

# **FRAUTSCHI POINT 2017 SURVEYS OF PLANTED AREAS FINAL REPORT**

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## **INTRODUCTION**

The Friends of Lakeshore Nature Preserve have been supporting the Preserve with planting activities for many years. In 2013-2016 there were several concerted and well-documented planting efforts in two well-defined areas of Frautschi Point, shown in Fig. 1. The North area was planted in 2015, while the South area was planted in 2013, 2014, and 2016. In fall 2016 the Lakeshore Nature Preserve Committee requested that the Friends conduct systematic surveys of these two specific areas, to help assess the success of the 2013-2016 plantings in these well-defined areas. In winter 2017, Friends volunteers compiled information for the areas and the specific plantings, developed survey protocols, and organized surveys. Surveys of each area were conducted by Friends volunteers in spring and summer of 2017. This report presents the data collected and their evaluation to assess planting success.

## **HISTORY OF THE SURVEYED AREAS**

In 1988, the Frautschi Point area was gifted to the university in honor of Walter Frautschi by his two sons. Still farmland in the 1940s, the land had received little care for decades.

### **Historical maps indicating changes in vegetation cover**

The sequence of maps in Fig. 2 below tells the story of the vegetation cover of the Frautschi Point area for the last century. The land was part of the Stevens hobby farm, which extended from Frautschi Pt to Picnic Pt, as seen on the 1927 map. When Stevens daughters sold most of the land to Ed Young in 1924, they kept the Frautschi Point area. After Elizabeth Stevens married Reginald H. Jackson, the surgeon who founded the Jackson Clinic in Madison, they built a cottage at Frautschi Point.

As apparent on the 1937 map, the Jacksons had built a stately mansion on the cleared area visible near the point and had planted non-native decorative trees along the main road from the entrance, the current parking lot area, to the house. In addition, Jackson had established a small orchard to the west of the house. The Friends north planting area, west of the orchard and access road, was left unimproved, with vegetation gradually moving into the former fields. The south planting area had been converted from farm field to conifer stands. By 1940, these conifer plantings are very distinct. A solid area of conifers was added along the stone wall of the Park and Pleasure drive coming up from the Bay. The Big Oak stands alone in the old farm field.

The two aerial photos of 1949 show more solid, brushy vegetation moving into the area east of the main road. The north planting area was apparently cleared of vegetation, with two smaller single trees standing. Reggie Jackson, jr, who had inherited the land after the death of his father in 1939, used the grounds east of the road as pheasant and quail hunting grounds, and seems to

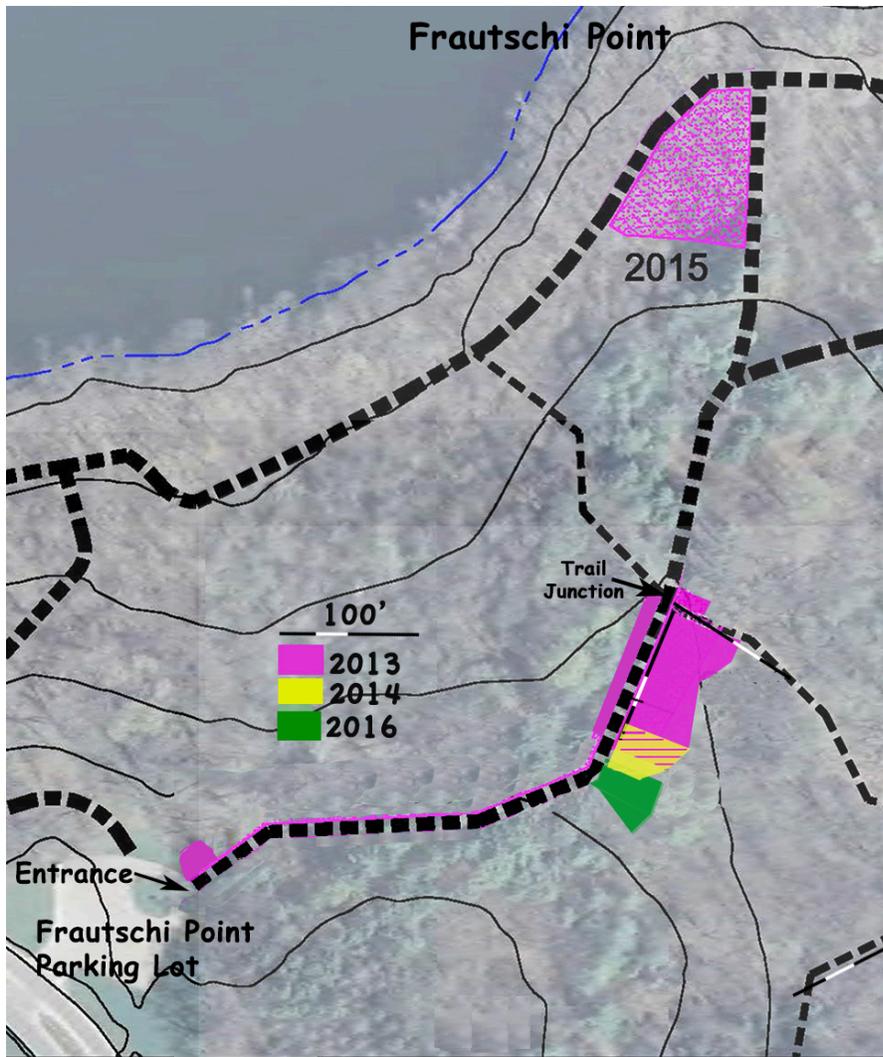
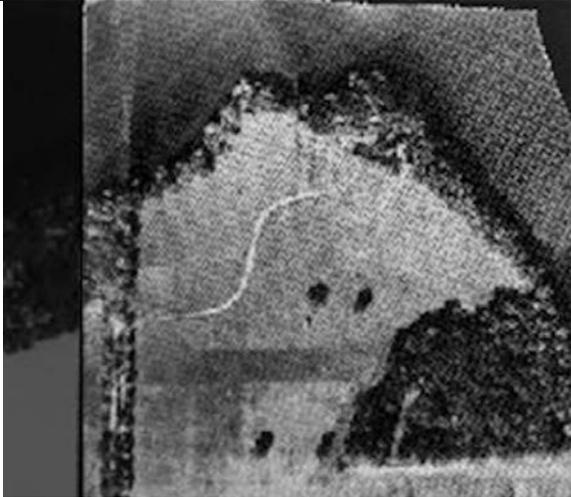


Figure 1. Delineation of 2017 survey areas, with planting years noted. The area in this image is approximately the upper left  $\frac{1}{4}$  of the area shown in the later air photos in Fig. 2.

have preferred low vegetation for hunting. The 1955 map shows no major vegetation changes, but now a bridle path encircles the old farm field. The conifers along the main road are fully grown, covering the south planting area. The north planting area is also overgrown. By 1968 (winter photo) there is a change in the vegetation of the south planting area, with some of the conifers gone along the path branching from the main road toward the Big Oak. Some vegetation has been removed from the north planting area. Trees have moved in to the formerly open farm fields on both sides of the main road. We also know that during the late 1970s, buckthorn and honeysuckle began to move into the Frautschi Point area, smothering existing ground vegetation.

