 2.67                      |
| Number of Shrub Circles Not Sampled in Plot 5111: 0 |                                       |          |          |          |          |          |                           |

| <b>Plot: 5140</b>                                   |                                       |          |          |          |          |          |                           |
|-----------------------------------------------------|---------------------------------------|----------|----------|----------|----------|----------|---------------------------|
| <b>Species</b>                                      | <b>Percent cover in shrub circles</b> |          |          |          |          |          | <b>mean percent cover</b> |
|                                                     | <b>1</b>                              | <b>2</b> | <b>3</b> | <b>4</b> | <b>5</b> | <b>6</b> |                           |
| Cornus alternifolia                                 |                                       |          | 2        |          | 1        | 10       | 2.17                      |
| Euonymus atropurpurea                               |                                       |          | 1        | 1        |          |          | 0.33                      |
| Parthenocissus sp.                                  | 5                                     |          | 1        | 2        |          | 2        | 1.67                      |
| Rhamnus cathartica                                  |                                       |          |          | 1        | 5        | 10       | 2.67                      |
| Ribes hirtellum                                     |                                       | 2        | 1        | 2        |          |          | 0.83                      |
| Smilax tamnoides                                    | 1                                     |          | 1        | 1        | 1        | 1        | 0.83                      |
| Viburnum lantana                                    |                                       |          |          | 5        |          |          | 0.83                      |
| Viburnum lentago                                    |                                       |          | 10       |          |          |          | 1.67                      |
| Vitis riparia                                       | 1                                     |          | 1        |          |          |          | 0.33                      |
| Number of Shrub Circles Not Sampled in Plot 5140: 0 |                                       |          |          |          |          |          |                           |

| <b>Plot: 5142</b>                                   |                                       |          |          |          |          |          |                               |
|-----------------------------------------------------|---------------------------------------|----------|----------|----------|----------|----------|-------------------------------|
| <b>Species</b>                                      | <b>Percent cover in shrub circles</b> |          |          |          |          |          | <b>mean<br/>percent cover</b> |
|                                                     | <b>1</b>                              | <b>2</b> | <b>3</b> | <b>4</b> | <b>5</b> | <b>6</b> |                               |
| Menispermum canadense                               |                                       |          | 1        |          |          |          | 0.17                          |
| Sambucus nigra ssp. canadensis                      | 2                                     |          | 1        |          |          |          | 0.50                          |
| Vitis riparia                                       |                                       |          |          |          |          | 1        | 0.17                          |
| Number of Shrub Circles Not Sampled in Plot 5142: 0 |                                       |          |          |          |          |          |                               |

| <b>Plot: 5148</b>                                   |                                       |          |          |          |          |          |                               |
|-----------------------------------------------------|---------------------------------------|----------|----------|----------|----------|----------|-------------------------------|
| <b>Species</b>                                      | <b>Percent cover in shrub circles</b> |          |          |          |          |          | <b>mean<br/>percent cover</b> |
|                                                     | <b>1</b>                              | <b>2</b> | <b>3</b> | <b>4</b> | <b>5</b> | <b>6</b> |                               |
| Parthenocissus sp.                                  |                                       | 5        | 2        | 1        |          |          | 1.33                          |
| Rhamnus cathartica                                  | 10                                    | 35       | 1        |          | 1        |          | 7.83                          |
| Ribes americanum                                    |                                       |          | 2        |          |          |          | 0.33                          |
| Ribes hirtellum                                     | 10                                    | 1        | 20       |          |          |          | 5.17                          |
| Rubus occidentalis                                  |                                       | 1        |          |          |          |          | 0.17                          |
| Sambucus nigra ssp. canadensis                      |                                       |          | 1        |          |          |          | 0.17                          |
| Solanum dulcamara                                   |                                       | 1        |          |          |          |          | 0.17                          |
| Vitis riparia                                       | 1                                     | 1        |          |          |          |          | 0.33                          |
| Number of Shrub Circles Not Sampled in Plot 5148: 0 |                                       |          |          |          |          |          |                               |

# Frequency of Species in Groundlayer Quadrats

## Plot: 5002

| Species                             | Quadrat Frequency |     |     | Mean Quadrat Frequency |
|-------------------------------------|-------------------|-----|-----|------------------------|
|                                     | 1                 | 2   | 3   |                        |
| Acer negundo                        | 0.4               | 0.1 | 0.1 | 0.20                   |
| Anemone quinquefolia                | 0.0               | 0.0 | 0.3 | 0.10                   |
| Arisaema triphyllum                 | 0.7               | 0.9 | 0.6 | 0.73                   |
| Athyrium filix-femina ssp. angustum | 0.0               | 0.0 | 0.2 | 0.07                   |
| Boehmeria cylindrica                | 0.1               | 0.0 | 0.0 | 0.03                   |
| Caltha palustris                    | 0.0               | 0.0 | 0.1 | 0.03                   |
| Carex blanda                        | 0.3               | 0.3 | 0.1 | 0.23                   |
| Carex pedunculata                   | 0.2               | 0.1 | 0.1 | 0.13                   |
| Carex radiata                       | 0.1               | 0.1 | 0.0 | 0.07                   |
| Carex sp.                           | 0.0               | 0.1 | 0.1 | 0.07                   |
| Carya cordiformis                   | 0.1               | 0.4 | 0.8 | 0.43                   |
| Caulophyllum thalictroides          | 0.2               | 0.0 | 0.1 | 0.10                   |
| Celtis occidentalis                 | 0.6               | 0.3 | 0.1 | 0.33                   |
| Circaea lutetiana ssp. canadensis   | 1                 | 0.9 | 1   | 0.97                   |
| Cornus alternifolia                 | 0.0               | 0.0 | 0.1 | 0.03                   |
| Cystopteris fragilis                | 0.0               | 0.0 | 0.1 | 0.03                   |
| Fraxinus pennsylvanica              | 0.2               | 0.1 | 0.3 | 0.20                   |
| Galium aparine                      | 1                 | 1   | 1   | 1.00                   |
| Galium triflorum                    | 0.0               | 0.0 | 0.3 | 0.10                   |
| Geranium maculatum                  | 0.2               | 0.8 | 0.7 | 0.57                   |
| Geum sp.                            | 0.4               | 0.3 | 0.7 | 0.47                   |
| Hydrophyllum virginianum            | 0.0               | 0.7 | 0.2 | 0.30                   |
| Impatiens sp.                       | 0.2               | 0.0 | 0.0 | 0.07                   |
| Lonicera morrowii                   | 0.6               | 0.2 | 0.0 | 0.27                   |
| Maianthemum canadense               | 1                 | 0.0 | 0.3 | 0.43                   |
| Menispermum canadense               | 0.0               | 0.3 | 0.0 | 0.10                   |
| Osmorhiza claytonii                 | 0.4               | 0.0 | 0.0 | 0.13                   |
| Parthenocissus sp.                  | 0.3               | 0.5 | 0.4 | 0.40                   |
| Polygonatum biflorum                | 0.3               | 0.0 | 0.0 | 0.10                   |
| Prunus serotina                     | 0.3               | 0.0 | 0.0 | 0.10                   |
| Prunus virginiana                   | 0.1               | 0.0 | 0.2 | 0.10                   |
| Rhamnus cathartica                  | 0.6               | 0.5 | 0.4 | 0.50                   |
| Ribes cynosbati                     | 0.0               | 0.0 | 0.3 | 0.10                   |
| Ribes hirtellum                     | 0.9               | 0.8 | 0.6 | 0.77                   |
| Rubus occidentalis                  | 0.0               | 0.0 | 0.1 | 0.03                   |
| Rubus pubescens                     | 0.0               | 0.1 | 0.0 | 0.03                   |
| Sambucus nigra ssp. canadensis      | 0.0               | 0.0 | 0.2 | 0.07                   |
| Sambucus racemosa var. racemosa     | 0.2               | 0.0 | 0.0 | 0.07                   |
| Sanguinaria canadensis              | 0.2               | 0.1 | 0.1 | 0.13                   |
| Sanicula sp.                        | 0.0               | 0.5 | 0.0 | 0.17                   |
| Smilax tamnoides                    | 0.0               | 0.0 | 0.1 | 0.03                   |
| Solidago sp.                        | 0.3               | 0.2 | 0.0 | 0.17                   |
| Streptopus lanceolatus var. roseus  | 0.0               | 0.0 | 0.1 | 0.03                   |
| Thalictrum dioicum                  | 0.0               | 0.0 | 0.2 | 0.07                   |
| Ulmus rubra                         | 0.5               | 0.1 | 0.2 | 0.27                   |
| Viola pubescens                     | 0.0               | 0.7 | 0.0 | 0.23                   |
| Viola sp.                           | 0.5               | 0.0 | 0.9 | 0.47                   |

## Plot: 5004

| Species                           | Quadrat Frequency |     |     | Mean Quadrat Frequency |
|-----------------------------------|-------------------|-----|-----|------------------------|
|                                   | 1                 | 2   | 3   |                        |
| Acer negundo                      | 0.2               | 0.0 | 0.0 | 0.07                   |
| Alliaria petiolata                | 1                 | 0.2 | 0.0 | 0.40                   |
| Arctium minus                     | 0.3               | 0.2 | 0.0 | 0.17                   |
| Cardamine pensylvanica            | 0.1               | 0.1 | 0.1 | 0.10                   |
| Carex sp.                         | 0.1               | 0.0 | 0.0 | 0.03                   |
| Celtis occidentalis               | 0.1               | 0.0 | 0.0 | 0.03                   |
| Circaea lutetiana ssp. canadensis | 0.1               | 0.0 | 0.0 | 0.03                   |
| Fraxinus pennsylvanica            | 0.1               | 0.0 | 0.0 | 0.03                   |
| Galium triflorum                  | 0.1               | 0.0 | 0.0 | 0.03                   |
| Geum sp.                          | 0.2               | 0.0 | 0.0 | 0.07                   |
| Impatiens sp.                     | 0.3               | 0.0 | 0.0 | 0.10                   |
| Laportea canadensis               | 0.2               | 0.5 | 0.9 | 0.53                   |
| Lemna minor                       | 0.0               | 0.5 | 0.0 | 0.17                   |
| Parthenocissus sp.                | 0.6               | 0.2 | 0.0 | 0.27                   |
| Phalaris arundinacea              | 0.0               | 0.2 | 0.0 | 0.07                   |
| Poaceae fam.                      | 0.0               | 0.0 | 0.1 | 0.03                   |
| Rhamnus cathartica                | 0.8               | 0.1 | 0.0 | 0.30                   |
| Rubus occidentalis                | 0.0               | 0.1 | 0.0 | 0.03                   |
| Sanguinaria canadensis            | 0.2               | 0.0 | 0.0 | 0.07                   |
| Solidago sp.                      | 0.2               | 0.3 | 0.0 | 0.17                   |
| Stachys tenuifolia                | 0.0               | 0.2 | 0.0 | 0.07                   |
| Taraxacum officinale              | 0.1               | 0.0 | 0.0 | 0.03                   |
| Viola sp.                         | 0.2               | 0.0 | 0.0 | 0.07                   |
| Vitis riparia                     | 0.4               | 0.0 | 0.0 | 0.13                   |

