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Natural Resource Stewardship and Science

Implementation of a Long-term Vegetation Monitoring Program at Apostle Islands National Lakeshore

Natural Resource Technical Report NPS/GLKN/NRTR—2012/613

ON THE COVER
Clockwise from top left: hemlock (*Tsuga canadensis*) sapling; browse on mountain maple (*Acer spicatum*); measuring tree diameter; gypsy moth (*Lymantria dispar*) laying an egg mass. Photographs by GLKN field crew.

Implementation of a Long-term Vegetation Monitoring Program at Apostle Islands National Lakeshore

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Suzanne Sanders and Jessica Grochowski

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

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Executive Summary

We initiated a long-term vegetation monitoring program at Apostle Islands National Lakeshore (APIS) 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 48 plots at APIS, distributed among five forest types. In the hemlock-hardwoods forest type, sugar maple, yellow birch, and hemlock were all abundant and regenerating, although it is not clear whether the structure of this forest type is converging on that observed in old growth hemlock-hardwood forests in the region. The bigtooth aspen-paper birch type is succeeding toward a mid-successional sere. Currently, red maple dominates; it is not clear whether this is transitioning toward a hemlock-hardwood type or possibly to the balsam fir cover type. Mountain maple-black ash forests are are also succeeding toward a mid-successional sere, although the successional trajectory is not clear. Currently, these plots are dominated by mountain maple, which does not attain large diameters or great height, and by black ash. The latter species is expected to be eliminated from the park due to the impending arrival of the emerald ash borer (EAB). Eastern white cedar forest is common throughout the islands and is a climax type. Like cedar, the balsam fir forests are fairly stable and, barring massive disturbance, will not likely transition to other types in the coming decades.

Preventing the introductions of invasive species, particularly buckthorn and exotic honeysuckles, is especially important to maintaining the health of the Park's forests. This is especially relevent in black ash-alder swamps where only two species dominate. The loss of black ash due to EAB could reduce the stability of these habitats, allowing invasives to more easily establish a foothold. It is highly recommended that ash seed is collected within the park for deposit with the USDA National Plant Germplasm System. This could preserve locally adapted genotypes for future reintroduction after effective EAB control measures are developed. This would also allow researchers to test for possible resistance. These plots at Apostle Islands National Lakeshore 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 Ted Gostomski for boat transportation and to Peggy Burkman and Julie Van Stappen for planning and logistical assistance. Finally, we greatly appreciate 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 Apostle Islands National Lakeshore (APIS) 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 APIS 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 APIS. 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 APIS from 6 July–23 August 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% 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 ≤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 ≥2.5 cm. Groundlayer vegetation was collected in 1 m^2 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 seedling counts. 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, cedar). 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^2 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 2005); and, if possible, the species. Because we defined CWM as having a diameter ≥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 × 100 m plot area to locate any additional species not previously recorded in any of the sampling.

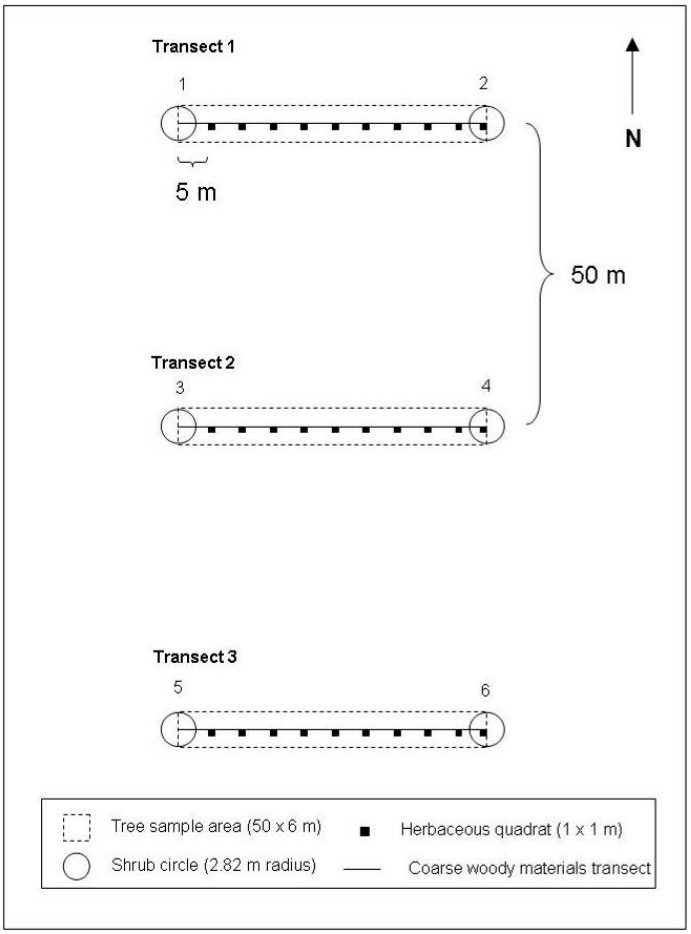

Figure 1. The hybrid plot configuration consisted of three parallel transects, each 50 m long and oriented east-to-west.

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^2 (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^2. 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).

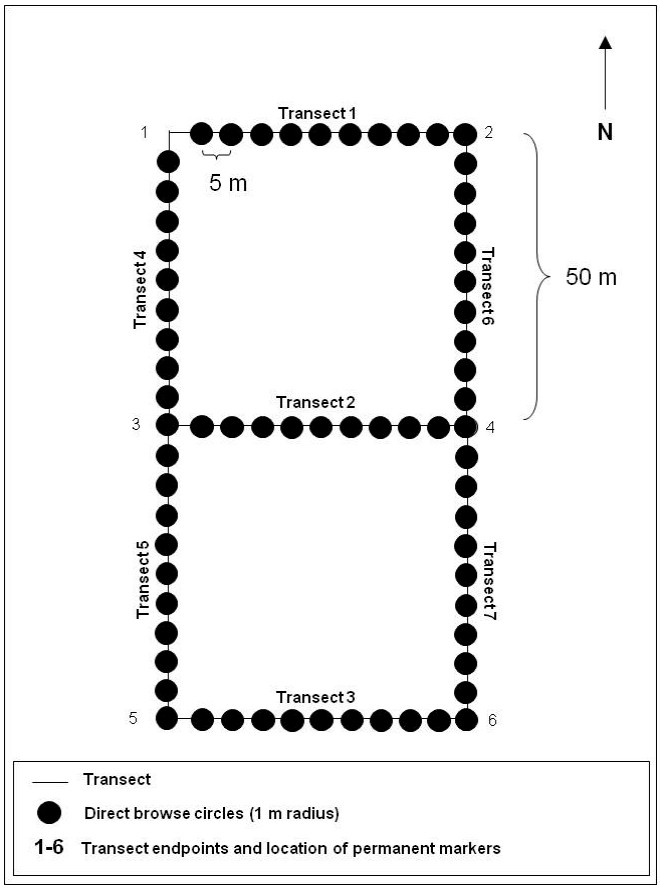

Figure 2. Location of the direct browse sampling circles in a plot.

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: *Clintonia borealis* (Aiton) Raf. (blue-bead lily), *Aralia nudicaulis* L. (wild sarsaparilla), and *Streptopus lanceolatus* (Aiton) Reveal var. *roseus* (Michx.) Reveal (rosy twisted-stalk). For each target species within each 1 m^2 herbaceous quadrat (see Figure 1), 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

diagnosis of the root cause can possibly be assigned upon further investigation. We feel that this 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 to potential disease or insect outbreaks, which would require further investigation by the park to identify the exact disease or pest.

Earthworm Assessments

Earthworm assessments were done at vegetation monitoring plots to determine the extent of invasive earthworm presence at APIS. Earthworm presence was determined using a simple visual assessment of the forest floor combined with a soil core assessment that followed methods developed for the invasive earthworm rapid assessment tool (Loss et al., in prep). The forest floor assessment involves determining if the forest floor has fresh litter, duff, and organic matter. In addition, the presence of both earthworm casts, or excretions, are noted, as well as middens, which are piles of cast material created by the nightcrawler (*Lumbricus terrestris* L.) (Hale and Host 2005). The soil core allows for a visual inspection of the depth of the organic layer, as well as an inspection of the A and E soil horizons, to determine their presence and thickness. Forests experiencing an earthworm invasion show a decrease in organic matter, and a thickening of the A soil horizon (Hale et al. 2005, Hale et al. 2008). From this, samples can be ranked as earthworm-free, minimally invaded, moderately invaded, substantially invaded, or heavily invaded. For example, an earthworm-free sample has fresh litter, duff, and organic matter present; no evidence of earthworm casts or middens; and the presence of an E soil horizon. A moderately invaded sample has fresh litter and decayed litter, but no organic matter present; earthworm casts are present but not abundant; and earthworm middens may be present or absent. A heavily invaded sample would have fresh litter, but no decayed litter and no organic matter, and earthworm casts and middens would be abundant (Loss et al., in prep). Four earthworm assessments were done at each monitoring plot, in areas that were representative of the plot overall.

Assigning Forest Types

Because we may want to stratify by forest or habitat type during later analyses (i.e., post-sampling stratification), we planned to assign a forest type for each plot, while we were at the plot, using both of two classification systems. The Kotar classification system (Kotar et al. 2002) defines forest types based on the potential vegetation rather than the current vegetation. Potential vegetation is the expected climax forest in a stand and reflects both the moisture level as well as the nutrient availability within the stand. Moisture and nutrient availability are inherent properties of the soil and are not expected to change over decadal time scales. As such, the expected climax type should not vary between site visits. Thus, any post-sampling stratification that is performed should result in the same groupings of plots following any sampling event. While the Kotar system has been developed for the entire state of Wisconsin, classes have not been defined for wet habitats. Hence, we experienced difficulty assigning a forest type for many plots with cedar and black ash.

In addition to the Kotar classification system, we also assigned a current type based on the National Vegetation Classification System (Federal Geographic Data Committee 2008). The drawback with using the current type is that that plots will likely not be grouped in the same

manner after successive sampling events, potentially complicating analyses of long-term change. We continued to use the Kotar classification system as well, provided a plot clearly fell into one of the pre-defined classes.

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. 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.

Analysis and Classification Methods

Cluster Analysis

We used cluster analysis to place the 48 plots into groups with similar tree species composition. We limited inclusion in the cluster analysis to those species that were present in at least 10% (5 of 48) of the plots. Collectively, the plots supported 16 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 Sørenson distance measure and a flexible beta linkage (ß = -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 taxon 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 either woody (trees and shrubs), graminoid (grasses, sedges, and rushes), or forbs. For this report, the latter class included ferns and fern allies. 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 native, non-native, or native/non-native. Naturalized taxa (e.g., *Prunella vulgaris* L. [heal-all]) were considered non-native. In some instances taxa were identified only to the genus level and

could not be assigned to a nativity group, as species within these genera are both native and non-native. Examples include *Poa* sp. (bluegrass) and *Hieraceum* sp. (hawkweed).

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). Mean COC values were calculated for each of the five forest types.

Results

A total of 48 plots were completed at APIS (Figure 3). Examination of the species assemblages in the clustered groups, along with Kotar and NVCS classifications for many plots, allowed us to subjectively assign a forest type to each group (Table 1). Twenty-three tree species were recorded in the sampling plots (Appendix B), as were 29 shrub and woody vine species and 156 species of herbs.

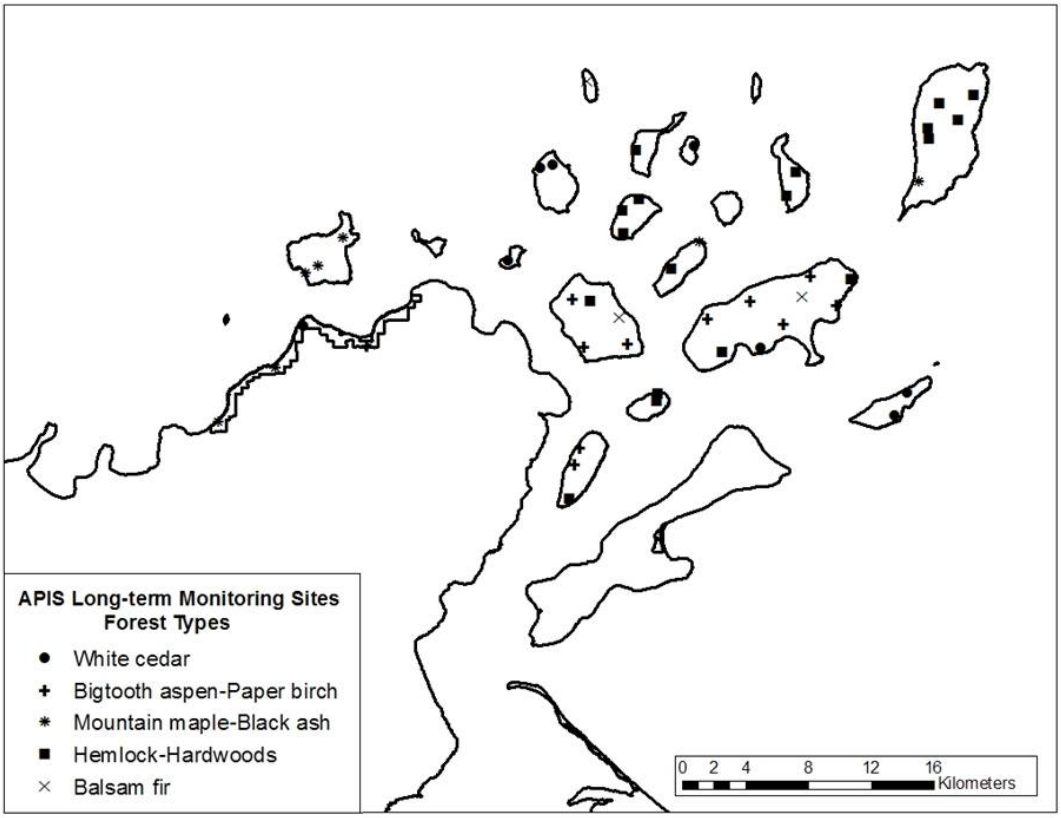

Figure 3. Apostle Islands long-term vegetation monitoring plot locations and forest types (in 2011).

Table 1. Forest types at the Apostle Islands and the plots classified in each.

Forest type	Plots
Hemlock-hardwood	1009, 1012, 1014, 1016, 1017, 1022, 1025, 1027, 1028, 1029, 1037, 1040, 1042, 1044, 1049, 1050, 1053, 1055
Bigtooth aspen-paper birch	1003, 1005, 1006, 1013, 1015, 1018, 1026, 1033, 1038, 1046, 1057
Eastern white cedar	1002, 1007, 1010, 1021, 1023, 1030, 1039, 1047
Mountain maple-black ash	1004, 1020, 1024, 1036, 1041, 1043, 1059
Balsam fir	1011, 1031, 1034, 1035

Hemlock-Hardwood Forests

Hemlock-hardwood forest was the most common forest type sampled, with 18 plots classified as such. These plots were distributed over eight islands, primarily with no current resident deer populations (Figure 3). These islands were Outer (five of the 10 plots on that island), Otter (3 of 3 plots), Stockton (2 of 12 plots), Cat (2 of 2 plots), Hermit (2 of 2 plots), and one plot each on Manitou, Oak, Basswood, and Rocky islands. These plots were nutrient-rich and tended to have a dense understory of Canada yew (*Taxus canadensis* Marsh.).

Sugar maple (*Acer saccharum* Marsh.) had the greatest density (495 trees/ha; Table 2) and comprised 35% of the total trees, while yellow birch (*Betula alleghaniensis* Britton) exhibited the greatest basal area (11.62 m^2/ha) and 31% of the total trees (Table 2). Hemlock (*Tsuga canadensis* (L.) Carrière) had both moderately high density (94.44 trees/ha) and basal area (4.30 m^2/ha; Table 2).

Sugar maple density, as well as red maple (*Acer rubrum* L.) density, were greater in smaller size classes compared with larger size classes (Figure 4a), although yellow birch densities were fairly uniform across size classes (Figure 4a). Among conifers, both balsam fir and hemlock had high densities in small size classes, indicating regeneration is occurring (Figure 4b).

Table 2. Basal area and density of live trees in hemlock-hardwood forests at Apostle Islands NL, 2011.

Latin name	Common name	Basal area (m^2/ha)	Density (trees/ha)
Hardwoods			
Acer saccharum	sugar maple	6.30	495.06
Betula alleghaniensis	yellow birch	11.62	303.70
Acer rubrum	red maple	4.99	146.91
Acer spicatum	mountain maple	0.14	101.23
Betula papyrifera	paper birch	2.65	38.27
Quercus rubra	red oak	2.55	37.65
Ostrya virginiana	ironwood	0.03	4.94
Populus tremuloides	trembling aspen	0.34	3.09
Sorbus decora	mountain ash	0.10	3.09
Tilia americana	basswood	0.23	3.09
Betula sp.	birch	0.02	0.62
Conifers			
Abies balsamea	balsam fir	0.37	95.06
Tsuga canadensis	hemlock	4.30	94.44
Thuja occidentalis	eastern white cedar	3.67	84.57
Total		37.31	1,411.72

Sugar maple seedling density was 11,045 seedlings/ha, representing 47.9% of the total. Collectively, maple density (sugar, red, and mountain) was 17,638 seedlings/ha, or 76.5% of the total (Table 3). Yellow birch and hemlock seedling densities were fairly low at 185.19 and 111.11 seedlings/ha, respectively (Table 3).

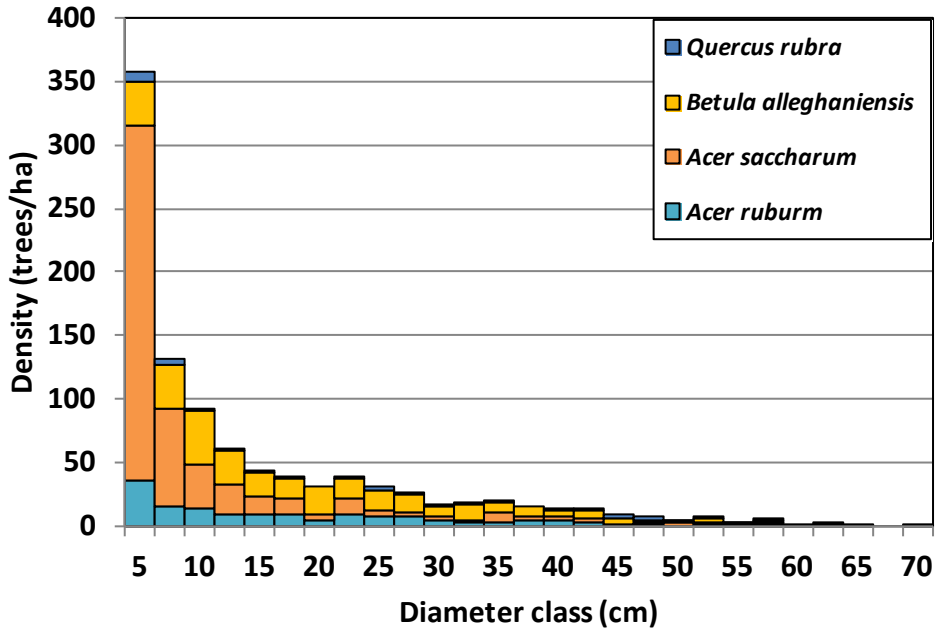

Figure 4a. Densities and diameter classes of hardwood tree species in hemlock-hardwood forests at Apostle Islands National Lakeshore, 2011.

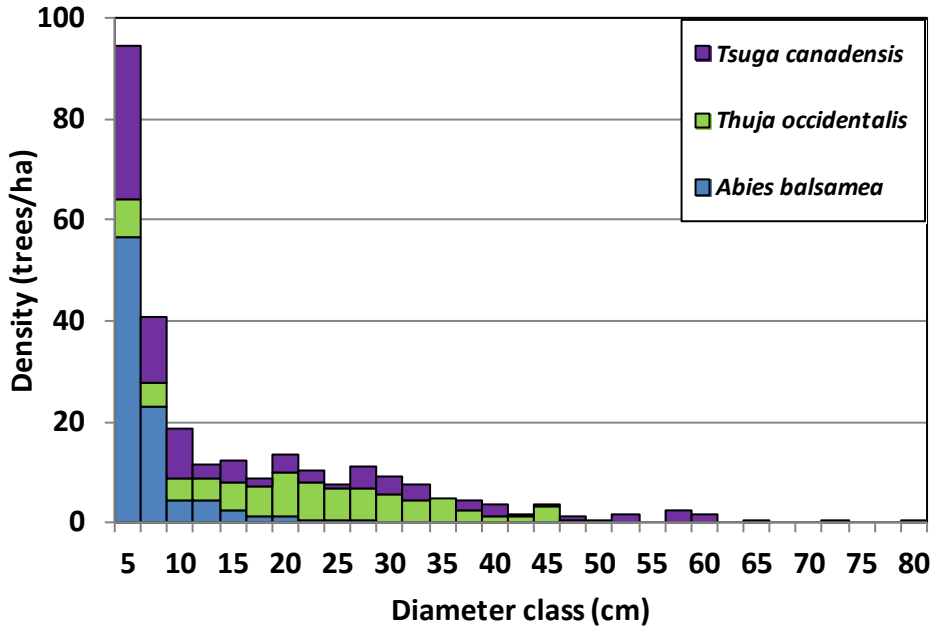

Figure 4b. Densities and diameter classes of conifer species in hemlock-hardwood forests at Apostle Islands National Lakeshore, 2011.

Table 3. Seedling density in hemlock-hardwood forests at Apostle Islands NL, 2011.

Latin name	Common name	Density (seedlings/ha)
Acer saccharum	sugar maple	11,045.27
Acer spicatum	mountain maple	3,481.48
Acer rubrum	red maple	3,111.11
Quercus rubra	red oak	2,876.54
Thuja occidentalis	eastern white cedar	962.96
Abies balsamea	balsam fir	462.96
Sorbus decora	mountain ash	312.17
Populus tremuloides	trembling aspen	279.84
Betula alleghaniensis	yellow birch	185.19
Tsuga canadensis	hemlock	111.11
Ostrya virginiana	ironwood	92.59
Prunus pensylvanica	pin cherry	74.07
Populus grandidentata	bigtooth aspen	37.04
Betula papyrifera	paper birch	18.52
Total		23,050.85

Seven shrub species were located in hemlock–hardwood plots (Table 4). Percent cover was less than 1% for all species except Canada yew (15.85%). No non-native shrub species were located in these plots.

Table 4. Shrub percent cover in hemlock-hardwood forests at Apostle Islands NL, 2011.

Latin name	Common name	% Cover
Taxus canadensis	Canada yew	15.85
Corylus cornuta	beaked hazel	0.94
Amelanchier sp. (group 2)	serviceberry	0.50
Lonicera canadensis	fly honeysuckle	0.06
Rubus idaeus ssp. *strigosus*	red raspberry	0.06
Sambucus racemosa var. *racemosa*	red elderberry	0.01
Rubus canadensis	smooth blackberry	0.01

Bigtooth Aspen-Paper Birch Forests

Bigtooth aspen-paper birch forest was the second most common forest type sampled at APIS, with 11 plots dispersed over Stockton (five plots), Oak (three plots), and Basswood (two plots) Islands, and one plot on the mainland. These plots were typically mid-successional with mature paper birch (*Betula papyrifera* Marsh.) trees.

Eleven plots were located in bigtooth aspen-paper birch forest. Despite the forest type name, red maple exhibited the greatest density (443 trees/ha) and basal area (11.10 m^2/ha) of any species in these plots (Table 5). The prominence of bigtooth aspen (*Populus grandidentata* Michx.) in this forest type is due mainly to the presence of a few large individuals in the 30-45 cm DBH size classes, while the prominence of paper birch is due to large individuals in the 12.5-32.5 cm DBH classes (Figure 5a). Because red maple is fairly common in all forest types, we felt the current name is a better descriptor of the sites in these forests. Among conifers, balsam fir was the most abundant and was common in all size classes, although both eastern white cedar (*Thuja occidentalis* L.) and hemlock were present in small size classes (Figure 5b).

Table 5. Basal area and density of live trees in bigtooth aspen-paper birch forests at Apostle Islands NL, 2011.

Latin name	Common name	Basal area (m^2/ha)	Density (trees/ha)
Hardwoods			
Acer rubrum	red maple	11.10	443.43
Acer saccharum	sugar maple	3.48	414.14
Quercus rubra	red oak	4.44	105.05
Betula papyrifera	paper birch	3.99	88.89
Betula alleghaniensis	yellow birch	1.54	69.70
Fraxinus pennsylvanica	green ash	0.28	66.67
Acer spicatum	mountain maple	0.12	59.60
Ostrya virginiana	ironwood	0.22	57.58
Populus grandidentata	bigtooth aspen	5.23	45.45
Tilia americana	basswood	0.20	22.22
Amelanchier arborea	serviceberry	0.18	20.20
Populus tremuloides	trembling aspen	1.84	14.14
Populus sp.	aspen	0.69	5.05
Fraxinus nigra	black ash	0.08	3.03
Sorbus decora	mountain ash	0.04	1.01
Conifers			
Abies balsamea	balsam fir	1.20	252.53
Thuja occidentalis	eastern white cedar	0.85	34.34
Tsuga canadensis	hemlock	0.72	28.28
Picea glauca	white spruce	<0.01	1.01
Picea sp.	spruce	0.09	1.01
Pinus strobus	white pine	<0.01	1.01
Total		36.29	1,734.34

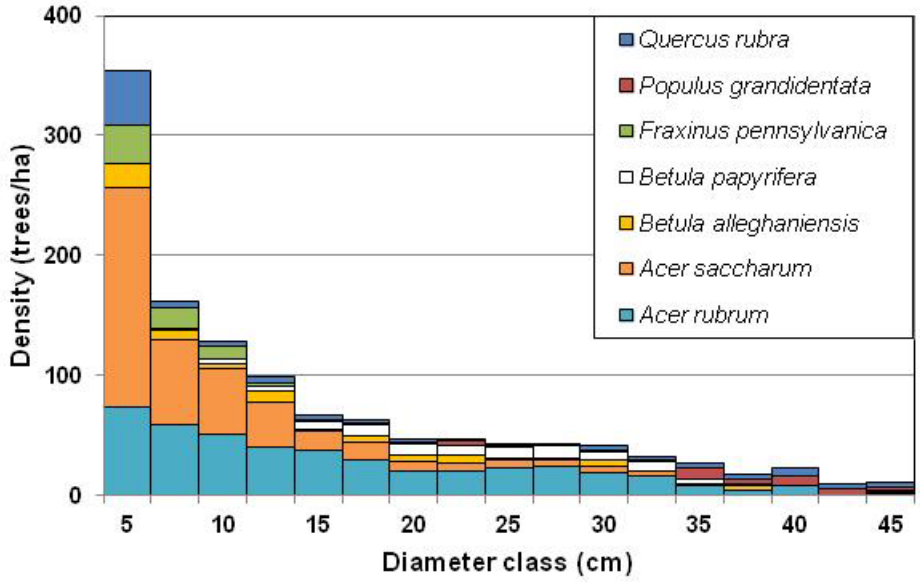

Figure 5a. Densities and diameter classes of hardwood tree species in bigtooth aspen-paper birch forests at Apostle Islands National Lakeshore, 2011.