The 1996 aerial photo clearly outlines the conifers in dark color along the main road and in the little conifer forest at the entrance wall. The north planting area seems unchanged. After the



1927



1937



1940



1949



1949 October 12



1955

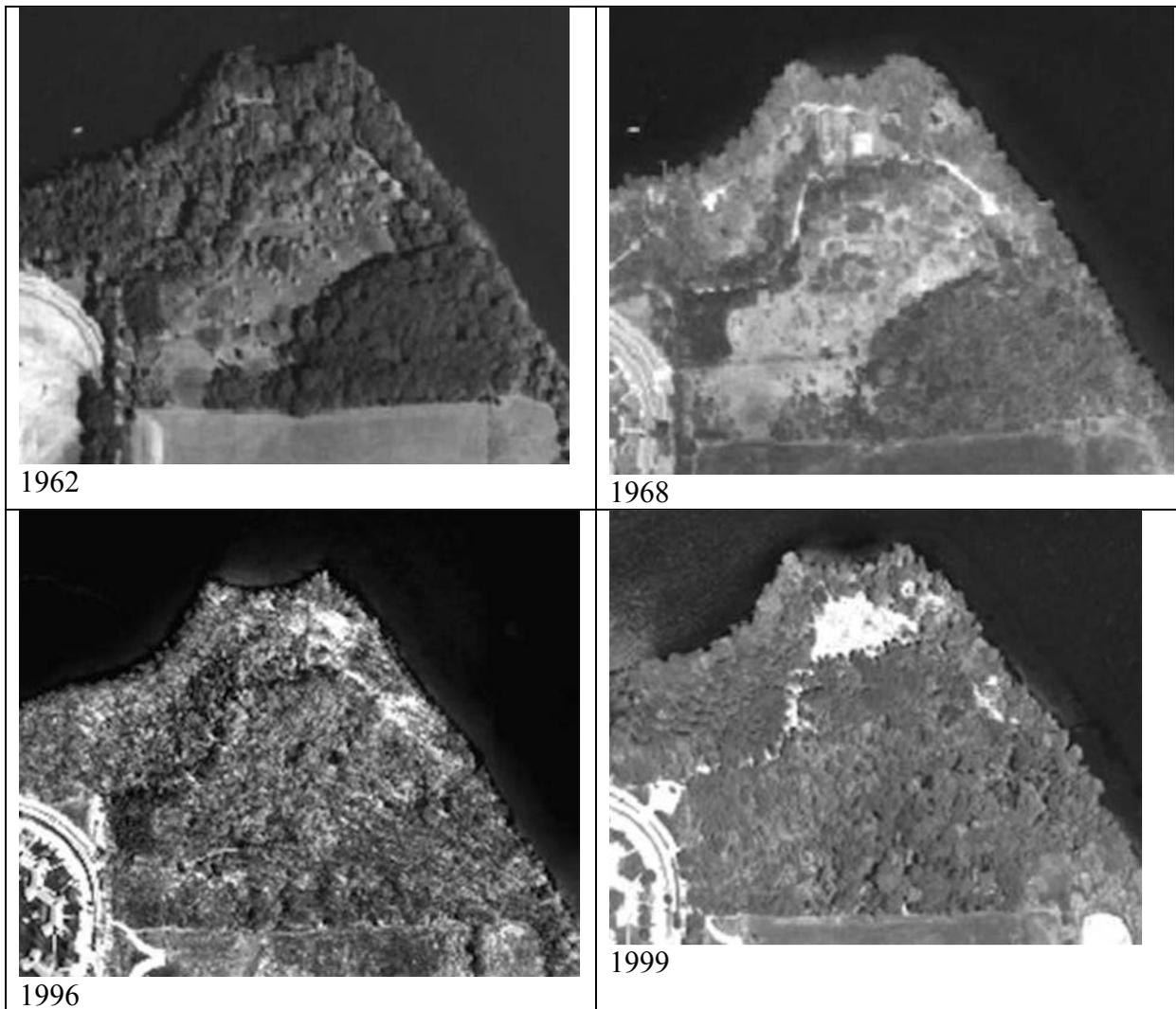


Fig. 2. Time series of Frautschi Point air photos illustrating the history of the vegetation. <https://www.flickr.com/photos/lakeshorenaturepreserve/albums/72157674201934035/with/29728342952/> - excerpts from original larger maps assembled by Sam Batzli

death of Reggie Jackson in 1986, deciduous trees moved in and now cover all former farmland, seemingly crowding out some of the conifers. The 1999 map shows that the north planting area is now entirely tree covered. Vegetation of the south planting area appears thinned, with some of the conifers gone at the junction with Big Oak trail. The map also shows the bare area after removal of trees in the triangle formed by the main road to the Jackson mansion and access road to the orchard, which is now overgrown.

### **Reclamation of the land**

Reclamation began with removal of enormous buckthorns and honeysuckle from the South planting area in 2009 as a boy scout project organized and led by Glenda Denniston, and from the North area in 2011 by Preserve staff.

### ***South area***

From 2005 onward Glenda Denniston and Friends volunteers planted wild flowers, ferns and sedges all along Big Oak trail from its beginning at the Frautschi Point parking lot, within a about a yard of the trail.

In 2009, Glenda led a project with an Eagle Scout and 15 of his friends and relatives to rehabilitate the South area. They built one path into the area from Big Oak trail, which also formed the boundary of the 2013/14 plantings, and another path from the main road, forming a large square. The plot was totally cleared. Virtually all undesirables were dug out or removed by weed wrench, mostly buckthorn and honeysuckle. Bigger, tree-like buckthorn were removed later by Preserve staff. The big logs, most likely fallen conifers, now seen from the main path in the background, were present at the time. Some of the 2009 plantings (6 flats) have survived to this day, including columbine, Short's aster, bottlebrush grass and bloodroot, as well as pagoda dogwood and one black cherry. In 2011 and 2012 Glenda cut back or removed buckthorn and honeysuckle regrowth and kept garlic mustard under control. She moved in wild geranium and wood violets from other areas, still doing well in 2017. She also thinned elderberry each year.

The 2013/14 site preparation assessment by Preserve staff found that conditions varied across the South planting area. Some areas near paths, planted in the past by Friends volunteers and other groups, only needed supplementing of existing vegetation. Other areas toward the interior were bare, especially under the large mature conifers. Invasive woody vegetation was removed and cut stems were treated with herbicide. Native elderberry was cut back but not treated. Three hackberry (15-20feet tall) were removed from the southeast corner of plot 9 at the junction of the main and secondary trail to allow more light to enter the site. All brush was piled, chipped and removed. During planting in 2013 and 2014 (species names and numbers of plants by year in Appendix Table A1), considerable amounts of woodbine were pulled or cut.

Glenda followed up with watering occasionally during the first summer. She has maintained the area to a degree, with assistants, since plantings were completed. Currently in 2017, we observe sprouting of maple saplings, regrowth (short) of woody invasives, and prolific growth of woodbine hindering natural spreading of planted herbaceous species. Left to itself, this area would likely tend toward a mature maple/basswood forest. To keep Open Woodland vegetation, continual care is required. By 2015 these plants were observed in the planting area: great blue lobelia, hyssops, smooth and Short asters, spikenard, jack in the pulpit, and white baneberry.

In 2016, the most southern part of the South planting area was minimally prepared, by cutting and treating buckthorn and removing the cuttings. Then the area was planted (Appendix Table A1). Glenda also weed wrenched the entire length along the main drive. Some of the bare root mayapple plants survived. The planting day was sunny, followed by a good rain three days later.

### ***North area***

In 2011 interns directed by Adam Gundlach cleared the area of buckthorn and other non-native shrubs. In 2012 contractors followed up with cutting and treating. The area was already populated with some patches of trout lily and some Jacob's ladder. Pre-planting assessment also revealed white snakeroot, hackelia, white avens, enchanter's nightshade, and some zigzag goldenrod along edges. By May 2015 the site was fairly overgrown again with knee- to hip-deep

vegetation (much of it native). Weather was favorable for planting, and it rained almost every day in the two-week period following the planting. As follow-up since 2015, there has been some cutting back of weeds in 2015 and 2016 where they especially overpowered plantings.