**Plot: 5006**

| Species                            | Quadrat Frequency |     |     | Mean<br>Quadrat<br>Frequency |
|------------------------------------|-------------------|-----|-----|------------------------------|
|                                    | 1                 | 2   | 3   |                              |
| Acer saccharum                     | 0.0               | 0.1 | 0.1 | 0.07                         |
| Carex assiniboinensis              | 0.3               | 0.0 | 0.0 | 0.10                         |
| Carex blanda                       | 0.1               | 0.0 | 0.3 | 0.13                         |
| Carex pensylvanica                 | 0.0               | 0.1 | 0.0 | 0.03                         |
| Carya cordiformis                  | 0.0               | 0.3 | 0.0 | 0.10                         |
| Cerastium fontanum ssp. vulgare    | 0.0               | 0.0 | 0.1 | 0.03                         |
| Circaea lutetiana ssp. canadensis  | 0.1               | 0.1 | 0.0 | 0.07                         |
| Clematis virginiana                | 0.0               | 0.0 | 0.1 | 0.03                         |
| Erigeron sp.                       | 0.0               | 0.0 | 0.1 | 0.03                         |
| Euonymus atropurpurea              | 0.3               | 0.0 | 0.0 | 0.10                         |
| Fragaria vesca                     | 0.0               | 0.0 | 0.1 | 0.03                         |
| Fragaria virginiana                | 0.0               | 0.4 | 0.4 | 0.27                         |
| Fraxinus nigra                     | 0.0               | 0.0 | 0.1 | 0.03                         |
| Fraxinus pennsylvanica             | 0.7               | 0.0 | 0.2 | 0.30                         |
| Galium aparine                     | 0.0               | 0.2 | 0.0 | 0.07                         |
| Galium asprellum                   | 0.4               | 0.0 | 0.0 | 0.13                         |
| Galium trifidum                    | 0.0               | 0.0 | 0.2 | 0.07                         |
| Galium triflorum                   | 0.0               | 0.1 | 0.0 | 0.03                         |
| Geranium maculatum                 | 0.0               | 0.0 | 0.1 | 0.03                         |
| Geum laciniatum                    | 0.0               | 0.2 | 0.0 | 0.07                         |
| Geum sp.                           | 0.1               | 0.0 | 0.0 | 0.03                         |
| Hydrophyllum virginianum           | 0.1               | 0.4 | 0.1 | 0.20                         |
| Laportea canadensis                | 0.2               | 0.0 | 0.0 | 0.07                         |
| Lonicera (exotic) sp.              | 0.0               | 0.4 | 0.0 | 0.13                         |
| Medicago lupulina                  | 0.0               | 0.0 | 0.2 | 0.07                         |
| Menispermum canadense              | 0.1               | 0.0 | 0.0 | 0.03                         |
| Parthenocissus sp.                 | 0.7               | 1   | 0.3 | 0.67                         |
| Poa compressa                      | 0.0               | 0.0 | 0.4 | 0.13                         |
| Polygonatum biflorum               | 0.0               | 0.0 | 0.1 | 0.03                         |
| Prunus pensylvanica                | 0.0               | 0.3 | 0.0 | 0.10                         |
| Prunus virginiana                  | 0.0               | 0.0 | 0.1 | 0.03                         |
| Rhamnus cathartica                 | 0.9               | 1   | 1   | 0.97                         |
| Ribes hirtellum                    | 0.6               | 0.6 | 0.4 | 0.53                         |
| Rubus idaeus ssp. strigosus        | 0.1               | 0.1 | 0.1 | 0.10                         |
| Rubus occidentalis                 | 0.2               | 0.0 | 0.3 | 0.17                         |
| Sambucus nigra ssp. canadensis     | 0.1               | 0.0 | 0.0 | 0.03                         |
| Sicyos angulatus                   | 0.5               | 0.0 | 0.1 | 0.20                         |
| Smilax tamnoides                   | 0.1               | 0.0 | 0.0 | 0.03                         |
| Solidago sp.                       | 0.1               | 0.1 | 0.0 | 0.07                         |
| Streptopus lanceolatus var. roseus | 0.0               | 0.0 | 0.1 | 0.03                         |
| Taraxacum officinale               | 0.0               | 0.4 | 0.3 | 0.23                         |
| Tilia americana                    | 0.0               | 0.1 | 0.1 | 0.07                         |
| Verbascum thapsus                  | 0.0               | 0.0 | 0.2 | 0.07                         |
| Viola sp.                          | 0.2               | 0.0 | 0.3 | 0.17                         |
| Vitis riparia                      | 0.2               | 0.5 | 0.3 | 0.33                         |
| Zanthoxylum americanum             | 0.1               | 0.0 | 0.0 | 0.03                         |

**Plot: 5010**

| Species                     | Quadrat Frequency |     |     | Mean<br>Quadrat<br>Frequency |
|-----------------------------|-------------------|-----|-----|------------------------------|
|                             | 1                 | 2   | 3   |                              |
| Arctium minus               | 0.0               | 0.0 | 0.2 | 0.07                         |
| Bidens cernua               | 0.0               | 0.1 | 0.0 | 0.03                         |
| Boehmeria cylindrica        | 0.0               | 0.0 | 0.1 | 0.03                         |
| Impatiens sp.               | 0.0               | 0.2 | 0.0 | 0.07                         |
| Laportea canadensis         | 0.4               | 0.9 | 0.7 | 0.67                         |
| Menispermum canadense       | 0.0               | 0.0 | 0.2 | 0.07                         |
| Phalaris arundinacea        | 0.4               | 0.0 | 0.7 | 0.37                         |
| Ranunculus sp.              | 0.0               | 0.0 | 0.1 | 0.03                         |
| Rudbeckia laciniata         | 0.0               | 0.0 | 0.1 | 0.03                         |
| Rumex sp.                   | 0.0               | 0.0 | 0.1 | 0.03                         |
| Sanicula sp.                | 0.0               | 0.0 | 0.2 | 0.07                         |
| Scutellaria sp.             | 0.4               | 0.0 | 0.1 | 0.17                         |
| Smilax tamnoides            | 0.0               | 0.1 | 0.0 | 0.03                         |
| Solanum dulcamara           | 0.1               | 0.0 | 0.0 | 0.03                         |
| Solidago sp.                | 0.3               | 0.1 | 0.1 | 0.17                         |
| Ulmus rubra                 | 0.1               | 0.0 | 0.0 | 0.03                         |
| Urtica dioica ssp. gracilis | 0.1               | 0.0 | 0.0 | 0.03                         |

**Plot: 5016**

| Species                             | Quadrat Frequency |     |     | Mean<br>Quadrat<br>Frequency |
|-------------------------------------|-------------------|-----|-----|------------------------------|
|                                     | 1                 | 2   | 3   |                              |
| Alliaria petiolata                  | 0.1               | 0.3 | 0.0 | 0.13                         |
| Amphicarpaea bracteata              | 0.0               | 0.1 | 0.0 | 0.03                         |
| Boehmeria cylindrica                | 0.3               | 0.0 | 0.0 | 0.10                         |
| Bromus inermis                      | 0.1               | 0.0 | 0.0 | 0.03                         |
| Carex blanda                        | 0.1               | 0.0 | 0.0 | 0.03                         |
| Carex grisea                        | 0.2               | 0.0 | 0.0 | 0.07                         |
| Carex sp.                           | 0.0               | 0.3 | 0.0 | 0.10                         |
| Celtis occidentalis                 | 0.2               | 0.6 | 0.1 | 0.30                         |
| Circaea lutetiana ssp. canadensis   | 0.4               | 0.0 | 0.0 | 0.13                         |
| Cryptotaenia canadensis             | 0.2               | 0.4 | 0.0 | 0.20                         |
| Elymus sp.                          | 0.1               | 0.0 | 0.0 | 0.03                         |
| Elymus virginicus                   | 0.0               | 0.4 | 0.0 | 0.13                         |
| Fraxinus nigra                      | 0.0               | 0.0 | 0.1 | 0.03                         |
| Fraxinus pennsylvanica              | 0.2               | 0.0 | 0.1 | 0.10                         |
| Galium aparine                      | 0.6               | 0.3 | 0.1 | 0.33                         |
| Galium triflorum                    | 0.1               | 0.0 | 0.0 | 0.03                         |
| Geum sp.                            | 0.1               | 0.0 | 0.0 | 0.03                         |
| Glechoma hederacea                  | 0.8               | 1   | 0.6 | 0.80                         |
| Hackelia virginiana                 | 0.1               | 0.1 | 0.1 | 0.10                         |
| Heracleum sphondylium ssp. montanum | 0.0               | 0.7 | 0.1 | 0.27                         |
| Hydrophyllum virginianum            | 0.4               | 0.1 | 0.1 | 0.20                         |
| Impatiens sp.                       | 0.2               | 0.3 | 0.1 | 0.20                         |
| Laportea canadensis                 | 0.8               | 1   | 0.5 | 0.77                         |
| Leonurus cardiaca                   | 0.1               | 0.0 | 0.0 | 0.03                         |
| Lysimachia ciliata                  | 0.0               | 0.1 | 0.0 | 0.03                         |
| Oxalis sp.                          | 0.2               | 0.0 | 0.0 | 0.07                         |
| Parthenocissus sp.                  | 0.2               | 1   | 0.5 | 0.57                         |
| Phalaris arundinacea                | 0.1               | 0.0 | 0.0 | 0.03                         |
| Pilea sp.                           | 0.2               | 0.4 | 0.0 | 0.20                         |
| Plantago major                      | 0.0               | 0.0 | 0.1 | 0.03                         |
| Plantago rugelii                    | 0.2               | 0.0 | 0.1 | 0.10                         |
| Poa compressa                       | 0.0               | 0.0 | 0.2 | 0.07                         |
| Poa pratensis                       | 0.3               | 0.0 | 0.3 | 0.20                         |
| Poaceae fam.                        | 0.0               | 0.0 | 0.1 | 0.03                         |
| Polygonatum biflorum                | 0.2               | 0.0 | 0.3 | 0.17                         |
| Prunus serotina                     | 0.1               | 0.0 | 0.0 | 0.03                         |
| Prunus virginiana                   | 0.0               | 0.0 | 0.1 | 0.03                         |
| Ranunculus abortivus                | 0.0               | 0.0 | 0.1 | 0.03                         |
| Ranunculus sceleratus               | 0.1               | 0.0 | 0.0 | 0.03                         |
| Rhamnus cathartica                  | 0.6               | 0.3 | 0.5 | 0.47                         |
| Ribes hirtellum                     | 0.7               | 0.1 | 0.4 | 0.40                         |
| Rubus occidentalis                  | 0.3               | 0.3 | 0.1 | 0.23                         |
| Solidago sp.                        | 0.4               | 0.4 | 0.3 | 0.37                         |
| Stachys tenuifolia                  | 0.0               | 0.3 | 0.2 | 0.17                         |
| Taraxacum officinale                | 0.2               | 0.0 | 0.3 | 0.17                         |
| Viola sp.                           | 0.2               | 0.1 | 0.4 | 0.23                         |
| Vitis riparia                       | 0.5               | 0.6 | 0.2 | 0.43                         |
| Zanthoxylum americanum              | 0.1               | 0.0 | 0.4 | 0.17                         |