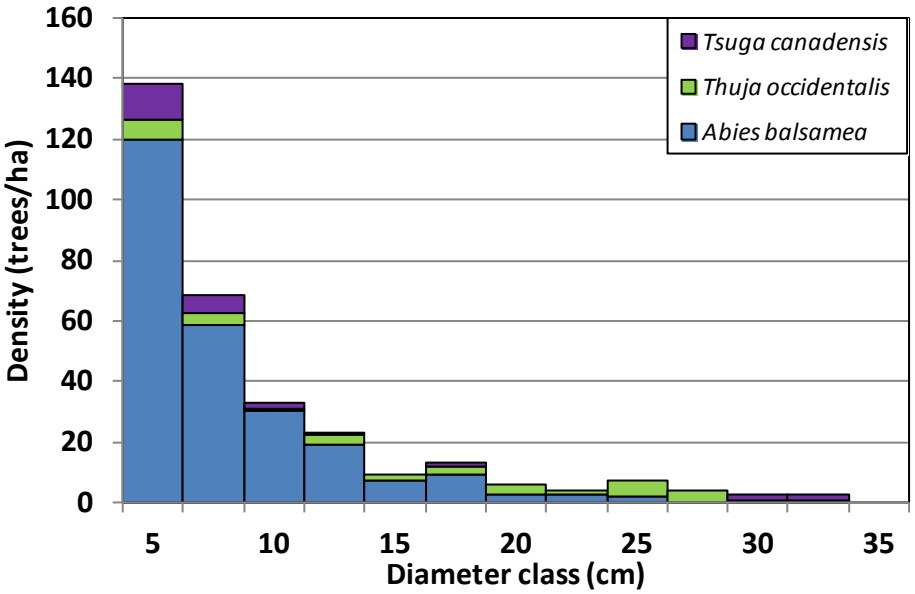

Figure 5b. Densities and diameter classes of conifer species in bigtooth aspen-paper birch forests at Apostle Islands National Lakeshore, 2011.

Seedling density was high in bigtooth aspen-paper birch forests with maple family (Sapindaceae) species present at 25,030 seedlings/ha and comprising 75.3% of the total (Table 6). Other species showing high seedling densities were trembling aspen (3,091 seedlings/ha) and red oak (1,789 seedlings/ha) (Table 6).

Table 6. Seedling density in bigtooth aspen-paper birch forests at Apostle Islands NL, 2011.

Latin name	Common name	Density (seedlings/ha)
Acer saccharum	sugar maple	18,151.52
Acer rubrum	red maple	3,636.36
Acer spicatum	mountain maple	3,242.42
Populus tremuloides	trembling aspen	3,090.91
Quercus rubra	red oak	1,787.88
Abies balsamea	balsam fir	696.97
Thuja occidentalis	eastern white cedar	636.36
Fraxinus pennsylvanica	green ash	636.36
Populus grandidentata	bigtooth aspen	575.76
Betula alleghaniensis	yellow birch	242.42
Sorbus decora	mountain ash	181.82
Tilia americana	basswood	121.21
Tsuga canadensis	hemlock	90.91
Ostrya virginiana	ironwood	60.61
Betula papyrifera	paper birch	30.30
Fraxinus nigra	black ash	30.30
Pinus strobus	white pine	30.30
Total		33,242.41

Fourteen shrub species were located in bigtooth aspen-paper birch forests (Table 7) with only three species having greater than 1% cover: beaked hazel (*Corylus cornuta* Marsh., 3.45%), fly honeysuckle (*Lonicera canadensis* Bartram ex. Marsh., 1.39%), and serviceberry (*Amelanchier* sp. Medik, 1.24%).

Table 7. Shrub percent cover in bigtooth aspen-paper birch forests at Apostle Islands NL, 2011.

Latin name	Common name	% Cover
Corylus cornuta	beaked hazel	3.45
Lonicera canadensis	fly honeysuckle	1.39
Amelanchier sp. (group 2)	serviceberry	1.24
Rubus pubescens	dwarf red blackberry	0.61
Rubus parviflorus	thimbleberry	0.52
Taxus canadensis	Canada yew	0.26
Diervilla lonicera	bush honeysuckle	0.20
Ribes glandulosum	skunk currant	0.11
Vaccinium myrtilloides	velvetleaf blueberry	0.08
Ribes triste	red currant	0.08
Cornus sericea	red osier dogwood	0.03
Vaccinium angustifolium	lowbush blueberry	0.02
Rosa blanda	smooth rose	0.02
Rubus canadensis	smooth blackberry	0.02

Eastern White Cedar Forests

Eastern white cedar forests exhibited large diameter cedars (*Thuja occidentalis* L.) along with a great deal of coarse woody material. Eight plots were located in eastern white cedar forests, with two of these on Bear Island, two on Michigan Island, and one each on Stockton, Raspberry, and South Twin Islands and the mainland. Cedar had both the highest density (533 trees/ha) and the greatest basal area (21.40 m^2/ha; Table 8). Other species with high densities were mountain maple (264 trees/ha) and balsam fir (282 trees/ha), while yellow birch also exhibited a high basal area (9.33 m^2/ha; Table 8). Cedar densities were fairly constant across all size classes, while balsam fir densities were greater in smaller size classes (Figure 6a). Among hardwoods, sugar maple and red maple generally exhibited greater densities in the smallest size classes (Figure 6b).

Table 8. Basal area and density of live trees in eastern white cedar forests at Apostle Islands NL, 2011.

Latin name	Common name	Basal area (m^2/ha)	Density (trees/ha)
Hardwoods			
Acer spicatum	mountain maple	0.45	263.89
Betula alleghaniensis	yellow birch	9.33	138.89
Acer rubrum	red maple	2.67	76.39
Acer saccharum	sugar maple	0.80	62.50
Betula papyrifera	paper birch	1.29	22.22
Sorbus decora	mountain ash	0.11	6.94
Prunus pensylvanica	pin cherry	0.04	2.78
Betula sp.	birch	0.09	1.39
Fraxinus nigra	black ash	0.16	1.39
Conifers			
Thuja occidentalis	eastern white cedar	21.40	533.33
Abies balsamea	balsam fir	1.71	281.94
Tsuga canadensis	hemlock	2.35	30.56
Picea mariana	black spruce	0.07	12.50
Pinus strobus	white pine	0.39	1.39
Total		40.86	1,436.11

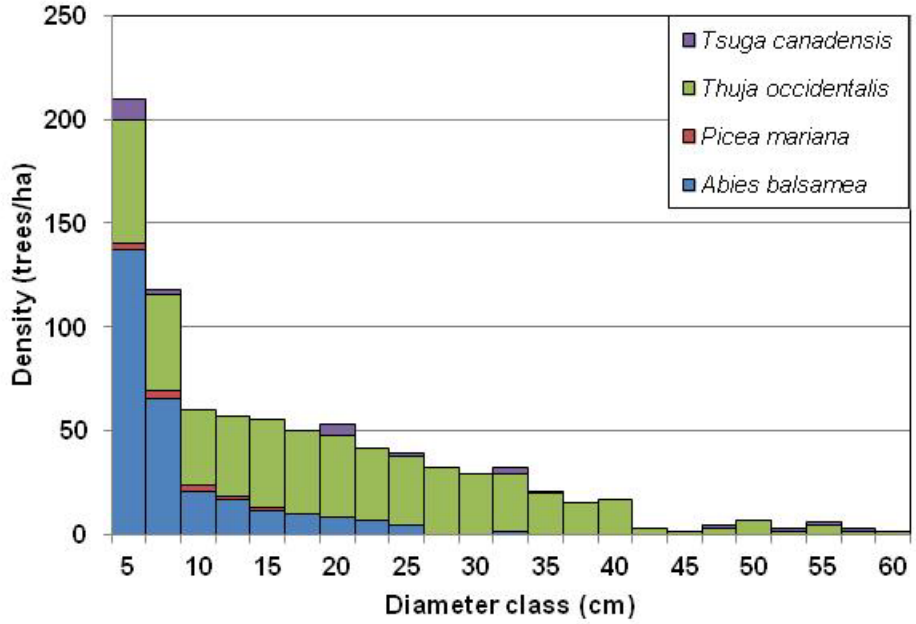

Figure 6a. Densities and diameter classes of conifer species in in eastern white cedar forests at Apostle Islands National Lakeshore, 2011.

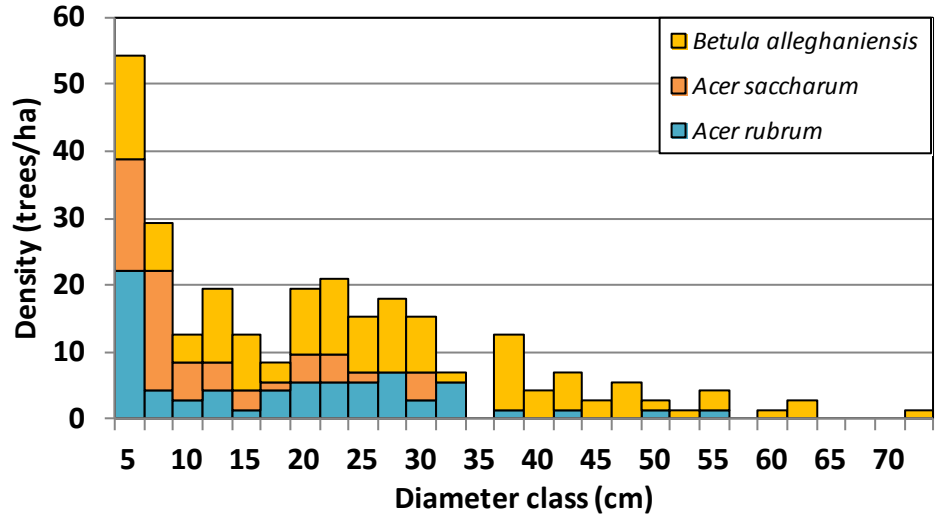

Figure 6b. Densities and diameter classes of hardwoods in eastern white cedar forests at Apostle Islands National Lakeshore, 2011.

Seedling density in eastern white cedar forests was generally high for all maple species (2,417 – 3,958 seedlings/ha) as well as for cedar (3,416 seedlings/ha) (Table 9). Twelve shrub species were present in this forest type, but only two had greater than 1% cover: Canada yew (12.3%) and fly honeysuckle (1.2%) (Table 10).

Table 9. Seedling density in eastern white cedar forests at Apostle Islands NL, 2011.

Latin name	Common name	Density (seedlings/ha)
Acer spicatum	mountain maple	3,958.33
Thuja occidentalis	eastern white cedar	3,416.67
Acer saccharum	sugar maple	3,208.33
Acer rubrum	red maple	2,416.67
Abies balsamea	balsam fir	1,666.67
Quercus rubra	red oak	708.33
Sorbus decora	mountain ash	500.00
Populus tremuloides	trembling aspen	250.00
Betula alleghaniensis	yellow birch	83.33
Picea mariana	black spruce	41.67
Populus grandidentata	bigtooth aspen	41.67
Total		16,291.67

Table 10. Shrub percent cover in eastern white cedar forests at Apostle Islands NL, 2011.

Latin name	Common name	% Cover
Taxus canadensis	Canada yew	12.29
Lonicera canadensis	fly honeysuckle	1.19
Rubus idaeus ssp. *strigosus*	red raspberry	0.94
Corylus cornuta	beaked hazel	0.88
Ledum groenlandicum	Labrador tea	0.85
Rubus parviflorus	thimbleberry	0.83
Ilex mucronata	catberry	0.63
Amelanchier sp. (group 2)	serviceberry	0.25
Alnus incana ssp. *rugosa*	speckled alder	0.23
Rubus pubescens	dwarf red blackberry	0.08
Ribes glandulosum	skunk currant	0.04
Vaccinium oxycoccos	small cranberry	0.02

Mountain Maple-Black Ash Forests

There were seven plots in mountain maple-black ash forests, with three on Sand Island, two on the mainland, one near the southern end of Outer Island, and one at the northern end of Manitou Island. These plots typically contained several large, standing, dead paper birch and trembling aspen, and many small individuals of mountain maple (*Acer spicatum* Lam.) and black ash (*Fraxinus nigra* Marsh.). The shrub layer was dense in this forest type.

Mountain maple had the highest density of all trees species (770 trees/ha or 41% of the total) (Table 11). Black ash exhibited relatively high basal area (1.15 m^2/ha) and density (196.83 trees/ha). Yellow and paper birch displayed the greatest basal area, though this was mainly due to a small number of individuals in the larger size classes. All four dominant species in this forest type showed increasing densities in progressively smaller size classes (Figure 7). Conifers were not a prominent component of this forest type, though balsam fir density and basal area was relatively high (Table 11).

Table 11. Basal area and density of live trees in mountain maple-black ash forests at Apostle Islands NL, 2011.

Latin name	Common name	Basal area (m^2/ha)	Density (trees/ha)
Hardwoods			
Acer spicatum	mountain maple	1.17	769.84
Acer saccharum	sugar maple	2.72	292.06
Fraxinus nigra	black ash	1.15	196.83
Populus tremuloides	trembling aspen	3.20	139.68
Betula papyrifera	paper birch	6.12	112.70
Acer rubrum	red maple	0.70	58.73
Betula alleghaniensis	yellow birch	3.48	50.79
Prunus virginiana	choke cherry	0.03	22.22
Sorbus decora	mountain ash	0.30	7.94
Quercus rubra	red oak	0.31	4.76
Prunus pensylvanica	pin cherry	0.07	3.17
Ostrya virginiana	ironwood	<0.01	1.59
Conifers			
Abies balsamea	balsam fir	1.85	180.95
Thuja occidentalis	eastern white cedar	0.76	17.46
Tsuga canadensis	hemlock	1.18	4.76
Picea glauca	white spruce	0.38	3.17
Total		23.42	1,866.65

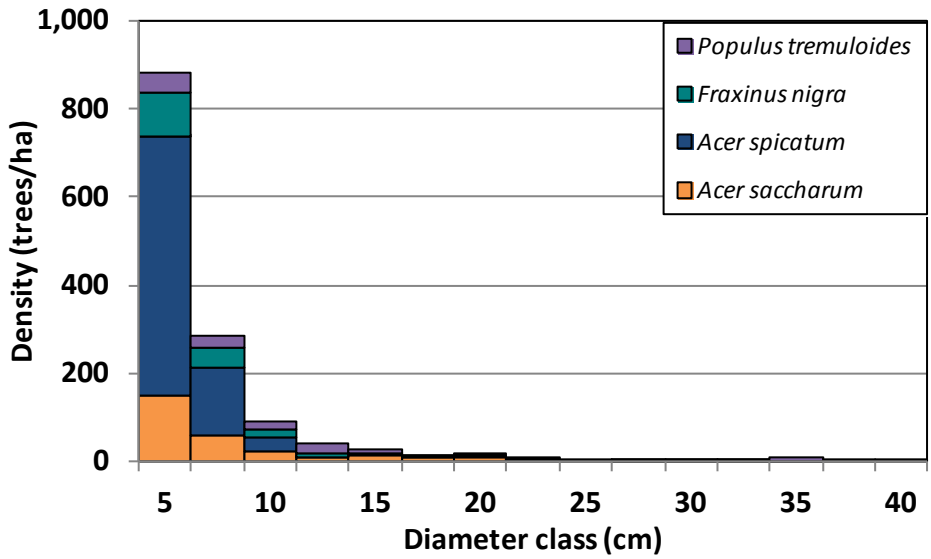

Figure 7. Densities and diameter classes of hardwoods in mountain maple-black ash forests at Apostle Islands NL, 2011.

Seedling density in mountain maple-black ash forests was high (27,810 seedlings/ha), with sugar and mountain maple collectively comprising 83% (Table 12).

Table 12. Seedling density in mountain maple-black ash forests at Apostle Islands NL, 2011.

Latin name	Common name	Density (seedlings/ha)
Acer saccharum	sugar maple	16,000.00
Acer spicatum	mountain maple	7,000.00
Acer rubrum	red maple	1,333.33
Prunus virginiana	choke cherry	952.38
Populus tremuloides	trembling aspen	809.52
Thuja occidentalis	eastern white cedar	761.90
Abies balsamea	balsam fir	476.19
Fraxinus nigra	black ash	238.10
Sorbus decora	mountain ash	190.48
Prunus pensylvanica	pin cherry	47.62
Total		27,809.52

Twenty-three species of shrubs were recorded in mountain maple-black ash forests, the highest of any of the five forest types (Table 13). Shrub cover was greater than 1% for 10 species including beaked hazel (5.2%), speckled alder (*Alnus incana* [L.] ssp. *rugosa* [Du Roi] R.T. Clausen, 5.1%), and Canada yew (4.7%).

Table 13. Shrub percent cover in mountain maple-black ash forests at Apostle Islands NL, 2011.

Latin name	Common name	% Cover
Corylus cornuta	beaked hazel	5.17
Alnus incana ssp. *rugosa*	speckled alder	5.07
Taxus canadensis	Canada yew	4.71
Diervilla lonicera	bush honeysuckle	3.55
Rubus pubescens	dwarf red blackberry	2.33
Cornus sericea	red osier dogwood	2.24
Rubus idaeus ssp. *strigosus*	red raspberry	2.24
Rubus parviflorus	thimbleberry	1.26
Rubus canadensis	smooth blackberry	1.19
Ribes triste	red currant	1.02
Amelanchier sp. (group 2)	serviceberry	0.93
Sambucus racemosa var. *racemosa*	red elderberry	0.71
Ribes glandulosum	skunk currant	0.29
Rubus flagellaris	northern dewberry	0.19
Lonicera canadensis	fly honeysuckle	0.17
Salix humilis	prairie willow	0.12
Vaccinium myrtilloides	velvetleaf blueberry	0.10
Viburnum opulus var. *americanum*	American cranberrybush	0.02
Ilex verticillata	winterberry	0.02
Cornus alternifolia	alternate-leaved dogwood	0.02
Vaccinium angustifolium	lowbush blueberry	0.02
Ribes hirtellum	hairystem gooseberry	0.02
Rubus alleghaniensis	blackberry	0.02

Balsam Fir Forests

Four plots were placed in the balsam fir forest type and all typically exhibited a high density of small diameter balsam fir (*Abies balsamea* [L.] Mill). Islands with plots in this forest type were Devils, Stockton, and Oak, and there was one plot on the mainland. Balsam fir comprised 62% of the trees (Table 14) with the greatest densities in small size classes (Figure 8a). Hardwood species with the highest densities were sugar maple (386 trees/ha) and yellow birch (317 trees/ha) (Table 14). Sugar maple densities were fairly constant in the smallest size classes, while densities of yellow birch generally showed increasing densities with progressively smaller size classes (Figure 8b).

Table 14. Basal area and density of live trees in balsam fir forests at Apostle Islands NL, 2011.

Latin name	Common name	Basal area (m^2/ha)	Density (trees/ha)
Hardwoods			
Acer saccharum	sugar maple	7.22	386.11
Betula alleghaniensis	yellow birch	5.56	316.67
Acer rubrum	red maple	4.26	175.00
Betula papyrifera	paper birch	2.43	83.33
Quercus rubra	red oak	2.24	55.56
Populus tremuloides	trembling aspen	1.61	22.22
Tilia americana	basswood	0.59	19.44
Ostrya virginiana	ironwood	0.01	8.33
Acer spicatum	mountain maple	0.01	5.56
Sorbus decora	mountain ash	0.03	5.56
Conifers			
Abies balsamea	balsam fir	6.96	2,083.33
Tsuga canadensis	hemlock	1.04	102.78
Picea mariana	black spruce	0.57	33.33
Thuja occidentalis	eastern white cedar	1.18	30.56
Pinus strobus	white pine	0.58	8.33
Picea glauca	white spruce	0.01	5.56
Total		34.30	3,341.67

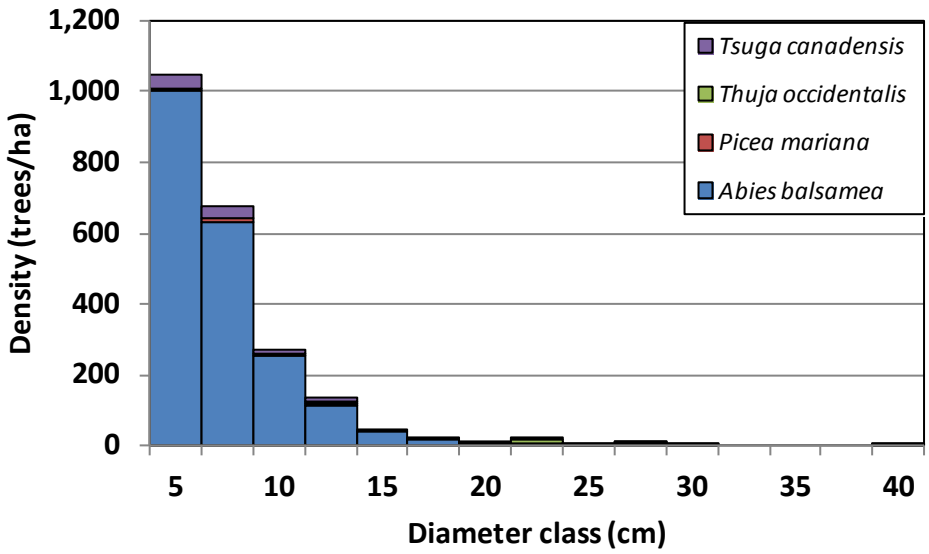

Figure 8a. Densities and diameter classes of conifers in balsam fir forests at Apostle Islands NL, 2011.

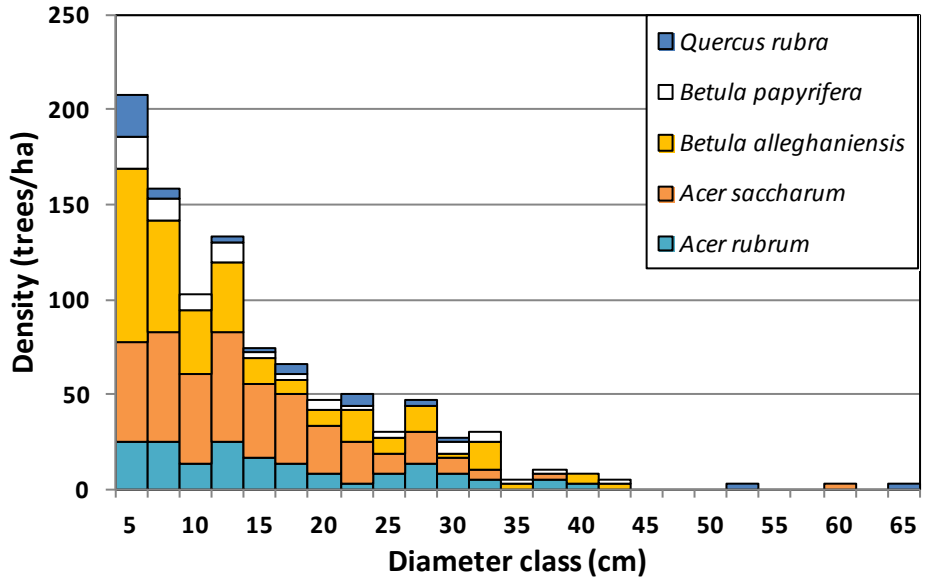

Figure 8b. Densities and diameter classes of hardwoods in balsam fir forests at Apostle Islands NL, 2011.

Sugar maple seedling density was 9,833 seedlings/ha, comprising 53% of the total (Table 15). Seedling density was also high for red oak, balsam fir, and red maple (Table 15).

Table 15. Seedling density in balsam fir forests at Apostle Islands NL, 2011.

Latin name	Common name	Density (seedlings/ha)
Acer saccharum	sugar maple	9,833.33
Quercus rubra	red oak	2,583.33
Abies balsamea	balsam fir	2,000.00
Acer rubrum	red maple	1,583.33
Populus tremuloides	trembling aspen	583.33
Tilia americana	basswood	333.33
Tsuga canadensis	hemlock	333.33
Acer spicatum	mountain maple	333.33
Thuja occidentalis	eastern white cedar	250.00
Picea mariana	black spruce	250.00
Betula alleghaniensis	yellow birch	83.33
Betula papyrifera	paper birch	83.33
Ostrya virginiana	ironwood	83.33
Pinus strobus	white pine	83.33
Total		18,416.63

Shrub cover in balsam fir forests was generally low, likely due to the thick understory of small balsam fir seedlings and trees (Table 16). Eleven shrub species were present in balsam fir forests, although three of these in the Ericaceae (heath) family were due to a portion of one plot bordering a bog. Only two species (fly honeysuckle and beaked hazel) were present at greater than 1% cover.

Table 16. Shrub percent cover in balsam fir forests, at Apostle Islands NL, 2011.

Latin name	Common name	% Cover
Lonicera canadensis	fly honeysuckle	1.92
Corylus cornuta	beaked hazel	1.63
Amelanchier sp. (group 2)	serviceberry	0.46
Vaccinium myrtilloides	velvetleaf blueberry	0.29
Rubus pubescens	dwarf red blackberry	0.25
Taxus canadensis	Canada yew	0.21
Vaccinium angustifolium	lowbush blueberry	0.17
Diervilla lonicera	bush honeysuckle	0.13
Rubus parviflorus	thimbleberry	0.13
Ledum groenlandicum	Labrador tea	0.08
Cornus alternifolia	alternate-leaved dogwood	0.04

Coarse Woody Material

Coarse woody material (CWM) varied greatly between habitats with cedar forests having the greatest volume (77.09 m^3/ha) and biomass (22,059 kg/ha) (Table 17). Bigtooth aspen-paper birch had the least volume (41.23 m^3/ha), and balsam fir had the least biomass (11,480 kg/ha) (Table 17). Cedar had the highest density (657.58 pieces/ha), while bigtooth aspen-paper birch had the least (350.81 pieces/ha) (Table 18). All forest types had at least nine standing dead trees with a DBH ≥30 cm (Table 19).

Table 17. Coarse woody material volume and biomass for each forest type at Apostle Islands NL, 2011.

Forest type	Number of plots in habitat	Volume (m^3/ha)	Biomass (kg/ha)	Biomass (tons/ac)
Hemlock-hardwood	18	51.41	16,244.98	7.25
Bigtooth aspen-paper birch	11	41.23	13,217.45	5.90
Mountain maple-black ash	7	54.92	17,869.92	7.97
Eastern white cedar	8	77.09	22,058.83	9.84
Balsam fir	4	42.67	11,479.97	5.12
Mean		52.99	16,321.25	7.28

Table 18. Density of coarse woody material by diameter class in each forest type at Apostle Islands NL, 2011.

Habitat	Density (pieces/ha) for each diameter class (cm)				Total
	7.5-19.9	20.0-32.9	33.0-45.9	46.0-60	pieces/ha
Hemlock-hardwood	402.46	53.41	8.37	4.75	468.99
Bigtooth aspen-paper birch	273.04	73.79	2.36	1.62	350.81
Mountain maple-black ash	509.88	87.10	2.91	1.20	601.08
Eastern white cedar	575.46	73.21	6.88	1.98	657.53
Balsam fir	247.00	101.36	8.77	0.00	357.13
Mean	403.16	70.51	5.94	2.63	482.24

Table 19. Density of standing dead trees ≥30 cm DBH in each forest type at Apostle Islands NL, 2011.

Forest type	Density (trees/ha)
Hemlock-hardwood	17.93
Bigtooth aspen-paper birch	19.19
Mountain maple-black ash	28.60
Eastern white cedar	9.73
Balsam fir	11.12

Browse and Disease

Browse pressure at APIS varied greatly in 2011, with 27.8% of browse circles in bigtooth aspen-paper birch plots having at least one species browsed, while only 4.2% of circles in hemlock-hardwood plots showed this (Table 20).

Table 20. Direct browse at the 3.14 m^2 (1 m radius) browse circles, by forest type and for the whole park.

Habitat	Number of plots	Browse circles with evident browse	Browse circles with species present	Browse index*
Hemlock-hardwood	18	47	1,142	0.042
Bigtooth aspen-paper birch	11	206	743	0.278
Mountain maple-black ash	7	281	469	0.599
Eastern white cedar	8	54	516	0.106
Balsam fir	4	27	259	0.107
Whole park	48	615	3,129	0.197

*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.

At the island level, direct browse varied greatly, with several islands not having any browse but with Sand Island, as well as the mainland unit, have browse indices >0.500.

Table 21. Direct browse at the 3.14 m^2 (1 m radius) browse circles, by unit (island or mainland).