## **SURVEY METHODS**

### **Survey areas and survey methods**

In April 2017, the North and South survey areas (Fig. 1) were walked by Glenda Denniston, Gisela Kutzbach, and Susan Will-Wolf; boundaries were defined and marked based on experiences of Glenda and Gisela at planting parties and their measurements performed in December 2016 to establish a plot grid in each area. In May 2017 (one week before surveys began) the same team measured and marked plot boundaries in the South area (Fig. 3), and marked off start and end points for transects through the center of each row of (unmarked) plots in the North area (Fig. 4).

The South area was relatively flat and the main portion was rectangular, with few large logs, mostly low shrubs, and 1 m tall herbaceous vegetation in the planted area. Plot boundaries were easily visible to facilitate complete surveys of herbaceous plants in each plot. Each team worked independently to complete the survey of a single plot, while collaborating on species identification to facilitate consistency.

The North area, in contrast, was sloping, triangular in shape, had many large logs and tall shrubs, and had herbaceous vegetation up to 1.5 m in areas. Plot boundaries would have been difficult to see, so they were not marked and complete herbaceous plant surveys by plot were not attempted. Instead all plants visible from an E-W transect line through the center of each plot were recorded. Teams traversed each transect in parallel, observing plants within ~2m of their transect, then stopped together at the far edge of plots to consult on species identification with adjacent teams. Records of species seen in that plot were revised as needed for consistent species identification, before moving to the next plot along the transect.

Surveys were conducted in spring and again in summer for each area by teams of volunteers. In both survey areas, species were checked when seen. If 5-9 plants of a species were seen in the plot or along the transect length, a + was added; if 10 or more were seen ++ was added. Cover of vegetation layers was recorded for each plot or transect length by four categories (<20%, 20-60%, 60-80%, or >80%) assigned by team consensus. For the South area, percent cover was recorded for total herbaceous cover, litter and bare ground, vines, and tree or shrub seedlings in both surveys. For the North area, only total herbaceous cover was recorded in both surveys. In summer surveys of both areas, combined tree and shrub cover was recorded to estimate the amount of light reaching the herbaceous plants.

Separate field data sheets were developed for each area. All planted species were included, along with non-planted species either recorded as present in past field notes, or species seen or expected by Glenda Denniston, who has regularly walked the areas for many years. Spring data sheets were modified for summer use based on further observations. Copies of the data sheets used have been archived with Preserve staff.

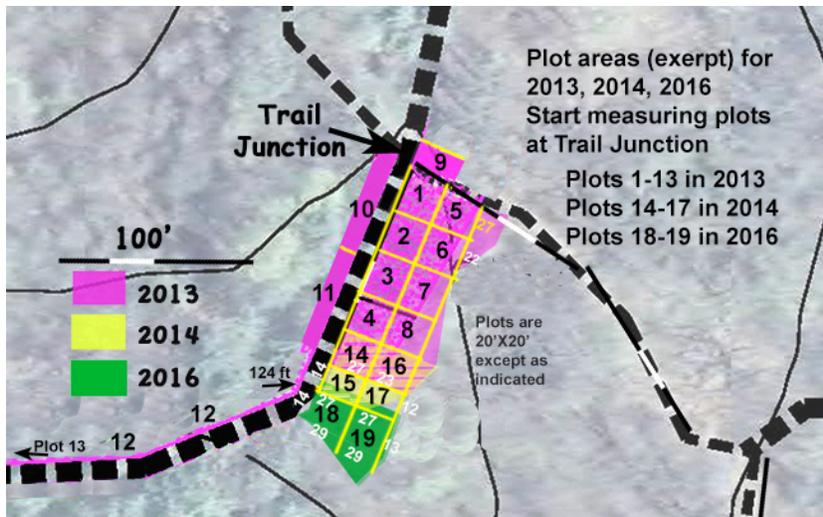


Figure 3. Plot grid in the South area, with measurements for plots not the standard size and shape. Plots 10-13 along the trail were measured linearly along the trail, and plants were recorded from within 1-2 m of the trail as indicated

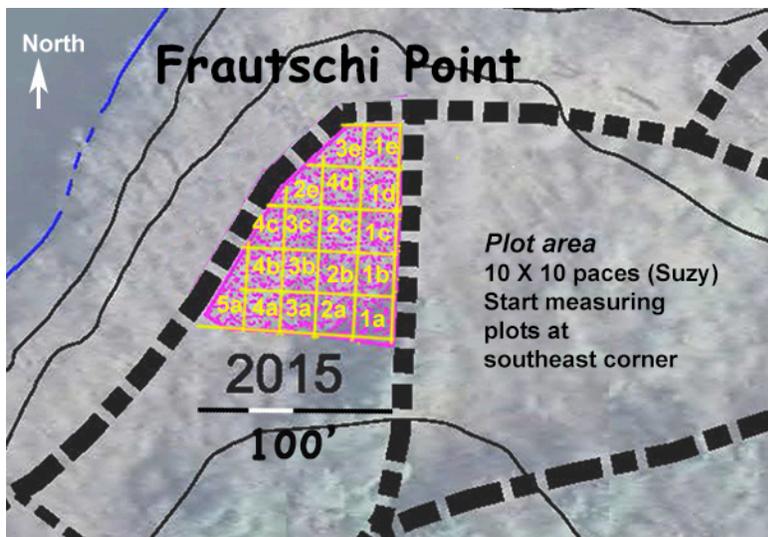


Figure 4. Approximate plot grid in the North area; each square plot was approximately 7 m or 22 feet on a side as paced.

### Species Identification

Each survey team had at least one person knowledgeable about plant identification, with consultation between teams to ensure consistency of identification. Samples of difficult species were collected and identified by Mary Ann Feist, Herbarium Curator, Wisconsin State Herbarium in the UW Botany Department, and some also by Ted Cochrane, Emeritus Academic Curator there.

## **Survey Data Analysis**

Survey data sheets were proofread and amended with later species identifications by Glenda Denniston, Gisela Kutzbach, Monica and Steve Sentoff, and Susan Will-Wolf. Glenda, Monica and Steve, and Susan collaborated to ensure consistent application of species names for all data. Data were entered into spreadsheets by Gisela and Monica with proofreading by Susan. Monica and Susan collaborated to summarize and analyze data in spreadsheets. The team collaborated to present and interpret results. For analyses, the three abundance classes recorded in the field were used to calculate weighted count estimates (WC) for individuals of species as follows:

$$WC = 1 * (\text{count of 1-4 observed}) + 5 * (\text{count of 5-10 observed}) + 10 * (\text{count of } > 10 \text{ observed})$$

After data were entered, analysis was done per plot and per species. Per plot analysis included:

- count of species observed by plot
- count of planted species by plot
- weighted count of individuals of species observed by plot; and
- weighted count of individuals of planted species by plot

Per species analysis included calculating estimated percentage survival of planted species and general frequency of non-planted species.

Another level of analysis was to look at the relative “integrity” of the species observed. A preliminary analysis was done using the concept of Floristic Quality Assessment and the information on Coefficients of Conservatism (C of C) presented in Development of a Floristic Quality Assessment Methodology for Wisconsin (Bernthal 2003). As discussed in that document, many herbaceous species were assigned C of C values of 0 (low, widely distributed in many environments, tolerant of disturbance) to 10 (high, strong fidelity to their preferred environment, not tolerant of disturbance). A total and average C of C value was calculated for each planting area from the C of C values of species present. A site or area’s average C of C is a “measure of the site’s intactness, an indication of its ecological integrity” on a scale of 0 (low) to 10 (high).