**Plot: 5018**

| Species                           | Quadrat Frequency |     |     | Mean<br>Quadrat<br>Frequency |
|-----------------------------------|-------------------|-----|-----|------------------------------|
|                                   | 1                 | 2   | 3   |                              |
| Actaea sp.                        | 0.0               | 0.1 | 0.0 | 0.03                         |
| Arisaema triphyllum               | 0.0               | 0.0 | 0.1 | 0.03                         |
| Asteraceae fam.                   | 0.1               | 0.0 | 0.0 | 0.03                         |
| Betula sp.                        | 0.1               | 0.1 | 0.0 | 0.07                         |
| Botrychium sp.                    | 0.1               | 0.0 | 0.0 | 0.03                         |
| Bromus inermis                    | 0.1               | 0.0 | 0.0 | 0.03                         |
| Carex blanda                      | 0.1               | 0.1 | 0.0 | 0.07                         |
| Carex pennsylvanica               | 0.2               | 0.1 | 0.1 | 0.13                         |
| Carya cordiformis                 | 0.3               | 0.1 | 0.1 | 0.17                         |
| Caulophyllum thalictroides        | 0.0               | 0.0 | 0.1 | 0.03                         |
| Cerastium sp.                     | 0.1               | 0.0 | 0.0 | 0.03                         |
| Circaea lutetiana ssp. canadensis | 0.1               | 0.1 | 0.1 | 0.10                         |
| Cornus alternifolia               | 0.1               | 0.0 | 0.1 | 0.07                         |
| Cornus racemosa                   | 0.4               | 0.1 | 0.0 | 0.17                         |
| Corylus americana                 | 0.0               | 0.0 | 0.1 | 0.03                         |
| Desmodium sp.                     | 0.0               | 0.0 | 0.2 | 0.07                         |
| Equisetum hyemale                 | 0.0               | 0.3 | 0.2 | 0.17                         |
| Equisetum pratense                | 0.0               | 0.1 | 0.0 | 0.03                         |
| Erigeron philadelphicus           | 0.0               | 0.1 | 0.0 | 0.03                         |
| Eurybia macrophylla               | 0.5               | 0.4 | 0.3 | 0.40                         |
| Fragaria virginiana               | 0.0               | 0.0 | 0.2 | 0.07                         |
| Fraxinus pennsylvanica            | 0.3               | 0.0 | 0.1 | 0.13                         |
| Galium triflorum                  | 0.2               | 0.1 | 0.2 | 0.17                         |
| Geranium maculatum                | 0.4               | 0.0 | 0.0 | 0.13                         |
| Hydrophyllum virginianum          | 0.1               | 0.1 | 0.0 | 0.07                         |
| Juniperus virginiana              | 0.0               | 0.0 | 0.2 | 0.07                         |
| Lonicera (exotic) sp.             | 0.6               | 0.7 | 0.8 | 0.70                         |
| Maianthemum racemosum             | 0.0               | 0.1 | 0.0 | 0.03                         |
| Maianthemum stellatum             | 0.0               | 0.0 | 0.1 | 0.03                         |
| Orchidaceae fam.                  | 0.1               | 0.0 | 0.0 | 0.03                         |
| Osmorhiza claytonii               | 0.0               | 0.0 | 0.1 | 0.03                         |
| Ostrya virginiana                 | 0.5               | 0.1 | 0.1 | 0.23                         |
| Oxalis sp.                        | 0.0               | 0.1 | 0.0 | 0.03                         |
| Parthenocissus sp.                | 0.5               | 0.6 | 0.8 | 0.63                         |
| Plantago rugelii                  | 0.1               | 0.1 | 0.1 | 0.10                         |
| Poa compressa                     | 0.2               | 0.0 | 0.1 | 0.10                         |
| Poa sp.                           | 0.0               | 0.1 | 0.1 | 0.07                         |
| Polygonatum biflorum              | 0.2               | 0.1 | 0.1 | 0.13                         |
| Populus tremuloides               | 0.0               | 0.1 | 0.0 | 0.03                         |
| Potentilla anserina ssp. anserina | 0.0               | 0.0 | 0.2 | 0.07                         |
| Prunus pensylvanica               | 0.0               | 0.2 | 0.1 | 0.10                         |
| Prunus sp.                        | 0.0               | 0.0 | 0.1 | 0.03                         |
| Prunus virginiana                 | 0.1               | 0.1 | 0.1 | 0.10                         |
| Quercus rubra                     | 0.2               | 0.0 | 0.0 | 0.07                         |
| Rhamnus cathartica                | 0.2               | 0.2 | 0.5 | 0.30                         |
| Ribes hirtellum                   | 0.1               | 0.2 | 0.1 | 0.13                         |
| Rubus occidentalis                | 0.1               | 0.0 | 0.0 | 0.03                         |
| Sanguinaria canadensis            | 0.7               | 0.1 | 0.0 | 0.27                         |
| Smilax sp.                        | 0.0               | 0.2 | 0.0 | 0.07                         |
| Smilax tamnoides                  | 0.2               | 0.1 | 0.3 | 0.20                         |
| Solidago sp.                      | 0.1               | 0.1 | 0.0 | 0.07                         |
| Taraxacum officinale              | 0.1               | 0.2 | 0.1 | 0.13                         |
| Tilia americana                   | 0.2               | 0.1 | 0.0 | 0.10                         |
| Toxicodendron radicans            | 0.4               | 0.1 | 0.0 | 0.17                         |
| Trifolium pratense                | 0.1               | 0.0 | 0.0 | 0.03                         |
| Trifolium repens                  | 0.0               | 0.0 | 0.1 | 0.03                         |
| Ulmus rubra                       | 0.2               | 0.0 | 0.0 | 0.07                         |

**Plot: 5018**

| Species                       | Quadrat Frequency |     |     | Mean<br>Quadrat<br>Frequency |
|-------------------------------|-------------------|-----|-----|------------------------------|
|                               | 1                 | 2   | 3   |                              |
| <i>Uvularia grandiflora</i>   | 0.0               | 0.2 | 0.0 | 0.07                         |
| <i>Verbascum thapsus</i>      | 0.0               | 0.0 | 0.1 | 0.03                         |
| <i>Vitis riparia</i>          | 0.3               | 0.0 | 0.3 | 0.20                         |
| <i>Zanthoxylum americanum</i> | 0.1               | 0.2 | 0.2 | 0.17                         |

**Plot: 5020**

| Species                                         | Quadrat Frequency |     |     | Mean<br>Quadrat<br>Frequency |
|-------------------------------------------------|-------------------|-----|-----|------------------------------|
|                                                 | 1                 | 2   | 3   |                              |
| <i>Acer negundo</i>                             | 0.4               | 0.2 | 0.1 | 0.23                         |
| <i>Actaea rubra</i>                             | 0.0               | 0.0 | 0.1 | 0.03                         |
| <i>Alliaria petiolata</i>                       | 0.0               | 0.0 | 0.1 | 0.03                         |
| <i>Amphicarpaea bracteata</i>                   | 0.0               | 0.5 | 0.2 | 0.23                         |
| <i>Arisaema triphyllum</i>                      | 0.1               | 0.5 | 0.5 | 0.37                         |
| <i>Boehmeria cylindrica</i>                     | 0.6               | 0.0 | 0.1 | 0.23                         |
| <i>Carex blanda</i>                             | 0.3               | 0.1 | 0.6 | 0.33                         |
| <i>Carex grisea</i>                             | 0.0               | 0.0 | 0.1 | 0.03                         |
| <i>Carex stipata</i>                            | 0.1               | 0.0 | 0.0 | 0.03                         |
| <i>Celtis occidentalis</i>                      | 0.1               | 0.2 | 0.2 | 0.17                         |
| <i>Circaea lutetiana</i> ssp. <i>canadensis</i> | 0.2               | 0.5 | 0.7 | 0.47                         |
| <i>Cornus amomum</i>                            | 0.6               | 0.0 | 0.0 | 0.20                         |
| <i>Cornus sericea</i>                           | 0.0               | 0.1 | 0.0 | 0.03                         |
| <i>Daucus carota</i>                            | 0.0               | 0.2 | 0.0 | 0.07                         |
| <i>Equisetum arvense</i>                        | 0.4               | 0.1 | 0.5 | 0.33                         |
| <i>Fraxinus nigra</i>                           | 0.2               | 1   | 0.8 | 0.67                         |
| <i>Fraxinus pennsylvanica</i>                   | 0.8               | 0.6 | 0.3 | 0.57                         |
| <i>Geranium maculatum</i>                       | 0.0               | 0.0 | 0.4 | 0.13                         |
| <i>Geum aleppicum</i>                           | 0.4               | 0.2 | 0.6 | 0.40                         |
| <i>Hesperis matronalis</i>                      | 0.0               | 0.0 | 0.1 | 0.03                         |
| <i>Hydrophyllum virginianum</i>                 | 0.0               | 0.6 | 0.8 | 0.47                         |
| <i>Impatiens</i> sp.                            | 0.8               | 0.8 | 0.1 | 0.57                         |
| <i>Laportea canadensis</i>                      | 0.0               | 0.0 | 0.2 | 0.07                         |
| <i>Leersia oryzoides</i>                        | 0.2               | 0.4 | 0.1 | 0.23                         |
| <i>Lonicera</i> (exotic) sp.                    | 0.0               | 0.0 | 0.1 | 0.03                         |
| <i>Lycopus uniflorus</i>                        | 0.1               | 0.0 | 0.0 | 0.03                         |
| <i>Maianthemum racemosum</i>                    | 0.0               | 0.0 | 0.2 | 0.07                         |
| <i>Maianthemum stellatum</i>                    | 0.0               | 0.0 | 0.3 | 0.10                         |
| <i>Menispermum canadense</i>                    | 0.0               | 0.1 | 0.0 | 0.03                         |
| <i>Oxalis stricta</i>                           | 0.0               | 0.1 | 0.0 | 0.03                         |
| <i>Parthenocissus</i> sp.                       | 0.6               | 0.6 | 0.6 | 0.60                         |
| <i>Phalaris arundinacea</i>                     | 1                 | 0.1 | 0.0 | 0.37                         |
| <i>Plantago major</i>                           | 0.0               | 0.0 | 0.1 | 0.03                         |
| Poaceae fam.                                    | 0.0               | 0.2 | 0.0 | 0.07                         |
| <i>Prunus virginiana</i>                        | 0.0               | 0.0 | 0.2 | 0.07                         |
| <i>Rhamnus cathartica</i>                       | 0.2               | 0.6 | 1   | 0.60                         |
| <i>Ribes americanum</i>                         | 0.0               | 0.1 | 0.4 | 0.17                         |
| <i>Ribes hirtellum</i>                          | 0.0               | 0.0 | 0.1 | 0.03                         |
| <i>Sanguinaria canadensis</i>                   | 0.0               | 0.0 | 0.2 | 0.07                         |
| <i>Smilax tamnoides</i>                         | 0.0               | 0.0 | 0.2 | 0.07                         |
| <i>Solidago</i> sp.                             | 0.4               | 0.3 | 0.5 | 0.40                         |
| <i>Taraxacum officinale</i>                     | 0.0               | 0.0 | 0.1 | 0.03                         |
| <i>Tilia americana</i>                          | 0.0               | 0.1 | 0.1 | 0.07                         |
| <i>Ulmus rubra</i>                              | 0.1               | 0.1 | 0.0 | 0.07                         |
| <i>Viburnum lentago</i>                         | 0.0               | 0.1 | 0.1 | 0.07                         |
| <i>Viola</i> sp.                                | 0.1               | 0.0 | 0.0 | 0.03                         |
| <i>Vitis riparia</i>                            | 0.5               | 0.8 | 0.2 | 0.50                         |

**Plot: 5021**

| Species                     | Quadrat Frequency |     |     | Mean Quadrat Frequency |
|-----------------------------|-------------------|-----|-----|------------------------|
|                             | 1                 | 2   | 3   |                        |
| Arctium minus               | 0.1               | 0.0 | 0.0 | 0.03                   |
| Carex sp.                   | 0.1               | 0.0 | 0.0 | 0.03                   |
| Glechoma hederacea          | 0.1               | 0.0 | 0.1 | 0.07                   |
| Impatiens sp.               | 0.5               | 0.0 | 0.2 | 0.23                   |
| Laportea canadensis         | 0.7               | 0.0 | 0.6 | 0.43                   |
| Lemna minor                 | 0.0               | 1   | 0.3 | 0.43                   |
| Lycopus sp.                 | 0.0               | 0.0 | 0.1 | 0.03                   |
| Lysimachia ciliata          | 0.0               | 0.1 | 0.0 | 0.03                   |
| Phalaris arundinacea        | 0.4               | 0.0 | 0.0 | 0.13                   |
| Ranunculus sp.              | 0.1               | 0.0 | 0.0 | 0.03                   |
| Rhamnus cathartica          | 0.0               | 0.0 | 0.1 | 0.03                   |
| Solidago sp.                | 0.1               | 0.0 | 0.2 | 0.10                   |
| Urtica dioica ssp. gracilis | 0.1               | 0.0 | 0.0 | 0.03                   |
| Veronica sp.                | 0.0               | 0.1 | 0.0 | 0.03                   |
| Viola sp.                   | 0.4               | 0.0 | 0.0 | 0.13                   |