Unit	Number of plots	Number of quadrats Browsed	Number of quadrats present	Browse index
Basswood	3	52	193	0.269
Bear	2	0	132	0
Cat	2	0	136	0
Devils	1	0	57	0
Hermit	2	12	135	0.089
Mainland	5	210	324	0.648
Manitou	2	1	128	0.008
Michigan	2	1	133	0.008
Oak	5	107	339	0.316
Otter	3	3	199	0.015
Outer	6	2	398	0.005
Raspberry	1	0	67	0
Sand	3	170	204	0.833
Rocky	1	3	68	0.044
South Twin	1	6	63	0.095
Stockton	9	25	551	0.045

*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.

Herbaceous browse by deer was not regularly observed on our three target species in 2011; only 23 individuals showed evidence of being bitten (Table 22). Of these 23 individuals, 17 were *Clintonia borealis*, one was *Streptopus lanceolatus* var. *roseus*, and five were *Aralia nudicaulis*.

Evidence of disease and insect damage in 2011 was limited, although both gypsy moth (*Lymantria dispar* L.) adults and caterpillars were observed in bigtooth aspen-paper birch forests.

Table 22. Summary of indirect browse documented at Apostle Islands NL 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
Hemlock-hardwoods	*Streptopus lanceolatus* var. *roseus*	32	18	94	88	5	1
	Clintonia borealis	125	19.4	1,092	1,030	57	5
	Aralia nudicaulis	90	29.3	302	296	4	2
Bigtooth aspen-paper birch	*Streptopus lanceolatus* var. *roseus*	18	22.1	94	87	7	0
	Clintonia borealis	57	21.4	481	437	40	4
	Aralia nudicaulis	107	28	245	241	1	3
Mountain maple-black ash	*Streptopus lanceolatus* var. *roseus*	6	17.8	14	10	4	0
	Clintonia borealis	35	15.7	430	426	3	1
	Aralia nudicaulis	25	33.3	75	75	0	0
White cedar	*Clintonia borealis*	61	18.1	571	534	30	7
	Aralia nudicaulis	11	27.2	20	20	0	0
Balsam fir	*Streptopus lanceolatus* var. *roseus*	4	20.9	35	33	2	0
	Clintonia borealis	16	12.9	87	86	1	0
	Aralia nudicaulis	22	24.3	41	41	0	0

Community Indices

There were 208 total species in the 48 plots, with a mean of 39.54 species per plot. Across all habitats, the overwhelming majority were perennial and native (Table 23). Herbaceous species represented 54% of the total, and, within the pollination group, species were fairly evenly distributed between the biotically and the abiotically pollinated classes.

Table 23. Plot species richness within classes of each functional group.

Functional group	Class	Mean richness 2011
Life history	annual	0.59
	biennial	0.05
	perennial	38.90
Growth form	forb	17.38
	graminoid	4.12
	woody	18.04
Pollination	abiotic	16.42
	biotic	17.00
	N/A	6.12
Nativity	native	39.19
	non-native	0.27
	native/non-native	0.08

Coefficient of conservatism (COC) values ranged from 5.01–5.78 for the five habitats (Figure 9), with a mean of 5.24 for the entire park. Mean plot species richness ranged from 32–48 across the five habitats (Figure 9).

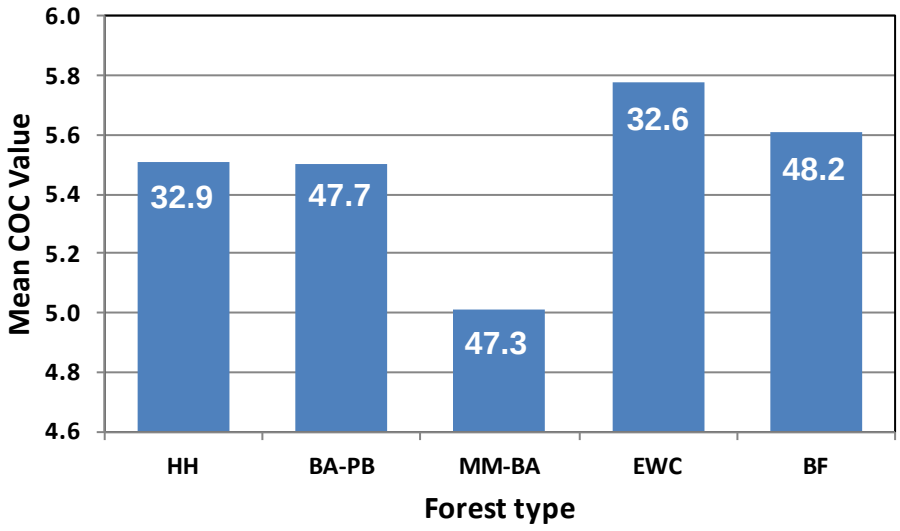

Figure 9. Mean coefficient of conservatism (COC) values for the five forest types. HH = hemlock-hardwoods, BA-PB = bigtooth aspen-paper birch, MM-BA = mountain maple-black ash, EWC = eastern white cedar, BF = balsam fir. Numbers on the blue bars are the mean plot species richness in those forest types.

Earthworm Assessments

We collected 160 earthworm assessment samples from plots in 2011. Four plots were not assessed for earthworms due to time constraints, while eleven plots did not have the full complement of four replicate samples due to issues with the corer. The majority of earthworm assessment samples were earthworm-free (79.4%), while 16.88% were minimally invaded, and 3.75% were moderately invaded (Table 24). No samples were substantially invaded or heavily invaded. The islands with at least one sample being minimally invaded were Basswood, Cat, Devils, Michigan, Outer, Raspberry, Sand, and Stockton, as well as the mainland. All six samples ranked as moderately invaded are from two plots located on the mainland. One of these plots is near Meyers Beach, just off of the trail, and the other is just off of Big Sand Bay Road. Of the 15 islands sampled, six had not evidence of earthworm presence.

Table 24. Earthworm assessment rankings by forest type at Apostle Islands NL, 2011.

Forest type	Number of samples	Number of samples that are:				
		Earthworm free	Minimally invaded	Moderately invaded	Substantially invaded	Heavily invaded
Hemlock-hardwood	57	54	3	0	0	0
Bigtooth aspen-paper birch	38	32	6	0	0	0
Mountain maple-black ash	24	12	8	4	0	0
Eastern white cedar	26	20	6	0	0	0
Balsam fir	15	9	4	2	0	0
Whole park	160	127	27	6	0	0

Discussion

Ecology and Interpretation

Two forest types present in 2011, big-tooth aspen-paper birch and mountain maple-black ash, are in early to mid-seral stages, while balsam fir, cedar, and hemlock-hardwoods are in later successional stages.

Hemlock-dominated forests with large components of sugar maple and yellow birch are believed to have been the dominant landcover type in northern Wisconsin prior to large-scale logging of the 1880s (Curtis 1959, White and Mladenoff 1994). It is estimated that these forests currently occupy about 0.5% of the landscape in the upper Great Lakes region (Mladenoff and Stearns 1993). Hemlock requires a suite of favorable conditions for successful recruitment; most notably, the seeds and seedlings require a warm, moist, organic substrate (McGee 2001). Marx and Walters (2008) found hemlock and yellow birch seedlings were at least 42 times more abundant on either hemlock or yellow birch wood than on soil. They also noted a higher incidence of both hemlock and yellow birch seedlings on hemlock coarse woody material than on sugar maple CWM. In addition to substrate requirements, densities of white-tailed deer must be kept to a minimum to allow regeneration. Hemlock is a preferred browse species of white-tailed deer, and densities above historic levels of 2-4 deer/km^2 may prevent recruitment (Alverson et al. 1988). Of the 18 sites that were classified as hemlock-hardwoods, five were on islands for which there is no evidence of historic deer occupation, and nine are on islands believed to have not harbored deer populations for at least four decades (Beals and Cottam 1960).

Despite the presence of hemlock across all size classes, seedling density of both hemlock (111/ha) and yellow birch (185/ha) remained low in hemlock-hardwood forests. (We defined seedlings as at least 15 cm in height, but less than 2.5 cm DBH, and must not be germinants from the current year.) In contrast, the density of sugar maple seedlings was high (11,045/ha).

The relative abundance of seedlings of these three species may be typical of climax hemlock-hardwood forests. Sterns (1951) studied three mature hemlock-hardwood stands in northern Wisconsin between 1941 and 1946. Across all three sites, they found the seedling densities of hemlock, yellow birch, and sugar maple to be 532/ha, 1,877/ha, and 71,631 seedling/ha, respectively (see Table 25). The ratio of these three species from Sterns (1951) is 1 : 3.5 : 140; we found a ratio of 1 : 1.7 : 100 at APIS in 2011. Any direct comparison of seedlings from our work with that of Sterns must be interpreted with caution, as he did not specify a minimum size or growth qualification. Hence, the current year germinants in the 1951 work would have been included in the densities reported above. Despite the relatively similar ratios, the absolute densities of these three species at APIS in 2011 are on the order of 10-20% of the abundance in northern Wisconsin in the 1940s. One reason for this may be the large contribution of balsam fir.

Balsam fir has increased in importance in stands throughout northern Wisconsin. Beals and Cottam (1960) sampled vegetation in 1956 and 1957 at 75 sites on 18 of the 22 Apostle Islands (including Madeline Island). They noted that balsam fir was present in most stands but at lower densities than other species, including yellow birch, paper birch, and white cedar. They found balsam fir to be the dominant species in only three of the stands sampled, but secondarily dominant in 16 stands. Balsam fir has a wide ecological breadth, and able to grow in a range of

soil moisture and nutrient regimes, but it is typically limited to areas with lower light as it can outcompete most other species. In addition, on the Apostle Islands, it is also commonly observed along island perimeters because it can better survive the wind exposure than many other species. Table 26 lists tree species densities reported by Sterns (1951) in old-growth hemlock-hardwood stands in northern Wisconsin along with densities we recorded for those same species in the Apostle Islands in 2011. The densities of sugar maple and of all trees collectively are roughly similar, while the density of hemlock in 2011 is only 41% of the value reported from the old growth stands. The density of balsam fir and yellow birch increased 62% and 232%, respectively, between the two study years (Table 26).

Table 25. Seedling densities in northern Wisconsin old growth hemlock-hardwood stands reported by Stearns (1951) compared to seedling densities of those species in hemlock-hardwood stands at the Apostle Islands National Lakeshore in 2011. Dashes indicate species for which no seedlings were located.

Species	**Density (seedlings/ha)**	
	1940s	2011
Acer saccharum	71,631	11,045
Tsuga canadensis	532	111
Betula alleghaniensis	1,877	185
Tilia americana	980	--
Ulmus americana	182	--
Ostrya virginiana	865	92.6
Abies balsamea	87.3	462
Pinus strobus	0	--
Other species	2,397	11,621
Total	78,551.3	23,516.6

Table 26. Tree densities in northern Wisconsin old growth hemlock-hardwood stands reported by Stearns (1951), compared to tree densities of those species in hemlock-hardwood stands at the Apostle Islands National Lakeshore in 2011. Dashes indicate that no trees of that species were present in 2011.

Species	**Density (trees/ha)**	
	1940s	2011
Acer saccharum	436	495
Tsuga canadensis	232	94.4
Betula alleghaniensis	91.4	303
Tilia americana	94.6	3.09
Ulmus americana	20.5	--
Ostrya virginiana	76.1	4.94
Abies balsamea	58.8	95.1
Pinus strobus	6.42	--
Other species	27.18	415
Total	1,043	1,410

It is difficult to determine whether Apostle Islands hemlock-hardwood forests are on a trajectory to attain old growth characteristics. Seedling density of hemlock observed at APIS in 2011 was approximately one-fifth of that reported in old growth hemlock-hardwood stands in northern Wisconsin (Sterns 1951) (Table 25). In addition, although we did observe increased tree densities in smaller size classes compared with larger classes, the absolute densities in these small size classes was still low. One potential limiting factor on hemlock regeneration is the availability of down woody material (Marx and Walters 2008).

Although the successional dynamics of the tree layer in hemlock-hardwood forests is not clear, the shrub layer may, indeed, be moving toward old-growth characteristics. Canada yew coverage was 15.9% in hemlock-hardwood plots, and 8.7% across all plots in all habitats. Beals and Cottom (1960) found Canada yew to be "nearly ubiquitous," noting that it was located in more than two-thirds of the sites sampled and that it accounted for >50% of the groundcover in nearly half of the stands sampled. The difference between the current results and those of Beals and Cottam (1960) must be interpreted cautiously. Our sampling sites were selected using a method to ensure that they are randomly located throughout the sampling frame, but also spatially balanced, meaning that they fairly evenly distributed across this sampling frame (Stevens and Olsen 2004). As such, they represent a range of stand ages and compositions, disturbance histories, and any number of other factors including soil type, moisture regime, and nutrient availability. Beals and Cottam intentionally selected sites with less evidence of disturbance, whether human-caused or otherwise. This criteria would necessarily promote a higher occurrence and coverage of Canada yew, which is slow growing and highly susceptible to both deer browse (Allison 1990a, b) and alterations in light (De Grandpré and Bergeron 1997) that can be brought on by logging.

Bigtooth aspen-paper birch forests may be succeeding towards the hemlock-hardwood type. Following post-logging fires in the upper Midwest, bigtooth aspen became abundant on large areas of coarse textured soils, previously dominated by hemlock, red pine, and white pine. Bigtooth aspen's ability to spread vegetatively via stump sprouting and adventitious root buds allowed it to become the dominant, early successional species in these high light environments (Gates 1930, Kilburn 1960). In this forest type, we found no bigtooth aspen smaller than 17.5 cm DBH, with most trees 32-45 cm DBH. Similarly, nearly all paper birch were greater than 15 cm. Collectively, these indicate that this forest type is moving toward a mid-successional sere. We found sugar maple was the dominant hardwood in smaller size classes, along with red maple, green ash, yellow birch, and red oak, suggesting these species will generally increase in importance over the coming decades. Among conifers in this forest type, both hemlock and balsam fir are increasing within smaller diameter size classes. The role that white-tailed deer will play in this progression is unclear.

The 11 bigtooth aspen-paper birch forest types were located on the mainland and three of the more interior islands. The mainland and Basswood and Oak Islands (6 plots collectively) have had resident deer since at least the irruption of the 1940s and 1950s (Christensen 1959). The deer population on Stockton Island (5 plots) is not clear, but it is likely that this island has had a very small deer population for a number of years (Curtis 1960; personal communication, Julie Van Stappen, Chief of Resources, Apostle Islands National Lakeshore). Deer browse in bigtooth aspen-paper birch forests was the second highest of the five forest types, with 28% of browse

circles containing at least one species with evident bite marks. Much of the high browse percentage in this forest type was due to browse on aspen species, with trembling and bigtooth aspen being browsed in 64% and 82%, respectively, of the circles where they were present. The 82% browse frequency on bigtooth aspen was the highest observed on any species in any of the five habitats. The impacts of browse on overstory species in this forest type is unclear. Both aspen species are early successional and these species are not expected to be a significant overstory component even in the absence of deer.

The eight cedar plots were distributed over the mainland (1 plot) and five islands. Of these five islands, two (Raspberry and South Twin) have no evidence of historic deer occupation, two (Michigan, and Bear) are believed to have not harbored deer populations for at least four decades, and Stockton has a very low deer population. In cedar forests, both cedar and yellow birch had fairly constant densities across all size classes, while the densities of balsam fir were greater in the smaller size classes. In species that are successfully regenerating, there is typically a greater density in the smaller size classes. Thus, it is unclear whether cedar and yellow birch will be able to maintain their current level of dominance over the coming decades. Both balsam fir and cedar are shade tolerant species adapted to moist habitats. In northern coniferous forests, in the absence of fire, balsam fir is a late successional species and cedar is a climax forest type in the region (Bergeron and Dubuc 1989).

Mountain maple-black ash forests appear to be moving beyond the early successional stage to the mid-seral stage. Three of the seven plots in this type were on Sand Island, one each is on Outer and Manitou Islands, and two are on the mainland. These plots were typically on finer textured soils with higher water tables. The successional path of this type is unclear. Mountain maple typically does not get larger than 12-15 cm DBH and will rarely reach the canopy. Black ash can become canopy-dominant, although the impending arrival of the emerald ash borer will likely prevent that from happening at APIS.

The emerald ash borer, or EAB (*Agrilus planipennis* Fairmaire) is a beetle native to Asia. It was first discovered in the Detroit, Michigan–Windsor, Ontario, area in 2002. EAB lays eggs on the bark surface or in cracks. Upon hatching, larvae immediately bore through the bark and feed within the phloem layer, disrupting the flow of water and nutrients throughout the plant. Typically, an infested tree will die within four years of the initial colonization. Unfortunately, all native ash species (white, green, and black ash) are susceptible to this insect, damage is lethal, and there are no effective control measures. The arrival of EAB will lead to unprecedented forest change, possibly greater than that observed when chestnut blight fungus (*Cryphonectria parasitica* Murr. [Barr.]) was introduced.

Balsam fir forests were thick with all size classes of this species. The four plots in this type were dispersed throughout the park with one each on Devil's, Stockton, and Oak islands, and one on the mainland. The plot on Devil's Island exhibited typical krumholtz vegetation with many small, "dog-eared" individuals. This island's exposure to westerly winds imparts challenging growing conditions, preventing development of these individuals into larger trees.

Threats to Apostle Islands Forests

While each of the islands have unique characteristics that pose specific sets of challenges for the forests, there are two overriding threats to APIS forests that may impact many islands. These are the impending arrival of the emerald ash borer, and the continued impacts of deer browse. The emerald ash borer will ultimately invade the Apostle Islands. By March of 2012, EAB presence had been documented in the Twin Cities metro area of Minnesota and in the Keweenaw Peninsula of Michigan. Adults generally do not fly more than about 1-2 km from the tree of their larval stage. Unintentional spread by humans, however—typically from transporting infested firewood—facilitates this spread by creating nascent foci from which new populations expand. The Lakeshore implemented a ban on transportation of firewood from the mainland to the islands and between islands in 2006. Nonetheless, a small percentage of mated females were reported to have flown greater than 20 km (Taylor et al. 2010). Thus, once this insect reaches the Bayfield Peninsula, there is little to prevent it from colonizing the islands. Water will serve as a barrier, to some degree, so that infestations will likely begin by one or a few colonizing individuals, rather than an advancing front. This will likely slow the spread of EAB from the mainland and between islands, buffering its impacts, and will potentially allow other overstory species to fill in the niche left vacant by dying ash.

Ash was limited to three forest types at APIS, and in one of these (white cedar), it was only intermittently observed. Black ash density in white cedar forests was 1.39 trees/ha, comprising only a trace of both the total density and basal area. In contrast, in mountain maple-black ash forests, black ash comprised 10.5% of all trees and 5.2% of the basal area. In bigtooth aspen-paper birch forests, both black and green ash were present, with the latter considerably more dominant. Collectively, these comprised 4.0% of the density and 1.0% of the basal area.

It may be possible that EAB arrival on the islands may occur by one or a few mated females rather than a mass of individuals as part of the advancing front. This could result in slightly slower rates of spread than observed on the mainland. The primary forest type of concern will be mountain maple-black ash. Of the seven plots in this type, there were three each on the mainland and Sand Island, and one on Outer Island. These tended to be wetter than others with relatively high speckled alder cover (5.1%). Speckled alder and black ash commonly grow together and these habitats may be the most vulnerable to change as EAB moves in. Here, species diversity is low, and loss of one species could increase instability, allowing easier establishment and spread of potential future invasive plant species.

Deer browse is the other major threat to APIS forests. Browse on woody species varied greatly by habitat. Browse pressure was generally low in hemlock-hardwoods, cedar, and balsam fir forests with 4.2%, 10.6%, and 10.7% of browse circles in the respective forest types having browse on at least one individual. These low values was not surprising as most of these plots are on islands with little or no deer presence. In contrast, browse pressure in both bigtooth aspen-paper birch and in mountain maple-black ash forests was high. In the former type, 27.8% of browse circles contained at least one plant that had been browsed. This is largely due to the high pressure on bigtooth aspen, which was browsed in 89.9% of the circles where it was present. In mountain maple-black ash forests, 59.9% of browse circles had at least one species browsed. This was largely due to mountain maple, which was browsed in 62.6% of the circles where it was present.

At the island level, 11 of the 15 islands sampled exhibited some degree of browse (Table 21), although this was minimal on six of the 11 islands. It is possible that the islands that showed a small degree of browse did support a single deer or small, non-reproductive populations. For example, in addition to the direct browse recorded within one of the plots on Otter Island, we also observed at least two patches of blue-bead lily where numerous ramets had produced flowers, but where all of these flowers had been bitten off. This is a classic sign of deer browse in the region. Clear evidence was also observed on Rocky and South Twin Islands. Nonetheless, three of the islands (Michigan, Manitou, and Outer) have browse noted in either one or two circles. It is possible on Michigan and Manitou, and probable on Outer, that some type of branch damage resulted in an appearance similar to that of deer browse. On Hermit Island, we observed a fairly sizable amount of deer browse; although browse was not recorded in one of the two plots there, 12 of 67 circles in the other plot showed browse. Field workers noted that they observed a single deer while working there, and that a sizable amount of browse was observed during the bushwhack to access the plot. Hermit Island is only 2.3 km from Basswood Island, which supports a reproducing population of deer.

Management goals are stated in the park's Wildlife Management Plan for Harvestable Species (National Park Service 2007). Under this plan, active management may be used to maintain historic deer densities on islands. Efforts may be made to ensure very low deer densities on those islands that historically supported only a few, to no deer. These islands include Devils, Eagle, Gull, North Twin, Outer, Raspberry, Sand, and York. On other islands, managers are targeting densities below 3.86 deer/km^2 (10 deer/mi^2). These islands are Basswood, Bear, Cat, Hermit, Ironwood, Manitou, Michigan, Oak, Otter, Rocky, South Twin, and Stockton. In addition to the open hunting season established by the state, park managers have been actively attempting to control deer on Sand and York Islands through culling. There is no evidence of historic deer occupation on either island, prior to 2000. This condition allowed Canada yew, a shrub species nearly extirpated on the mainland, to achieve structural characteristics such as height and density, similar to that historically observed in old-growth forests. The arrival of deer in the early 2000s, however, has resulted in severe loss of Canada yew biomass, and likely also reproductive ability. As of spring, 2012, York Island is believed to be free of deer, although the island will be monitored closely for any signs of recolonization. Efforts to reduce the size of the heard are continuing on Sand Island.

Browse pressure by deer on understory herbs is difficult to assess after one visit. Direct evidence of browse (i.e., bite marks) is not as commonly observed on herbs as it is on woody species. Instead, browse becomes evident after several years, and it is manifested as smaller individuals at lower densities (Anderson 1994, McGraw and Furedi 2005). In 2011, we used methods that will allow us to detect browse impacts during future visits. We assessed abundance of three species in each of three categories: not reproductive and not browsed, reproductive and not browsed, and browsed (regardless of reproductive state). Unfortunately, due to the large numbers of individuals in some quadrats, counting proved to be time-prohibitive and resulted in questionable data. As an alternative, we will look at changes in frequency of these target species over time. Frerker and Waller (in review) studied understory browse in seven national parks in the Great Lakes region. They compared the densities of three target browse species in plots at each national park with their frequency in those same plots. They found a direct positive relationship; species with higher diversity counts were found in more quadrats – i.e., at greater frequency. We

will continue to record the maximum height of each target species on our plots and to document if any reproductive individuals are present.

One other threat to Apostle Islands forests is invasion by exotic earthworms. With the earthworm assessment ranking system used in our monitoring, a minimally invaded sample indicates the presence of earthworm species that are not deep burrowing and do not mix the organic matter in with the mineral soils. These species do not seem to disrupt plant germination and growth (Loss et al. in prep). Earthworm assessment rankings of moderately invaded, substantially invaded, and heavily invaded indicate the presence of earthworm species that consume the litter and duff layers on the forest floor and are deep burrowing, resulting in a depletion of the organic, or humus, layer and a mixing of organic matter in with the mineral soil (Loss et al. in prep, Frelich et al. 2006). The loss of the litter and duff layers results in less protection for seeds to overwinter and germinate (Frelich et al. 2006), and the deep burrowing nature of the earthworms causes disruption of the fine roots of tree seedlings and herbaceous plants, and disruption of mycorrhizae associations with plants (Nuzzo et al. 2009, Frelich et al. 2006). Forests that are heavily invaded by exotic earthworms may become dominated by non-native plants that do not rely on mycorrhizae and are already adapted to European forests with deep burrowing earthworms (Nuzzo et al. 2009). The mainland samples that we ranked as moderately invaded could become substantially or heavily invaded with time, as they are located close to roads and trails, humans are the primary vector of transporting exotic earthworms, and distance to the nearest road or cabin are a good predictors of invasion potential (Holdsworth et al. 2007). Islands with earthworm assessments that were ranked as earthworm-free in 2011 (Hermit, Manitou, Oak, Otter, Rocky, and South Twin) may still have earthworms present. For example, earthworms were noted by the vegetation monitoring crew at the Manitou Island campsite, even though signs of earthworms were not found at the sampling plots on that island.

Suggestions for Management

Key areas for park managers are invasive species, loss of ash, and promoting regeneration, particularly of hemlock. It is important to monitor for and eradicate any buckthorn (*Rhamnus cathartica* L.) and non-native honeysuckle (*Lonicera* spp.) appearing on the islands. These species are both present on the Bayfield Peninsula and are both bird dispersed. As such, establishment on the islands will likely occur in isolated tracts, not necessarily in areas where a new population would be noticed immediately. This is especially relevant in wet areas dominated by black ash and only a few other species. If any buckthorn is introduced here, the ultimate loss of ash could facilitate the spread of buckthorn.

Ultimately, all ash will disappear from the park. It would be beneficial to the park, and the public in general, to collect ash seeds from APIS and submit them to the National Plant Germplasm System. This is a division of the Department of Agriculture that seeks to identify EAB-resistant genotypes through research efforts and to preserve seeds and other genetic materials for possible later reintroduction after suitable control measures for EAB are discovered.

Implementation: Problems, Logistics, and Future Plans

We anticipate making some changes in the protocol. The summer of 2011 marks the completion of one full cycle of sampling in the nine parks. Minor adjustments in procedures and methods

have been made every year, and we feel that substantial improvements in accuracy and efficiency can be made with a few final changes. As detailed above, we will likely eliminate counts of target herbaceous browse species in the groundlayer quadrats. In addition, shrub cover will likely be assessed as frequency of occurrence (in each of the 68 direct browse circles, rather than as a visual estimate of percent cover). We felt that the high degree of variability between observers resulted in questionable data with little repeatability.

Sampling during the 2011 field season at APIS went very smoothly, with little difficulties related to weather, boating, or injuries. We will make every attempt to resample all 48 plots during the next revisit in 2017.

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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 at Apostle Islands National Lakeshore, 2011.

Species Encountered during Site Visits - by Park

Park: APIS 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

Dennstaedtiaceae
- Pteridium aquilinum var. latiusculum

Dryopteridaceae
- Athyrium filix-femina ssp. angustum
- Cystopteris fragilis
- Dryopteris carthusiana
- Dryopteris intermedia
- Gymnocarpium dryopteris
- Matteuccia struthiopteris
- Onoclea sensibilis

Equisetaceae
- Equisetum arvense
- Equisetum palustre
- Equisetum pratense
- Equisetum sp.
- Equisetum sylvaticum

Lycopodiaceae
- Huperzia lucidula
- Lycopodium annotinum
- Lycopodium clavatum
- Lycopodium dendroideum
- Lycopodium digitatum
- Lycopodium hickeyi
- Lycopodium obscurum

Ophioglossaceae
- Botrychium sp.

Osmundaceae
- Osmunda cinnamomea
- Osmunda claytoniana
- Osmunda sp.