## **RESULTS AND DISCUSSION**

### **Field Surveys**

Spring surveys were conducted on May 8 and 13, 2017; summer surveys were conducted on July 17, 21 and 24, 2017. Survey volunteers were Janis Cooper, Diane Dempsey, Glenda Denniston, Doris Dubielzig, Lynne Krainer, Gisela Kutzbach, Roma Lenehan, Karen Nakasone, Paul Quinlan, Monica Sentoff, Steve Sentoff, Susan Slapnick, Susan Will-Wolf; most of the volunteers participated in both spring and summer surveys (Figs. 5, 6). Composition of survey teams had about 75% consistency between spring and summer surveys, and teams often surveyed the same subset of plots in both surveys. Data sheets were collected by Gisela Kutzbach at the end of each field day; new ones were used each day. Unclear markings, incomplete records, and any inconsistencies were resolved soon after field surveys via email using scans of data sheets.



Figure 5. Friends surveying the South 2013-14-16 planting area on May 8, 2017.



Figure 6. Friends surveying the North 2015 planting area on July 24, 2017.

### **Survey Data**

After reconciliation of as many species identification issues as possible, data for each species recorded in each plot in spring and summer surveys were entered into spreadsheets, and then compiled across seasons for the full survey area data set. These original data files are archived with the Lakeshore Nature Preserve, that include notes about how season data were combined. A total of 151 named herbaceous species were recorded between the two surveys, with 16

additional unnamed different herbaceous species, most not even with a genus. Seedlings of 23 woody vine, shrub, and tree species were found, bringing the grand total to 190 different species.

The somewhat different environments of the two survey areas were not strongly reflected in vegetation coverage. Summer tree and shrub canopy cover averaged 70% in the South area and 58% in the North area; summer herbaceous cover was 80% in the South area and 73% in the North area. There were some differences; litter and bare ground had 45-63% cover in the South area and 10% in the North area, and the spring herbaceous cover was 55% in the South area vs 86% cover in the North area. These small differences are consistent with a more natural understory in the North area, given the similar canopy cover. However, all cover estimates were recorded inconsistently and were especially sparse in the North area, limiting their value.

Data summarized by plot demonstrated variation in species diversity across each surveyed area. The highest diversity plots are reported in Table 1; note their locations in Figs. 3 and 4. Also note that plots with the most total herbaceous species often also had the most planted species. The lowest diversity plot in the South 2013-14-16 planting area was Plot 16 with 19 herbaceous

Table 1. Highest diversity plots in each area: different criteria in each column. For “all species” columns numbers in parentheses are counts of herbaceous species or weighted estimate counts of individuals for herbaceous species, followed by values for all species including woody plants.

2013-14-16 Planting Area: Most Diverse Plots			
Highest count of species total	Highest count of planted species	Highest weighted count of species total	Highest weighted count of planted species
Plot 1 (45, 49)	Plot 1 (21)	Plot 2 (141, 159)	Plot 1 (63)
Plot 2 (35, 44)	Plot 2 (17)	Plot 5 (148, 159)	Plot 2 (76)
Plot 3 (37, 46)	Plot 3 (20)	Plot 6 (172, 205)	Plot 6 (75)
Plot 5 (37, 44)	Plot 15 (19)	Plot 12/13 (141, 172)	Plot 7 (54)
Plot 9 (40, 40)	Plot 18 (20)	Plot 15 (145, 173)	Plot 15 (61)
Plot 12/13 (36, 45)			
Plot 15 (37, 37)			
2015 Planting Area: Most Diverse Plots			
Highest count of species total	Highest count of planted species	Highest weighted count of species total	Highest weighted count of planted species
Plot 1A (45, 55)	Plot 2A (12)	Plot 1A (127, 146)	Plot 1A (34)
Plot 1E (44, 50)	Plot 2B (10)	Plot 1B (131, 148)	Plot 1B (28)
Plot 2A (40, 46)	Plot 2E (10)	Plot 1E (164, 187)	Plot 2B (31)
Plot 2C (37, 37)	Plot 3A (10)	Plot 2A (140, 155)	Plot 4A (31)
Plot 3A (37, 45)	Plot 3E (10)	Plot 2B (127, 149)	Plot 4B (25)
Plot 4A (33, 41)	Plot 4A (10)		

species, 7 planted species, estimated 93 individuals, and 15 planted species individuals. The lowest diversity plot in the North 2015 planting area was Plot 5A with 20 herbaceous species, 3 planted species, estimated 67 individuals, and 7 planted species individuals.

Data summarized by species (both common and scientific name) in Appendix Tables 1-3 reported data across all plots. There was much variation in abundance of herbaceous species from presence in one to all 18 plots and one to >100 individuals total (data in archived files).

In the South area, 103 herbaceous species were reported from a total of 18 plots. Plots 10 + 11 and 12 + 13 were surveyed as a single unit in spring (a large brush pile obscured half of plot 10). So even though the four were surveyed as separate plots in summer, they were summarized as only two plots for this report. Average canopy cover (summer) was 70%; average herbaceous cover was 55% in spring, 80% in summer; average litter & bare ground cover was 45% in spring, 63% in summer. Planted herbaceous species totaled 61; 45 or 73.7% of these were recorded in surveys, summarized in Tables 2 and 3. They were 43.7% of all herbaceous species recorded, and 38.8% of total estimated herbaceous plants. In the 2017 survey 40 non-planted native herbaceous species were recorded (See Appendix Table A1): yellow-flowered jewelweed, enchanter's nightshade, white avens, Jack-in-the-pulpit, and Virginia waterleaf were the most common with >70 plants each.

In the North area, 107 herbaceous species were reported from a total of 18 plots. Average canopy cover (summer) was 58%; average herbaceous cover was 86% in spring and 73% in summer. Average litter & bare ground cover was not estimated, but was observed as quite low. Planted herbaceous species totaled 29; 19 or 65.5% of these were recorded, summarized in Table 2. These were 17.8% of all herbaceous species recorded, and 16.1% of total estimated herbaceous plants. In the 2017 survey 62 non-planted native herbaceous species were recorded (See Appendix Table A1): zig-zag golderod, enchanter's nightshade, white avens, honewort, white trout lily, and stickseed were the most common, with >70 plants each.

Several herbaceous taxa not identified to species were recorded in both areas (Appendix Table A2). Non-planted native woody vines and seedlings of several non-planted native trees or shrubs were also recorded (Appendix Table A3); woodbine/Virginia creeper was the most common in both the South and North areas. Exotic species (including woody plants) were recorded in both areas: 20 species in the South area and 19 in the North area. Common buckthorn seedlings were the most common in both areas; garlic mustard was also common in the South area.

### **Success of Plantings**

The success of planted species is estimated in Tables 2 and 3. Estimated success is likely a maximum for the South area; many of the planted species were also planted in earlier years and some survived (see section HISTORY OF THE SURVEYED AREAS above). The numbers of individuals planted in 2013-14-16 (Appendix Table A1) are thus underestimates for at least some species of the pool of planted individuals. Estimated success for planted species in the North area is more accurate, since few pre-2015 plantings were done in that area.

Most of the species planted in both areas (Table 2) had relatively similar success in both areas; 63% of those in the South area and half of those in the North area had at least medium success.

Table 2. Relative success of 24 species planted in both areas, grouped by four general classes of success. For individual species success: high = 50-100+% survival; medium = 10-50% survival; low = 1-10% survival. An asterisk marks species with very different success between areas. See Appendix Table A1 for exact survival rates.