**Plot: 5022**

| Species                | Quadrat Frequency |     |     | Mean Quadrat Frequency |
|------------------------|-------------------|-----|-----|------------------------|
|                        | 1                 | 2   | 3   |                        |
| Acer saccharinum       | 0.0               | 0.0 | 0.1 | 0.03                   |
| Boehmeria cylindrica   | 0.0               | 0.0 | 0.2 | 0.07                   |
| Carex sp.              | 0.1               | 0.1 | 0.0 | 0.07                   |
| Celtis occidentalis    | 0.1               | 0.0 | 0.1 | 0.07                   |
| Fraxinus pennsylvanica | 0.6               | 0.3 | 0.1 | 0.33                   |
| Impatiens sp.          | 0.1               | 0.0 | 0.0 | 0.03                   |
| Laportea canadensis    | 0.8               | 0.6 | 0.1 | 0.50                   |
| Lemna minor            | 0.1               | 0.1 | 0.6 | 0.27                   |
| Lysimachia nummularia  | 0.0               | 0.1 | 0.4 | 0.17                   |
| Phalaris arundinacea   | 0.0               | 0.3 | 0.8 | 0.37                   |
| Rhamnus cathartica     | 0.0               | 0.0 | 0.2 | 0.07                   |
| Solidago sp.           | 0.3               | 0.0 | 0.7 | 0.33                   |
| Ulmus rubra            | 0.1               | 0.2 | 0.9 | 0.40                   |
| Viola sp.              | 0.2               | 0.2 | 0.2 | 0.20                   |
| Vitis riparia          | 0.6               | 0.5 | 0.8 | 0.63                   |

**Plot: 5030**

| Species              | Quadrat Frequency |     |     | Mean Quadrat Frequency |
|----------------------|-------------------|-----|-----|------------------------|
|                      | 1                 | 2   | 3   |                        |
| Asteraceae fam.      | 0.1               | 0.0 | 0.0 | 0.03                   |
| Calystegia sepium    | 0.1               | 0.0 | 0.0 | 0.03                   |
| Cucurbitaceae fam.   | 0.3               | 0.1 | 0.0 | 0.13                   |
| Laportea canadensis  | 0.7               | 0.2 | 0.0 | 0.30                   |
| Phalaris arundinacea | 0.4               | 0.7 | 0.0 | 0.37                   |
| Stachys palustris    | 0.1               | 0.1 | 0.0 | 0.07                   |

**Plot: 5031**

| Species                           | Quadrat Frequency |     |     | Mean Quadrat Frequency |
|-----------------------------------|-------------------|-----|-----|------------------------|
|                                   | 1                 | 2   | 3   |                        |
| Actaea sp.                        | 0.1               | 0.0 | 0.0 | 0.03                   |
| Amelanchier Group 2 sp.           | 0.0               | 0.0 | 0.1 | 0.03                   |
| Amphicarpaea bracteata            | 0.1               | 0.0 | 0.1 | 0.07                   |
| Arctium minus                     | 0.0               | 0.0 | 0.1 | 0.03                   |
| Carex pennsylvanica               | 0.0               | 0.1 | 0.3 | 0.13                   |
| Carex rosea                       | 0.0               | 0.0 | 0.1 | 0.03                   |
| Celtis occidentalis               | 0.0               | 0.2 | 0.0 | 0.07                   |
| Circaea lutetiana ssp. canadensis | 0.7               | 0.6 | 0.7 | 0.67                   |
| Desmodium glutinosum              | 0.0               | 0.0 | 0.1 | 0.03                   |
| Fraxinus pennsylvanica            | 0.0               | 0.1 | 0.1 | 0.07                   |
| Galium aparine                    | 0.1               | 0.0 | 0.0 | 0.03                   |
| Galium trifidum                   | 0.1               | 0.3 | 0.2 | 0.20                   |
| Geum sp.                          | 0.0               | 0.1 | 0.1 | 0.07                   |
| Hackelia virginiana               | 0.0               | 0.1 | 0.0 | 0.03                   |
| Lonicera (exotic) sp.             | 0.0               | 0.0 | 0.2 | 0.07                   |
| Maianthemum canadense             | 0.1               | 0.1 | 0.0 | 0.07                   |
| Oxalis stricta                    | 0.1               | 0.0 | 0.0 | 0.03                   |
| Parthenocissus sp.                | 0.7               | 0.8 | 0.7 | 0.73                   |
| Pilea sp.                         | 0.0               | 0.1 | 0.1 | 0.07                   |
| Plantago rugelii                  | 0.0               | 0.0 | 0.1 | 0.03                   |
| Poa pratensis                     | 0.0               | 0.0 | 0.1 | 0.03                   |
| Polygonatum biflorum              | 0.0               | 0.0 | 0.2 | 0.07                   |
| Populus tremuloides               | 0.0               | 0.1 | 0.0 | 0.03                   |
| Prunus serotina                   | 0.3               | 0.4 | 0.6 | 0.43                   |
| Pyrola elliptica                  | 0.0               | 0.1 | 0.0 | 0.03                   |
| Quercus rubra                     | 0.0               | 0.0 | 0.1 | 0.03                   |
| Ranunculus abortivus              | 0.0               | 0.0 | 0.1 | 0.03                   |
| Rhamnus cathartica                | 1                 | 1   | 1   | 1.00                   |
| Ribes hirtellum                   | 0.3               | 0.6 | 0.3 | 0.40                   |
| Rubus occidentalis                | 0.1               | 0.1 | 0.1 | 0.10                   |
| Solidago sp.                      | 0.0               | 0.3 | 0.1 | 0.13                   |
| Symphoricarpos occidentalis       | 0.0               | 0.0 | 0.1 | 0.03                   |
| Taraxacum officinale              | 0.0               | 0.0 | 0.1 | 0.03                   |
| Ulmus americana                   | 0.0               | 0.0 | 0.1 | 0.03                   |
| Viola sp.                         | 0.2               | 0.2 | 0.0 | 0.13                   |
| Vitis riparia                     | 0.2               | 0.0 | 0.4 | 0.20                   |
| Zanthoxylum americanum            | 0.0               | 0.1 | 0.0 | 0.03                   |

**Plot: 5033**

| Species                           | Quadrat Frequency |     |     | Mean Quadrat Frequency |
|-----------------------------------|-------------------|-----|-----|------------------------|
|                                   | 1                 | 2   | 3   |                        |
| Acer negundo                      | 0.2               | 0.0 | 0.0 | 0.07                   |
| Arctium minus                     | 0.8               | 0.6 | 0.2 | 0.53                   |
| Arisaema triphyllum               | 0.2               | 0.0 | 0.0 | 0.07                   |
| Cannabis sativa                   | 0.8               | 0.1 | 0.0 | 0.30                   |
| Carya cordiformis                 | 0.0               | 0.1 | 0.0 | 0.03                   |
| Celtis occidentalis               | 0.3               | 0.5 | 0.0 | 0.27                   |
| Chenopodium album                 | 0.1               | 0.1 | 0.0 | 0.07                   |
| Chenopodium simplex               | 0.1               | 0.0 | 0.0 | 0.03                   |
| Circaea lutetiana ssp. canadensis | 0.3               | 0.7 | 0.1 | 0.37                   |
| Cirsium altissimum                | 0.3               | 0.0 | 0.0 | 0.10                   |
| Fallopia convolvulus              | 0.1               | 0.1 | 0.0 | 0.07                   |
| Galium aparine                    | 0.4               | 0.4 | 0.0 | 0.27                   |
| Galium trifidum                   | 0.2               | 0.4 | 0.1 | 0.23                   |
| Geum sp.                          | 0.2               | 0.5 | 0.0 | 0.23                   |
| Glechoma hederacea                | 0.0               | 0.2 | 0.0 | 0.07                   |
| Hackelia virginiana               | 0.1               | 0.0 | 0.0 | 0.03                   |
| Impatiens sp.                     | 0.4               | 0.0 | 0.0 | 0.13                   |
| Leonurus cardiaca                 | 0.4               | 0.2 | 0.0 | 0.20                   |
| Lonicera morrowii                 | 0.3               | 0.3 | 0.3 | 0.30                   |
| Nepeta cataria                    | 0.1               | 0.1 | 0.0 | 0.07                   |
| Parthenocissus sp.                | 0.5               | 0.3 | 0.0 | 0.27                   |
| Pilea pumila                      | 0.7               | 0.4 | 0.0 | 0.37                   |
| Poaceae fam.                      | 0.0               | 0.1 | 0.0 | 0.03                   |
| Prunus serotina                   | 0.4               | 0.1 | 0.1 | 0.20                   |
| Prunus virginiana                 | 0.1               | 0.0 | 0.1 | 0.07                   |
| Ranunculus abortivus              | 0.1               | 0.1 | 0.0 | 0.07                   |
| Rhamnus cathartica                | 0.8               | 1   | 0.9 | 0.90                   |
| Ribes hirtellum                   | 0.6               | 0.6 | 0.2 | 0.47                   |
| Rubus idaeus ssp. strigosus       | 0.2               | 0.4 | 0.0 | 0.20                   |
| Sicyos angulatus                  | 0.1               | 0.0 | 0.0 | 0.03                   |
| Solidago sp.                      | 0.1               | 0.3 | 0.0 | 0.13                   |
| Ulmus rubra                       | 0.1               | 0.1 | 0.0 | 0.07                   |
| Viola sp.                         | 0.4               | 0.6 | 0.0 | 0.33                   |
| Vitis riparia                     | 0.4               | 0.3 | 0.2 | 0.30                   |

**Plot: 5034**

| Species                        | Quadrat Frequency |     |     | Mean Quadrat Frequency |
|--------------------------------|-------------------|-----|-----|------------------------|
|                                | 1                 | 2   | 3   |                        |
| Bidens frondosa                | 0.1               | 0.0 | 0.0 | 0.03                   |
| Cicuta maculata                | 0.0               | 0.1 | 0.0 | 0.03                   |
| Impatiens sp.                  | 0.0               | 0.3 | 0.0 | 0.10                   |
| Laportea canadensis            | 1                 | 0.9 | 1   | 0.97                   |
| Oxalis sp.                     | 0.1               | 0.0 | 0.0 | 0.03                   |
| Pilea sp.                      | 0.3               | 0.1 | 0.0 | 0.13                   |
| Poaceae fam.                   | 0.1               | 0.0 | 0.3 | 0.13                   |
| Rudbeckia laciniata            | 0.2               | 0.0 | 0.0 | 0.07                   |
| Sagittaria latifolia           | 0.1               | 0.0 | 0.0 | 0.03                   |
| Sambucus nigra ssp. canadensis | 0.1               | 0.0 | 0.0 | 0.03                   |
| Sicyos angulatus               | 0.2               | 0.1 | 0.0 | 0.10                   |
| Ulmus rubra                    | 0.1               | 0.0 | 0.0 | 0.03                   |
| Vitis riparia                  | 0.1               | 0.0 | 0.3 | 0.13                   |

**Plot: 5035**

| Species                   | Quadrat Frequency |     |     | Mean Quadrat Frequency |
|---------------------------|-------------------|-----|-----|------------------------|
|                           | 1                 | 2   | 3   |                        |
| Bidens connata            | 0.0               | 0.2 | 0.0 | 0.07                   |
| Celtis occidentalis       | 0.3               | 0.0 | 0.0 | 0.10                   |
| Fraxinus nigra            | 0.2               | 0.0 | 0.0 | 0.07                   |
| Impatiens sp.             | 0.1               | 0.0 | 0.1 | 0.07                   |
| Laportea canadensis       | 1                 | 0.9 | 1   | 0.97                   |
| Lysimachia ciliata        | 0.1               | 0.0 | 0.0 | 0.03                   |
| Matteuccia struthiopteris | 0.3               | 0.0 | 0.0 | 0.10                   |
| Menispermum canadense     | 0.5               | 0.0 | 0.0 | 0.17                   |
| Parthenocissus sp.        | 0.1               | 0.0 | 0.0 | 0.03                   |
| Poaceae fam.              | 0.1               | 0.1 | 0.0 | 0.07                   |
| Rudbeckia laciniata       | 0.2               | 0.0 | 0.0 | 0.07                   |
| Smilax tamnoides          | 0.2               | 0.0 | 0.0 | 0.07                   |
| Viola sp.                 | 0.1               | 0.0 | 0.0 | 0.03                   |