Pteridaceae
- Adiantum pedatum

HERBACEOUS - Forb

Apiaceae
- Osmorhiza claytonii
- Osmorhiza longistylis

Apocynaceae
- Apocynum androsaemifolium

Araceae
- Arisaema triphyllum

Araliaceae
- Aralia nudicaulis
- Aralia racemosa

Asparagaceae
- Polygonatum pubescens

Asparagaceae
- Maianthemum canadense
- Maianthemum racemosum

Asparagaceae
- Maianthemum trifolium

Asteraceae
- Eurybia macrophylla
- Hieracium aurantiacum
- Hieracium sp.
- Lactuca biennis
- Lactuca canadensis
- Lactuca sp.
- Petasites frigidus var. palmatus
- Prenanthes alba
- Solidago canadensis
- Solidago gigantea
- Solidago sp.
- Symphyotrichum lanceolatum
- Symphyotrichum lateriflorum
- Symphyotrichum puniceum
- Taraxacum officinale

Balsaminaceae
- Impatiens capensis
- Impatiens pallida
- Impatiens sp.

Colchicaceae
- Uvularia grandiflora
- Uvularia sessilifolia

Cornaceae
- Cornus canadensis

Droseraceae
- Drosera rotundifolia

Ericaceae
- Gaultheria hispidula
- Gaultheria procumbens

Fabaceae
- Trifolium sp.

Iridaceae
- Iris versicolor

Lamiaceae
- Clinopodium vulgare
- Galeopsis tetrahit
- Lycopus uniflorus
- Prunella vulgaris
- Scutellaria lateriflora
- Stachys tenuifolia

Liliaceae
- Clintonia borealis
- Streptopus amplexifolius
- Streptopus lanceolatus var. roseus

Melanthiaceae
- Trillium cernuum
- Trillium grandiflorum
- Trillium sp.

Monotropaceae
- Monotropa hypopithys
- Monotropa uniflora

Species Encountered during Site Visits - by Park

Onagraceae
- Chamerion angustifolium
- Circaea alpina
- Circaea lutetiana ssp. canadensis
- Epilobium ciliatum ssp. ciliatum

Orchidaceae
- Corallorrhiza maculata
- Corallorrhiza sp.
- Cypripedium acaule
- Cypripedium sp.
- Goodyera oblongifolia
- Goodyera tesselata
- Listera cordata
- Platanthera orbiculata

Orobanchaceae
- Conopholis americana
- Melampyrum lineare

Oxalidaceae
- Oxalis montana
- Oxalis sp.

Primulaceae
- Trientalis borealis

Pyrolaceae
- Chimaphila umbellata
- Pyrola americana
- Pyrola elliptica
- Pyrola sp.

Ranunculaceae
- Actaea rubra
- Actaea sp.
- Anemone quinquefolia
- Caltha palustris
- Clematis virginiana
- Coptis trifolia
- Ranunculus acris
- Ranunculus hispidus
- Ranunculus recurvatus
- Thalictrum dasycarpum

Rosaceae
- Fragaria virginiana
- Geum aleppicum
- Geum macrophyllum

Rubiaceae
- Galium trifidum
- Galium triflorum
- Mitchella repens

Thelypteridaceae
- Phegopteris connectilis

Violaceae
- Viola pubescens
- Viola sp.

HERBACEOUS - Forb (vine)

Convolvulaceae
- Convolvulus arvensis

Polygonaceae
- Fallopia cilinodis

HERBACEOUS - Graminoid

Cyperaceae
- Carex arctata
- Carex brunnescens
- Carex communis
- Carex crinita
- Carex deweyana
- Carex disperma
- Carex gracillima
- Carex gynandra
- Carex intumescens
- Carex lacustris
- Carex leptonervia
- Carex pedunculata
- Carex pensylvanica
- Carex projecta
- Carex retrorsa
- Carex sp.
- Carex stipata
- Carex trisperma
- Eriophorum vaginatum
- Scirpus cyperinus

Poaceae
- Brachyelytrum erectum
- Bromus ciliatus
- Calamagrostis canadensis
- Cinna latifolia
- Danthonia spicata
- Elymus sp.
- Glyceria canadensis
- Glyceria striata
- Oryzopsis asperifolia
- Poa compressa
- Poa pratensis
- Poa sp.
- Poaceae fam.
- Schizachne purpurascens

SHRUB

Adoxaceae
- Sambucus racemosa var. racemosa
- Viburnum opulus var. americanum

Aquifoliaceae
- Ilex mucronata
- Ilex verticillata

Betulaceae
- Alnus incana ssp. rugosa
- Corylus cornuta

Caprifoliaceae
- Lonicera canadensis

Cornaceae
- Cornus alternifolia
- Cornus sericea

Diervillaceae
- Diervilla lonicera

Species Encountered during Site Visits - by Park

Diervillaceae

Ericaceae
- Ledum groenlandicum
- Vaccinium angustifolium
- Vaccinium myrtilloides
- Vaccinium oxycoccos

Grossulariaceae
- Ribes glandulosum
- Ribes hirtellum
- Ribes triste

Rosaceae
- Amelanchier Group 2 sp.
- Rosa acicularis ssp. sayi
- Rosa blanda
- Rubus allegheniensis
- Rubus canadensis
- Rubus flagellaris
- Rubus idaeus ssp. strigosus
- Rubus parviflorus
- Rubus pubescens
- Spiraea alba

Salicaceae
- Salix humilis

Taxaceae
- Taxus canadensis

TREE

Betulaceae
- Betula alleghaniensis
- Betula papyrifera
- Betula sp.
- Ostrya virginiana

Cupressaceae
- Thuja occidentalis

Fagaceae
- Quercus rubra

Malvaceae
- Tilia americana

Oleaceae
- Fraxinus nigra
- Fraxinus pennsylvanica

Pinaceae
- Abies balsamea
- Picea glauca
- Picea mariana
- Picea sp.
- Pinus strobus
- Tsuga canadensis

Rosaceae
- Amelanchier arborea
- Prunus pensylvanica
- Prunus virginiana
- Sorbus americana
- Sorbus decora

Salicaceae
- Populus grandidentata
- Populus sp.
- Populus tremuloides

Sapindaceae
- Acer rubrum
- Acer saccharum
- Acer sp.
- Acer spicatum

Appendix C. Individual plot data.

Density and Basal Area of Tree Species (Live trees)

Plot: 1002	Density (individuals / ha)	Basal Area (m^2/ ha)
hardwood		
Acer saccharum	211.1	1.6
Acer spicatum	666.7	1.2
Betula alleghaniensis	66.7	7.7
softwood		
Abies balsamea	11.1	0.4
Thuja occidentalis	144.4	13.4
TOTAL	**1,100.0**	**24.3**

Plot: 1003	Density (individuals / ha)	Basal Area (m^2/ ha)
hardwood		
Acer rubrum	633.3	16.7
Acer saccharum	400.0	2.9
Acer spicatum	111.1	0.7
Betula alleghaniensis	22.2	0.2
Betula papyrifera	66.7	2.8
Populus tremuloides	55.6	9.4
Quercus rubra	66.7	0.1
Tilia americana	11.1	0.0
softwood		
Abies balsamea	511.1	3.1
Thuja occidentalis	11.1	0.1
TOTAL	**1,888.9**	**36.0**

Plot: 1004	Density (individuals / ha)	Basal Area (m^2/ ha)
hardwood		
Acer rubrum	44.4	0.2
Acer spicatum	1744.4	2.0
Betula papyrifera	77.8	2.9
Fraxinus nigra	311.1	3.2
Populus tremuloides	222.2	1.9
Prunus virginiana	155.6	0.2
Sorbus decora	11.1	0.0
softwood		
Abies balsamea	488.9	3.4
Picea glauca	11.1	1.5
TOTAL	**3,066.7**	**15.3**

Plot: 1005	Density (individuals / ha)	Basal Area (m^2/ ha)
hardwood		
Acer rubrum	211.1	7.7
Acer saccharum	88.9	1.7
Acer spicatum	44.4	0.0
Betula papyrifera	66.7	2.8
Ostrya virginiana	77.8	0.2
Populus grandidentata	22.2	2.1
Populus sp.	33.3	4.9
Populus tremuloides	11.1	1.9
Quercus rubra	200.0	8.4
softwood		
Abies balsamea	233.3	1.0
TOTAL	**988.9**	**30.7**

Plot: 1006	Density (individuals / ha)	Basal Area (m^2/ ha)
hardwood		
Acer rubrum	400.0	13.8
Acer saccharum	144.4	4.2
Acer spicatum	22.2	0.0
Betula papyrifera	122.2	7.5
Ostrya virginiana	11.1	0.0
Populus grandidentata	11.1	1.7
Quercus rubra	77.8	7.3
softwood		
Abies balsamea	88.9	0.2
Thuja occidentalis	77.8	2.2
Tsuga canadensis	11.1	0.7
TOTAL	**966.7**	**37.8**

Plot: 1007	Density (individuals / ha)	Basal Area (m^2/ ha)
hardwood		
Acer spicatum	788.9	1.5
Betula alleghaniensis	22.2	3.3
softwood		
Abies balsamea	111.1	1.2
Thuja occidentalis	277.8	13.3
TOTAL	**1,200.0**	**19.3**

Plot: 1009

Species	Density (individuals / ha)	Basal Area (m^2/ ha)
hardwood		
Acer rubrum	100.0	6.0
Acer saccharum	244.4	8.1
Acer spicatum	44.4	0.1
Betula alleghaniensis	122.2	8.9
Betula papyrifera	33.3	4.2
Quercus rubra	44.4	2.1
Tilia americana	22.2	1.2
softwood		
Abies balsamea	33.3	0.2
Thuja occidentalis	211.1	7.6
Tsuga canadensis	55.6	6.7
TOTAL	**911.1**	**44.9**

Plot: 1010

Species	Density (individuals / ha)	Basal Area (m^2/ ha)
hardwood		
Acer rubrum	44.4	1.2
Betula alleghaniensis	311.1	9.8
Betula papyrifera	44.4	0.2
Sorbus decora	11.1	0.2
softwood		
Abies balsamea	977.8	4.3
Picea mariana	100.0	0.6
Thuja occidentalis	922.2	15.0
Tsuga canadensis	88.9	3.4
TOTAL	**2,500.0**	**34.7**

Plot: 1011

Species	Density (individuals / ha)	Basal Area (m^2/ ha)
hardwood		
Acer rubrum	100.0	1.4
Betula alleghaniensis	566.7	3.6
Betula papyrifera	200.0	1.1
Sorbus decora	22.2	0.1
softwood		
Abies balsamea	4477.8	15.7
Picea glauca	11.1	0.0
Picea mariana	122.2	2.2
Pinus strobus	33.3	2.3
Thuja occidentalis	11.1	1.4
TOTAL	**5,544.4**	**27.9**

Plot: 1012

Species	Density (individuals / ha)	Basal Area (m^2/ ha)
hardwood		
Acer rubrum	44.4	0.8
Acer saccharum	988.9	10.4
Betula alleghaniensis	366.7	10.3
Quercus rubra	55.6	10.9
softwood		
Thuja occidentalis	11.1	0.8
Tsuga canadensis	66.7	5.5
TOTAL	**1,533.3**	**38.6**

Plot: 1013

Species	Density (individuals / ha)	Basal Area (m^2/ ha)
hardwood		
Acer rubrum	377.8	3.4
Acer saccharum	577.8	6.5
Betula alleghaniensis	44.4	0.3
Betula papyrifera	22.2	1.5
Ostrya virginiana	33.3	0.1
Populus grandidentata	88.9	12.4
Quercus rubra	144.4	11.9
softwood		
Abies balsamea	211.1	0.4
Tsuga canadensis	44.4	5.6
TOTAL	**1,544.4**	**42.1**

Plot: 1014

Species	Density (individuals / ha)	Basal Area (m^2/ ha)
hardwood		
Acer rubrum	388.9	5.1
Acer saccharum	22.2	0.0
Acer spicatum	22.2	0.0
Betula alleghaniensis	733.3	23.9
Quercus rubra	11.1	0.0
softwood		
Abies balsamea	188.9	0.4
Thuja occidentalis	44.4	0.7
Tsuga canadensis	88.9	2.7
TOTAL	**1,500.0**	**32.8**

Plot: 1015

Species	Density (individuals / ha)	Basal Area (m^2/ ha)
hardwood		
Acer rubrum	355.6	8.9
Acer saccharum	677.8	5.6
Betula papyrifera	133.3	5.0
Populus grandidentata	55.6	10.5
Populus sp.	22.2	2.6
Populus tremuloides	11.1	1.1
softwood		
Abies balsamea	288.9	0.6
TOTAL	**1,544.4**	**34.2**

Plot: 1016

Species	Density (individuals / ha)	Basal Area (m^2/ ha)
hardwood		
Acer rubrum	66.7	2.8
Acer saccharum	900.0	5.2
Betula alleghaniensis	433.3	11.2
Betula papyrifera	22.2	1.4
softwood		
Abies balsamea	55.6	0.1
Tsuga canadensis	55.6	0.7
TOTAL	**1,533.3**	**21.5**

Plot: 1017	Density (individuals / ha)	Basal Area (m²/ ha)
Species		
hardwood		
Acer rubrum	77.8	9.0
Acer saccharum	433.3	1.9
Acer spicatum	111.1	0.1
Betula alleghaniensis	400.0	13.0
Betula papyrifera	66.7	6.2
Betula sp.	11.1	0.3
softwood		
Abies balsamea	455.6	0.8
Tsuga canadensis	44.4	7.8
TOTAL	**1,600.0**	**39.2**

Plot: 1018	Density (individuals / ha)	Basal Area (m²/ ha)
Species		
hardwood		
Acer rubrum	288.9	3.7
Acer saccharum	911.1	5.4
Acer spicatum	11.1	0.0
Betula alleghaniensis	111.1	1.9
Betula papyrifera	277.8	7.9
Populus grandidentata	188.9	17.1
Quercus rubra	11.1	2.2
Tilia americana	44.4	0.7
softwood		
Abies balsamea	111.1	0.5
TOTAL	**1,955.6**	**39.5**

Plot: 1020	Density (individuals / ha)	Basal Area (m²/ ha)
Species		
hardwood		
Acer rubrum	11.1	1.8
Acer spicatum	1344.4	2.4
Betula alleghaniensis	122.2	13.1
Prunus pensylvanica	11.1	0.1
Sorbus decora	11.1	0.9
softwood		
Abies balsamea	66.7	0.8
TOTAL	**1,566.7**	**19.3**

Plot: 1021	Density (individuals / ha)	Basal Area (m²/ ha)
Species		
hardwood		
Acer rubrum	22.2	0.0
Acer saccharum	55.6	0.9
Acer spicatum	177.8	0.2
Betula alleghaniensis	177.8	10.5
Betula papyrifera	11.1	3.0
softwood		
Thuja occidentalis	477.8	25.6
Tsuga canadensis	66.7	7.8
TOTAL	**988.9**	**48.0**

Plot: 1022	Density (individuals / ha)	Basal Area (m²/ ha)
Species		
hardwood		
Acer rubrum	66.7	1.0
Acer saccharum	1055.6	1.8
Acer spicatum	244.4	0.4
Betula alleghaniensis	444.4	17.8
Betula papyrifera	22.2	0.3
softwood		
Thuja occidentalis	266.7	16.2
TOTAL	**2,100.0**	**37.5**

Plot: 1023	Density (individuals / ha)	Basal Area (m²/ ha)
Species		
hardwood		
Acer rubrum	88.9	0.9
Acer spicatum	77.8	0.1
Betula alleghaniensis	222.2	14.5
Betula papyrifera	33.3	1.9
Sorbus decora	11.1	0.0
softwood		
Abies balsamea	555.6	2.4
Pinus strobus	11.1	3.1
Thuja occidentalis	744.4	13.0
Tsuga canadensis	55.6	4.9
TOTAL	**1,800.0**	**40.8**

Plot: 1024	Density (individuals / ha)	Basal Area (m²/ ha)
Species		
hardwood		
Acer rubrum	100.0	0.4
Acer saccharum	300.0	7.1
Acer spicatum	733.3	1.0
Betula alleghaniensis	11.1	0.1
Betula papyrifera	155.6	16.5
Populus tremuloides	22.2	1.4
softwood		
Abies balsamea	33.3	0.1
TOTAL	**1,355.6**	**26.6**

Plot: 1025	Density (individuals / ha)	Basal Area (m²/ ha)
Species		
hardwood		
Acer rubrum	88.9	0.2
Acer saccharum	877.8	13.6
Acer spicatum	200.0	0.2
Betula alleghaniensis	111.1	14.7
Quercus rubra	22.2	0.1
Sorbus decora	11.1	0.8
softwood		
Abies balsamea	22.2	0.4
Thuja occidentalis	66.7	6.2
Tsuga canadensis	88.9	5.3
TOTAL	**1,488.9**	**41.5**

Plot: 1026	Density (individuals / ha)	Basal Area (m^2/ ha)
hardwood		
Acer rubrum	388.9	22.3
Acer saccharum	22.2	0.0
Acer spicatum	211.1	0.3
Amelanchier arborea	222.2	1.9
Betula alleghaniensis	255.6	5.3
Betula papyrifera	44.4	3.8
Sorbus decora	11.1	0.5
softwood		
Abies balsamea	177.8	0.9
Thuja occidentalis	11.1	0.6
Tsuga canadensis	66.7	0.5
TOTAL	**1,411.1**	**36.1**

Plot: 1027	Density (individuals / ha)	Basal Area (m^2/ ha)
hardwood		
Acer rubrum	55.6	2.8
Acer saccharum	344.4	7.5
Acer spicatum	155.6	0.3
Betula alleghaniensis	55.6	2.5
Quercus rubra	88.9	0.1
softwood		
Abies balsamea	55.6	0.6
Thuja occidentalis	344.4	8.1
Tsuga canadensis	22.2	4.3
TOTAL	**1,122.2**	**26.2**

Plot: 1028	Density (individuals / ha)	Basal Area (m^2/ ha)
hardwood		
Acer rubrum	266.7	13.6
Acer saccharum	511.1	3.9
Betula alleghaniensis	377.8	10.3
Quercus rubra	22.2	1.7
Sorbus decora	44.4	1.1
softwood		
Abies balsamea	11.1	0.0
Tsuga canadensis	300.0	5.0
TOTAL	**1,533.3**	**35.6**

Plot: 1029	Density (individuals / ha)	Basal Area (m^2/ ha)
hardwood		
Acer rubrum	344.4	11.2
Acer saccharum	555.6	3.4
Acer spicatum	11.1	0.0
Betula alleghaniensis	255.6	9.7
Betula papyrifera	33.3	3.7
Quercus rubra	111.1	10.4
softwood		
Abies balsamea	177.8	0.2
Tsuga canadensis	77.8	3.0
TOTAL	**1,566.7**	**41.7**

Plot: 1030	Density (individuals / ha)	Basal Area (m^2/ ha)
hardwood		
Acer rubrum	244.4	7.7
Acer saccharum	66.7	0.5
Acer spicatum	55.6	0.0
Betula alleghaniensis	44.4	1.7
Betula papyrifera	66.7	3.4
Fraxinus nigra	11.1	1.3
softwood		
Abies balsamea	188.9	0.6
Thuja occidentalis	411.1	16.7
Tsuga canadensis	22.2	0.0
TOTAL	**1,111.1**	**31.9**

Plot: 1031	Density (individuals / ha)	Basal Area (m^2/ ha)
hardwood		
Acer rubrum	188.9	6.3
Acer saccharum	800.0	12.3
Betula alleghaniensis	66.7	0.1
Betula papyrifera	111.1	8.0
Populus tremuloides	11.1	1.1
Tilia americana	11.1	1.4
softwood		
Abies balsamea	1666.7	4.2
Picea mariana	11.1	0.0
Thuja occidentalis	33.3	1.4
TOTAL	**2,900.0**	**34.9**

Plot: 1033	Density (individuals / ha)	Basal Area (m^2/ ha)
hardwood		
Acer rubrum	622.2	4.5
Acer saccharum	188.9	0.9
Fraxinus nigra	33.3	0.8
Fraxinus pennsylvanica	733.3	3.1
Ostrya virginiana	455.6	1.8
Populus tremuloides	44.4	2.1
Quercus rubra	288.9	9.1
Tilia americana	188.9	1.5
softwood		
Abies balsamea	311.1	1.6
Picea sp.	11.1	0.9
Thuja occidentalis	55.6	1.2
Tsuga canadensis	44.4	0.1
TOTAL	**2,977.8**	**27.7**

Plot: 1034

Species	Density (individuals / ha)	Basal Area (m^2/ ha)
hardwood		
Acer rubrum	177.8	3.6
Acer saccharum	400.0	8.1
Acer spicatum	22.2	0.0
Betula alleghaniensis	455.6	13.7
Betula papyrifera	22.2	0.7
Ostrya virginiana	33.3	0.0
Quercus rubra	22.2	6.0
Tilia americana	22.2	0.8
softwood		
Abies balsamea	1177.8	3.0
Tsuga canadensis	300.0	0.8
TOTAL	**2,633.3**	**36.8**

Plot: 1035

Species	Density (individuals / ha)	Basal Area (m^2/ ha)
hardwood		
Acer rubrum	233.3	5.7
Acer saccharum	344.4	8.5
Betula alleghaniensis	177.8	4.8
Populus tremuloides	77.8	5.3
Quercus rubra	200.0	3.0
Tilia americana	44.4	0.2
softwood		
Abies balsamea	1011.1	4.9
Picea glauca	11.1	0.0
Thuja occidentalis	77.8	1.9
Tsuga canadensis	111.1	3.3
TOTAL	**2,288.9**	**37.6**

Plot: 1036

Species	Density (individuals / ha)	Basal Area (m^2/ ha)
hardwood		
Acer rubrum	22.2	1.2
Acer saccharum	88.9	1.8
Acer spicatum	811.1	1.5
Betula alleghaniensis	111.1	6.5
Betula papyrifera	11.1	0.4
Fraxinus nigra	122.2	2.9
Prunus pensylvanica	11.1	0.4
Quercus rubra	22.2	2.1
Sorbus decora	22.2	1.1
softwood		
Abies balsamea	200.0	5.3
Picea glauca	11.1	1.2
Thuja occidentalis	11.1	0.3
TOTAL	**1,444.4**	**24.6**

Plot: 1037

Species	Density (individuals / ha)	Basal Area (m^2/ ha)
hardwood		
Acer rubrum	233.3	7.2
Acer saccharum	355.6	4.7
Acer spicatum	111.1	0.1
Betula alleghaniensis	133.3	8.4
Ostrya virginiana	44.4	0.4
Quercus rubra	22.2	0.0
Tilia americana	33.3	2.9
softwood		
Abies balsamea	77.8	0.6
Thuja occidentalis	100.0	7.5
TOTAL	**1,111.1**	**31.8**

Plot: 1038

Species	Density (individuals / ha)	Basal Area (m^2/ ha)
hardwood		
Acer rubrum	533.3	12.4
Acer saccharum	422.2	1.0
Acer spicatum	100.0	0.1
Betula alleghaniensis	166.7	6.1
Betula papyrifera	66.7	2.1
Populus tremuloides	22.2	4.0
Quercus rubra	188.9	1.8
softwood		
Abies balsamea	333.3	3.6
Picea glauca	11.1	0.0
Thuja occidentalis	177.8	4.9
Tsuga canadensis	144.4	1.0
TOTAL	**2,166.7**	**37.0**

Plot: 1039

Species	Density (individuals / ha)	Basal Area (m^2/ ha)
hardwood		
Acer rubrum	144.4	9.2
Acer saccharum	22.2	0.1
Acer spicatum	200.0	0.4
Betula alleghaniensis	177.8	22.6
Betula sp.	11.1	0.7
Prunus pensylvanica	22.2	0.3
softwood		
Abies balsamea	411.1	4.7
Thuja occidentalis	666.7	27.4
TOTAL	**1,655.6**	**65.4**

Plot: 1040	Density (individuals / ha)	Basal Area (m²/ ha)
hardwood		
Acer rubrum	44.4	1.8
Acer saccharum	355.6	2.3
Betula alleghaniensis	500.0	16.1
Populus tremuloides	55.6	6.2
Quercus rubra	55.6	1.6
softwood		
Tsuga canadensis	133.3	13.7
TOTAL	**1,144.4**	**41.7**

Plot: 1041	Density (individuals / ha)	Basal Area (m²/ ha)
hardwood		
Acer saccharum	166.7	5.6
Acer spicatum	344.4	0.7
Betula alleghaniensis	111.1	4.6
Betula papyrifera	122.2	13.2
Ostrya virginiana	11.1	0.0
softwood		
Abies balsamea	11.1	0.0
Thuja occidentalis	111.1	5.0
Tsuga canadensis	33.3	8.3
TOTAL	**911.1**	**37.4**

Plot: 1042	Density (individuals / ha)	Basal Area (m²/ ha)
hardwood		
Acer rubrum	177.8	7.5
Acer saccharum	288.9	0.6
Acer spicatum	477.8	0.7
Betula alleghaniensis	155.6	20.3
softwood		
Abies balsamea	55.6	1.4
Thuja occidentalis	22.2	1.5
Tsuga canadensis	188.9	3.3
TOTAL	**1,366.7**	**35.3**

Plot: 1043	Density (individuals / ha)	Basal Area (m²/ ha)
hardwood		
Acer rubrum	166.7	0.8
Acer saccharum	1488.9	4.6
Acer spicatum	66.7	0.0
Betula papyrifera	300.0	5.8
Populus tremuloides	222.2	6.4
Quercus rubra	11.1	0.0
Sorbus decora	11.1	0.0
softwood		
Abies balsamea	22.2	0.1
TOTAL	**2,288.9**	**17.8**

Plot: 1044	Density (individuals / ha)	Basal Area (m²/ ha)
hardwood		
Acer rubrum	77.8	2.4
Acer saccharum	511.1	23.6
Betula alleghaniensis	377.8	8.1
Quercus rubra	22.2	2.1
softwood		
Tsuga canadensis	77.8	2.8
TOTAL	**1,066.7**	**38.8**

Plot: 1046	Density (individuals / ha)	Basal Area (m²/ ha)
hardwood		
Acer rubrum	833.3	25.0
Acer saccharum	166.7	1.0
Acer spicatum	155.6	0.1
Betula alleghaniensis	111.1	2.7
Betula papyrifera	33.3	3.6
Populus tremuloides	11.1	1.6
Quercus rubra	66.7	0.0
softwood		
Abies balsamea	244.4	1.1
Pinus strobus	11.1	0.0
Thuja occidentalis	44.4	0.3
TOTAL	**1,677.8**	**35.5**

Plot: 1047	Density (individuals / ha)	Basal Area (m²/ ha)
hardwood		
Acer rubrum	66.7	2.3
Acer saccharum	144.4	3.4
Acer spicatum	144.4	0.2
Betula alleghaniensis	88.9	4.7
Betula papyrifera	22.2	1.8
Sorbus decora	33.3	0.7
softwood		
Thuja occidentalis	622.2	46.7
Tsuga canadensis	11.1	2.7
TOTAL	**1,133.3**	**62.6**

Plot: 1049	Density (individuals / ha)	Basal Area (m²/ ha)
hardwood		
Acer rubrum	166.7	5.9
Acer saccharum	200.0	3.1
Acer spicatum	11.1	0.0
Betula alleghaniensis	377.8	3.5
Betula papyrifera	11.1	1.4
Quercus rubra	100.0	15.3
softwood		
Abies balsamea	33.3	0.2
Tsuga canadensis	433.3	11.2
TOTAL	**1,333.3**	**40.6**

Plot: 1050

Species	Density (individuals / ha)	Basal Area (m²/ ha)
hardwood		
Acer rubrum	177.8	7.2
Acer saccharum	477.8	2.7
Acer spicatum	122.2	0.2
Betula alleghaniensis	300.0	6.5
Betula papyrifera	188.9	16.6
softwood		
Abies balsamea	188.9	0.4
Tsuga canadensis	22.2	2.8
TOTAL	**1,477.8**	**36.5**