Genus	Species	Common name	Success in 2013-14-16 area	Success in 2015 area
<i>Blephilia</i>	<i>hirsuta</i>	hairy wood mint	high	high
<i>Eutrochium</i>	<i>purpureum</i>	sweet joe-pye weed	high	high
<i>Symphyotrichum</i> (aster)	<i>drummondii</i>	hairy heart-leaved aster	high	high
<i>Carex</i>	<i>sprengelii</i>	Sprengel's sedge	high	medium
<i>Agastache</i>	<i>nepetoides</i>	yellow hyssop	medium	high
<i>Agastache</i>	<i>scrophulariaefolia</i>	purple giant hyssop	medium	high
<i>Elymus</i>	<i>hystrix</i>	eastern bottlebrush grass	high	medium
<i>Geranium</i>	<i>maculatum</i>	wild geranium	high	medium
<i>Lactuca</i>	<i>floridiana</i>	blue lettuce	low	high *
<i>Maianthemum</i>	<i>racemosum</i>	Racemed false Solomon seal	medium	high
<i>Tradescantia</i>	<i>virginiana</i>	spiderwort	none	high *
<i>Uvularia</i>	<i>grandiflora</i>	large-flowered bellwort	high	none *
<i>Blephilia</i>	<i>ciliata</i>	downy wood mint	low	medium
<i>Agastache</i>	<i>foeniculum</i>	anise hyssop	medium	low
<i>Anemone</i>	<i>virginiana</i>	Tall thimbleweed	medium	medium
<i>Polemonium</i>	<i>reptans</i>	Jacob's ladder	medium	medium
<i>Symphyotrichum</i> (aster)	<i>lateriflorum</i>	calico aster	medium	low
<i>Symphyotrichum</i> (aster)	<i>shortii</i>	Short's aster	medium	low
<i>Asclepias</i>	<i>exaltata</i>	poke milkweed	none	low
<i>Campanula</i>	<i>americana</i>	American bellflower	low	low
<i>Carex</i>	<i>brevior</i>	plains oval sedge	none	none
<i>Carex</i>	<i>molesta</i>	"troublesome" sedge	none	none
<i>Carex</i>	<i>pennsylvanica</i>	Pennsylvania sedge	low	none
<i>Doellingeria</i> (aster)	<i>umbellata</i>	flat-topped white aster	none	none

Only the three marked species differed drastically in their success between areas; they represent a subgroup of species for which local site conditions are relatively important. A lower proportion (52%) of species planted only in the South area (Table 3) had at least medium success, while none of the five species planted only in the North area—nodding onion, crested sedge, Gray's sedge, muskingum sedge, and hairy or frost aster—was recorded in 2017. Those South area-only

Table 3. Relative success of 37 species planted only in the 2013-14-16 South area, grouped by three general classes of success. For individual species success: high = 50-100+% survival; medium = 10-50% survival; low = 1-10% survival. Almost 50% had low to no survival success.

<b>genus</b>	<b>species</b>	<b>Common name</b>	<b>Success</b>
<i>Actaea</i>	<i>rubra</i>	red baneberry	high
<i>Aralia</i>	<i>racemosa</i>	American spikenard	high
<i>Asarum</i>	<i>canadense</i>	Canada wild ginger	high
<i>Dryopteris</i>	<i>carthusiana</i>	wood fern	high
<i>Mertensia</i>	<i>virginica</i>	Virginia bluebells	high
<i>Thalictrum</i>	<i>dioicum</i>	early meadow-rue	high
<i>Adiantum</i>	<i>pedatum</i>	maidenhair fern	medium
<i>Allium</i>	<i>tricoccum</i>	wild leek	medium
<i>Aquilegia</i>	<i>canadensis</i>	Wild columbine	medium
<i>Athyrium</i>	<i>filix-femina</i>	lady fern	medium
<i>Cystopteris</i>	<i>bulbifera</i>	bulblet bladder fern	medium
<i>Lobelia</i>	<i>cardinalis</i>	cardinal flower	medium
<i>Lobelia</i>	<i>siphilitica</i>	great blue lobelia	medium
<i>Podophyllum</i>	<i>peltatum</i>	mayapple	medium
<i>Sanguinaria</i>	<i>canadensis</i>	bloodroot	medium
<i>Smilax</i>	<i>herbacea</i>	smooth carrion flower	medium
<i>Solidago</i>	<i>flexicaulis</i>	zig-zag goldenrod	medium
<i>Trillium</i>	<i>grandiflorum</i>	big white trillium	medium
<i>Veronicastrum</i>	<i>virginicum</i>	culver's root	medium
<i>Actaea</i>	<i>pachypoda</i>	white baneberry	none
<i>Anemonella</i>	<i>thalictroides</i>	rue anemone	none
<i>Carex</i>	<i>normalis</i>	greater straw sedge	low
<i>Diarrhena</i>	<i>obovata</i> var. <i>americana</i>	ovate beak grass	low
<i>Dicentra</i>	<i>cucullaria</i>	Dutchman's breeches	none
<i>Dodecatheon</i>	<i>meadia</i>	shooting star	low
<i>Elymus</i>	<i>villosus</i>	silky wild rye	none
<i>Eurybia (Aster)</i>	<i>macrophyllus</i>	big leaf aster	low
<i>Fragaria</i>	<i>virginiana</i>	wild strawberry	none
<i>Glyceria</i>	<i>striata</i>	woodland brome	none
<i>Mitella</i>	<i>diphylla</i>	two-leaf miterwort	low
<i>Penstemon</i>	<i>digitalis</i>	foxglove beardtongue	low
<i>Phlox</i>	<i>divaricata</i>	woodland phlox	low
<i>Prenanthes</i>	<i>alba</i>	lion's foot	none
<i>Pycnanthemum</i>	<i>virginianum</i>	mountain mint	none
<i>Rudbeckia</i>	<i>laciniata</i>	wild goldenglow	none
<i>Sorghastrum</i>	<i>nutans</i>	Indiangrass	none
<i>Verbena</i>	<i>hastata</i>	blue vervain	none

planted species with at least medium success are potentially additional members of the species group for which local conditions matter.

**Success of non-planted native species**

Quite a few more non-planted native species were recorded in the North area; 63 as opposed to only 40 in the South area. This is consistent with the more severe disturbances to herbaceous plants in the South area since ~1970 (See section **Historical maps...**) Of the 32 species with more than 20 plants in at least one of the surveys, eight were common in both areas: jack-in-the-pulpit, enchanter's nightshade, white avens, stickseed, Virginia waterleaf, yellow wood-sorrel, clearweed, and common goldenrod. Seven were common only in the South area, while 17 were common only in the North area (including zig-zag goldenrod and early meadow-rue planted in the South area). Thus more local specialization was documented for the non-planted native herbaceous species than for the planted species.

**Conservation value of survey area plants**

There were C of C ratings for only 123 of the total 190 species recorded in the surveys. Total and average C of C were calculated for each survey area for all species, all herbaceous species, and planted species (Table 4) from the available species ratings (Appendix Tables A1 and A3). The C of C values for species are for their preferred particular environment – woodland, wetland, etc. A species with a high C of C in one environment may not be appropriate or survive as well in another environment. The average C of C values of planted species reflect which species

Table 4. Plots with the highest C of C ratings in each survey area. Numbers in parentheses are the C of C values for plots. For the “all species” columns, C of C for herbaceous species only is followed by the C of C for all species including woody plants.