**Plot: 5038**

| Species                           | Quadrat Frequency |     |     | Mean Quadrat Frequency |
|-----------------------------------|-------------------|-----|-----|------------------------|
|                                   | 1                 | 2   | 3   |                        |
| Acer negundo                      | 0.1               | 0.0 | 0.0 | 0.03                   |
| Alliaria petiolata                | 0.1               | 0.0 | 0.0 | 0.03                   |
| Celtis occidentalis               | 0.0               | 0.1 | 0.0 | 0.03                   |
| Circaea lutetiana ssp. canadensis | 0.0               | 0.2 | 0.0 | 0.07                   |
| Fraxinus pennsylvanica            | 0.0               | 0.1 | 0.0 | 0.03                   |
| Impatiens sp.                     | 0.5               | 0.5 | 0.4 | 0.47                   |
| Laportea canadensis               | 1                 | 1   | 1   | 1.00                   |
| Lycopus sp.                       | 0.1               | 0.0 | 0.0 | 0.03                   |
| Menispermum canadense             | 0.4               | 0.1 | 0.0 | 0.17                   |
| Parthenocissus sp.                | 0.1               | 0.0 | 0.0 | 0.03                   |
| Phalaris arundinacea              | 0.2               | 0.0 | 0.0 | 0.07                   |
| Rhamnus cathartica                | 0.1               | 0.0 | 0.0 | 0.03                   |
| Rudbeckia laciniata               | 0.2               | 0.0 | 0.0 | 0.07                   |
| Sanicula sp.                      | 0.1               | 0.0 | 0.0 | 0.03                   |
| Solidago sp.                      | 0.1               | 0.0 | 0.0 | 0.03                   |
| Viola sp.                         | 0.3               | 0.5 | 0.3 | 0.37                   |

**Plot: 5039**

| Species                             | Quadrat Frequency |     |     | Mean<br>Quadrat<br>Frequency |
|-------------------------------------|-------------------|-----|-----|------------------------------|
|                                     | 1                 | 2   | 3   |                              |
| Alliaria petiolata                  | 0.4               | 0.8 | 0.6 | 0.60                         |
| Amphicarpaea bracteata              | 1                 | 0.4 | 0.4 | 0.60                         |
| Athyrium filix-femina ssp. angustum | 0.0               | 0.1 | 0.0 | 0.03                         |
| Brachyelytrum erectum               | 0.0               | 0.1 | 0.0 | 0.03                         |
| Calamagrostis canadensis            | 0.0               | 0.0 | 0.1 | 0.03                         |
| Carex pensylvanica                  | 0.2               | 0.0 | 0.0 | 0.07                         |
| Carex projecta                      | 0.1               | 0.0 | 0.1 | 0.07                         |
| Carex rosea                         | 0.0               | 0.1 | 0.0 | 0.03                         |
| Carex sp.                           | 0.1               | 0.1 | 0.0 | 0.07                         |
| Celtis occidentalis                 | 0.0               | 0.0 | 0.1 | 0.03                         |
| Circaea lutetiana ssp. canadensis   | 0.2               | 0.3 | 0.1 | 0.20                         |
| Desmodium glutinosum                | 0.7               | 0.7 | 0.5 | 0.63                         |
| Fraxinus nigra                      | 0.0               | 0.0 | 0.2 | 0.07                         |
| Fraxinus pennsylvanica              | 0.2               | 0.1 | 0.1 | 0.13                         |
| Galium aparine                      | 0.3               | 0.2 | 0.0 | 0.17                         |
| Galium trifidum                     | 0.0               | 0.1 | 0.1 | 0.07                         |
| Galium triflorum                    | 0.4               | 0.0 | 0.0 | 0.13                         |
| Geranium maculatum                  | 0.8               | 0.6 | 0.9 | 0.77                         |
| Geum sp.                            | 0.4               | 0.2 | 0.1 | 0.23                         |
| Hackelia virginiana                 | 0.0               | 0.2 | 0.0 | 0.07                         |
| Menispermum canadense               | 0.0               | 0.1 | 0.0 | 0.03                         |
| Moehringia lateriflora              | 0.0               | 0.0 | 0.2 | 0.07                         |
| Oxalis stricta                      | 0.0               | 0.0 | 0.1 | 0.03                         |
| Parthenocissus quinquefolia         | 0.1               | 0.0 | 0.0 | 0.03                         |
| Parthenocissus sp.                  | 0.3               | 0.1 | 0.2 | 0.20                         |
| Pilea sp.                           | 0.0               | 0.1 | 0.0 | 0.03                         |
| Poa sp.                             | 0.1               | 0.0 | 0.0 | 0.03                         |
| Poaceae fam.                        | 0.0               | 0.0 | 0.1 | 0.03                         |
| Populus tremuloides                 | 0.2               | 0.0 | 0.0 | 0.07                         |
| Potentilla simplex                  | 0.2               | 0.0 | 0.0 | 0.07                         |
| Prunus serotina                     | 0.3               | 0.1 | 0.2 | 0.20                         |
| Prunus virginiana                   | 0.1               | 0.2 | 0.0 | 0.10                         |
| Quercus rubra                       | 0.1               | 0.1 | 0.0 | 0.07                         |
| Ranunculus abortivus                | 0.1               | 0.2 | 0.0 | 0.10                         |
| Rhamnus cathartica                  | 0.4               | 0.1 | 0.2 | 0.23                         |
| Ribes hirtellum                     | 0.2               | 0.6 | 0.2 | 0.33                         |
| Rubus occidentalis                  | 0.5               | 0.2 | 0.0 | 0.23                         |
| Rubus pensilvanicus                 | 0.2               | 0.2 | 0.1 | 0.17                         |
| Solidago sp.                        | 0.3               | 0.3 | 0.0 | 0.20                         |
| Thalictrum thalictroides            | 0.5               | 0.5 | 0.6 | 0.53                         |
| Toxicodendron rydbergii             | 0.0               | 0.2 | 0.0 | 0.07                         |
| Ulmus rubra                         | 0.1               | 0.0 | 0.0 | 0.03                         |
| Uvularia sessilifolia               | 0.0               | 0.2 | 0.0 | 0.07                         |
| Viola sp.                           | 0.0               | 0.1 | 0.0 | 0.03                         |
| Vitis riparia                       | 0.3               | 0.1 | 0.2 | 0.20                         |

**Plot: 5042**

| Species             | Quadrat Frequency |     |     | Mean<br>Quadrat<br>Frequency |
|---------------------|-------------------|-----|-----|------------------------------|
|                     | 1                 | 2   | 3   |                              |
| Laportea canadensis | 1                 | 0.0 | 0.0 | 0.33                         |
| Rudbeckia laciniata | 0.3               | 0.0 | 0.0 | 0.10                         |
| Viola sp.           | 0.1               | 0.0 | 0.0 | 0.03                         |

**Plot: 5052**

| Species                           | Quadrat Frequency |     |     | Mean<br>Quadrat<br>Frequency |
|-----------------------------------|-------------------|-----|-----|------------------------------|
|                                   | 1                 | 2   | 3   |                              |
| Acer negundo                      | 0.1               | 0.0 | 0.0 | 0.03                         |
| Cardamine pensylvanica            | 0.4               | 0.0 | 0.0 | 0.13                         |
| Carex grisea                      | 0.1               | 0.0 | 0.0 | 0.03                         |
| Circaea lutetiana ssp. canadensis | 0.6               | 0.0 | 0.0 | 0.20                         |
| Fraxinus pennsylvanica            | 0.3               | 0.0 | 0.0 | 0.10                         |
| Geum sp.                          | 0.1               | 0.0 | 0.0 | 0.03                         |
| Laportea canadensis               | 0.4               | 0.0 | 0.0 | 0.13                         |
| Lemna minor                       | 0.0               | 1   | 0.0 | 0.33                         |
| Parthenocissus sp.                | 0.2               | 0.0 | 0.0 | 0.07                         |
| Poaceae fam.                      | 0.4               | 0.0 | 0.0 | 0.13                         |
| Rhamnus cathartica                | 0.4               | 0.0 | 0.0 | 0.13                         |
| Ribes americanum                  | 0.1               | 0.0 | 0.0 | 0.03                         |
| Rudbeckia laciniata               | 0.1               | 0.0 | 0.0 | 0.03                         |
| Ulmus rubra                       | 0.1               | 0.1 | 0.0 | 0.07                         |
| Viola sp.                         | 0.2               | 0.0 | 0.0 | 0.07                         |
| Vitis riparia                     | 0.1               | 0.0 | 0.0 | 0.03                         |

**Plot: 5056**

| Species                     | Quadrat Frequency |     |     | Mean<br>Quadrat<br>Frequency |
|-----------------------------|-------------------|-----|-----|------------------------------|
|                             | 1                 | 2   | 3   |                              |
| Acer negundo                | 0.1               | 0.0 | 0.0 | 0.03                         |
| Alliaria petiolata          | 0.4               | 0.4 | 0.5 | 0.43                         |
| Amaranthus retroflexus      | 0.1               | 0.0 | 0.0 | 0.03                         |
| Amphicarpaea bracteata      | 0.0               | 0.1 | 0.0 | 0.03                         |
| Arctium minus               | 0.5               | 0.4 | 0.7 | 0.53                         |
| Asteraceae fam.             | 0.2               | 0.0 | 0.0 | 0.07                         |
| Cardamine impatiens         | 0.5               | 0.4 | 0.3 | 0.40                         |
| Carex sp.                   | 0.1               | 0.2 | 0.0 | 0.10                         |
| Celtis occidentalis         | 0.1               | 0.2 | 0.0 | 0.10                         |
| Cryptotaenia canadensis     | 0.0               | 0.1 | 0.0 | 0.03                         |
| Fraxinus pennsylvanica      | 0.0               | 0.1 | 0.2 | 0.10                         |
| Glechoma hederacea          | 0.6               | 0.1 | 0.0 | 0.23                         |
| Impatiens sp.               | 0.3               | 0.1 | 0.0 | 0.13                         |
| Laportea canadensis         | 0.1               | 0.6 | 0.3 | 0.33                         |
| Oxalis stricta              | 0.0               | 0.1 | 0.0 | 0.03                         |
| Parthenocissus sp.          | 0.5               | 0.4 | 0.2 | 0.37                         |
| Poa sp.                     | 0.0               | 0.1 | 0.0 | 0.03                         |
| Poaceae fam.                | 0.3               | 0.0 | 0.0 | 0.10                         |
| Rhamnus cathartica          | 0.2               | 0.3 | 0.5 | 0.33                         |
| Ribes americanum            | 0.0               | 0.1 | 0.0 | 0.03                         |
| Rudbeckia laciniata         | 0.0               | 0.1 | 0.0 | 0.03                         |
| Sicyos angulatus            | 0.0               | 0.0 | 0.2 | 0.07                         |
| Stachys palustris           | 0.1               | 0.0 | 0.0 | 0.03                         |
| Thalictrum dioicum          | 0.0               | 0.1 | 0.0 | 0.03                         |
| Ulmus rubra                 | 0.0               | 0.1 | 0.0 | 0.03                         |
| Urtica dioica ssp. gracilis | 0.0               | 0.0 | 0.2 | 0.07                         |
| Viola sp.                   | 0.3               | 0.4 | 0.0 | 0.23                         |
| Vitis riparia               | 0.1               | 0.4 | 0.0 | 0.17                         |