Plot: 1053

Species	Density (individuals / ha)	Basal Area (m²/ ha)
hardwood		
Acer rubrum	111.1	3.7
Acer saccharum	488.9	12.9
Acer spicatum	22.2	0.0
Betula alleghaniensis	122.2	8.9
Betula papyrifera	177.8	5.8
Ostrya virginiana	44.4	0.1
Quercus rubra	77.8	1.5
softwood		
Abies balsamea	33.3	0.6
Thuja occidentalis	200.0	5.7
Tsuga canadensis	44.4	2.5
TOTAL	**1,322.2**	**41.7**

Plot: 1055

Species	Density (individuals / ha)	Basal Area (m²/ ha)
hardwood		
Acer rubrum	155.6	1.7
Acer saccharum	300.0	7.6
Acer spicatum	288.9	0.3
Betula alleghaniensis	200.0	15.0
Betula papyrifera	133.3	8.2
Quercus rubra	44.4	0.1
softwood		
Abies balsamea	322.2	0.9
Thuja occidentalis	255.6	11.7
TOTAL	**1,700.0**	**45.6**

Plot: 1057

Species	Density (individuals / ha)	Basal Area (m²/ ha)
hardwood		
Acer rubrum	233.3	3.8
Acer saccharum	955.6	9.1
Betula alleghaniensis	55.6	0.5
Betula papyrifera	144.4	6.8
Ostrya virginiana	55.6	0.4
Populus grandidentata	133.3	13.7
Quercus rubra	111.1	7.9
softwood		
Abies balsamea	266.7	0.3
TOTAL	**1,955.6**	**42.5**

Plot: 1059

Species	Density (individuals / ha)	Basal Area (m²/ ha)
hardwood		
Acer rubrum	66.7	0.5
Acer spicatum	344.4	0.6
Betula papyrifera	122.2	4.1
Fraxinus nigra	944.4	2.0
Populus tremuloides	511.1	12.7
softwood		
Abies balsamea	444.4	3.1
TOTAL	**2,433.3**	**23.0**

Density and Basal Area of Tree Species (Dead trees)

Plot: 1002	Density (individuals / ha)	Basal Area (m^2/ ha)
hardwood		
Acer saccharum	11.1	0.0
Acer spicatum	44.4	0.1
unknown tree - hardwood	22.2	4.0
softwood		
Abies balsamea	11.1	0.7
TOTAL	**88.9**	**4.9**

Plot: 1003	Density (individuals / ha)	Basal Area (m^2/ ha)
hardwood		
Acer rubrum	22.2	0.3
Acer saccharum	22.2	0.1
Betula papyrifera	100.0	3.8
unknown tree - hardwood	22.2	0.1
softwood		
Abies balsamea	22.2	0.0
TOTAL	**188.9**	**4.3**

Plot: 1004	Density (individuals / ha)	Basal Area (m^2/ ha)
hardwood		
Acer spicatum	188.9	0.2
Betula papyrifera	11.1	0.5
Populus tremuloides	33.3	12.4
unknown tree - hardwood	33.3	0.2
softwood		
Abies balsamea	66.7	2.3
TOTAL	**333.3**	**15.6**

Plot: 1005	Density (individuals / ha)	Basal Area (m^2/ ha)
hardwood		
Acer rubrum	11.1	1.2
Betula papyrifera	22.2	2.4
Populus grandidentata	11.1	0.7
Populus tremuloides	11.1	1.1
Quercus rubra	11.1	1.3
unknown tree - hardwood	11.1	0.0
softwood		
Abies balsamea	11.1	0.5
TOTAL	**88.9**	**7.2**

Plot: 1006	Density (individuals / ha)	Basal Area (m^2/ ha)
hardwood		
Acer rubrum	22.2	0.6
Betula alleghaniensis	11.1	1.4
Betula papyrifera	44.4	1.6
Quercus rubra	11.1	1.8
unknown tree - hardwood	33.3	0.5
TOTAL	**122.2**	**6.0**

Plot: 1007	Density (individuals / ha)	Basal Area (m^2/ ha)
hardwood		
Acer spicatum	44.4	0.1
unknown tree - hardwood	11.1	0.0
softwood		
Thuja occidentalis	11.1	0.7
TOTAL	**66.7**	**0.8**

Plot: 1009	Density (individuals / ha)	Basal Area (m^2/ ha)
hardwood		
Acer spicatum	11.1	0.0
Betula alleghaniensis	11.1	0.0
Betula papyrifera	22.2	1.7
softwood		
Thuja occidentalis	44.4	2.4
TOTAL	**88.9**	**4.2**

Plot: 1010	Density (individuals / ha)	Basal Area (m^2/ ha)
hardwood		
Betula alleghaniensis	222.2	7.1
unknown tree - hardwood	22.2	1.0
softwood		
Abies balsamea	177.8	0.9
Picea sp.	11.1	0.1
Thuja occidentalis	33.3	0.1
unknown tree - softwood	33.3	0.2
TOTAL	**500.0**	**9.4**

Plot: 1011	Density (individuals / ha)	Basal Area (m²/ ha)
Species		
hardwood		
Acer rubrum	11.1	0.4
Betula alleghaniensis	155.6	1.7
Betula papyrifera	44.4	0.7
Sorbus decora	22.2	0.2
unknown tree - hardwood	11.1	0.6
softwood		
Abies balsamea	877.8	2.5
unknown tree - softwood	122.2	1.2
TOTAL	**1,244.4**	**7.3**

Plot: 1012	Density (individuals / ha)	Basal Area (m²/ ha)
Species		
hardwood		
Acer saccharum	33.3	0.0
Betula alleghaniensis	77.8	4.3
Betula sp.	11.1	1.2
unknown tree - hardwood	77.8	0.8
TOTAL	**200.0**	**6.2**

Plot: 1013	Density (individuals / ha)	Basal Area (m²/ ha)
Species		
hardwood		
Acer rubrum	55.6	0.1
Acer saccharum	22.2	0.0
Acer sp.	33.3	0.0
Betula papyrifera	11.1	0.3
unknown tree - hardwood	22.2	0.5
TOTAL	**144.4**	**1.0**

Plot: 1014	Density (individuals / ha)	Basal Area (m²/ ha)
Species		
hardwood		
Betula alleghaniensis	133.3	3.0
Betula papyrifera	11.1	0.2
unknown tree - hardwood	11.1	0.0
softwood		
Abies balsamea	11.1	0.0
Tsuga canadensis	11.1	0.1
TOTAL	**177.8**	**3.3**

Plot: 1015	Density (individuals / ha)	Basal Area (m²/ ha)
Species		
hardwood		
Acer saccharum	100.0	0.2
Acer sp.	44.4	0.6
Betula papyrifera	55.6	0.9
Populus tremuloides	22.2	2.7
TOTAL	**222.2**	**4.4**

Plot: 1016	Density (individuals / ha)	Basal Area (m²/ ha)
Species		
hardwood		
Acer saccharum	77.8	0.2
Betula alleghaniensis	133.3	1.6
Betula papyrifera	11.1	0.6
TOTAL	**222.2**	**2.4**

Plot: 1017	Density (individuals / ha)	Basal Area (m²/ ha)
Species		
hardwood		
Acer saccharum	22.2	0.0
Betula alleghaniensis	11.1	0.6
Betula papyrifera	11.1	0.4
Betula sp.	11.1	0.3
softwood		
Abies balsamea	22.2	0.0
TOTAL	**77.8**	**1.3**

Plot: 1018	Density (individuals / ha)	Basal Area (m²/ ha)
Species		
hardwood		
Acer rubrum	11.1	0.0
Acer saccharum	55.6	0.9
Betula alleghaniensis	22.2	0.2
Betula papyrifera	66.7	0.9
Populus grandidentata	33.3	2.1
Populus sp.	22.2	0.9
unknown tree - hardwood	33.3	0.3
softwood		
Abies balsamea	22.2	0.1
Thuja occidentalis	11.1	0.2
TOTAL	**277.8**	**5.6**

Plot: 1020	Density (individuals / ha)	Basal Area (m²/ ha)
Species		
hardwood		
Acer spicatum	233.3	0.6
Betula alleghaniensis	11.1	0.6
softwood		
Abies balsamea	22.2	1.3
unknown tree - softwood	33.3	2.7
TOTAL	**300.0**	**5.2**

Plot: 1021	Density (individuals / ha)	Basal Area (m²/ ha)
Species		
hardwood		
Acer spicatum	55.6	0.1
Betula alleghaniensis	44.4	2.9
softwood		
Thuja occidentalis	66.7	1.6
TOTAL	**166.7**	**4.6**

Plot: 1022	Density (individuals / ha)	Basal Area (m²/ ha)
Species		
hardwood		
Acer rubrum	11.1	0.0
Acer sp.	22.2	0.0
Acer spicatum	33.3	0.3
Betula alleghaniensis	77.8	2.2
unknown tree - hardwood	33.3	1.8
softwood		
Abies balsamea	33.3	0.2
Thuja occidentalis	55.6	1.6
unknown tree - softwood	11.1	0.0
TOTAL	**277.8**	**6.1**

Plot: 1023	Density (individuals / ha)	Basal Area (m²/ ha)
Species		
hardwood		
Betula alleghaniensis	22.2	0.5
Betula papyrifera	11.1	0.9
unknown tree - hardwood	22.2	0.3
softwood		
Abies balsamea	77.8	2.6
Thuja occidentalis	44.4	0.8
unknown tree - softwood	55.6	0.6
TOTAL	**233.3**	**5.7**

Plot: 1024	Density (individuals / ha)	Basal Area (m²/ ha)
Species		
hardwood		
Acer spicatum	166.7	0.3
Betula papyrifera	66.7	5.0
unknown tree - hardwood	55.6	0.5
TOTAL	**288.9**	**5.8**

Plot: 1025	Density (individuals / ha)	Basal Area (m²/ ha)
Species		
hardwood		
Acer spicatum	22.2	0.0
Betula alleghaniensis	11.1	1.3
TOTAL	**33.3**	**1.3**

Plot: 1026	Density (individuals / ha)	Basal Area (m²/ ha)
Species		
hardwood		
Acer rubrum	11.1	0.1
Acer spicatum	11.1	0.0
Amelanchier arborea	22.2	0.2
Betula alleghaniensis	44.4	3.4
unknown tree - hardwood	55.6	0.4
softwood		
unknown tree - softwood	11.1	0.0
TOTAL	**155.6**	**4.2**

Plot: 1027	Density (individuals / ha)	Basal Area (m²/ ha)
Species		
hardwood		
Acer spicatum	22.2	0.0
Betula alleghaniensis	22.2	1.6
unknown tree - hardwood	33.3	1.1
softwood		
Abies balsamea	22.2	0.8
Thuja occidentalis	22.2	0.2
unknown tree - softwood	11.1	0.0
TOTAL	**133.3**	**3.7**

Plot: 1028	Density (individuals / ha)	Basal Area (m²/ ha)
Species		
hardwood		
Acer rubrum	11.1	1.1
Acer saccharum	11.1	0.1
Acer sp.	11.1	0.1
Betula alleghaniensis	144.4	2.3
Quercus rubra	11.1	1.5
unknown tree - hardwood	66.7	0.2
TOTAL	**255.6**	**5.3**

Plot: 1029	Density (individuals / ha)	Basal Area (m²/ ha)
Species		
hardwood		
Acer rubrum	22.2	0.2
Acer saccharum	77.8	0.1
Acer sp.	33.3	0.3
Betula alleghaniensis	88.9	6.2
Betula papyrifera	11.1	0.3
TOTAL	**233.3**	**7.1**

Plot: 1030	Density (individuals / ha)	Basal Area (m²/ ha)
Species		
hardwood		
Acer rubrum	33.3	0.2
Acer spicatum	33.3	0.0
Betula papyrifera	33.3	0.8
unknown tree - hardwood	22.2	0.1
softwood		
Abies balsamea	88.9	2.1
Thuja occidentalis	11.1	0.6
unknown tree - softwood	33.3	0.3
TOTAL	**255.6**	**4.2**

Plot: 1031	Density (individuals / ha)	Basal Area (m²/ ha)
Species		
hardwood		
Acer saccharum	55.6	0.1
Acer sp.	44.4	0.3
Betula papyrifera	33.3	1.5
Betula sp.	11.1	0.3
unknown tree - hardwood	22.2	2.3
softwood		
Abies balsamea	33.3	0.1
TOTAL	**200.0**	**4.8**

Plot: 1033	Density (individuals / ha)	Basal Area (m²/ ha)
Species		
hardwood		
Acer rubrum	11.1	0.0
Betula papyrifera	11.1	0.3
Betula sp.	33.3	0.1
Populus tremuloides	22.2	0.5
Quercus rubra	11.1	0.2
Tilia americana	22.2	0.1
unknown tree - hardwood	144.4	0.3
softwood		
Abies balsamea	22.2	0.3
TOTAL	**277.8**	**1.9**

Plot: 1034	Density (individuals / ha)	Basal Area (m²/ ha)
Species		
hardwood		
Acer saccharum	11.1	0.1
Acer spicatum	11.1	0.0
Betula alleghaniensis	11.1	0.5
unknown tree - hardwood	33.3	0.1
softwood		
Abies balsamea	66.7	0.1
TOTAL	**133.3**	**0.8**

Plot: 1035	Density (individuals / ha)	Basal Area (m²/ ha)
Species		
hardwood		
Acer saccharum	11.1	0.0
Betula alleghaniensis	11.1	0.1
Populus tremuloides	22.2	1.5
Quercus rubra	11.1	0.0
unknown tree - hardwood	44.4	1.3
softwood		
Abies balsamea	22.2	0.1
Thuja occidentalis	11.1	0.7
unknown tree - softwood	22.2	0.0
TOTAL	**155.6**	**3.7**

Plot: 1036	Density (individuals / ha)	Basal Area (m²/ ha)
Species		
hardwood		
Acer saccharum	22.2	0.0
Acer spicatum	55.6	0.2
Betula alleghaniensis	11.1	0.2
Sorbus decora	11.1	0.2
softwood		
Abies balsamea	11.1	0.5
unknown tree - softwood	22.2	0.6
TOTAL	**133.3**	**1.7**

Plot: 1037	Density (individuals / ha)	Basal Area (m²/ ha)
Species		
hardwood		
Acer spicatum	11.1	0.0
Betula alleghaniensis	22.2	5.6
softwood		
Abies balsamea	22.2	0.0
TOTAL	**55.6**	**5.7**

Plot: 1038	Density (individuals / ha)	Basal Area (m²/ ha)
Species		
hardwood		
Acer rubrum	11.1	0.0
Betula alleghaniensis	55.6	1.8
Betula papyrifera	77.8	2.4
Betula sp.	11.1	0.2
unknown tree - hardwood	22.2	0.0
softwood		
Abies balsamea	22.2	0.1
Thuja occidentalis	44.4	1.8
unknown tree - softwood	22.2	0.9
TOTAL	**266.7**	**7.2**

Plot: 1039	Density (individuals / ha)	Basal Area (m²/ ha)
Species		
hardwood		
Acer spicatum	11.1	0.0
Betula papyrifera	22.2	2.2
Betula sp.	22.2	1.0
softwood		
Abies balsamea	166.7	1.4
Thuja occidentalis	77.8	0.6
unknown tree - softwood	11.1	0.0
TOTAL	**311.1**	**5.3**

Plot: 1040	Density (individuals / ha)	Basal Area (m²/ ha)
Species		
hardwood		
Betula alleghaniensis	88.9	0.4
unknown tree - hardwood	66.7	0.4
TOTAL	**155.6**	**0.8**

Plot: 1041	Density (individuals / ha)	Basal Area (m^2/ ha)
Species		
hardwood		
Acer spicatum	77.8	0.1
Betula alleghaniensis	33.3	1.5
Betula papyrifera	66.7	4.6
softwood		
Abies balsamea	11.1	0.5
Thuja occidentalis	22.2	0.5
TOTAL	**211.1**	**7.2**

Plot: 1042	Density (individuals / ha)	Basal Area (m^2/ ha)
Species		
hardwood		
Acer sp.	11.1	0.0
Acer spicatum	11.1	0.0
Betula alleghaniensis	55.6	6.9
Betula sp.	22.2	1.2
unknown tree - hardwood	11.1	0.0
softwood		
unknown tree - softwood	11.1	0.0
TOTAL	**122.2**	**8.2**

Plot: 1043	Density (individuals / ha)	Basal Area (m^2/ ha)
Species		
hardwood		
Betula papyrifera	133.3	4.2
Populus tremuloides	77.8	3.2
TOTAL	**211.1**	**7.3**

Plot: 1044	Density (individuals / ha)	Basal Area (m^2/ ha)
Species		
hardwood		
Acer saccharum	11.1	0.0
Betula alleghaniensis	55.6	0.1
unknown tree - hardwood	33.3	0.1
softwood		
Tsuga canadensis	22.2	0.0
TOTAL	**122.2**	**0.3**

Plot: 1046	Density (individuals / ha)	Basal Area (m^2/ ha)
Species		
hardwood		
Acer rubrum	55.6	0.6
Acer saccharum	11.1	0.0
Betula papyrifera	22.2	1.8
Populus tremuloides	22.2	2.5
unknown tree - hardwood	44.4	0.5
TOTAL	**155.6**	**5.3**

Plot: 1047	Density (individuals / ha)	Basal Area (m^2/ ha)
Species		
hardwood		
Acer sp.	11.1	0.0
Acer spicatum	55.6	0.2
Betula alleghaniensis	11.1	0.0
Sorbus decora	11.1	0.1
unknown tree - hardwood	11.1	0.3
softwood		
Thuja occidentalis	22.2	0.0
TOTAL	**122.2**	**0.5**

Plot: 1049	Density (individuals / ha)	Basal Area (m^2/ ha)
Species		
hardwood		
Acer rubrum	11.1	0.0
Acer saccharum	33.3	0.0
Acer sp.	11.1	0.0
Betula alleghaniensis	44.4	1.4
Betula papyrifera	11.1	0.4
unknown tree - hardwood	133.3	2.5
softwood		
Tsuga canadensis	22.2	1.2
TOTAL	**266.7**	**5.6**

Plot: 1050	Density (individuals / ha)	Basal Area (m^2/ ha)
Species		
hardwood		
Acer saccharum	11.1	0.0
Betula alleghaniensis	44.4	2.3
Betula papyrifera	100.0	3.6
TOTAL	**155.6**	**5.9**

Plot: 1053	Density (individuals / ha)	Basal Area (m^2/ ha)
Species		
hardwood		
Betula alleghaniensis	66.7	1.4
softwood		
Abies balsamea	11.1	0.0
Thuja occidentalis	22.2	0.1
TOTAL	**100.0**	**1.5**

Plot: 1055	Density (individuals / ha)	Basal Area (m^2/ ha)
Species		
hardwood		
Betula papyrifera	77.8	4.0
softwood		
Abies balsamea	66.7	0.9
Thuja occidentalis	100.0	2.8
TOTAL	**244.4**	**7.8**

Plot: 1057 Species	Density (individuals / ha)	Basal Area (m^2/ ha)
hardwood		
Acer saccharum	111.1	0.2
Betula alleghaniensis	22.2	0.1
Populus grandidentata	11.1	0.3
TOTAL	**144.4**	**0.6**

Plot: 1059 Species	Density (individuals / ha)	Basal Area (m^2/ ha)
hardwood		
Betula papyrifera	22.2	1.0
Fraxinus nigra	11.1	0.0
Populus sp.	33.3	2.9
Populus tremuloides	88.9	4.8
unknown tree - hardwood	111.1	0.2
softwood		
Abies balsamea	44.4	0.3
TOTAL	**311.1**	**9.2**

Percent Cover of Shrub Species

Plot: 1002

Species	Percent cover in shrub circles 1	2	3	4	5	6	mean percent cover
Corylus cornuta				25		10	5.83
Taxus canadensis	75	75	90	20	20	80	60.00

Number of Shrub Circles Not Sampled in Plot 1002: 0

Plot: 1003

Species	Percent cover in shrub circles 1	2	3	4	5	6	mean percent cover
Amelanchier Group 2 sp.	1	3	5	1		1	1.83
Cornus sericea				1			0.17
Corylus cornuta	20		5	3	8	12	8.00
Diervilla lonicera			1	2	3	3	1.50
Lonicera canadensis					3		0.50
Ribes triste				1			0.17
Rubus pubescens	1			2			0.50

Number of Shrub Circles Not Sampled in Plot 1003: 0

Plot: 1004

Species	Percent cover in shrub circles 1	2	3	4	5	6	mean percent cover
Alnus incana ssp. rugosa	25		30	40	70		27.50
Amelanchier Group 2 sp.	1	1					0.33
Cornus sericea	4	1	1	4	10	1	3.50
Diervilla lonicera	1	1	1				0.50
Lonicera canadensis		1	1			1	0.50
Ribes glandulosum				1			0.17
Ribes hirtellum					1		0.17
Ribes triste					2	3	0.83
Rubus allegheniensis	1						0.17
Rubus flagellaris				8			1.33
Rubus idaeus ssp. strigosus			4	8	3		2.50
Rubus pubescens	5	5	8	8	15	5	7.67
Taxus canadensis		1		4		2	1.17

Number of Shrub Circles Not Sampled in Plot 1004: 0

Plot: 1005

Species	Percent cover in shrub circles 1	2	3	4	5	6	mean percent cover
Amelanchier Group 2 sp.	2	5	2		1	1	1.83
Corylus cornuta	15	20	8	10	8	10	11.83
Diervilla lonicera		1			1		0.33
Lonicera canadensis	1		1	2	4	4	2.00
Rubus parviflorus		2	5	3	10	4	4.00

Number of Shrub Circles Not Sampled in Plot 1005: 0

Plot: 1006

Species	Percent cover in shrub circles 1	2	3	4	5	6	mean percent cover
Amelanchier Group 2 sp.	1	1					0.33
Corylus cornuta					20		3.33
Lonicera canadensis			3			1	0.67
Taxus canadensis				1			0.17

Number of Shrub Circles Not Sampled in Plot 1006: 0

Plot: 1007

Species	Percent cover in shrub circles 1	2	3	4	5	6	mean percent cover
Taxus canadensis	8	4	4	50			16.50

Number of Shrub Circles Not Sampled in Plot 1007: 2

Plot: 1009

Species	Percent cover in shrub circles 1	2	3	4	5	6	mean percent cover
Amelanchier Group 2 sp.		1					0.17
Corylus cornuta		1	1	1	1	1	0.83
Taxus canadensis	10	4	12	30	3	20	13.17

Number of Shrub Circles Not Sampled in Plot 1009: 0

Plot: 1010

Species	Percent cover in shrub circles 1	2	3	4	5	6	mean percent cover
Alnus incana ssp. rugosa					1	10	1.83
Amelanchier Group 2 sp.	1	1					0.33
Ilex mucronata					25	5	5.00
Ledum groenlandicum					1	40	6.83
Taxus canadensis		10					1.67
Vaccinium oxycoccos						1	0.17

Number of Shrub Circles Not Sampled in Plot 1010: 0

Plot: 1011

Species	Percent cover in shrub circles 1	2	3	4	5	6	mean percent cover
Ledum groenlandicum					1	1	0.33
Taxus canadensis					4		0.67
Vaccinium angustifolium						4	0.67
Vaccinium myrtilloides	1	5				1	1.17

Number of Shrub Circles Not Sampled in Plot 1011: 0

Plot: 1012

Species	Percent cover in shrub circles 1	2	3	4	5	6	mean percent cover
Amelanchier Group 2 sp.					1		0.17
Rubus canadensis					1		0.17
Taxus canadensis	50	60	50	70		40	45.00

Number of Shrub Circles Not Sampled in Plot 1012: 0

Plot: 1013

Species	Percent cover in shrub circles 1	2	3	4	5	6	mean percent cover
Amelanchier Group 2 sp.	1	2	1		1		0.83
Corylus cornuta		2	1	1		7	1.83
Lonicera canadensis	1	5				1	1.17
Rubus parviflorus				3	1		0.67

Number of Shrub Circles Not Sampled in Plot 1013: 0

Plot: 1014

Species	Percent cover in shrub circles 1	2	3	4	5	6	mean percent cover
Amelanchier Group 2 sp.	1	1	3	2	1	1	1.50
Corylus cornuta	7						1.17
Lonicera canadensis		1			1		0.33
Taxus canadensis		10		1		30	6.83

Number of Shrub Circles Not Sampled in Plot 1014: 0

Plot: 1015

Species	Percent cover in shrub circles 1	2	3	4	5	6	mean percent cover
Amelanchier Group 2 sp.	1			1	1	1	0.67
Corylus cornuta	4	15	25	5	1	1	8.50
Diervilla lonicera					1		0.17
Lonicera canadensis	1	1	1		1	1	0.83
Rubus parviflorus					4	1	0.83
Rubus pubescens					1		0.17

Number of Shrub Circles Not Sampled in Plot 1015: 0

Plot: 1016

Species	Percent cover in shrub circles 1	2	3	4	5	6	mean percent cover
Amelanchier Group 2 sp.	1		1	1		4	1.17
Taxus canadensis		10	25		55	20	18.33

Number of Shrub Circles Not Sampled in Plot 1016: 0

Plot: 1017

Species	Percent cover in shrub circles 1	2	3	4	5	6	mean percent cover
Amelanchier Group 2 sp.	1	1	1	1	1	1	1.00
Corylus cornuta	1				1		0.33
Taxus canadensis			4	8			2.00

Number of Shrub Circles Not Sampled in Plot 1017: 0

Plot: 1018

Species	Percent cover in shrub circles 1	2	3	4	5	6	mean percent cover
Amelanchier Group 2 sp.	1	1			1	1	0.67
Corylus cornuta		1	1	1			0.50
Lonicera canadensis			1	1	10	2	2.33
Rubus parviflorus			1				0.17
Taxus canadensis	1						0.17

Number of Shrub Circles Not Sampled in Plot 1018: 0

Plot: 1020

Species	Percent cover in shrub circles 1	2	3	4	5	6	mean percent cover
Alnus incana ssp. rugosa			5				0.83
Corylus cornuta	8	10	12	1	1	50	13.67
Ribes triste		1					0.17
Rubus idaeus ssp. strigosus	4						0.67
Rubus pubescens			1			5	1.00
Taxus canadensis	4	8	20	30	40	2	17.33

Number of Shrub Circles Not Sampled in Plot 1020: 0

Plot: 1021

Species	Percent cover in shrub circles 1	2	3	4	5	6	mean percent cover
Amelanchier Group 2 sp.						1	0.17
Taxus canadensis		20	6	25	7	1	9.83

Number of Shrub Circles Not Sampled in Plot 1021: 0

Plot: 1022

Species	Percent cover in shrub circles 1	2	3	4	5	6	mean percent cover
Amelanchier Group 2 sp.				1			0.17
Rubus idaeus ssp. strigosus	1				1	1	0.50
Sambucus racemosa var. racemosa						1	0.17
Taxus canadensis	10	50		75			22.50

Number of Shrub Circles Not Sampled in Plot 1022: 0

Plot: 1023

Species	Percent cover in shrub circles 1	2	3	4	5	6	mean percent cover
Corylus cornuta				3			0.50
Taxus canadensis	10	5		5	2	3	4.17

Number of Shrub Circles Not Sampled in Plot 1023: 0

Plot: 1024

Species	Percent cover in shrub circles 1	2	3	4	5	6	mean percent cover
Amelanchier Group 2 sp.	1	1	1	1	1	1	1.00
Corylus cornuta		1	4		7	15	4.50
Diervilla lonicera		1	1				0.33
Lonicera canadensis				4			0.67
Rubus parviflorus	4	4			10	10	4.67

Number of Shrub Circles Not Sampled in Plot 1024: 0

Plot: 1025

Species	Percent cover in shrub circles 1	2	3	4	5	6	mean percent cover
Amelanchier Group 2 sp.				1	1	1	0.50
Taxus canadensis	1	2	2	1	12	2	3.33