2013-14-16 Planting Area: Highest C of C Plots			
Highest total C of C for all species	Highest total Cof C for planted species	Highest average C of C for all species	Highest average C of C for planted species
Plot 1 (174, 179)	Plot 1 (119)	Plot 4 (4.44, 3.94)	Plot 4 (5.94)
Plot 2 (152, 167)	Plot 3 (117)	Plot 7 (4.57, 4.57)	Plot 5A (5.92)
Plot 3 (161, 176)	Plot 9 (96)	Plot 15 (4.38, 3.93)	Plot 9 (6.00)
Plot 9 (150, 160)	Plot 15 (105)	Plot 17 (4.76, 4.20)	Plot 10/11 (5.90)
Plot 15 (162, 169)	Plot 18 (113)	Plot 18 (4.45, 3.93)	Plot 19 (5.87)
		Plot 19 (4.91, 4.37)	
2015 Planting Area: Highest C of C Plots			
Highest total C of C for all species	Highest total Cof C for planted species	Highest average C of C for all species	Highest average C of C for planted species
Plot 1A (150, 165)	Plot 1E (48)	Plot 1E (3.93, 3.93)	Plot 1B (5.86)
Plot 1E (173, 185)	Plot 2A (65)	Plot 2A (3.83, 3.83 )	Plot 1C (6.00)
Plot 2A (153, 160)	Plot 2E (48)	Plot 2B (3.94, 3.65)	Plot 2A (5.42)
Plot 3A (138, 152))	Plot 3A (52)	Plot 3E (4.43, 4.32)	Plot 3C (5.40)
Plot 3E (155, 160)	Plot 3E (54)	Plot 4A (3.55, 3.20)	Plot 3E (5.40)
	Plot 4A (55)	Plot 4C (3.79, 3.55)	Plot 4A (5.50)
		Plot 5A (3.65, 3.55)	

survived in that area. Most of the average C of C values for plots are <5, indicating species with on average moderate fidelity to their preferred environment and moderate tolerance to disturbance. This is not unexpected for woodlands embedded in an urban area, and with a history of moderate to severe disturbances in the past. It appears from the “all species” average C of C values that for these most diverse plots, woody species mostly have lower C of C values than herbaceous species, and the planted species have notably higher C of C values (more fidelity to their preferred environment, less tolerance of disturbance) than the non-planted species.

Comparison of the average C of C status of the two surveyed areas is summarized in Table 5. In the South 2013-14-15 area in general, in contrast to the highest diversity plots (Table 4), woody plants in the average plot increased the C of C value from non-planted species. In the North 2015 planting area, woody plants consistently decreased the C of C value.

Table 5. Average C of C for the 2013-14-16 and 2015 Planting Areas as a whole. For non-planted and total species, the C of C for herbaceous species only is followed by that including woody species.

	2013-14-16 PA	2015 PA
Average C of C planted species	5.71	5.22
Average C of C non-planted species	2.84, 3.42	3.21, 3.01
Average C of C total species	4.19, 3.72	3.66, 3.44

### Plot survey summary

In general, plot characterization from both species abundance data (counts and weighted counts) and floristic quality values (C of C) by plot can be interpreted to designate some of the plots as “better” than others. Of course, all of the data are subject to the quality and completeness of the observations and these might have varied by plot. In particular, summary C of C values are limited because only 60% of the species recorded had assigned C of C values. With those caveats, it does appear that the plantings are contributing to the Planting Areas, since C of C values for surviving planted species are always higher than for non-planted species. The latter include relatively weedy native species with low C of C values, the species most likely to naturally colonize the Preserve embedded in a large city with mostly non-native vegetation, and with a history of disturbance to the land.

Some generalizations can be made from relative planting success in the two survey areas. For example, most of the less common sedges (*Carex*) had at best poor success, as did some of the less common species of asters and other composites. Also, the low success of shooting star in the South area contrasts with its relatively large population on slopes farther along on the Big Oak Trail. The latter success could have resulted from better site conditions for shooting star and/or from multiple years of planting, as well as from the dedicated care and weeding of that population each year by Glenda Denniston, Roma Lenehan, and other Friends.

Results of these surveys suggest that for future projects selection of fewer species with a good track record of planting success overall as well as in similar areas would achieve similar results more economically. The relatively high abundance of garlic mustard and seedlings of buckthorn in the surveys signals the need for continued weed removal in those areas. The relative scarcity of native herbaceous species in the interior of the South area from the Preserve staff assessment just before the 2013 plantings also highlights the importance of regular management to keep exotic shrubs under control.

### **Value and feasibility of the surveys**

Quite a few Friends members participated in the 2017 Frautschi Point surveys, and most expressed satisfaction with their participation. The protocols were simple enough to teach and conduct, and they generated data useful to Preserve management. Glenda is planning somewhat less formal surveys of the other planted areas in Frautschi Point; several volunteers for this project have expressed interest in participating in those surveys. Some of the difficulties interpreting results of these surveys have highlighted the value of keeping good notes and records from all planting parties.

Several lessons were learned to improve Friends survey projects in the future. Amount of shade is important for evaluating species choice and planting success, but our cover estimates were somewhat less than perfect. We suggest that in future two or three people make summer cover estimates at each of several places in a survey area, then report and use for interpretations the averages for each place from estimates of all people. We also began the data analysis phase of the project before reconciliation of all species identification issues had been completed. This gave us a lot of extra work during the data analysis part of the project and had the potential for introducing errors, though we worked very hard to avoid that. We strongly recommend that in future all parties agree that all species identification issues have been resolved and the entered data sets have been completely proofread for accurate numbers and redundant rows, before data analysis is begun.

### REFERENCE

Bernthal, Thomas W. June 2003. Development of a Floristic Quality Assessment Methodology for Wisconsin, Final Report to the U. S. Environmental Protection Agency Region V. [dnr.wi.gov/files/PDF/pubs/ss/SS09](http://dnr.wi.gov/files/PDF/pubs/ss/SS09)

Appendix Table A1. Summary of survey data by area for identified herbaceous species. Columns with an asterisk are based on estimates from three abundance classes; see Methods.

Genus	Species	Common Name	Type	WDNR CoC	exotic	South area, 2013-14-16 plantings				North area, 2015 plantings			
						total # planted	count: plots species observed (max 18)	# plants: weighted count*	% survival planted species*	total # planted	count: plots species observed (max 18)	# plants: weighted count*	% survival planted species*
Acalypha	rhomboidea	3-seeded mercury	herb		yes		1	1					
Achillea	millefolia	yarrow	herb	1	yes					2	2		
Actaea	pachypoda	white baneberry	herb	6		2			none				
Actaea	rubra	red baneberry	herb	7		2	3	3	150%				
Adiantum	pedatum	maidenhair fern	herb	7		10	2	2	20%				
Agastache	foeniculum	blue giant hyssop	herb	6		64	5	13	20%	32	1	1	3%
Agastache	nepetoides	yellow giant hyssop	herb	5		32	5	9	28%	32	10	18	56%
Agastache	scrophulariaefolia	purple giant hyssop	herb	4		64	8	12	19%	32	9	22	69%
Agrimonia	gryposepala	tall hairy agrimony	herb	2			1	1					
Alliaria	petiolata	Garlic mustard	herb		yes		12	81			11	28	
Allium	cernuum	nodding onion	herb	7						32			none
Allium	triccoccum	wild leek	herb	6		5	1	1	20%				
Ambrosia	trifida	giant ragweed	herb				3	7			5	9	
Anemone	virginiana	Tall thimbleweed	herb	5		96	9	13	14%	32	7	7	22%
Anemonella	thalictroides	rue anemone	herb			5			none				
Aquilegia	canadensis	Wild columbine	herb	5		224	10	30	13%		8	8	
Aralia	racemosa	American spikenard	herb	7		2	6	6	300%				
Arisaema	triphylllum	Jack-in-the-pulpit	herb	5			18	108			14	26	
Asarum	canadense	wild ginger	herb	7		24	7	19	79%		4	12	
Asclepias	exaltata	poke milkweed	herb	7		16			none	32	3	3	9%
Athyrium	filix-femina	lady fern	herb	5		74	7	24	32%				
Bidens	frondosa	beggar's tick	herb	1	yes						4	13	
Blephilia	ciliata	downy wood mint	herb	7		96	5	9	9%	32	4	4	13%
Blephilia	hirsuta	hairy wood mint	herb	7		128	15	99	77%	32	12	33	103%
Bromus	latiglumis	earlyleaf brome	herb								2	20	
Campanula	americana	American bellflower	herb	4		64	1	1	2%	32	2	2	6%
Campanula	rapunculoides	creeping bellflower	herb		yes						4	17	
Campanula	sp. reptans	yellow bellflower	herb								2	2	
Carduus	acanthoides	spiny plumeless thistle	herb		yes		1	1					
Carex	blanda	common wood sedge	herb	3			10	28			11	15	
Carex	brevior	plains oval sedge	herb	3		32			none	32			none
Carex	crisatella	crested sedge	herb	4						32			none
Carex	grayii	Gray's sedge	herb	7						32			none