**Plot: 5073**

| Species                           | Quadrat Frequency |     |     | Mean Quadrat Frequency |
|-----------------------------------|-------------------|-----|-----|------------------------|
|                                   | 1                 | 2   | 3   |                        |
| Acalypha rhomboidea               | 0.0               | 0.4 | 0.4 | 0.27                   |
| Alliaria petiolata                | 0.3               | 0.2 | 0.2 | 0.23                   |
| Amphicarpaea bracteata            | 0.8               | 0.5 | 0.5 | 0.60                   |
| Calystegia sepium                 | 0.1               | 0.0 | 0.0 | 0.03                   |
| Carex blanda                      | 0.2               | 0.1 | 0.1 | 0.13                   |
| Carex pensylvanica                | 0.1               | 0.0 | 0.0 | 0.03                   |
| Carex radiata                     | 0.0               | 0.0 | 0.1 | 0.03                   |
| Carex spengelii                   | 0.1               | 0.3 | 0.1 | 0.17                   |
| Carya cordiformis                 | 0.5               | 0.0 | 0.1 | 0.20                   |
| Celtis occidentalis               | 0.8               | 0.3 | 0.4 | 0.50                   |
| Chenopodium album                 | 0.0               | 0.0 | 0.1 | 0.03                   |
| Circaea lutetiana ssp. canadensis | 0.7               | 0.9 | 0.4 | 0.67                   |
| Desmodium canadense               | 0.1               | 0.1 | 0.0 | 0.07                   |
| Fraxinus pennsylvanica            | 0.1               | 0.1 | 0.0 | 0.07                   |
| Galium aparine                    | 0.6               | 0.3 | 0.1 | 0.33                   |
| Galium trifidum                   | 0.8               | 0.3 | 0.1 | 0.40                   |
| Geum sp.                          | 0.5               | 0.4 | 0.1 | 0.33                   |
| Gymnocladus dioicus               | 0.0               | 0.1 | 0.2 | 0.10                   |
| Hackelia virginiana               | 0.6               | 0.2 | 0.5 | 0.43                   |
| Impatiens sp.                     | 0.1               | 0.0 | 0.0 | 0.03                   |
| Laportea canadensis               | 0.1               | 0.0 | 0.1 | 0.07                   |
| Lonicera (exotic) sp.             | 0.2               | 0.2 | 0.0 | 0.13                   |
| Osmorhiza claytonii               | 0.1               | 0.0 | 0.2 | 0.10                   |
| Oxalis stricta                    | 0.0               | 0.1 | 0.1 | 0.07                   |
| Parthenocissus sp.                | 0.8               | 0.3 | 0.5 | 0.53                   |
| Pilea sp.                         | 0.8               | 0.9 | 1   | 0.90                   |
| Poa compressa                     | 0.1               | 0.0 | 0.0 | 0.03                   |
| Poaceae fam.                      | 0.1               | 0.0 | 0.0 | 0.03                   |
| Polygonatum biflorum              | 0.0               | 0.0 | 0.1 | 0.03                   |
| Prunus serotina                   | 0.5               | 0.0 | 0.3 | 0.27                   |
| Prunus virginiana                 | 0.3               | 0.1 | 0.1 | 0.17                   |
| Rhamnus cathartica                | 0.6               | 0.2 | 0.2 | 0.33                   |
| Ribes hirtellum                   | 0.6               | 0.5 | 0.3 | 0.47                   |
| Rubus idaeus ssp. strigosus       | 0.0               | 0.0 | 0.1 | 0.03                   |
| Rubus occidentalis                | 0.0               | 0.1 | 0.0 | 0.03                   |
| Rubus pensilvanicus               | 0.5               | 0.0 | 0.0 | 0.17                   |
| Rubus pubescens                   | 0.0               | 0.1 | 0.1 | 0.07                   |
| Rubus semisetosus                 | 0.0               | 0.0 | 0.1 | 0.03                   |
| Rumex obtusifolius                | 0.0               | 0.0 | 0.1 | 0.03                   |
| Sanicula marilandica              | 0.2               | 0.1 | 0.0 | 0.10                   |
| Smilax tamnoides                  | 0.1               | 0.1 | 0.1 | 0.10                   |
| Stachys palustris                 | 1                 | 0.6 | 0.5 | 0.70                   |
| Ulmus rubra                       | 0.0               | 0.0 | 0.1 | 0.03                   |
| unknown Herbaceous species        | 0.1               | 0.0 | 0.0 | 0.03                   |
| Urtica dioica ssp. gracilis       | 0.1               | 0.0 | 0.0 | 0.03                   |
| Viola sp.                         | 0.8               | 0.9 | 0.7 | 0.80                   |
| Vitis riparia                     | 0.2               | 0.1 | 0.5 | 0.27                   |

**Plot: 5076**

| Species                           | Quadrat Frequency |     |     | Mean Quadrat Frequency |
|-----------------------------------|-------------------|-----|-----|------------------------|
|                                   | 1                 | 2   | 3   |                        |
| Alliaria petiolata                | 0.7               | 0.6 | 0.2 | 0.50                   |
| Anemone virginiana                | 0.1               | 0.0 | 0.0 | 0.03                   |
| Arisaema triphyllum               | 0.0               | 0.0 | 0.1 | 0.03                   |
| Cardamine pensylvanica            | 0.2               | 0.1 | 0.0 | 0.10                   |
| Carex sp.                         | 0.1               | 0.0 | 0.0 | 0.03                   |
| Celtis occidentalis               | 0.5               | 0.1 | 0.2 | 0.27                   |
| Chelidonium majus                 | 0.0               | 0.0 | 0.1 | 0.03                   |
| Circaea lutetiana ssp. canadensis | 0.1               | 0.2 | 0.0 | 0.10                   |
| Fraxinus pennsylvanica            | 0.1               | 0.1 | 0.0 | 0.07                   |
| Galium aparine                    | 0.2               | 0.0 | 0.0 | 0.07                   |
| Glechoma hederacea                | 0.4               | 0.2 | 0.1 | 0.23                   |
| Impatiens sp.                     | 0.2               | 0.6 | 0.0 | 0.27                   |
| Laportea canadensis               | 0.7               | 1   | 1   | 0.90                   |
| Leonurus cardiaca                 | 0.1               | 0.0 | 0.0 | 0.03                   |
| Matteuccia struthiopteris         | 0.0               | 0.1 | 0.0 | 0.03                   |
| Menispermum canadense             | 0.3               | 0.4 | 0.0 | 0.23                   |
| Parthenocissus sp.                | 0.7               | 0.2 | 0.2 | 0.37                   |
| Phalaris arundinacea              | 0.1               | 0.0 | 0.0 | 0.03                   |
| Polygonatum biflorum              | 0.3               | 0.0 | 0.1 | 0.13                   |
| Ranunculus fascicularis           | 0.0               | 0.1 | 0.0 | 0.03                   |
| Rhamnus cathartica                | 0.4               | 0.0 | 0.1 | 0.17                   |
| Ribes americanum                  | 0.0               | 0.1 | 0.0 | 0.03                   |
| Sicyos angulatus                  | 0.0               | 0.2 | 0.0 | 0.07                   |
| Solidago sp.                      | 0.1               | 0.0 | 0.0 | 0.03                   |
| Teucrium canadense                | 0.1               | 0.0 | 0.0 | 0.03                   |
| Thalictrum dioicum                | 0.2               | 0.0 | 0.0 | 0.07                   |
| Urtica dioica ssp. gracilis       | 0.1               | 0.0 | 0.0 | 0.03                   |
| Viola sp.                         | 0.0               | 0.3 | 0.0 | 0.10                   |
| Vitis riparia                     | 0.1               | 0.1 | 0.0 | 0.07                   |

**Plot: 5082**

| Species                            | Quadrat Frequency |     |     | Mean Quadrat Frequency |
|------------------------------------|-------------------|-----|-----|------------------------|
|                                    | 1                 | 2   | 3   |                        |
| Anemone quinquefolia               | 0.0               | 0.0 | 0.3 | 0.10                   |
| Carya cordiformis                  | 0.0               | 0.0 | 0.1 | 0.03                   |
| Celtis occidentalis                | 0.3               | 0.2 | 0.1 | 0.20                   |
| Circaea lutetiana ssp. canadensis  | 0.0               | 0.1 | 0.0 | 0.03                   |
| Crataegus sp.                      | 0.0               | 0.0 | 0.1 | 0.03                   |
| Dioscorea villosa                  | 0.0               | 0.1 | 0.0 | 0.03                   |
| Euonymus atropurpurea              | 0.0               | 0.1 | 0.2 | 0.10                   |
| Galium aparine                     | 0.0               | 0.1 | 0.0 | 0.03                   |
| Geranium maculatum                 | 0.2               | 0.0 | 0.1 | 0.10                   |
| Geum sp.                           | 0.0               | 0.1 | 0.1 | 0.07                   |
| Hydrophyllum virginianum           | 0.2               | 0.0 | 0.1 | 0.10                   |
| Lonicera (exotic) sp.              | 0.1               | 0.7 | 0.2 | 0.33                   |
| Maianthemum canadense              | 0.2               | 0.2 | 0.3 | 0.23                   |
| Parthenocissus sp.                 | 0.3               | 0.0 | 0.5 | 0.27                   |
| Prunus serotina                    | 0.0               | 0.4 | 0.2 | 0.20                   |
| Prunus virginiana                  | 0.1               | 0.0 | 0.1 | 0.07                   |
| Rhamnus cathartica                 | 0.8               | 0.8 | 1   | 0.87                   |
| Ribes cynosbati                    | 0.0               | 0.1 | 0.3 | 0.13                   |
| Ribes sp.                          | 0.1               | 0.0 | 0.0 | 0.03                   |
| Sanguinaria canadensis             | 0.1               | 0.0 | 0.0 | 0.03                   |
| Smilax tamnoides                   | 0.1               | 0.0 | 0.0 | 0.03                   |
| Solidago sp.                       | 0.0               | 0.0 | 0.1 | 0.03                   |
| Streptopus lanceolatus var. roseus | 0.0               | 0.1 | 0.0 | 0.03                   |
| Ulmus rubra                        | 0.0               | 0.2 | 0.0 | 0.07                   |
| Viola sp.                          | 0.0               | 0.0 | 0.1 | 0.03                   |
| Vitis riparia                      | 0.2               | 0.0 | 0.0 | 0.07                   |

**Plot: 5084**

| Species                           | Quadrat Frequency |     |     | Mean Quadrat Frequency |
|-----------------------------------|-------------------|-----|-----|------------------------|
|                                   | 1                 | 2   | 3   |                        |
| Arctium minus                     | 0.0               | 0.4 | 1   | 0.47                   |
| Bromus inermis                    | 0.0               | 0.0 | 0.6 | 0.20                   |
| Cardamine impatiens               | 0.0               | 0.0 | 0.2 | 0.07                   |
| Celtis occidentalis               | 0.0               | 0.1 | 0.1 | 0.07                   |
| Circaea lutetiana ssp. canadensis | 0.0               | 0.0 | 0.1 | 0.03                   |
| Cirsium arvense                   | 0.0               | 0.0 | 0.1 | 0.03                   |
| Daucus carota                     | 0.0               | 0.0 | 0.2 | 0.07                   |
| Echinocystis lobata               | 0.0               | 0.0 | 0.3 | 0.10                   |
| Fraxinus pennsylvanica            | 0.0               | 0.1 | 0.1 | 0.07                   |
| Glechoma hederacea                | 0.0               | 0.1 | 0.3 | 0.13                   |
| Hesperis matronalis               | 0.0               | 0.0 | 0.2 | 0.07                   |
| Laportea canadensis               | 0.0               | 0.1 | 0.1 | 0.07                   |
| Leonurus cardiaca                 | 0.0               | 0.0 | 0.1 | 0.03                   |
| Parthenocissus sp.                | 0.0               | 0.0 | 0.2 | 0.07                   |
| Pilea sp.                         | 0.0               | 0.0 | 0.5 | 0.17                   |
| Poaceae fam.                      | 0.0               | 0.1 | 0.0 | 0.03                   |
| Polygonatum pubescens             | 0.0               | 0.0 | 0.2 | 0.07                   |
| Rhamnus cathartica                | 0.0               | 0.1 | 0.1 | 0.07                   |
| Solidago sp.                      | 0.0               | 0.0 | 0.1 | 0.03                   |
| Urtica dioica ssp. gracilis       | 0.0               | 0.0 | 0.3 | 0.10                   |
| Viola sp.                         | 0.0               | 0.0 | 0.1 | 0.03                   |
| Vitis riparia                     | 0.0               | 0.2 | 0.0 | 0.07                   |