Number of Shrub Circles Not Sampled in Plot 1025: 0

Plot: 1026

Species	Percent cover in shrub circles 1	2	3	4	5	6	mean percent cover
Amelanchier Group 2 sp.	1		1		1		0.50
Corylus cornuta	5		1		5		1.83
Lonicera canadensis					2		0.33
Ribes glandulosum				1			0.17
Rubus canadensis		1					0.17
Taxus canadensis	1	4				2	1.17
Vaccinium angustifolium				1			0.17

Number of Shrub Circles Not Sampled in Plot 1026: 0

Plot: 1027

Species	Percent cover in shrub circles 1	2	3	4	5	6	mean percent cover
Amelanchier Group 2 sp.				1			0.17
Corylus cornuta	5	1			25		5.17
Rubus idaeus ssp. strigosus	1				2	1	0.67
Taxus canadensis	1	10	90		60		26.83

Number of Shrub Circles Not Sampled in Plot 1027: 0

Plot: 1028

Species	Percent cover in shrub circles 1	2	3	4	5	6	mean percent cover
Amelanchier Group 2 sp.	1						0.17
Taxus canadensis		30	40	40	50	50	35.00

Number of Shrub Circles Not Sampled in Plot 1028: 0

Plot: 1029

Species	Percent cover in shrub circles 1	2	3	4	5	6	mean percent cover
Amelanchier Group 2 sp.		1			1		0.33
Corylus cornuta		1	1				0.33

Number of Shrub Circles Not Sampled in Plot 1029: 0

Plot: 1030

Species	Percent cover in shrub circles 1	2	3	4	5	6	mean percent cover
Amelanchier Group 2 sp.	1	1		1	1		0.67
Corylus cornuta			1				0.17
Lonicera canadensis		1	4	10	4	1	3.33
Rubus pubescens		1	1				0.33
Taxus canadensis	1		1	1	1		0.67

Number of Shrub Circles Not Sampled in Plot 1030: 0

Plot: 1031

Species	Percent cover in shrub circles 1	2	3	4	5	6	mean percent cover
Amelanchier Group 2 sp.				1	1		0.33
Corylus cornuta	5	5	1	2		10	3.83
Lonicera canadensis	5	5	1	4	5		3.33
Rubus parviflorus	1	1					0.33
Rubus pubescens						5	0.83

Number of Shrub Circles Not Sampled in Plot 1031: 0

Plot: 1033

Species	Percent cover in shrub circles 1	2	3	4	5	6	mean percent cover
Amelanchier Group 2 sp.	1	1	3		1		1.00
Cornus sericea		1					0.17
Lonicera canadensis		4	1	1	2	5	2.17
Ribes glandulosum				4			0.67
Ribes triste				4			0.67
Rosa blanda	1						0.17
Rubus pubescens	20	1		10	1		5.33

Number of Shrub Circles Not Sampled in Plot 1033: 0

Plot: 1034

Species	Percent cover in shrub circles 1	2	3	4	5	6	mean percent cover
Amelanchier Group 2 sp.	1	1	1	1			0.67
Corylus cornuta	1	1	1	2			0.83
Lonicera canadensis					1	1	0.33
Rubus parviflorus					1		0.17

Number of Shrub Circles Not Sampled in Plot 1034: 0

Plot: 1035

Species	Percent cover in shrub circles 1	2	3	4	5	6	mean percent cover
Amelanchier Group 2 sp.	1	1	1		1	1	0.83
Cornus alternifolia				1			0.17
Corylus cornuta	5	1	1	1	1	2	1.83
Diervilla lonicera	3						0.50
Lonicera canadensis	1	5	1	15		2	4.00
Rubus pubescens						1	0.17
Taxus canadensis	1						0.17

Number of Shrub Circles Not Sampled in Plot 1035: 0

Plot: 1036

Species	Percent cover in shrub circles 1	2	3	4	5	6	mean percent cover
Amelanchier Group 2 sp.					1		0.17
Corylus cornuta		3	4	8			2.50
Rubus idaeus ssp. strigosus			1				0.17
Rubus pubescens			1				0.17
Taxus canadensis	15	1		25	1	10	8.67

Number of Shrub Circles Not Sampled in Plot 1036: 0

Plot: 1037

Species	Percent cover in shrub circles 1	2	3	4	5	6	mean percent cover
Amelanchier Group 2 sp.			1				0.17
Corylus cornuta	1	8			15		4.00
Taxus canadensis	3	55	4	30	5		16.17

Number of Shrub Circles Not Sampled in Plot 1037: 0

Plot: 1038

Species	Percent cover in shrub circles 1	2	3	4	5	6	mean percent cover
Amelanchier Group 2 sp.				1		1	0.33
Lonicera canadensis	5		5	1	5	4	3.33
Ribes glandulosum			1		1		0.33
Taxus canadensis			8				1.33

Number of Shrub Circles Not Sampled in Plot 1038: 0

Plot: 1039

Species	Percent cover in shrub circles 1	2	3	4	5	6	mean percent cover
Amelanchier Group 2 sp.	1	1	1	1	1		0.83
Lonicera canadensis		1					0.17
Taxus canadensis	6		1	1	15	10	5.50

Number of Shrub Circles Not Sampled in Plot 1039: 0

Plot: 1040

Species	Percent cover in shrub circles 1	2	3	4	5	6	mean percent cover
Corylus cornuta	4						0.67
Taxus canadensis	30	85	1	25	35	75	41.83

Number of Shrub Circles Not Sampled in Plot 1040: 0

Plot: 1041

Species	Percent cover in shrub circles 1	2	3	4	5	6	mean percent cover
Amelanchier Group 2 sp.	1		2				0.50
Corylus cornuta			1				0.17
Taxus canadensis	1	5		2		2	1.67

Number of Shrub Circles Not Sampled in Plot 1041: 0

Plot: 1042

Species	Percent cover in shrub circles 1	2	3	4	5	6	mean percent cover
Amelanchier Group 2 sp.	1	1	1	1			1.00
Taxus canadensis		50	5				13.75

Number of Shrub Circles Not Sampled in Plot 1042: 2

Plot: 1043

Species	Percent cover in shrub circles 1	2	3	4	5	6	mean percent cover
Amelanchier Group 2 sp.	4	4	4	5		4	3.50
Cornus sericea		4	5		40	4	8.83
Corylus cornuta	12	10	4	20	5	40	15.17
Diervilla lonicera	20	20	15	10		75	23.33
Ilex verticillata		1					0.17
Ribes glandulosum			1		5		1.00
Rubus canadensis	4	10	10	5	20	1	8.33
Rubus idaeus ssp. strigosus			4				0.67
Salix humilis		1				4	0.83
Sambucus racemosa var. racemosa					30		5.00
Taxus canadensis				5		20	4.17
Vaccinium angustifolium	1						0.17
Vaccinium myrtilloides						4	0.67

Number of Shrub Circles Not Sampled in Plot 1043: 0

Plot: 1044

Species	Percent cover in shrub circles 1	2	3	4	5	6	mean percent cover
Amelanchier Group 2 sp.					1		0.17
Corylus cornuta				2		1	0.50
Taxus canadensis		35	25	15	15	6	16.00

Number of Shrub Circles Not Sampled in Plot 1044: 0

Plot: 1046

Species	Percent cover in shrub circles 1	2	3	4	5	6	mean percent cover
Amelanchier Group 2 sp.	4	4	4	4	10	4	5.00
Corylus cornuta			4		8		2.00
Diervilla lonicera	1						0.17
Lonicera canadensis	1		4	4	1		1.67
Rubus pubescens				4			0.67
Vaccinium myrtilloides		1				4	0.83

Number of Shrub Circles Not Sampled in Plot 1046: 0

Plot: 1047

Species	Percent cover in shrub circles 1	2	3	4	5	6	mean percent cover
Corylus cornuta		1		2			0.50
Lonicera canadensis	25			10	1		6.00
Ribes glandulosum		2					0.33
Rubus idaeus ssp. strigosus	30	10	5				7.50
Rubus parviflorus	10		30				6.67
Rubus pubescens		2					0.33

Number of Shrub Circles Not Sampled in Plot 1047: 0

Plot: 1049

Species	Percent cover in shrub circles 1	2	3	4	5	6	mean percent cover
Amelanchier Group 2 sp.		1	1		3	3	1.33
Corylus cornuta		4			1	2	1.17
Lonicera canadensis	1				2	1	0.67

Number of Shrub Circles Not Sampled in Plot 1049: 0

Plot: 1050

Species	Percent cover in shrub circles 1	2	3	4	5	6	mean percent cover
Amelanchier Group 2 sp.	1	1	1	1			0.67
Corylus cornuta	2					5	1.17
Taxus canadensis		10	4			3	2.83

Number of Shrub Circles Not Sampled in Plot 1050: 0

Plot: 1053

Species	Percent cover in shrub circles 1	2	3	4	5	6	mean percent cover
Amelanchier Group 2 sp.		1					0.17
Corylus cornuta	3	1	4			1	1.50
Taxus canadensis	1	17	8	15	35	50	21.00

Number of Shrub Circles Not Sampled in Plot 1053: 0

Plot: 1055

Species	Percent cover in shrub circles 1	2	3	4	5	6	mean percent cover
Amelanchier Group 2 sp.					1		0.17
Taxus canadensis	1	2				1	0.67

Number of Shrub Circles Not Sampled in Plot 1055: 0

Plot: 1057

Species	Percent cover in shrub circles 1	2	3	4	5	6	mean percent cover
Amelanchier Group 2 sp.		1	1		2		0.67
Corylus cornuta			1				0.17
Lonicera canadensis	1					1	0.33

Number of Shrub Circles Not Sampled in Plot 1057: 0

Plot: 1059

Species	Percent cover in shrub circles 1	2	3	4	5	6	mean percent cover
Alnus incana ssp. rugosa	5	8	1	4	10	15	7.17
Amelanchier Group 2 sp.	1			1	4		1.00
Cornus alternifolia	1						0.17
Cornus sericea	5	1	1	4	5	4	3.33
Corylus cornuta	1						0.17
Diervilla lonicera						4	0.67
Ribes glandulosum		5					0.83
Ribes triste	12	15			10		6.17
Rubus idaeus ssp. strigosus			1	50	4	15	11.67
Rubus parviflorus	4	10		1	10		4.17
Rubus pubescens	8	5	4	10	10	8	7.50
Viburnum opulus var. americanum	1						0.17

Number of Shrub Circles Not Sampled in Plot 1059: 0

Frequency of Species in Groundlayer Quadrats

Plot: 1002

Species	Quadrat Frequency Transect 1	2	3	Mean Quadrat Frequency
Acer saccharum	0.1	0.0	0.0	0.03
Acer spicatum	0.4	0.2	0.1	0.23
Clintonia borealis	0.2	0.2	0.2	0.20
Corylus cornuta	0.2	0.1	0.1	0.13
Dryopteris intermedia	0.4	0.3	0.8	0.50
Huperzia lucidula	0.1	0.0	0.0	0.03
Lycopodium annotinum	0.0	0.2	0.0	0.07
Lycopodium dendroideum	0.3	0.0	0.0	0.10
Maianthemum canadense	0.1	0.0	0.1	0.07
Taxus canadensis	0.9	0.9	0.9	0.90
Trientalis borealis	0.0	0.1	0.0	0.03

Plot: 1003

Species	Quadrat Frequency Transect 1	2	3	Mean Quadrat Frequency
Abies balsamea	0.2	0.0	0.0	0.07
Acer rubrum	0.1	0.1	0.0	0.07
Acer saccharum	0.6	1	0.9	0.83
Acer spicatum	0.1	0.6	0.3	0.33
Amelanchier Group 2 sp.	0.2	0.3	0.2	0.23
Aralia nudicaulis	0.4	0.2	0.0	0.20
Athyrium filix-femina ssp. angustum	0.1	0.0	0.2	0.10
Brachyelytrum erectum	0.1	0.1	0.0	0.07
Carex arctata	0.0	0.0	0.1	0.03
Carex gracillima	0.0	0.0	0.1	0.03
Carex sp.	0.0	0.0	0.1	0.03
Clintonia borealis	0.1	0.0	0.0	0.03
Corylus cornuta	0.5	0.3	0.2	0.33
Diervilla lonicera	0.0	0.1	0.2	0.10
Dryopteris intermedia	0.0	0.3	0.0	0.10
Equisetum arvense	0.0	0.0	0.1	0.03
Fragaria virginiana	0.0	0.0	0.1	0.03
Fraxinus nigra	0.0	0.0	0.1	0.03
Gymnocarpium dryopteris	0.0	0.2	0.0	0.07
Impatiens sp.	0.0	0.1	0.0	0.03
Lonicera canadensis	0.1	0.2	0.1	0.13
Maianthemum canadense	0.6	0.4	0.8	0.60
Pinus strobus	0.1	0.0	0.0	0.03
Poa compressa	0.0	0.0	0.2	0.07
Populus tremuloides	0.0	0.1	0.5	0.20
Pteridium aquilinum var. latiusculum	0.1	0.1	0.0	0.07
Pyrola americana	0.0	0.1	0.0	0.03
Pyrola elliptica	0.1	0.0	0.3	0.13
Quercus rubra	0.0	0.6	0.1	0.23
Ranunculus acris	0.0	0.0	0.1	0.03
Ranunculus hispidus	0.0	0.1	0.0	0.03
Ribes triste	0.0	0.0	0.1	0.03
Rubus pubescens	0.0	0.1	0.5	0.20
Scutellaria lateriflora	0.0	0.1	0.0	0.03
Solidago sp.	0.1	0.0	0.0	0.03
Tilia americana	0.0	0.0	0.2	0.07
Trientalis borealis	0.2	0.6	0.9	0.57
Trillium sp.	0.0	0.0	0.1	0.03

Plot: 1004

Species	Quadrat Frequency Transect 1	2	3	Mean Quadrat Frequency
Abies balsamea	0.0	0.0	0.2	0.07
Acer rubrum	0.0	0.1	0.0	0.03
Acer spicatum	0.3	0.2	0.2	0.23
Alnus incana ssp. rugosa	0.3	0.2	0.3	0.27
Amelanchier Group 2 sp.	0.1	0.0	0.0	0.03
Aralia nudicaulis	0.0	0.0	0.2	0.07
Calamagrostis canadensis	0.8	0.9	0.8	0.83
Carex arctata	0.2	0.1	0.0	0.10
Carex brunnescens	0.2	0.1	0.1	0.13
Carex intumescens	0.2	0.1	0.0	0.10
Carex leptonervia	0.1	0.0	0.0	0.03
Carex retrorsa	0.0	0.0	0.2	0.07
Carex sp.	0.1	0.1	0.3	0.17
Carex stipata	0.0	0.1	0.1	0.07
Circaea alpina	0.0	0.0	0.1	0.03
Cornus canadensis	0.1	0.4	0.2	0.23
Cornus sericea	0.3	0.0	0.3	0.20
Dryopteris carthusiana	0.5	0.0	0.0	0.17
Dryopteris intermedia	0.0	0.4	0.4	0.27
Equisetum pratense	0.0	0.0	0.2	0.07
Equisetum sp.	0.0	0.0	0.1	0.03
Eurybia macrophylla	0.1	0.0	0.0	0.03
Fragaria virginiana	0.0	0.3	0.3	0.20
Fraxinus nigra	0.0	0.1	0.1	0.07
Gymnocarpium dryopteris	0.1	0.0	0.0	0.03
Impatiens capensis	0.0	0.0	0.1	0.03
Impatiens pallida	0.0	0.0	0.1	0.03
Impatiens sp.	0.6	0.4	0.5	0.50
Maianthemum canadense	0.3	0.1	0.2	0.20
Matteuccia struthiopteris	0.1	0.0	0.0	0.03
Poaceae fam.	0.0	0.0	0.1	0.03
Populus tremuloides	0.2	0.1	0.1	0.13
Prunella vulgaris	0.0	0.0	0.2	0.07
Prunus virginiana	0.1	0.2	0.0	0.10
Pyrola sp.	0.1	0.0	0.0	0.03
Ranunculus acris	0.0	0.0	0.2	0.07
Ribes triste	0.1	0.2	0.3	0.20
Rubus flagellaris	0.0	0.3	0.0	0.10
Rubus idaeus ssp. strigosus	0.1	0.4	0.2	0.23
Rubus parviflorus	0.0	0.0	0.1	0.03
Rubus pubescens	1	1	0.9	0.97
Solidago sp.	0.0	0.0	0.1	0.03
Taxus canadensis	0.2	0.4	0.0	0.20
Trientalis borealis	0.5	0.2	0.2	0.30

Plot: 1005

Species	Quadrat Frequency Transect 1	2	3	Mean Quadrat Frequency
Abies balsamea	0.2	0.0	0.0	0.07
Acer rubrum	0.5	0.0	0.0	0.17
Acer saccharum	0.6	0.6	0.4	0.53
Acer spicatum	0.0	0.0	0.2	0.07
Amelanchier Group 2 sp.	0.1	0.0	0.0	0.03
Anemone quinquefolia	0.1	0.0	0.0	0.03
Aralia nudicaulis	0.8	0.6	0.6	0.67
Clintonia borealis	0.0	0.1	0.3	0.13
Corylus cornuta	0.1	0.6	0.5	0.40
Eurybia macrophylla	1	1	0.6	0.87
Lonicera canadensis	0.0	0.2	0.1	0.10
Maianthemum canadense	1	1	0.6	0.87
Maianthemum racemosum	0.0	0.1	0.1	0.07
Populus grandidentata	0.1	0.0	0.1	0.07
Populus tremuloides	0.2	0.0	0.0	0.07
Pteridium aquilinum var. latiusculum	0.5	0.0	0.6	0.37
Quercus rubra	0.3	0.2	0.2	0.23
Rubus parviflorus	0.1	0.3	0.3	0.23
Streptopus lanceolatus var. roseus	0.3	0.2	0.2	0.23
Trientalis borealis	0.9	0.8	0.7	0.80
Uvularia sessilifolia	0.0	0.0	0.1	0.03

Plot: 1006

Species	Quadrat Frequency Transect 1	2	3	Mean Quadrat Frequency
Acer rubrum	0.2	0.0	0.1	0.10
Acer saccharum	0.8	0.9	0.6	0.77
Acer spicatum	0.1	0.1	0.0	0.07
Aralia nudicaulis	0.2	0.0	0.2	0.13
Clintonia borealis	0.3	0.1	0.3	0.23
Corylus cornuta	0.0	0.0	0.1	0.03
Dryopteris carthusiana	0.0	0.1	0.0	0.03
Dryopteris intermedia	0.1	0.1	0.0	0.07
Lycopodium dendroideum	0.0	0.1	0.0	0.03
Maianthemum canadense	0.9	0.0	0.0	0.30
Ostrya virginiana	0.0	0.0	0.1	0.03
Populus grandidentata	0.0	0.0	0.1	0.03
Populus tremuloides	0.2	0.1	0.0	0.10
Quercus rubra	0.1	0.0	0.0	0.03
Sorbus decora	0.1	0.0	0.0	0.03
Taxus canadensis	0.1	0.0	0.0	0.03
Thuja occidentalis	0.1	0.1	0.0	0.07
Trientalis borealis	0.8	0.3	0.2	0.43

Plot: 1007

Species	Quadrat Frequency Transect 1	2	3	Mean Quadrat Frequency
Abies balsamea	0.0	0.0	0.2	0.07
Acer spicatum	0.2	0.3	0.5	0.33
Carex brunnescens	0.1	0.0	0.0	0.03
Cinna latifolia	0.1	0.0	0.0	0.03
Clintonia borealis	0.3	0.5	0.4	0.40
Dryopteris intermedia	0.5	0.1	0.0	0.20
Huperzia lucidula	0.6	0.6	0.5	0.57
Maianthemum canadense	0.1	0.0	0.2	0.10
Quercus rubra	0.0	0.0	0.1	0.03
Taxus canadensis	0.1	0.3	0.1	0.17
Thuja occidentalis	0.1	0.0	0.2	0.10
Trientalis borealis	0.3	0.8	0.1	0.40

Plot: 1009

Species	Quadrat Frequency Transect 1	2	3	Mean Quadrat Frequency
Acer rubrum	0.1	0.0	0.0	0.03
Acer saccharum	0.0	0.4	0.1	0.17
Acer spicatum	0.0	0.3	0.2	0.17
Corylus cornuta	0.0	0.1	0.0	0.03
Dryopteris intermedia	0.2	0.3	0.5	0.33
Maianthemum canadense	0.1	0.5	0.0	0.20
Quercus rubra	0.0	0.0	0.1	0.03
Sorbus decora	0.1	0.0	0.0	0.03
Taxus canadensis	0.9	0.5	0.7	0.70
Thuja occidentalis	0.3	0.1	0.0	0.13
Trientalis borealis	0.3	0.6	0.0	0.30

Plot: 1010

Species	Quadrat Frequency Transect 1	2	3	Mean Quadrat Frequency
Abies balsamea	0.8	0.1	0.1	0.33
Acer rubrum	0.0	0.1	0.1	0.07
Alnus incana ssp. rugosa	0.0	0.0	0.4	0.13
Aralia nudicaulis	0.1	0.1	0.0	0.07
Betula alleghaniensis	0.1	0.0	0.0	0.03
Carex lacustris	0.0	0.0	0.3	0.10
Carex trisperma	0.1	0.0	0.4	0.17
Clintonia borealis	0.2	0.0	0.0	0.07
Coptis trifolia	0.0	0.1	0.0	0.03
Cornus canadensis	0.1	0.0	0.4	0.17
Dryopteris intermedia	0.1	0.0	0.0	0.03
Gaultheria hispidula	0.1	0.0	0.4	0.17
Ilex mucronata	0.0	0.0	0.2	0.07
Ledum groenlandicum	0.0	0.0	0.8	0.27
Maianthemum canadense	0.4	0.5	0.1	0.33
Maianthemum trifolium	0.0	0.0	0.6	0.20
Picea mariana	0.0	0.0	0.1	0.03
Sorbus decora	0.3	0.1	0.0	0.13
Taxus canadensis	0.2	0.0	0.0	0.07
Thuja occidentalis	0.0	0.1	0.3	0.13
Trientalis borealis	0.4	0.2	0.3	0.30
Vaccinium myrtilloides	0.0	0.0	0.1	0.03
Vaccinium oxycoccos	0.0	0.0	0.2	0.07

Plot: 1011

Species	Quadrat Frequency Transect 1	2	3	Mean Quadrat Frequency
Abies balsamea	0.1	0.2	0.4	0.23
Betula alleghaniensis	0.0	0.0	0.1	0.03
Carex projecta	0.0	0.0	0.1	0.03
Carex trisperma	0.1	0.0	0.9	0.33
Clintonia borealis	0.1	0.0	0.1	0.07
Cornus canadensis	0.4	0.0	0.3	0.23
Gaultheria hispidula	0.1	0.0	0.3	0.13
Ledum groenlandicum	0.0	0.0	0.2	0.07
Maianthemum canadense	0.1	0.0	0.2	0.10
Maianthemum trifolium	0.0	0.0	0.6	0.20
Picea mariana	0.0	0.0	0.2	0.07
Pinus strobus	0.0	0.0	0.1	0.03
Trientalis borealis	0.4	0.0	0.3	0.23
Vaccinium angustifolium	0.0	0.0	0.1	0.03
Vaccinium myrtilloides	0.5	0.0	0.1	0.20
Vaccinium oxycoccos	0.0	0.0	0.5	0.17

Plot: 1012

Species	Quadrat Frequency Transect 1	2	3	Mean Quadrat Frequency
Acer saccharum	0.4	0.2	0.4	0.33
Acer spicatum	0.2	0.0	0.1	0.10
Aralia nudicaulis	0.1	0.0	0.1	0.07
Carex intumescens	0.0	0.0	0.1	0.03
Clintonia borealis	0.5	0.4	0.4	0.43
Dryopteris carthusiana	0.2	0.0	0.0	0.07
Dryopteris intermedia	0.1	0.3	0.5	0.30
Huperzia lucidula	0.2	0.1	0.0	0.10
Lycopodium dendroideum	0.1	0.1	0.0	0.07
Maianthemum canadense	0.0	0.0	0.2	0.07
Maianthemum racemosum	0.3	0.0	0.1	0.13
Mitchella repens	0.1	0.0	0.0	0.03
Populus tremuloides	0.1	0.1	0.0	0.07
Pyrola sp.	0.0	0.0	0.1	0.03
Quercus rubra	0.5	0.4	0.2	0.37
Rubus pubescens	0.0	0.0	0.1	0.03
Streptopus lanceolatus var. roseus	0.0	0.3	0.1	0.13
Taxus canadensis	1	0.9	0.8	0.90
Trientalis borealis	0.3	0.1	0.0	0.13

Plot: 1013

Species	Quadrat Frequency Transect 1	2	3	Mean Quadrat Frequency
Abies balsamea	0.0	0.2	0.1	0.10
Acer rubrum	0.2	0.0	0.3	0.17
Acer saccharum	0.4	0.7	0.4	0.50
Amelanchier Group 2 sp.	0.1	0.1	0.0	0.07
Aralia nudicaulis	0.5	0.8	0.3	0.53
Betula alleghaniensis	0.1	0.1	0.0	0.07
Corallorrhiza maculata	0.0	0.1	0.0	0.03
Corylus cornuta	0.2	0.1	0.2	0.17
Eurybia macrophylla	0.1	0.3	0.0	0.13
Gaultheria procumbens	0.2	0.0	0.4	0.20
Lonicera canadensis	0.2	0.0	0.1	0.10
Maianthemum canadense	0.7	1	0.7	0.80
Maianthemum racemosum	0.3	0.3	0.1	0.23
Monotropa uniflora	0.0	0.1	0.0	0.03
Populus grandidentata	0.0	0.2	0.1	0.10
Pteridium aquilinum var. latiusculum	0.1	0.3	0.4	0.27
Quercus rubra	0.0	0.1	0.0	0.03
Rubus parviflorus	0.0	0.1	0.4	0.17
Streptopus lanceolatus var. roseus	0.1	0.1	0.0	0.07
Trientalis borealis	1	1	0.9	0.97

Plot: 1014

Species	Quadrat Frequency Transect 1	2	3	Mean Quadrat Frequency
Abies balsamea	0.1	0.0	0.0	0.03
Acer rubrum	0.4	0.8	0.9	0.70
Acer saccharum	0.1	0.1	0.1	0.10
Acer spicatum	0.1	0.2	0.0	0.10
Amelanchier Group 2 sp.	0.3	0.4	0.3	0.33
Aralia nudicaulis	0.3	0.8	0.4	0.50
Carex communis	0.0	0.0	0.1	0.03
Clintonia borealis	0.4	0.8	0.4	0.53
Cornus canadensis	0.4	0.2	0.1	0.23
Dryopteris intermedia	0.2	0.4	0.3	0.30
Gaultheria procumbens	0.1	0.0	0.1	0.07
Huperzia lucidula	0.0	0.3	0.0	0.10
Lycopodium dendroideum	0.1	0.1	0.0	0.07
Maianthemum canadense	0.8	1	0.7	0.83
Populus tremuloides	0.0	0.0	0.1	0.03
Pteridium aquilinum var. latiusculum	0.2	0.0	0.0	0.07
Quercus rubra	0.1	0.1	0.1	0.10
Sorbus decora	0.1	0.0	0.0	0.03
Taxus canadensis	0.1	0.0	0.1	0.07
Thuja occidentalis	0.1	0.0	0.0	0.03
Trientalis borealis	0.5	0.6	0.7	0.60