Table A1, cont.

Genus	Species	Common Name	Type	WDNR CoC	exotic	South area, 2013-14-16 plantings				North area, 2015 plantings			
						total # planted	count: plots species observed (max 18)	# plants: weighted count*	% survival planted species*	total # planted	count: plots species observed (max 18)	# plants: weighted count*	% survival planted species*
Carex	molesta	"troublesome" sedge	herb	2		32			none	32			none
Carex	muskingumensis	muskingum sedge	herb	7						32			none
Carex	normalis	greater straw sedge	herb	5		32	2	2	6%				
Carex	pennsylvanica	Pennsylvania sedge	herb	3		96	1	1	1%	32			none
Carex	sprengelii	Sprengel's sedge	herb	6		32	12	45	141%	32	10	10	31%
Chenopodium	album	lambquarter	herb		yes		2	2			2	6	
Circaea	lutetiana	enchanter's nightshade	herb	2			17	122			18	132	
Cirsium	arvense	Canada thistle	herb		yes		1	1			4	4	
Convallaria	majalis	lily of the valley	herb		yes						6	42	
Convolvulus	arvensis	field bindweed	herb		yes		4	4					
Cryptotaenia	canadensis	honewort	herb	4							16	76	
Cystopteris	bulbifera	bulblet bladder fern	herb	8		5	1	1	20%				
Dentaria	laciniata	Cutleafed toothwort	herb								4	13	
Diarrhena	obovata var. americana	ovate beak grass	herb	10		64	2	6	9%				
Dicentra	cucullaria	Dutchman's breeches	herb	7		32			none		1	5	
Dodecatheon	meadia	shooting star	herb	7		32	3	3	9%				
Doellingeria	umbellata	flat-topped white aster	herb	6		32			none	32			none
Dryopteris	carthusiana	wood fern	herb	7		5	8	13	260%				
Echinacea	purpurea	purple coneflower	herb								3	3	
Elymus	canadensis	Canada wild rye	herb	4							6	28	
Elymus	hystrix	eastern bottlebrush grass	herb	6		64	15	40	63%	64	11	23	36%
Elymus	villosus	silky wild rye	herb	6		64			none				
Elymus	virginicus	Virginia wild rye	herb	6			5	5			6	6	
Epilobium	angustifolium	fireweed	herb	3			1	1					
Erigeron	anuus	daisy fleabane	herb				8	12			1	1	
Erythronium	alba	white trout lily	herb	7							11	74	
Eupatorium	rugosum	white snakeroot	herb	1			3	3					
Eurybia	macrophyllus	big leaf aster	herb	4		96	2	2	2%				
Eutrochium	purpureum	sweet joe-pye weed	herb	6		64	11	36	56%	32	15	31	97%
Fragaria	virginiana	wild strawberry	herb	1		72			none				
Galium	aparine	bedstraw/cleavers	herb	2			7	15			8	39	
Galium	concinnum	shining bedstraw	herb	6							17	54	
Galium	triflorum	fragrant bedstraw	herb	5			10	27			6	10	
Geranium	maculatum	wild geranium	herb	4		160	16	80	50%	64	7	19	30%
Geranium	pusillum	small-flowered geranium	herb		yes		9	31			5	14	

Table A1, cont.

Genus	Species	Common Name	Type	WDNR CoC	exotic	South area, 2013-14-16 plantings				North area, 2015 plantings			
						total # planted	count: plots observed (max 18)	# plants: weighted count*	% survival planted species*	total # planted	count: plots observed (max 18)	# plants: weighted count*	% survival planted species*
Geum	canadense	white avens	herb	2			18	132			17	78	
Glechoma	hederacea	creeping charlie	herb		yes		3	11					
Glyceria	striata	woodland brome	herb	4		32			none				
Hackelia	virginica	stickseed	herb	3			18	66			12	73	
Helianthus	hirsutus	hairy/woodland sunflower	herb	5							10	28	
Hydrophyllum	virginianum	Virginia waterleaf	herb	4			10	71			15	50	
Impatiens	capensis	orange-flowered jewelweed	herb	2			5	5					
Impatiens	pallida	yellow-flowered jewelweed	herb	6			18	180			1	5	
Lactuca	canadensis	Canada wild lettuce	herb	2			1	1			8	12	
Lactuca	floridiana	blue lettuce	herb	5		64	6	6	9%	32	14	43	134%
Lactuca	serriola	Prickly lettuce	herb		yes						2	2	
Leersia	virginica	whitegrass	herb	5			9	54			2	2	
Leonurus	cardiaca	Motherwort	herb								2	2	
Leucanthemum	vulgare	oxeye daisy	herb		yes						5	5	
Lobelia	cardinalis	cardinal flower	herb	7		32	2	11	34%				
Lobelia	siphilitica	great blue lobelia	herb	5		32	4	4	13%				
Lysimachia	nummularia	moneywort	herb		yes		1	1					
Maianthemum	racemosum	Racemed false Solomon seal	herb	5		32	5	14	44%	11	12	39	355%
Mertensia	virginica	Virginia bluebells	herb	4		12	3	12	100%				
Mitella	diphylla	two-leaf miterwort	herb	8		18	1	1	6%				
Monarda	fistulosa	wild bergamot	herb	3			2	2			14	47	
Oenothera	biennis	evening primrose	herb	1							6	6	
Onoclea	sensibilis	sensitive fern	herb	5			1	1					
Osmorhiza	longistylis	Smooth sweet cicely	herb	4			1	10			12	33	
Osmoriza	claytonii	sweet cicely	herb	5			1	1			12	38	
Oxalis	stricta	yellow wood-sorrel	herb				9	22			10	44	
Penstemon	digitalis	foxglove beardtongue	herb			64	1	1	2%		1	1	
Persicaria	maculosa	lady's thumb	herb				1	10					
Persicaria	pennsylvanica	smartweed	herb				3	7			2	2	
Persicaria	virginianum	jumpseed	herb	7			12	59			4	12	
Phalaris	arundinacea	reed canary grass	herb		yes		1	1					
Phlox	divaricata	woodland phlox	herb	7		32	2	2	6%				
Phryma	leptostachya	lopseed	herb	5			1	1			8	16	
Phytolacca	americana	pokeweed	herb	1			6	10					
Pilea	pumila	clearweed	herb	3			8	21			4	22	
Plantago	major	common plantain	herb		yes		1	5					

Table A1, cont.