**Plot: 5086**

| Species                 | Quadrat Frequency |     |     | Mean Quadrat Frequency |
|-------------------------|-------------------|-----|-----|------------------------|
|                         | 1                 | 2   | 3   |                        |
| Acer negundo            | 0.1               | 0.4 | 0.0 | 0.17                   |
| Acer saccharinum        | 0.0               | 0.1 | 0.0 | 0.03                   |
| Cryptotaenia canadensis | 0.0               | 0.2 | 0.0 | 0.07                   |
| Fraxinus pennsylvanica  | 0.3               | 0.1 | 0.4 | 0.27                   |
| Hydrocotyle americana   | 0.0               | 0.4 | 0.0 | 0.13                   |
| Impatiens sp.           | 0.1               | 0.1 | 0.2 | 0.13                   |
| Lamiaceae fam.          | 0.4               | 0.0 | 0.0 | 0.13                   |
| Laportea canadensis     | 0.3               | 0.2 | 0.0 | 0.17                   |
| Poaceae fam.            | 0.0               | 0.4 | 0.0 | 0.13                   |
| Solidago sp.            | 0.1               | 0.2 | 0.1 | 0.13                   |
| Viola sp.               | 0.0               | 0.3 | 0.0 | 0.10                   |
| Vitis riparia           | 0.3               | 0.2 | 0.0 | 0.17                   |

**Plot: 5096**

| Species                           | Quadrat Frequency |     |     | Mean Quadrat Frequency |
|-----------------------------------|-------------------|-----|-----|------------------------|
|                                   | 1                 | 2   | 3   |                        |
| Acer negundo                      | 0.1               | 0.0 | 0.0 | 0.03                   |
| Alliaria petiolata                | 1                 | 0.8 | 0.5 | 0.77                   |
| Amphicarpaea bracteata            | 0.5               | 0.2 | 0.0 | 0.23                   |
| Anemone quinquefolia              | 0.1               | 0.0 | 0.1 | 0.07                   |
| Arisaema triphyllum               | 0.2               | 0.0 | 0.0 | 0.07                   |
| Carex pensylvanica                | 0.2               | 0.0 | 0.0 | 0.07                   |
| Celtis occidentalis               | 0.4               | 0.1 | 0.1 | 0.20                   |
| Circaea lutetiana ssp. canadensis | 0.9               | 0.6 | 0.3 | 0.60                   |
| Fraxinus pennsylvanica            | 0.3               | 0.0 | 0.0 | 0.10                   |
| Galium aparine                    | 0.7               | 0.6 | 0.5 | 0.60                   |
| Galium asprellum                  | 0.0               | 0.0 | 0.1 | 0.03                   |
| Galium trifidum                   | 0.5               | 0.2 | 0.0 | 0.23                   |
| Geum sp.                          | 0.9               | 0.1 | 0.0 | 0.33                   |
| Glechoma hederacea                | 0.0               | 0.2 | 0.0 | 0.07                   |
| Laportea canadensis               | 0.2               | 0.0 | 0.0 | 0.07                   |
| Leonurus cardiaca                 | 0.5               | 0.0 | 0.0 | 0.17                   |
| Lonicera (exotic) sp.             | 0.1               | 0.1 | 0.0 | 0.07                   |
| Parthenocissus sp.                | 0.2               | 0.2 | 0.4 | 0.27                   |
| Pilea sp.                         | 0.4               | 0.1 | 0.1 | 0.20                   |
| Prunus serotina                   | 0.8               | 0.3 | 0.4 | 0.50                   |
| Prunus virginiana                 | 0.4               | 0.4 | 0.4 | 0.40                   |
| Pyrola sp.                        | 0.0               | 0.1 | 0.0 | 0.03                   |
| Quercus ellipsoidalis             | 0.2               | 0.0 | 0.0 | 0.07                   |
| Ranunculus abortivus              | 0.0               | 0.0 | 0.1 | 0.03                   |
| Rhamnus cathartica                | 1                 | 0.9 | 0.9 | 0.93                   |
| Ribes hirtellum                   | 1                 | 0.9 | 0.9 | 0.93                   |
| Rubus idaeus ssp. strigosus       | 0.0               | 0.1 | 0.1 | 0.07                   |
| Rubus occidentalis                | 0.0               | 0.1 | 0.0 | 0.03                   |
| Rubus pensilvanicus               | 0.2               | 0.2 | 0.0 | 0.13                   |
| Solanum dulcamara                 | 0.0               | 0.0 | 0.1 | 0.03                   |
| Solidago sp.                      | 0.0               | 0.2 | 0.0 | 0.07                   |
| Toxicodendron rydbergii           | 0.1               | 0.0 | 0.0 | 0.03                   |
| Ulmus rubra                       | 0.2               | 0.3 | 0.2 | 0.23                   |
| Urtica dioica ssp. gracilis       | 0.1               | 0.0 | 0.0 | 0.03                   |
| Viola sp.                         | 0.4               | 0.1 | 0.2 | 0.23                   |
| Vitis riparia                     | 0.2               | 0.0 | 0.1 | 0.10                   |
| Zanthoxylum americanum            | 0.0               | 0.0 | 0.1 | 0.03                   |

**Plot: 5097**

| Species                           | Quadrat Frequency |     |     | Mean<br>Quadrat<br>Frequency |
|-----------------------------------|-------------------|-----|-----|------------------------------|
|                                   | 1                 | 2   | 3   |                              |
| Acer negundo                      | 0.0               | 0.0 | 0.1 | 0.03                         |
| Acer saccharum                    | 0.1               | 0.0 | 0.0 | 0.03                         |
| Actaea sp.                        | 0.1               | 0.0 | 0.0 | 0.03                         |
| Anemone quinquefolia              | 0.0               | 0.1 | 0.0 | 0.03                         |
| Arisaema triphyllum               | 0.0               | 0.3 | 0.5 | 0.27                         |
| Carex projecta                    | 0.0               | 0.0 | 0.1 | 0.03                         |
| Carex sp.                         | 0.0               | 0.0 | 0.1 | 0.03                         |
| Carya cordiformis                 | 0.1               | 0.0 | 0.0 | 0.03                         |
| Caulophyllum thalictroides        | 0.1               | 0.1 | 0.3 | 0.17                         |
| Celtis occidentalis               | 0.0               | 0.2 | 0.0 | 0.07                         |
| Cinna arundinacea                 | 0.0               | 0.0 | 0.1 | 0.03                         |
| Circaea lutetiana ssp. canadensis | 0.2               | 0.3 | 0.3 | 0.27                         |
| Fraxinus pennsylvanica            | 0.0               | 0.1 | 0.1 | 0.07                         |
| Galium aparine                    | 0.1               | 0.3 | 0.3 | 0.23                         |
| Hydrophyllum virginianum          | 0.2               | 0.3 | 0.4 | 0.30                         |
| Impatiens sp.                     | 0.5               | 0.4 | 0.3 | 0.40                         |
| Laportea canadensis               | 0.3               | 0.6 | 0.6 | 0.50                         |
| Maianthemum canadense             | 0.0               | 0.1 | 0.0 | 0.03                         |
| Maianthemum racemosum             | 0.1               | 0.1 | 0.5 | 0.23                         |
| Menispermum canadense             | 0.3               | 0.0 | 0.6 | 0.30                         |
| Parthenocissus sp.                | 0.0               | 0.0 | 0.2 | 0.07                         |
| Plantago major                    | 0.0               | 0.0 | 0.1 | 0.03                         |
| Poa compressa                     | 0.0               | 0.0 | 0.1 | 0.03                         |
| Prunus serotina                   | 0.0               | 0.0 | 0.1 | 0.03                         |
| Prunus virginiana                 | 0.2               | 0.1 | 0.0 | 0.10                         |
| Quercus rubra                     | 0.1               | 0.2 | 0.0 | 0.10                         |
| Ribes hirtellum                   | 0.2               | 0.3 | 0.6 | 0.37                         |
| Sanguinaria canadensis            | 0.2               | 0.0 | 0.2 | 0.13                         |
| Smilax ecirrata                   | 0.1               | 0.0 | 0.0 | 0.03                         |
| Smilax tamnoides                  | 0.0               | 0.3 | 0.3 | 0.20                         |
| Solidago flexicaulis              | 0.0               | 0.0 | 0.3 | 0.10                         |
| Thalictrum dioicum                | 0.1               | 0.0 | 0.0 | 0.03                         |
| Uvularia grandiflora              | 0.0               | 0.1 | 0.1 | 0.07                         |
| Uvularia sessilifolia             | 0.1               | 0.0 | 0.0 | 0.03                         |
| Viola sp.                         | 0.2               | 0.4 | 0.4 | 0.33                         |
| Vitis riparia                     | 0.0               | 0.0 | 0.1 | 0.03                         |

**Plot: 5099**

| Species                        | Quadrat Frequency |     |     | Mean<br>Quadrat<br>Frequency |
|--------------------------------|-------------------|-----|-----|------------------------------|
|                                | 1                 | 2   | 3   |                              |
| Alliaria petiolata             | 0.4               | 0.2 | 0.0 | 0.20                         |
| Amphicarpaea bracteata         | 0.2               | 0.0 | 0.0 | 0.07                         |
| Bidens frondosa                | 0.0               | 0.1 | 0.0 | 0.03                         |
| Boehmeria cylindrica           | 0.2               | 0.3 | 0.0 | 0.17                         |
| Calamagrostis canadensis       | 0.0               | 0.1 | 0.0 | 0.03                         |
| Calystegia sepium              | 0.0               | 0.2 | 0.0 | 0.07                         |
| Cardamine impatiens            | 0.1               | 0.0 | 0.0 | 0.03                         |
| Cryptotaenia canadensis        | 0.1               | 0.0 | 0.0 | 0.03                         |
| Glechoma hederacea             | 0.0               | 0.1 | 0.0 | 0.03                         |
| Impatiens sp.                  | 0.4               | 0.2 | 0.0 | 0.20                         |
| Laportea canadensis            | 0.8               | 0.4 | 0.6 | 0.60                         |
| Matteuccia struthiopteris      | 0.1               | 0.0 | 0.0 | 0.03                         |
| Pilea sp.                      | 0.0               | 0.3 | 0.0 | 0.10                         |
| Poaceae fam.                   | 0.3               | 0.0 | 0.0 | 0.10                         |
| Rudbeckia laciniata            | 0.3               | 0.2 | 0.0 | 0.17                         |
| Sambucus nigra ssp. canadensis | 0.2               | 0.0 | 0.0 | 0.07                         |
| Solidago sp.                   | 0.0               | 0.1 | 0.0 | 0.03                         |
| Teucrium canadense             | 0.0               | 0.3 | 0.0 | 0.10                         |
| Urtica dioica ssp. gracilis    | 0.2               | 0.1 | 0.0 | 0.10                         |
| Vitis riparia                  | 0.3               | 0.0 | 0.0 | 0.10                         |