Plot: 1015

Species	Quadrat Frequency Transect 1	2	3	Mean Quadrat Frequency
Abies balsamea	0.1	0.0	0.0	0.03
Acer rubrum	0.4	0.3	0.0	0.23
Acer saccharum	0.3	0.0	0.2	0.17
Amelanchier Group 2 sp.	0.3	0.0	0.0	0.10
Aralia nudicaulis	0.9	0.9	0.4	0.73
Athyrium filix-femina ssp. angustum	0.0	0.0	0.1	0.03
Carex arctata	0.0	0.0	0.1	0.03
Carex brunnescens	0.1	0.0	0.0	0.03
Cornus canadensis	0.0	0.2	0.0	0.07
Corylus cornuta	0.4	0.3	0.3	0.33
Diervilla lonicera	0.0	0.1	0.0	0.03
Eurybia macrophylla	0.6	0.6	0.4	0.53
Gaultheria procumbens	0.0	0.0	0.1	0.03
Gymnocarpium dryopteris	0.1	0.0	0.0	0.03
Lonicera canadensis	0.0	0.1	0.0	0.03
Lycopodium annotinum	0.0	0.1	0.0	0.03
Maianthemum canadense	1	0.9	0.6	0.83
Maianthemum racemosum	0.0	0.0	0.1	0.03
Populus grandidentata	0.0	0.3	0.2	0.17
Populus tremuloides	0.2	0.0	0.2	0.13
Pteridium aquilinum var. latiusculum	0.5	0.1	0.7	0.43
Quercus rubra	0.1	0.3	0.2	0.20
Rubus parviflorus	0.1	0.0	0.0	0.03
Rubus pubescens	0.0	0.0	0.1	0.03
Streptopus lanceolatus var. roseus	0.1	0.0	0.0	0.03
Trientalis borealis	1	1	1	1.00
Vaccinium angustifolium	0.0	0.0	0.1	0.03

Plot: 1016

Species	Quadrat Frequency Transect 1	2	3	Mean Quadrat Frequency
Abies balsamea	0.0	0.1	0.0	0.03
Acer rubrum	0.2	0.1	0.0	0.10
Acer saccharum	0.6	0.8	0.6	0.67
Acer spicatum	0.3	0.5	0.5	0.43
Amelanchier Group 2 sp.	0.0	0.1	0.0	0.03
Aralia nudicaulis	0.2	0.9	0.7	0.60
Betula papyrifera	0.0	0.0	0.1	0.03
Carex pedunculata	0.0	0.0	0.1	0.03
Carex sp.	0.0	0.0	0.1	0.03
Clintonia borealis	0.7	0.6	1	0.77
Dryopteris carthusiana	0.0	0.0	0.1	0.03
Dryopteris intermedia	0.2	0.0	0.0	0.07
Gaultheria procumbens	0.0	0.0	0.1	0.03
Goodyera oblongifolia	0.0	0.2	0.0	0.07
Huperzia lucidula	0.3	0.0	0.0	0.10
Lycopodium dendroideum	0.0	0.1	0.0	0.03
Lycopodium hickeyi	0.1	0.0	0.0	0.03
Maianthemum canadense	0.3	1	1	0.77
Maianthemum racemosum	0.0	0.2	0.0	0.07
Mitchella repens	0.3	0.0	0.1	0.13
Populus grandidentata	0.0	0.1	0.0	0.03
Populus tremuloides	0.0	0.2	0.1	0.10
Quercus rubra	0.3	0.4	0.0	0.23
Sorbus decora	0.0	0.0	0.1	0.03
Streptopus lanceolatus var. roseus	0.2	0.0	0.1	0.10
Taxus canadensis	0.6	0.0	0.3	0.30
Trientalis borealis	0.1	1	0.3	0.47
Viola sp.	0.2	0.0	0.0	0.07

Plot: 1017

Species	Quadrat Frequency Transect 1	2	3	Mean Quadrat Frequency
Abies balsamea	0.4	0.1	0.1	0.20
Acer rubrum	0.0	0.3	0.4	0.23
Acer saccharum	0.5	0.8	0.5	0.60
Acer spicatum	0.0	0.4	0.1	0.17
Amelanchier Group 2 sp.	0.2	0.2	0.0	0.13
Aralia nudicaulis	0.3	0.4	0.7	0.47
Clintonia borealis	0.1	0.1	0.1	0.10
Corylus cornuta	0.3	0.0	0.0	0.10
Dryopteris intermedia	0.0	0.0	0.1	0.03
Gaultheria procumbens	0.0	0.0	0.3	0.10
Lonicera canadensis	0.0	0.0	0.1	0.03
Lycopodium annotinum	0.3	0.1	0.7	0.37
Lycopodium dendroideum	0.4	0.0	0.1	0.17
Lycopodium hickeyi	0.4	0.1	0.6	0.37
Maianthemum canadense	0.4	0.4	0.9	0.57
Maianthemum racemosum	0.1	0.0	0.0	0.03
Monotropa uniflora	0.4	0.0	0.0	0.13
Ostrya virginiana	0.0	0.0	0.1	0.03
Polygonatum pubescens	0.0	0.1	0.0	0.03
Quercus rubra	0.0	0.3	0.3	0.20
Streptopus lanceolatus var. roseus	0.2	0.0	0.1	0.10
Taxus canadensis	0.2	0.3	0.2	0.23
Trientalis borealis	1	0.3	0.8	0.70

Plot: 1018

Species	Quadrat Frequency Transect 1	2	3	Mean Quadrat Frequency
Abies balsamea	0.0	0.1	0.1	0.07
Acer rubrum	0.2	0.1	0.2	0.17
Acer saccharum	0.7	0.3	0.4	0.47
Acer spicatum	0.0	0.2	0.2	0.13
Amelanchier Group 2 sp.	0.1	0.0	0.0	0.03
Anemone quinquefolia	0.0	0.1	0.0	0.03
Aralia nudicaulis	0.1	0.2	0.4	0.23
Betula alleghaniensis	0.0	0.0	0.1	0.03
Carex arctata	0.0	0.0	0.1	0.03
Clintonia borealis	0.5	0.3	0.2	0.33
Corylus cornuta	0.0	0.1	0.2	0.10
Dryopteris carthusiana	0.1	0.0	0.1	0.07
Eurybia macrophylla	0.1	0.0	0.1	0.07
Huperzia lucidula	0.1	0.0	0.0	0.03
Lonicera canadensis	0.2	0.1	0.0	0.10
Lycopodium annotinum	0.0	0.0	0.6	0.20
Lycopodium dendroideum	0.3	0.2	0.0	0.17
Maianthemum canadense	0.8	0.4	0.8	0.67
Monotropa uniflora	0.1	0.0	0.0	0.03
Populus grandidentata	0.1	0.1	0.0	0.07
Populus tremuloides	0.0	0.1	0.2	0.10
Quercus rubra	0.2	0.2	0.4	0.27
Ribes triste	0.0	0.1	0.0	0.03
Trientalis borealis	1	0.8	1	0.93

Plot: 1020

Species	Quadrat Frequency Transect 1	2	3	Mean Quadrat Frequency
Acer spicatum	0.2	0.1	0.3	0.20
Alnus incana ssp. rugosa	0.0	0.0	0.1	0.03
Carex arctata	0.1	0.1	0.0	0.07
Carex brunnescens	0.1	0.0	0.0	0.03
Corylus cornuta	0.2	0.3	0.1	0.20
Dryopteris carthusiana	0.1	0.0	0.0	0.03
Dryopteris intermedia	0.7	0.8	0.7	0.73
Gymnocarpium dryopteris	0.1	0.0	0.0	0.03
Prunus pensylvanica	0.0	0.0	0.1	0.03
Rubus idaeus ssp. strigosus	0.1	0.2	0.0	0.10
Rubus pubescens	0.0	0.2	0.1	0.10
Taxus canadensis	1	1	0.9	0.97
Trientalis borealis	0.0	0.1	0.0	0.03

Plot: 1021

Species	Quadrat Frequency Transect 1	2	3	Mean Quadrat Frequency
Acer rubrum	0.1	0.0	0.0	0.03
Acer saccharum	0.1	0.0	0.1	0.07
Acer spicatum	0.1	0.1	0.6	0.27
Betula alleghaniensis	0.1	0.0	0.0	0.03
Carex sp.	0.0	0.0	0.1	0.03
Clintonia borealis	0.5	0.2	0.5	0.40
Cornus canadensis	0.2	0.0	0.0	0.07
Dryopteris intermedia	0.4	0.7	0.7	0.60
Huperzia lucidula	0.2	0.7	0.5	0.47
Maianthemum canadense	0.0	0.1	0.5	0.20
Sorbus decora	0.0	0.0	0.2	0.07
Streptopus amplexifolius	0.0	0.0	0.1	0.03
Taxus canadensis	0.8	0.9	0.4	0.70
Thuja occidentalis	0.0	0.0	0.3	0.10
Trientalis borealis	0.1	0.1	0.6	0.27

Plot: 1022

Species	Quadrat Frequency Transect 1	2	3	Mean Quadrat Frequency
Acer rubrum	0.0	0.1	0.0	0.03
Acer saccharum	0.1	0.3	0.6	0.33
Acer spicatum	0.2	0.2	0.1	0.17
Adiantum pedatum	0.0	0.0	0.1	0.03
Amelanchier Group 2 sp.	0.0	0.1	0.0	0.03
Aralia nudicaulis	0.0	0.0	0.1	0.03
Betula alleghaniensis	0.0	0.0	0.1	0.03
Carex arctata	0.0	0.1	0.0	0.03
Carex brunnescens	0.0	0.3	0.2	0.17
Clintonia borealis	0.0	0.1	0.0	0.03
Dryopteris intermedia	0.1	0.4	0.3	0.27
Gymnocarpium dryopteris	0.0	0.1	0.1	0.07
Huperzia lucidula	0.2	0.3	0.3	0.27
Lycopodium annotinum	0.0	0.2	0.0	0.07
Lycopodium dendroideum	0.1	0.0	0.0	0.03
Prunus pensylvanica	0.0	0.1	0.0	0.03
Quercus rubra	0.0	0.0	0.1	0.03
Rubus idaeus ssp. strigosus	0.0	0.0	0.1	0.03
Taxus canadensis	0.6	0.7	0.1	0.47
Thuja occidentalis	0.0	0.1	0.0	0.03
Trientalis borealis	0.1	0.3	0.3	0.23
Viola sp.	0.0	0.0	0.7	0.23

Plot: 1023

Species	Quadrat Frequency Transect 1	2	3	Mean Quadrat Frequency
Abies balsamea	0.1	0.2	0.4	0.23
Acer rubrum	0.0	0.2	0.2	0.13
Acer spicatum	0.4	0.2	0.0	0.20
Amelanchier Group 2 sp.	0.0	0.0	0.1	0.03
Clintonia borealis	0.0	0.2	0.2	0.13
Cornus canadensis	0.0	0.1	0.0	0.03
Dryopteris carthusiana	0.0	0.0	0.2	0.07
Dryopteris intermedia	0.2	0.2	0.0	0.13
Galium trifidum	0.1	0.0	0.0	0.03
Gymnocarpium dryopteris	0.1	0.0	0.0	0.03
Lycopodium annotinum	0.0	0.1	0.2	0.10
Maianthemum canadense	0.0	0.1	0.0	0.03
Sorbus decora	0.0	0.0	0.3	0.10
Taxus canadensis	0.5	0.0	0.2	0.23
Thuja occidentalis	0.4	0.3	0.6	0.43
Trientalis borealis	0.7	0.5	0.6	0.60

Plot: 1024

Species	Quadrat Frequency Transect 1	2	3	Mean Quadrat Frequency
Abies balsamea	0.0	0.2	0.0	0.07
Acer rubrum	0.0	0.5	0.0	0.17
Acer saccharum	0.8	0.7	1	0.83
Acer spicatum	0.9	0.3	0.8	0.67
Actaea sp.	0.0	0.0	0.1	0.03
Amelanchier Group 2 sp.	0.1	0.2	0.1	0.13
Aralia nudicaulis	0.9	0.3	0.8	0.67
Athyrium filix-femina ssp. angustum	0.0	0.1	0.0	0.03
Calamagrostis canadensis	0.0	0.0	0.1	0.03
Carex arctata	0.0	0.2	0.1	0.10
Carex brunnescens	0.0	0.2	0.0	0.07
Carex communis	0.0	0.4	0.0	0.13
Clintonia borealis	0.9	0.5	0.1	0.50
Cornus canadensis	0.0	0.1	0.0	0.03
Corylus cornuta	0.2	0.5	0.3	0.33
Diervilla lonicera	0.0	0.1	0.0	0.03
Dryopteris intermedia	0.0	0.1	0.0	0.03
Lonicera canadensis	0.0	0.2	0.0	0.07
Lycopodium annotinum	0.1	0.0	0.0	0.03
Lycopodium dendroideum	0.1	0.0	0.0	0.03
Maianthemum canadense	1	1	1	1.00
Maianthemum racemosum	0.0	0.0	0.1	0.03
Phegopteris connectilis	0.0	0.1	0.0	0.03
Populus tremuloides	0.0	0.1	0.0	0.03
Prenanthes alba	0.0	0.1	0.0	0.03
Pyrola elliptica	0.3	0.1	0.0	0.13
Rubus parviflorus	0.0	0.0	0.2	0.07
Trientalis borealis	1	0.9	1	0.97

Plot: 1025

Species	Quadrat Frequency Transect 1	2	3	Mean Quadrat Frequency
Acer rubrum	0.0	0.2	0.2	0.13
Acer saccharum	1	0.6	0.0	0.53
Acer spicatum	0.1	0.1	0.3	0.17
Amelanchier Group 2 sp.	0.0	0.0	0.1	0.03
Athyrium filix-femina ssp. angustum	0.1	0.0	0.0	0.03
Carex communis	0.1	0.0	0.0	0.03
Carex disperma	0.1	0.0	0.0	0.03
Clintonia borealis	0.4	0.0	0.0	0.13
Dryopteris intermedia	0.5	0.4	0.6	0.50
Huperzia lucidula	0.0	0.2	0.0	0.07
Lycopodium annotinum	0.0	0.0	0.1	0.03
Lycopodium dendroideum	0.0	0.5	0.1	0.20
Maianthemum canadense	0.3	0.0	0.1	0.13
Prunus pensylvanica	0.0	0.0	0.1	0.03
Taxus canadensis	0.1	0.3	0.3	0.23
Thuja occidentalis	0.0	0.0	0.1	0.03
Trientalis borealis	0.6	0.4	0.5	0.50

Plot: 1026

Species	Quadrat Frequency Transect 1	2	3	Mean Quadrat Frequency
Abies balsamea	0.0	0.0	0.1	0.03
Acer rubrum	0.0	0.1	0.3	0.13
Acer saccharum	0.0	0.1	0.1	0.07
Acer spicatum	0.4	0.4	0.5	0.43
Amelanchier Group 2 sp.	0.1	0.4	0.2	0.23
Aralia nudicaulis	0.2	0.0	0.4	0.20
Athyrium filix-femina ssp. angustum	0.0	0.1	0.0	0.03
Betula alleghaniensis	0.0	0.2	0.0	0.07
Calamagrostis canadensis	0.0	0.1	0.0	0.03
Clintonia borealis	0.4	0.8	0.6	0.60
Coptis trifolia	0.0	0.1	0.0	0.03
Cornus canadensis	0.1	0.3	0.3	0.23
Cypripedium sp.	0.0	0.0	0.1	0.03
Dryopteris intermedia	0.8	0.6	0.8	0.73
Eurybia macrophylla	0.0	0.2	0.0	0.07
Gaultheria procumbens	0.0	0.1	0.0	0.03
Lonicera canadensis	0.1	0.1	0.0	0.07
Lycopodium annotinum	0.5	0.4	0.8	0.57
Lycopodium dendroideum	0.2	0.1	0.2	0.17
Maianthemum canadense	0.8	0.3	0.9	0.67
Phegopteris connectilis	0.1	0.0	0.0	0.03
Rubus canadensis	0.0	0.1	0.0	0.03
Sorbus decora	0.0	0.1	0.0	0.03
Streptopus lanceolatus var. roseus	0.3	0.0	0.1	0.13
Taxus canadensis	0.1	0.0	0.2	0.10
Trientalis borealis	0.1	0.3	0.6	0.33
Tsuga canadensis	0.0	0.1	0.0	0.03

Plot: 1027

Species	Quadrat Frequency Transect 1	2	3	Mean Quadrat Frequency
Acer rubrum	0.1	0.1	0.0	0.07
Acer saccharum	0.5	0.6	0.1	0.40
Acer spicatum	0.3	0.0	0.4	0.23
Amelanchier Group 2 sp.	0.0	0.1	0.0	0.03
Clintonia borealis	0.1	0.0	0.0	0.03
Corylus cornuta	0.4	0.1	0.1	0.20
Dryopteris intermedia	0.2	0.0	0.0	0.07
Huperzia lucidula	0.0	0.1	0.1	0.07
Lycopodium dendroideum	0.2	0.2	0.0	0.13
Maianthemum canadense	0.2	0.0	0.0	0.07
Quercus rubra	0.2	0.3	0.0	0.17
Rubus idaeus ssp. strigosus	0.0	0.0	0.1	0.03
Streptopus lanceolatus var. roseus	0.1	0.0	0.0	0.03
Taxus canadensis	0.8	0.3	0.5	0.53
Thuja occidentalis	0.3	0.0	0.1	0.13
Trientalis borealis	0.2	0.1	0.0	0.10
Viola sp.	0.1	0.0	0.0	0.03

Plot: 1028

Species	Quadrat Frequency Transect 1	2	3	Mean Quadrat Frequency
Abies balsamea	0.0	0.0	0.1	0.03
Acer rubrum	0.2	0.1	0.0	0.10
Acer saccharum	0.1	0.2	0.2	0.17
Acer spicatum	0.2	0.1	0.0	0.10
Amelanchier Group 2 sp.	0.0	0.1	0.0	0.03
Aralia nudicaulis	0.2	0.2	0.0	0.13
Betula alleghaniensis	0.1	0.0	0.0	0.03
Clintonia borealis	0.4	0.5	0.2	0.37
Corylus cornuta	0.0	0.1	0.0	0.03
Dryopteris intermedia	0.3	0.5	0.1	0.30
Goodyera oblongifolia	0.0	0.1	0.0	0.03
Huperzia lucidula	0.2	0.1	0.2	0.17
Lycopodium annotinum	0.0	0.3	0.0	0.10
Lycopodium dendroideum	0.0	0.0	0.1	0.03
Maianthemum canadense	0.4	0.3	0.0	0.23
Quercus rubra	0.0	0.0	0.2	0.07
Rubus canadensis	0.0	0.1	0.0	0.03
Streptopus lanceolatus var. roseus	0.2	0.0	0.0	0.07
Taxus canadensis	0.6	0.9	0.8	0.77
Trientalis borealis	0.1	0.4	0.4	0.30

Plot: 1029

Species	Quadrat Frequency Transect 1	2	3	Mean Quadrat Frequency
Abies balsamea	0.3	0.2	0.2	0.23
Acer rubrum	0.3	0.4	0.0	0.23
Acer saccharum	0.9	1	0.5	0.80
Acer spicatum	0.1	0.0	0.0	0.03
Aralia nudicaulis	0.5	0.6	0.1	0.40
Carex communis	0.0	0.0	0.2	0.07
Clintonia borealis	0.7	0.1	0.0	0.27
Corylus cornuta	0.0	0.0	0.1	0.03
Eurybia macrophylla	0.0	0.1	0.0	0.03
Gaultheria procumbens	0.0	0.1	0.1	0.07
Huperzia lucidula	0.0	0.1	0.0	0.03
Lonicera canadensis	0.1	0.0	0.0	0.03
Lycopodium annotinum	0.6	0.2	0.0	0.27
Lycopodium clavatum	0.0	0.1	0.0	0.03
Lycopodium dendroideum	0.0	0.2	0.4	0.20
Maianthemum canadense	1	0.0	1	0.67
Maianthemum racemosum	0.1	0.0	0.1	0.07
Quercus rubra	0.2	0.1	0.0	0.10
Streptopus lanceolatus var. roseus	0.3	0.4	0.1	0.27
Trientalis borealis	1	0.9	1	0.97
Uvularia sessilifolia	0.0	0.0	0.1	0.03

Plot: 1030

Species	Quadrat Frequency Transect 1	2	3	Mean Quadrat Frequency
Abies balsamea	0.0	0.2	0.0	0.07
Acer rubrum	0.1	0.6	0.2	0.30
Acer saccharum	0.5	0.4	0.9	0.60
Acer spicatum	0.4	0.0	0.7	0.37
Amelanchier Group 2 sp.	0.2	0.1	0.2	0.17
Aralia nudicaulis	0.2	0.0	0.1	0.10
Athyrium filix-femina ssp. angustum	0.0	0.0	0.1	0.03
Carex arctata	0.0	0.0	0.2	0.07
Carex sp.	0.0	0.0	0.1	0.03
Clintonia borealis	0.7	0.8	0.4	0.63
Cornus canadensis	0.4	0.2	0.1	0.23
Dryopteris carthusiana	0.2	0.1	0.1	0.13
Dryopteris intermedia	0.1	0.0	0.1	0.07
Goodyera oblongifolia	0.0	0.1	0.0	0.03
Gymnocarpium dryopteris	0.1	0.0	0.1	0.07
Huperzia lucidula	0.2	0.0	0.1	0.10
Lonicera canadensis	0.1	0.0	0.2	0.10
Maianthemum canadense	0.7	0.9	0.9	0.83
Populus grandidentata	0.1	0.0	0.0	0.03
Populus tremuloides	0.1	0.2	0.3	0.20
Quercus rubra	0.1	0.6	0.2	0.30
Rubus pubescens	0.1	0.0	0.2	0.10
Sorbus decora	0.1	0.1	0.0	0.07
Taxus canadensis	0.1	0.0	0.1	0.07
Thuja occidentalis	0.4	0.1	0.0	0.17
Trientalis borealis	0.8	0.9	0.4	0.70

Plot: 1031

Species	Quadrat Frequency Transect 1	2	3	Mean Quadrat Frequency
Abies balsamea	0.1	0.4	0.2	0.23
Acer rubrum	0.0	0.0	0.1	0.03
Acer saccharum	0.6	0.3	0.2	0.37
Acer spicatum	0.2	0.0	0.0	0.07
Amelanchier Group 2 sp.	0.2	0.0	0.0	0.07
Aralia nudicaulis	0.4	0.2	0.4	0.33
Athyrium filix-femina ssp. angustum	0.0	0.0	0.1	0.03
Carex arctata	0.0	0.0	0.1	0.03
Carex brunnescens	0.0	0.0	0.1	0.03
Carex deweyana	0.1	0.0	0.1	0.07
Carex pensylvanica	0.1	0.3	0.4	0.27
Cinna latifolia	0.0	0.0	0.1	0.03
Clintonia borealis	0.3	0.1	0.2	0.20
Cornus canadensis	0.0	0.0	0.1	0.03
Corylus cornuta	0.3	0.2	0.2	0.23
Equisetum palustre	0.0	0.0	0.1	0.03
Equisetum pratense	0.0	0.0	0.1	0.03
Eurybia macrophylla	0.3	0.0	0.0	0.10
Lonicera canadensis	0.2	0.2	0.0	0.13
Maianthemum canadense	1	0.6	1	0.87
Maianthemum racemosum	0.2	0.0	0.0	0.07
Oryzopsis asperifolia	0.0	0.0	0.1	0.03
Polygonatum pubescens	0.1	0.0	0.0	0.03
Pteridium aquilinum var. latiusculum	0.0	0.0	0.2	0.07
Quercus rubra	0.1	0.1	0.3	0.17
Rubus parviflorus	0.4	0.0	0.1	0.17
Rubus pubescens	0.0	0.0	0.2	0.07
Tilia americana	0.0	0.1	0.0	0.03
Trientalis borealis	1	0.6	0.8	0.80
Tsuga canadensis	0.0	0.1	0.0	0.03

Plot: 1033

Species	Quadrat Frequency Transect 1	2	3	Mean Quadrat Frequency
Acer rubrum	0.6	0.4	0.2	0.40
Acer saccharum	0.0	0.2	0.6	0.27
Acer spicatum	0.0	0.0	0.1	0.03
Amelanchier Group 2 sp.	0.0	0.0	0.1	0.03
Aralia nudicaulis	0.0	0.3	0.5	0.27
Athyrium filix-femina ssp. angustum	0.1	0.2	0.0	0.10
Betula papyrifera	0.1	0.0	0.0	0.03
Carex arctata	0.4	0.0	0.0	0.13
Carex brunnescens	0.1	0.1	0.0	0.07
Carex projecta	0.1	0.1	0.0	0.07
Clinopodium vulgare	0.1	0.0	0.0	0.03
Cornus alternifolia	0.0	0.2	0.0	0.07
Cornus canadensis	0.0	0.1	0.0	0.03
Cornus sericea	0.1	0.0	0.0	0.03
Cystopteris fragilis	0.1	0.0	0.0	0.03
Diervilla lonicera	0.0	0.0	0.1	0.03
Eurybia macrophylla	0.0	0.1	0.1	0.07
Fragaria virginiana	0.5	0.3	0.0	0.27
Fraxinus pennsylvanica	0.2	0.2	0.5	0.30
Gymnocarpium dryopteris	0.0	0.0	0.1	0.03
Hieracium aurantiacum	0.2	0.1	0.0	0.10
Lonicera canadensis	0.2	0.2	0.0	0.13
Maianthemum canadense	0.4	0.4	0.7	0.50
Mitchella repens	0.1	0.0	0.0	0.03
Populus tremuloides	0.6	0.1	0.1	0.27
Pteridium aquilinum var. latiusculum	0.1	0.0	0.0	0.03
Pyrola elliptica	0.1	0.0	0.0	0.03
Pyrola sp.	0.0	0.0	0.1	0.03
Quercus rubra	0.0	0.1	0.0	0.03
Ranunculus acris	0.5	0.0	0.0	0.17
Ranunculus recurvatus	0.1	0.0	0.0	0.03
Ribes triste	0.0	0.2	0.0	0.07
Rubus pubescens	0.6	0.5	0.2	0.43
Solidago sp.	0.1	0.0	0.0	0.03
Tilia americana	0.0	0.0	0.1	0.03
Trientalis borealis	0.7	0.5	0.7	0.63

Plot: 1034

Species	Quadrat Frequency Transect 1	2	3	Mean Quadrat Frequency
Abies balsamea	0.2	0.0	0.1	0.10
Acer rubrum	0.1	0.5	0.1	0.23
Acer saccharum	0.4	0.2	0.3	0.30
Amelanchier Group 2 sp.	0.2	0.0	0.0	0.07
Aralia nudicaulis	0.2	0.5	0.0	0.23
Clintonia borealis	0.1	0.3	0.1	0.17
Corylus cornuta	0.1	0.5	0.0	0.20
Eurybia macrophylla	0.1	0.0	0.0	0.03
Gaultheria procumbens	0.1	0.1	0.0	0.07
Gymnocarpium dryopteris	0.0	0.0	0.1	0.03
Lonicera canadensis	0.1	0.1	0.2	0.13
Lycopodium annotinum	0.1	0.3	0.1	0.17
Lycopodium dendroideum	0.1	0.0	0.1	0.07
Maianthemum canadense	0.6	0.6	0.3	0.50
Maianthemum racemosum	0.0	0.1	0.0	0.03
Mitchella repens	0.0	0.1	0.0	0.03
Ostrya virginiana	0.0	0.0	0.1	0.03
Quercus rubra	0.0	0.3	0.1	0.13
Trientalis borealis	0.5	0.9	0.3	0.57
Tsuga canadensis	0.0	0.0	0.2	0.07
Uvularia sessilifolia	0.0	0.1	0.0	0.03