Genus	Species	Common Name	Type	WDNR CoC	exotic	South area, 2013-14-16 plantings				North area, 2015 plantings			
						total # planted	count: plots observed (max 18)	# plants: weighted count*	% survival planted species*	total # planted	count: plots observed (max 18)	# plants: weighted count*	% survival planted species*
Podophyllum	peltatum	mayapple	herb	4		22	3	7	32%				
Polemonium	reptans	Jacob's ladder	herb	6		160	16	61	38%	64	8	20	31%
Polygonatum	biflorum	Solomon's seal	herb	4			11	28			9	17	
Prenanthes	alba	lion's foot	herb	5		5			none		1	1	
Prunella	vulgaris	Self-heal	herb	1									
Pycnanthemum	virginianum	mountain mint	herb	6		32			none				
Ranunculus	abortivus	little leaf buttercup	herb	1			5	9			3	12	
Ratibida	pinnata	yellow coneflower	herb	4							9	21	
Rudbeckia	hirta	black-eyed Susan	herb	4			1	1			1	1	
Rudbeckia	laciniata	wild goldenglow	herb	6		32			none				
Rudbeckia	sp.	non-fuzzy	herb								1	1	
Rudbeckia	trifida	brown-eyed Susan	herb	4							3	16	
Rudbeckia	triloba	brown-eyed Susan	herb	4							11	46	
Sanguinaria	canadensis	bloodroot	herb	6		32	7	15	47%				
Sanicula	marilandica	black snakeroot	herb	5			1	1			3	3	
Scroph	mystery	mystery	herb								1	1	
Scrophularia	marilandica	figwort	herb	4			4	8			1	1	
Senna	sp.	senna (pea)?	herb								1	1	
Silene	vulgaris	bladder campion	herb		yes						1	1	
Smilax	herbacea	carrion flower, smooth	herb	5		32	2	11	34%		1	1	
Solanum	dulcamara	deadly nightshade	herb		yes		3	3			5	5	
Solanum	nigrum	black nightshade	herb		yes		1	1					
Solidago	canadensis	common goldenrod	herb	1			7	37			11	24	
Solidago	flexicaulis	zig-zag goldenrod	herb	6		96	10	36	38%		18	161	
Solidago	ulmifolia	elm-leaved goldenrod	herb	5									
Sorghastrum	nutans	Indiangrass	herb	5		32			none				
Stylophorum	diphyllum	Celendine popppy, pulled	herb		yes						1	1	
Symphyotrichum	drummondii	hairy heart-leaved aster	herb	4		64	9	44	69%	32	7	33	103%
Symphyotrichum	lanceolatum	panicked aster	herb	4							4	13	
Symphyotrichum	lateriflorum	calico aster	herb	3		96	7	27	28%	32	2	2	6%
Symphyotrichum	macrophyllus	bingleaf aster	herb	4							1	1	
Symphyotrichum	novae-angliae	New England	herb	3							1	1	
Symphyotrichum	pilosus	hairy or frost aster	herb	1						32			none
Symphyotrichum	sagittifolium	arrow-leaved aster	herb	3			1	1			9	40	
Symphyotrichum	shortii	Short's aster	herb	7		128	12	55	43%	32	1	1	3%
Symphyotrichum	urophyllum	white arrow-leaf aster	herb								5	37	

Table A1, cont.

Genus	Species	Common Name	Type	WDNR CoC	exotic	South area, 2013-14-16 plantings				North area, 2015 plantings			
						total # planted	count: plots species observed (max 18)	# plants: weighted count*	% survival planted species*	total # planted	count: plots species observed (max 18)	# plants: weighted count*	% survival planted species*
Taraxacum	officinale	dandelion	herb		yes		7	16			13	33	
Thalictrum	dioicum	early meadow-rue	herb	7		32	6	18	56%		8	34	
Tradescantia	virginiana	spiderwort	herb			32			none	32	6	15	47%
Trillium	grandiflorum	big white trillium	herb	6		5	1	1	20%				
Uvularia	grandiflora	large-flowered bellwort	herb	7		10	4	17	170%	32			none
Verbena	hastata	blue vervain	herb	3		32			none				
Verbena	urticifolia	white vervain	herb	2			2	2			3	3	
Veronicastrum	virginicum	culver's root	herb	6		32	5	5	16%				
Viola	pubescens	yellow forest-violet (stemmed)	herb	5			1	1					
Viola	sororia	dooryard violet(purple/white)	herb	3			9	48			8	16	
Zizia	aurea	golden alexander	herb	7				3			12	29	

Appendix Table A2. Summary of survey data by area for unidentified herbaceous species. Columns with an asterisk are based on estimates from three abundance classes; see Methods.

Genus	Species	Common Name	Type	WDNR CoC	exotic	South area, 2013-14- 16 plantings		North area, 2015 plantings	
						count: plots species observed (max 18)	# plants: weighted count*	count: plots species observed (max 18)	# plants: weighted count*
"Aster"		mystery 3	herb				74	1	1
"Aster"		July plot 1a	herb					1	1
"Aster"		weedy	herb					2	2
"Aster"		weedy small	herb					1	1
coarse, parsley family		May	herb					4	4
grass?		May	herb					1	1
Mystery		mystery	herb					1	1
mystery composites (2 species?)		May	herb					2	2
Symphotrichum		sp. July	herb			3	3		
unk 3 (May)		long linear leaf	herb			1	5		
unk 4 (May)		unknown mint, smooth	herb			1	1		
Unknown grass			herb					1	1
Unknown grass		droopy seed grass	herb					1	1
unk composite 1	lvs like Solidago,	but shiny no teeth	herb			3	3		
unk composite 3	alternate	broad/linear lvs, coarse teeth	herb			1	1		

Appendix Table A3. Summary of survey data by area for woody species seedlings. Columns with an asterisk are based on estimates from three abundance classes; see Methods.

Genus	Species	Common Name	Type	WDNR CoC	exotic	South area, 2013-14- 16 plantings		North area, 2015 plantings	
						count: plots species observed (max 18)	# plants: weighted count*	count: plots species observed (max 18)	# plants: weighted count*
Cornus	alternifolia	pagoda dogwood	shrub	7		2	2	4	4
Cornus	racemosa	gray dogwood	shrub	2		1	1		
Ligustrum	vulgare	privet	shrub		yes	3	3		
Lonicera	x bella hybrid	exotic honeysuckle	shrub		yes	10	31	3	12
Morus	alba	white mulberry	shrub		yes	1	1		
Rhamnus	cathartica	common buckthorn	shrub		yes	15	69	15	108
Rhus	sp.	sumac	shrub					3	3
Rubus	idaeus	red raspberry	shrub	3		4	12		
Rubus	occidentalis	black raspberry	shrub	2		5	9	4	8
Sambucus	racemosa	red-berried elderberry	shrub	3		9	13	2	6
Styrax	sp.	exotic	shrub		yes			1	1
Viburnum	sp.	(no other information)	shrub					1	1
Viburnum	sp. (May)	no petiolar glands	shrub			1	1		
Viburnum	trilobum var opulus	European (petiolar glands)	shrub		yes	5	13		
Tilia	americana	basswood	tree	5		1	1		
Ulmus	sp.	elm	tree			5	9		
Ampelopsis	brevipedunculata	porcelain berry	vine		yes			1	1
Celastrus	orbiculatus	oriental bittersweet	vine		yes	1	1	2	2
Parthenocissus	quinquefolia	woodbine/Virginia creeper	vine	5		16	132	13	87
Smilax	sp.	(no other info)	vine					1	1
Toxicodendron	radicans	poison ivy	vine	4		2	20		
Vitis	riparia	riverbank grape	vine	2		1	1		
Vitis	sp.	wild grape	vine			10	23	7	11