**Plot: 5104**

| Species                           | Quadrat Frequency |     |     | Mean<br>Quadrat<br>Frequency |
|-----------------------------------|-------------------|-----|-----|------------------------------|
|                                   | 1                 | 2   | 3   |                              |
| Acer negundo                      | 0.1               | 0.1 | 0.0 | 0.07                         |
| Acer saccharinum                  | 0.0               | 0.1 | 0.0 | 0.03                         |
| Alliaria petiolata                | 0.3               | 0.0 | 0.0 | 0.10                         |
| Arctium minus                     | 0.7               | 0.1 | 0.0 | 0.27                         |
| Boehmeria cylindrica              | 0.0               | 0.1 | 0.0 | 0.03                         |
| Carex blanda                      | 0.3               | 0.4 | 0.0 | 0.23                         |
| Celtis occidentalis               | 0.3               | 0.0 | 0.0 | 0.10                         |
| Circaea lutetiana ssp. canadensis | 0.3               | 0.1 | 0.0 | 0.13                         |
| Fraxinus pennsylvanica            | 0.4               | 0.3 | 0.1 | 0.27                         |
| Galium trifidum                   | 0.3               | 0.0 | 0.0 | 0.10                         |
| Impatiens sp.                     | 0.7               | 0.2 | 0.1 | 0.33                         |
| Laportea canadensis               | 0.0               | 0.0 | 0.3 | 0.10                         |
| Lemna minor                       | 0.0               | 0.0 | 0.1 | 0.03                         |
| Menispermum canadense             | 0.1               | 0.0 | 0.0 | 0.03                         |
| Oxalis stricta                    | 0.0               | 0.0 | 0.1 | 0.03                         |
| Parthenocissus sp.                | 0.6               | 0.1 | 0.1 | 0.27                         |
| Phalaris arundinacea              | 0.9               | 0.8 | 0.1 | 0.60                         |
| Poaceae fam.                      | 0.0               | 0.1 | 0.0 | 0.03                         |
| Rhamnus cathartica                | 0.6               | 0.1 | 0.0 | 0.23                         |
| Scutellaria sp.                   | 0.1               | 0.0 | 0.0 | 0.03                         |
| Solidago sp.                      | 0.1               | 0.1 | 0.0 | 0.07                         |
| Taraxacum officinale              | 0.1               | 0.0 | 0.0 | 0.03                         |
| Thalictrum thalictroides          | 0.4               | 0.1 | 0.0 | 0.17                         |
| Viola sp.                         | 0.6               | 0.1 | 0.2 | 0.30                         |
| Vitis riparia                     | 0.3               | 0.3 | 0.1 | 0.23                         |

**Plot: 5106**

| Species                     | Quadrat Frequency |     |     | Mean Quadrat Frequency |
|-----------------------------|-------------------|-----|-----|------------------------|
|                             | 1                 | 2   | 3   |                        |
| Calystegia sepium           | 0.2               | 0.0 | 0.0 | 0.07                   |
| Fraxinus pennsylvanica      | 0.1               | 0.0 | 0.0 | 0.03                   |
| Laportea canadensis         | 0.5               | 0.6 | 0.0 | 0.37                   |
| Lemna minor                 | 0.0               | 0.0 | 0.2 | 0.07                   |
| Pilea sp.                   | 0.0               | 0.1 | 0.0 | 0.03                   |
| Rudbeckia laciniata         | 0.4               | 0.0 | 0.0 | 0.13                   |
| Scutellaria sp.             | 0.2               | 0.0 | 0.0 | 0.07                   |
| Stachys sp.                 | 0.1               | 0.0 | 0.0 | 0.03                   |
| Ulmus rubra                 | 0.1               | 0.0 | 0.0 | 0.03                   |
| Urtica dioica ssp. gracilis | 0.1               | 0.0 | 0.0 | 0.03                   |

**Plot: 5111**

| Species                     | Quadrat Frequency |     |     | Mean Quadrat Frequency |
|-----------------------------|-------------------|-----|-----|------------------------|
|                             | 1                 | 2   | 3   |                        |
| Carex sp.                   | 0.0               | 0.0 | 0.2 | 0.07                   |
| Ceratophyllum demersum      | 0.0               | 0.1 | 0.0 | 0.03                   |
| Lamiaceae fam.              | 0.0               | 0.0 | 0.1 | 0.03                   |
| Lemna minor                 | 0.0               | 0.5 | 0.3 | 0.27                   |
| Phalaris arundinacea        | 0.3               | 0.0 | 0.2 | 0.17                   |
| Rhamnus cathartica          | 0.0               | 0.1 | 0.0 | 0.03                   |
| Sparganium sp.              | 0.0               | 0.1 | 0.0 | 0.03                   |
| Urtica dioica ssp. gracilis | 0.0               | 0.0 | 0.1 | 0.03                   |

**Plot: 5140**

| Species                           | Quadrat Frequency |     |     | Mean Quadrat Frequency |
|-----------------------------------|-------------------|-----|-----|------------------------|
|                                   | 1                 | 2   | 3   |                        |
| Alliaria petiolata                | 0.5               | 0.4 | 0.6 | 0.50                   |
| Arisaema triphyllum               | 0.4               | 0.4 | 0.6 | 0.47                   |
| Brachyelytrum erectum             | 0.0               | 0.2 | 0.1 | 0.10                   |
| Cardamine pensylvanica            | 0.1               | 0.0 | 0.0 | 0.03                   |
| Carex blanda                      | 0.0               | 0.1 | 0.5 | 0.20                   |
| Carex sp.                         | 0.1               | 0.1 | 0.0 | 0.07                   |
| Circaea lutetiana ssp. canadensis | 0.2               | 0.2 | 0.2 | 0.20                   |
| Cornus alternifolia               | 0.1               | 0.1 | 0.1 | 0.10                   |
| Euonymus atropurpurea             | 0.0               | 0.1 | 0.0 | 0.03                   |
| Galium aparine                    | 0.1               | 0.0 | 0.2 | 0.10                   |
| Geum sp.                          | 0.0               | 0.1 | 0.1 | 0.07                   |
| Hydrophyllum virginianum          | 0.4               | 0.5 | 0.5 | 0.47                   |
| Impatiens sp.                     | 0.9               | 0.7 | 0.5 | 0.70                   |
| Laportea canadensis               | 1                 | 0.8 | 0.9 | 0.90                   |
| Leonurus cardiaca                 | 0.0               | 0.1 | 0.0 | 0.03                   |
| Maianthemum racemosum             | 0.0               | 0.1 | 0.1 | 0.07                   |
| Parthenocissus sp.                | 0.1               | 0.3 | 0.0 | 0.13                   |
| Phlox divaricata                  | 0.1               | 0.0 | 0.0 | 0.03                   |
| Polygonatum biflorum              | 0.0               | 0.0 | 0.1 | 0.03                   |
| Ranunculus abortivus              | 0.1               | 0.0 | 0.0 | 0.03                   |
| Rhamnus cathartica                | 0.1               | 0.0 | 0.1 | 0.07                   |
| Sanguinaria canadensis            | 0.1               | 0.2 | 0.1 | 0.13                   |
| Smilax ecirrata                   | 0.0               | 0.1 | 0.0 | 0.03                   |
| Smilax tamnoides                  | 0.0               | 0.1 | 0.1 | 0.07                   |
| Thalictrum dasycarpum             | 0.0               | 0.1 | 0.0 | 0.03                   |
| Viburnum opulus var. americanum   | 0.0               | 0.0 | 0.1 | 0.03                   |
| Viola sp.                         | 0.0               | 0.0 | 0.1 | 0.03                   |

**Plot: 5142**

| Species                     | Quadrat Frequency |     |     | Mean Quadrat Frequency |
|-----------------------------|-------------------|-----|-----|------------------------|
|                             | 1                 | 2   | 3   |                        |
| Bidens sp.                  | 0.2               | 0.0 | 0.0 | 0.07                   |
| Calystegia sepium           | 0.1               | 0.0 | 0.0 | 0.03                   |
| Hydrocotyle americana       | 0.2               | 0.0 | 0.0 | 0.07                   |
| Impatiens capensis          | 0.1               | 0.2 | 0.0 | 0.10                   |
| Laportea canadensis         | 0.6               | 0.7 | 0.6 | 0.63                   |
| Lemna minor                 | 0.0               | 0.0 | 0.3 | 0.10                   |
| Phalaris arundinacea        | 0.2               | 0.2 | 0.0 | 0.13                   |
| Pilea pumila                | 0.1               | 0.2 | 0.0 | 0.10                   |
| Poa sp.                     | 0.0               | 0.1 | 0.0 | 0.03                   |
| Ranunculus sp.              | 0.1               | 0.1 | 0.0 | 0.07                   |
| Rudbeckia laciniata         | 0.5               | 0.5 | 0.0 | 0.33                   |
| Solidago sp.                | 0.2               | 0.1 | 0.0 | 0.10                   |
| Ulmus rubra                 | 0.1               | 0.0 | 0.0 | 0.03                   |
| Urtica dioica ssp. gracilis | 0.2               | 0.0 | 0.0 | 0.07                   |
| Vitis riparia               | 0.1               | 0.0 | 0.0 | 0.03                   |

**Plot: 5148**

| Species                             | Quadrat Frequency |     |     | Mean Quadrat Frequency |
|-------------------------------------|-------------------|-----|-----|------------------------|
|                                     | 1                 | 2   | 3   |                        |
| Acer saccharinum                    | 0.0               | 0.0 | 0.1 | 0.03                   |
| Alliaria petiolata                  | 0.8               | 0.3 | 0.1 | 0.40                   |
| Amphicarpaea bracteata              | 0.1               | 0.2 | 0.0 | 0.10                   |
| Arctium minus                       | 0.7               | 0.1 | 0.0 | 0.27                   |
| Boehmeria cylindrica                | 0.1               | 0.0 | 0.0 | 0.03                   |
| Brachyelytrum erectum               | 0.0               | 0.1 | 0.0 | 0.03                   |
| Celtis occidentalis                 | 0.1               | 0.0 | 0.0 | 0.03                   |
| Circaea lutetiana ssp. canadensis   | 0.4               | 0.1 | 0.4 | 0.30                   |
| Cirsium arvense                     | 0.1               | 0.0 | 0.0 | 0.03                   |
| Fraxinus pennsylvanica              | 0.1               | 0.1 | 0.0 | 0.07                   |
| Geum aleppicum                      | 0.3               | 0.0 | 0.0 | 0.10                   |
| Glechoma hederacea                  | 0.0               | 0.1 | 0.0 | 0.03                   |
| Heracleum sphondylium ssp. montanum | 0.1               | 0.0 | 0.0 | 0.03                   |
| Hydrophyllum virginianum            | 0.0               | 0.1 | 0.0 | 0.03                   |
| Impatiens sp.                       | 0.2               | 0.7 | 0.3 | 0.40                   |
| Laportea canadensis                 | 0.5               | 1   | 0.9 | 0.80                   |
| Lysimachia nummularia               | 0.1               | 0.0 | 0.0 | 0.03                   |
| Menispermum canadense               | 0.1               | 0.0 | 0.0 | 0.03                   |
| Parthenocissus sp.                  | 0.2               | 0.4 | 0.0 | 0.20                   |
| Phalaris arundinacea                | 0.2               | 0.1 | 0.1 | 0.13                   |
| Pilea sp.                           | 0.2               | 0.0 | 0.0 | 0.07                   |
| Rhamnus cathartica                  | 0.4               | 0.0 | 0.0 | 0.13                   |
| Ribes americanum                    | 0.0               | 0.1 | 0.0 | 0.03                   |
| Scutellaria sp.                     | 0.3               | 0.0 | 0.0 | 0.10                   |
| Sicyos angulatus                    | 0.2               | 0.1 | 0.3 | 0.20                   |
| Solidago sp.                        | 0.7               | 0.1 | 0.1 | 0.30                   |
| Urtica dioica ssp. gracilis         | 0.1               | 0.0 | 0.0 | 0.03                   |
| Viola sp.                           | 0.1               | 0.1 | 0.1 | 0.10                   |
| Vitis riparia                       | 0.2               | 0.0 | 0.0 | 0.07                   |



The Department of the Interior protects and manages the nation's natural resources and cultural heritage; provides scientific and other information about those resources; and honors its special responsibilities to American Indians, Alaska Natives, and affiliated Island Communities.

NPS 607/116665, August 2012

**National Park Service**  
**U.S. Department of the Interior**



---

**Natural Resource Stewardship and Science**

1201 Oakridge Drive, Suite 150  
Fort Collins, CO 80525

[www.nature.nps.gov](http://www.nature.nps.gov)

**EXPERIENCE YOUR AMERICA™**