Plot: 1035

Species	Quadrat Frequency Transect 1	2	3	Mean Quadrat Frequency
Abies balsamea	0.2	0.0	0.1	0.10
Acer rubrum	0.1	0.1	0.1	0.10
Acer saccharum	0.6	0.8	0.0	0.47
Alnus incana ssp. rugosa	0.0	0.0	0.1	0.03
Amelanchier Group 2 sp.	0.2	0.2	0.0	0.13
Aralia nudicaulis	0.1	0.1	0.3	0.17
Betula papyrifera	0.0	0.0	0.1	0.03
Calamagrostis canadensis	0.0	0.0	0.2	0.07
Carex pedunculata	0.1	0.4	0.1	0.20
Carex sp.	0.0	0.1	0.2	0.10
Clintonia borealis	0.0	0.3	0.0	0.10
Cornus alternifolia	0.2	0.0	0.0	0.07
Cornus canadensis	0.2	0.0	0.0	0.07
Corylus cornuta	0.2	0.6	0.1	0.30
Dryopteris intermedia	0.0	0.1	0.0	0.03
Elymus sp.	0.0	0.0	0.2	0.07
Equisetum arvense	0.0	0.0	0.4	0.13
Equisetum sylvaticum	0.0	0.0	0.3	0.10
Eurybia macrophylla	0.1	0.5	0.1	0.23
Fragaria virginiana	0.0	0.0	0.2	0.07
Galium triflorum	0.0	0.2	0.0	0.07
Gymnocarpium dryopteris	0.0	0.6	0.0	0.20
Huperzia lucidula	0.1	0.0	0.0	0.03
Impatiens sp.	0.0	0.0	0.1	0.03
Iris versicolor	0.0	0.0	0.1	0.03
Lonicera canadensis	0.1	0.1	0.0	0.07
Lycopodium dendroideum	0.1	0.0	0.0	0.03
Lycopodium digitatum	0.0	0.0	0.3	0.10
Lycopus uniflorus	0.0	0.0	0.2	0.07
Maianthemum canadense	0.4	0.6	0.4	0.47
Onoclea sensibilis	0.0	0.0	0.1	0.03
Osmorhiza longistylis	0.0	0.1	0.0	0.03
Petasites frigidus var. palmatus	0.0	0.0	0.2	0.07
Populus tremuloides	0.2	0.3	0.0	0.17
Pyrola elliptica	0.0	0.1	0.0	0.03
Quercus rubra	0.6	0.4	0.1	0.37
Rubus pubescens	0.0	0.1	0.5	0.20
Solidago sp.	0.0	0.0	0.3	0.10
Streptopus lanceolatus var. roseus	0.1	0.3	0.0	0.13
Symphyotrichum puniceum	0.0	0.0	0.1	0.03
Taxus canadensis	0.3	0.0	0.0	0.10
Thuja occidentalis	0.1	0.1	0.0	0.07
Tilia americana	0.0	0.2	0.0	0.07
Trientalis borealis	0.0	0.5	0.4	0.30
Trillium grandiflorum	0.0	0.1	0.0	0.03
Viola sp.	0.0	0.3	0.4	0.23

Plot: 1036

Species	Quadrat Frequency Transect 1	2	3	Mean Quadrat Frequency
Abies balsamea	0.0	0.0	0.1	0.03
Acer saccharum	0.6	0.2	0.0	0.27
Acer spicatum	0.5	0.2	0.1	0.27
Athyrium filix-femina ssp. angustum	0.0	0.2	0.0	0.07
Calamagrostis canadensis	0.0	0.1	0.0	0.03
Carex arctata	0.0	0.1	0.0	0.03
Carex brunnescens	0.0	0.2	0.0	0.07
Carex projecta	0.0	0.1	0.0	0.03
Carex stipata	0.0	0.1	0.0	0.03
Cinna latifolia	0.0	0.4	0.0	0.13
Circaea alpina	0.0	0.3	0.0	0.10
Clintonia borealis	0.1	0.0	0.0	0.03
Corylus cornuta	0.1	0.0	0.4	0.17
Dryopteris carthusiana	0.0	0.3	0.0	0.10
Galium triflorum	0.1	0.0	0.0	0.03
Gymnocarpium dryopteris	0.0	0.2	0.0	0.07
Huperzia lucidula	0.2	0.0	0.0	0.07
Lycopus uniflorus	0.0	0.1	0.0	0.03
Maianthemum canadense	0.1	0.0	0.0	0.03
Matteuccia struthiopteris	0.0	0.1	0.0	0.03
Populus tremuloides	0.0	0.0	0.2	0.07
Ribes hirtellum	0.0	0.1	0.0	0.03
Rubus idaeus ssp. strigosus	0.0	0.3	0.0	0.10
Scutellaria lateriflora	0.0	0.1	0.0	0.03
Taxus canadensis	0.9	0.6	1	0.83
Trientalis borealis	0.1	0.1	0.0	0.07

Plot: 1037

Species	Quadrat Frequency Transect 1	2	3	Mean Quadrat Frequency
Acer rubrum	0.0	0.0	0.1	0.03
Acer saccharum	0.5	0.4	0.4	0.43
Acer spicatum	0.2	0.2	0.0	0.13
Amelanchier Group 2 sp.	0.0	0.1	0.0	0.03
Aralia nudicaulis	0.0	0.3	0.0	0.10
Athyrium filix-femina ssp. angustum	0.0	0.1	0.0	0.03
Corallorrhiza sp.	0.0	0.1	0.0	0.03
Corylus cornuta	0.1	0.2	0.1	0.13
Dryopteris carthusiana	0.0	0.0	0.1	0.03
Dryopteris intermedia	0.0	0.1	0.3	0.13
Galium triflorum	0.2	0.1	0.1	0.13
Huperzia lucidula	0.0	0.2	0.2	0.13
Lycopodium dendroideum	0.1	0.1	0.0	0.07
Maianthemum canadense	0.0	0.5	0.2	0.23
Ostrya virginiana	0.1	0.1	0.0	0.07
Phegopteris connectilis	0.0	0.0	0.1	0.03
Quercus rubra	0.1	0.4	0.0	0.17
Sorbus decora	0.0	0.1	0.0	0.03
Taxus canadensis	0.9	0.7	0.7	0.77
Thuja occidentalis	0.0	0.0	0.1	0.03
Trientalis borealis	0.0	0.3	0.1	0.13
Viola sp.	0.2	0.1	0.3	0.20

Plot: 1038

Species	Quadrat Frequency Transect 1	2	3	Mean Quadrat Frequency
Abies balsamea	0.0	0.2	0.0	0.07
Acer rubrum	0.2	0.3	0.5	0.33
Acer saccharum	0.0	0.1	0.7	0.27
Acer spicatum	0.0	0.2	0.2	0.13
Amelanchier Group 2 sp.	0.0	0.1	0.1	0.07
Athyrium filix-femina ssp. angustum	0.0	0.0	0.1	0.03
Betula alleghaniensis	0.1	0.0	0.0	0.03
Carex arctata	0.0	0.0	0.1	0.03
Carex leptonervia	0.0	0.1	0.0	0.03
Carex sp.	0.0	0.1	0.0	0.03
Clintonia borealis	0.2	0.3	0.4	0.30
Coptis trifolia	0.0	0.1	0.0	0.03
Cornus canadensis	0.1	0.3	0.0	0.13
Corylus cornuta	0.0	0.1	0.0	0.03
Diervilla lonicera	0.0	0.0	0.2	0.07
Dryopteris carthusiana	0.0	0.1	0.0	0.03
Dryopteris intermedia	0.3	0.1	0.8	0.40
Equisetum arvense	0.0	0.0	0.2	0.07
Equisetum sylvaticum	0.0	0.2	0.0	0.07
Eurybia macrophylla	0.0	0.0	0.6	0.20
Goodyera oblongifolia	0.0	0.0	0.1	0.03
Gymnocarpium dryopteris	0.1	0.0	0.1	0.07
Listera cordata	0.0	0.1	0.0	0.03
Lonicera canadensis	0.0	0.2	0.0	0.07
Lycopodium dendroideum	0.0	0.0	0.2	0.07
Maianthemum canadense	0.8	0.7	0.6	0.70
Petasites frigidus var. palmatus	0.0	0.0	0.1	0.03
Populus tremuloides	0.0	0.0	0.1	0.03
Quercus rubra	0.1	0.1	0.1	0.10
Ribes glandulosum	0.0	0.0	0.1	0.03
Solidago sp.	0.0	0.1	0.0	0.03
Sorbus decora	0.1	0.0	0.2	0.10
Streptopus lanceolatus var. roseus	0.0	0.1	0.0	0.03
Taxus canadensis	0.0	0.1	0.1	0.07
Thuja occidentalis	0.1	0.1	0.1	0.10
Trientalis borealis	0.9	0.8	0.8	0.83
Tsuga canadensis	0.2	0.0	0.0	0.07
Viola sp.	0.2	0.2	0.2	0.20

Plot: 1039

Species	Quadrat Frequency Transect 1	2	3	Mean Quadrat Frequency
Abies balsamea	0.1	0.0	0.0	0.03
Acer rubrum	0.0	0.4	0.1	0.17
Acer spicatum	0.2	0.2	0.1	0.17
Amelanchier Group 2 sp.	0.0	0.1	0.0	0.03
Carex trisperma	0.1	0.1	0.0	0.07
Clintonia borealis	0.1	0.0	0.1	0.07
Dryopteris intermedia	0.1	0.3	0.4	0.27
Maianthemum canadense	0.2	0.0	0.1	0.10
Taxus canadensis	0.1	0.1	0.3	0.17
Thuja occidentalis	0.1	0.1	0.0	0.07
Trientalis borealis	0.3	0.3	0.3	0.30

Plot: 1040

Species	Quadrat Frequency Transect 1	2	3	Mean Quadrat Frequency
Acer rubrum	0.1	0.1	0.1	0.10
Acer saccharum	0.6	0.9	0.0	0.50
Acer spicatum	0.1	0.1	0.0	0.07
Aralia nudicaulis	0.0	0.4	0.0	0.13
Carex communis	0.0	0.1	0.0	0.03
Carex sp.	0.1	0.0	0.0	0.03
Clintonia borealis	0.2	0.9	0.2	0.43
Dryopteris intermedia	0.0	0.2	0.5	0.23
Huperzia lucidula	0.2	0.2	0.3	0.23
Lycopodium dendroideum	0.0	0.1	0.0	0.03
Maianthemum canadense	0.2	0.7	0.0	0.30
Maianthemum racemosum	0.0	0.3	0.0	0.10
Mitchella repens	0.0	0.2	0.2	0.13
Populus tremuloides	0.0	0.4	0.0	0.13
Quercus rubra	0.5	0.1	0.1	0.23
Streptopus lanceolatus var. roseus	0.1	0.5	0.0	0.20
Taxus canadensis	0.8	0.3	0.8	0.63
Trientalis borealis	0.5	0.5	0.0	0.33
Viola sp.	0.0	0.1	0.0	0.03

Plot: 1041

Species	Quadrat Frequency Transect 1	2	3	Mean Quadrat Frequency
Acer saccharum	0.0	0.3	0.7	0.33
Acer spicatum	0.4	0.2	0.3	0.30
Amelanchier Group 2 sp.	0.0	0.1	0.1	0.07
Carex communis	0.1	0.0	0.0	0.03
Clintonia borealis	0.1	0.0	0.0	0.03
Dryopteris intermedia	0.4	0.7	0.7	0.60
Huperzia lucidula	0.1	0.1	0.2	0.13
Lycopodium dendroideum	0.0	0.1	0.0	0.03
Maianthemum canadense	0.0	0.1	0.0	0.03
Sorbus decora	0.0	0.1	0.0	0.03
Taxus canadensis	0.1	0.0	0.2	0.10
Thuja occidentalis	0.1	0.2	0.2	0.17
Trientalis borealis	0.0	0.1	0.0	0.03

Plot: 1042

Species	Quadrat Frequency Transect 1	2	3	Mean Quadrat Frequency
Acer rubrum	0.2	0.2	1	0.47
Acer saccharum	0.4	0.2	0.0	0.20
Acer spicatum	0.3	0.2	0.0	0.17
Amelanchier Group 2 sp.	0.1	0.2	0.0	0.10
Aralia nudicaulis	0.6	0.3	0.0	0.30
Carex arctata	0.1	0.1	0.0	0.07
Clintonia borealis	0.5	0.2	0.0	0.23
Dryopteris intermedia	0.8	0.5	1	0.77
Huperzia lucidula	0.7	0.9	0.0	0.53
Lycopodium annotinum	0.5	0.6	1	0.70
Lycopodium dendroideum	0.3	0.5	1	0.60
Lycopodium hickeyi	0.1	0.1	0.0	0.07
Maianthemum canadense	0.5	0.1	0.0	0.20
Oxalis sp.	0.0	0.4	0.0	0.13
Quercus rubra	0.1	0.1	0.0	0.07
Sorbus decora	0.0	0.0	1	0.33
Taxus canadensis	0.9	0.3	0.0	0.40
Trientalis borealis	0.4	0.2	0.0	0.20

Plot: 1043

Species	Quadrat Frequency Transect 1	2	3	Mean Quadrat Frequency
Acer rubrum	0.4	0.0	0.1	0.17
Acer saccharum	0.2	0.6	1	0.60
Amelanchier Group 2 sp.	0.0	0.2	0.5	0.23
Anemone quinquefolia	0.1	0.1	0.0	0.07
Apocynum androsaemifolium	0.0	0.0	0.1	0.03
Aralia nudicaulis	0.4	0.0	0.0	0.13
Carex arctata	0.0	0.0	0.1	0.03
Carex sp.	0.4	0.2	0.0	0.20
Chamerion angustifolium	0.3	0.0	0.0	0.10
Clintonia borealis	0.4	0.7	0.7	0.60
Cornus canadensis	0.0	0.2	0.0	0.07
Cornus sericea	0.4	0.1	0.1	0.20
Corylus cornuta	0.0	0.1	0.3	0.13
Danthonia spicata	0.0	0.0	0.1	0.03
Diervilla lonicera	0.6	0.6	0.6	0.60
Dryopteris carthusiana	0.2	0.1	0.0	0.10
Eurybia macrophylla	0.1	0.3	0.5	0.30
Fallopia cilinodis	0.0	0.2	0.0	0.07
Fragaria virginiana	0.2	0.0	0.0	0.07
Galium trifidum	0.3	0.0	0.0	0.10
Galium triflorum	0.0	0.1	0.1	0.07
Hieracium sp.	0.1	0.0	0.0	0.03
Impatiens capensis	0.4	0.0	0.0	0.13
Lactuca canadensis	0.0	0.2	0.0	0.07
Lonicera canadensis	0.1	0.0	0.0	0.03
Lycopodium dendroideum	0.0	0.0	0.2	0.07
Lycopodium digitatum	0.3	0.0	0.4	0.23
Lycopodium hickeyi	0.0	0.1	0.0	0.03
Maianthemum canadense	0.6	0.9	1	0.83
Maianthemum racemosum	0.6	0.3	0.2	0.37
Melampyrum lineare	0.0	0.1	0.0	0.03
Osmorhiza claytonii	0.3	0.0	0.3	0.20
Petasites frigidus var. palmatus	0.1	0.0	0.0	0.03
Poaceae fam.	0.3	0.0	0.0	0.10
Populus tremuloides	0.4	0.2	0.0	0.20
Pyrola elliptica	0.2	0.1	0.0	0.10
Ribes glandulosum	0.0	0.0	0.3	0.10
Rubus canadensis	0.5	0.5	0.3	0.43
Rubus idaeus ssp. strigosus	0.0	0.2	0.0	0.07
Solidago sp.	0.5	0.0	0.1	0.20
Streptopus lanceolatus var. roseus	0.3	0.2	0.1	0.20
Symphyotrichum lateriflorum	0.0	0.1	0.0	0.03
Symphyotrichum puniceum	0.1	0.0	0.0	0.03
Taxus canadensis	0.0	0.0	0.1	0.03
Trientalis borealis	0.4	0.3	0.5	0.40
Trillium cernuum	0.0	0.1	0.0	0.03
Trillium grandiflorum	0.1	0.0	0.0	0.03
Viola sp.	0.0	0.2	0.2	0.13

Plot: 1044

Species	Quadrat Frequency Transect 1	2	3	Mean Quadrat Frequency
Acer rubrum	0.0	0.0	0.1	0.03
Acer saccharum	0.3	0.2	0.5	0.33
Acer spicatum	0.2	0.0	0.0	0.07
Aralia nudicaulis	0.0	0.0	0.1	0.03
Clintonia borealis	0.1	0.4	0.3	0.27
Dryopteris intermedia	0.0	0.0	0.2	0.07
Huperzia lucidula	0.2	0.2	0.3	0.23
Lonicera canadensis	0.0	0.0	0.1	0.03
Lycopodium dendroideum	0.1	0.0	0.0	0.03
Maianthemum canadense	0.1	0.0	0.2	0.10
Maianthemum racemosum	0.1	0.0	0.0	0.03
Quercus rubra	0.2	0.7	0.2	0.37
Streptopus lanceolatus var. roseus	0.1	0.1	0.0	0.07
Taxus canadensis	0.6	0.9	0.5	0.67
Trientalis borealis	0.4	0.4	0.1	0.30
Viola sp.	0.1	0.0	0.0	0.03

Plot: 1046

Species	Quadrat Frequency Transect 1	2	3	Mean Quadrat Frequency
Acer rubrum	0.2	0.0	0.1	0.10
Acer saccharum	0.5	0.5	0.6	0.53
Acer spicatum	0.2	0.7	0.3	0.40
Amelanchier Group 2 sp.	0.3	0.4	0.3	0.33
Aralia nudicaulis	0.5	0.3	0.3	0.37
Athyrium filix-femina ssp. angustum	0.1	0.3	0.0	0.13
Carex brunnescens	0.2	0.0	0.0	0.07
Clintonia borealis	0.1	0.2	0.4	0.23
Coptis trifolia	0.0	0.2	0.0	0.07
Cornus canadensis	0.1	0.1	0.2	0.13
Corylus cornuta	0.1	0.2	0.2	0.17
Dryopteris intermedia	0.1	0.0	0.1	0.07
Eurybia macrophylla	0.2	0.2	0.1	0.17
Fragaria virginiana	0.0	0.1	0.0	0.03
Lonicera canadensis	0.1	0.1	0.0	0.07
Lycopodium annotinum	0.1	0.0	0.0	0.03
Lycopodium dendroideum	0.0	0.0	0.1	0.03
Lycopodium digitatum	0.0	0.6	0.0	0.20
Lycopodium obscurum	0.2	0.0	0.2	0.13
Maianthemum canadense	0.8	0.8	1	0.87
Mitchella repens	0.1	0.0	0.0	0.03
Populus tremuloides	0.2	0.1	0.1	0.13
Pteridium aquilinum var. latiusculum	0.1	0.1	0.3	0.17
Pyrola elliptica	0.1	0.0	0.0	0.03
Quercus rubra	0.3	0.1	0.1	0.17
Rubus pubescens	0.0	0.1	0.0	0.03
Streptopus lanceolatus var. roseus	0.0	0.1	0.0	0.03
Taxus canadensis	0.0	0.1	0.0	0.03
Thuja occidentalis	0.2	0.0	0.1	0.10
Trientalis borealis	0.9	0.7	0.7	0.77
Vaccinium myrtilloides	0.0	0.0	0.2	0.07
Viola sp.	0.2	0.1	0.0	0.10

Plot: 1047

Species	Quadrat Frequency Transect 1	2	3	Mean Quadrat Frequency
Acer rubrum	0.1	0.1	0.0	0.07
Acer saccharum	0.1	0.3	0.0	0.13
Acer spicatum	0.1	0.1	0.2	0.13
Amelanchier Group 2 sp.	0.1	0.0	0.0	0.03
Aralia nudicaulis	0.4	0.2	0.0	0.20
Athyrium filix-femina ssp. angustum	0.1	0.0	0.1	0.07
Brachyelytrum erectum	0.0	0.0	0.1	0.03
Calamagrostis canadensis	0.2	0.0	0.0	0.07
Carex arctata	0.1	0.0	0.0	0.03
Carex brunnescens	0.0	0.0	0.1	0.03
Carex communis	0.0	0.5	0.1	0.20
Carex gynandra	0.1	0.0	0.0	0.03
Carex intumescens	0.0	0.1	0.0	0.03
Carex pensylvanica	0.0	0.0	0.4	0.13
Carex projecta	0.1	0.0	0.0	0.03
Carex sp.	0.2	0.2	0.2	0.20
Cinna latifolia	0.1	0.1	0.0	0.07
Clintonia borealis	0.3	0.2	0.0	0.17
Cornus canadensis	0.0	0.1	0.0	0.03
Dryopteris intermedia	0.6	0.5	0.6	0.57
Equisetum pratense	0.1	0.0	0.0	0.03
Eurybia macrophylla	0.1	0.0	0.0	0.03
Fallopia cilinodis	0.3	0.0	0.0	0.10
Galeopsis tetrahit	0.3	0.0	0.0	0.10
Glyceria striata	0.0	0.1	0.0	0.03
Gymnocarpium dryopteris	0.1	0.0	0.0	0.03
Hieracium sp.	0.1	0.0	0.0	0.03
Impatiens sp.	0.2	0.0	0.0	0.07
Lactuca biennis	0.1	0.0	0.0	0.03
Lonicera canadensis	0.2	0.3	0.1	0.20
Maianthemum canadense	0.8	0.8	0.3	0.63
Osmunda claytoniana	0.0	0.0	0.1	0.03
Oxalis sp.	0.1	0.3	0.2	0.20
Phegopteris connectilis	0.1	0.2	0.0	0.10
Poa sp.	0.1	0.0	0.0	0.03
Poaceae fam.	0.0	0.2	0.1	0.10
Rubus idaeus ssp. strigosus	0.4	0.0	0.0	0.13
Rubus parviflorus	0.5	0.8	0.0	0.43
Solidago gigantea	0.2	0.0	0.0	0.07
Streptopus lanceolatus var. roseus	0.2	0.0	0.0	0.07
Trientalis borealis	0.3	0.7	0.6	0.53

Plot: 1049

Species	Quadrat Frequency Transect 1	2	3	Mean Quadrat Frequency
Abies balsamea	0.0	0.0	0.2	0.07
Acer rubrum	0.3	0.0	0.1	0.13
Acer saccharum	0.3	0.0	0.4	0.23
Amelanchier Group 2 sp.	0.0	0.1	0.0	0.03
Aralia nudicaulis	0.0	0.0	0.1	0.03
Betula alleghaniensis	0.2	0.0	0.0	0.07
Carex communis	0.1	0.1	0.0	0.07
Clintonia borealis	0.0	0.1	0.1	0.07
Dryopteris intermedia	0.3	0.0	0.0	0.10
Eurybia macrophylla	0.0	0.0	0.3	0.10
Lonicera canadensis	0.0	0.1	0.0	0.03
Lycopodium annotinum	0.2	0.1	0.1	0.13
Lycopodium dendroideum	0.0	0.1	0.1	0.07
Maianthemum canadense	0.7	0.6	0.7	0.67
Mitchella repens	0.0	0.0	0.1	0.03
Pyrola elliptica	0.1	0.0	0.0	0.03
Quercus rubra	0.0	0.0	0.2	0.07
Streptopus lanceolatus var. roseus	0.1	0.1	0.1	0.10
Trientalis borealis	0.9	0.4	0.8	0.70
Tsuga canadensis	0.3	0.1	0.1	0.17
Uvularia sessilifolia	0.1	0.0	0.0	0.03

Plot: 1050

Species	Quadrat Frequency Transect 1	2	3	Mean Quadrat Frequency
Acer rubrum	0.1	0.1	0.0	0.07
Acer saccharum	0.7	0.6	0.9	0.73
Acer spicatum	0.1	0.7	0.4	0.40
Amelanchier Group 2 sp.	0.2	0.2	0.0	0.13
Aralia nudicaulis	0.4	0.2	0.3	0.30
Athyrium filix-femina ssp. angustum	0.0	0.0	0.2	0.07
Carex sp.	0.0	0.0	0.1	0.03
Clintonia borealis	0.3	0.5	0.8	0.53
Corylus cornuta	0.0	0.1	0.1	0.07
Diervilla lonicera	0.0	0.0	0.1	0.03
Dryopteris intermedia	0.6	0.6	0.3	0.50
Gymnocarpium dryopteris	0.1	0.0	0.0	0.03
Lycopodium annotinum	0.0	0.0	0.1	0.03
Lycopodium dendroideum	0.3	0.2	0.3	0.27
Maianthemum canadense	0.1	0.5	0.9	0.50
Monotropa uniflora	0.2	0.4	0.1	0.23
Osmunda claytoniana	0.0	0.0	0.1	0.03
Phegopteris connectilis	0.0	0.1	0.1	0.07
Populus tremuloides	0.2	0.0	0.0	0.07
Ribes glandulosum	0.0	0.3	0.0	0.10
Sorbus decora	0.1	0.2	0.0	0.10
Streptopus lanceolatus var. roseus	0.0	0.1	0.4	0.17
Taxus canadensis	0.3	0.1	0.1	0.17
Thuja occidentalis	0.0	0.0	0.1	0.03
Trientalis borealis	0.5	0.8	0.8	0.70

Plot: 1053

Species	Quadrat Frequency Transect 1	2	3	Mean Quadrat Frequency
Acer saccharum	0.1	0.2	0.1	0.13
Acer spicatum	0.0	0.1	0.0	0.03
Amelanchier Group 2 sp.	0.0	0.1	0.0	0.03
Betula alleghaniensis	0.1	0.1	0.0	0.07
Carex brunnescens	0.2	0.1	0.0	0.10
Carex sp.	0.1	0.0	0.1	0.07
Cinna latifolia	0.0	0.1	0.0	0.03
Clintonia borealis	0.0	0.1	0.0	0.03
Corylus cornuta	0.0	0.2	0.1	0.10
Dryopteris carthusiana	0.0	0.1	0.0	0.03
Dryopteris intermedia	0.2	0.2	0.2	0.20
Gymnocarpium dryopteris	0.3	0.4	0.0	0.23
Huperzia lucidula	0.4	0.0	0.4	0.27
Lycopodium dendroideum	0.1	0.0	0.0	0.03
Maianthemum canadense	0.0	0.3	0.0	0.10
Quercus rubra	0.1	0.2	0.1	0.13
Streptopus lanceolatus var. roseus	0.0	0.1	0.2	0.10
Taxus canadensis	0.7	0.6	1	0.77
Thuja occidentalis	0.2	0.1	0.2	0.17
Trientalis borealis	0.2	0.2	0.0	0.13
Viola sp.	0.1	0.2	0.0	0.10

Plot: 1055

Species	Quadrat Frequency Transect 1	2	3	Mean Quadrat Frequency
Abies balsamea	0.1	0.0	0.0	0.03
Acer rubrum	0.0	0.4	0.1	0.17
Acer saccharum	0.3	0.4	0.1	0.27
Acer spicatum	0.0	0.4	0.2	0.20
Amelanchier Group 2 sp.	0.1	0.0	0.0	0.03
Betula alleghaniensis	0.0	0.0	0.1	0.03
Carex arctata	0.0	0.1	0.1	0.07
Cornus canadensis	0.0	0.0	0.1	0.03
Corylus cornuta	0.0	0.1	0.0	0.03
Dryopteris carthusiana	0.2	0.0	0.1	0.10
Dryopteris intermedia	0.0	0.0	0.1	0.03
Lycopodium annotinum	0.0	0.0	0.1	0.03
Maianthemum canadense	0.0	0.0	0.2	0.07
Monotropa uniflora	0.0	0.0	0.1	0.03
Quercus rubra	0.2	0.4	0.5	0.37
Sorbus decora	0.1	0.1	0.1	0.10
Taxus canadensis	0.0	0.1	0.0	0.03
Thuja occidentalis	0.1	0.2	0.0	0.10
Trientalis borealis	0.0	0.2	0.2	0.13

Plot: 1057

Species	Quadrat Frequency Transect 1	2	3	Mean Quadrat Frequency
Abies balsamea	0.1	0.3	0.1	0.17
Acer rubrum	0.0	0.0	0.2	0.07
Acer saccharum	1	0.7	0.3	0.67
Amelanchier Group 2 sp.	0.1	0.0	0.1	0.07
Aralia nudicaulis	0.4	0.0	0.3	0.23
Betula alleghaniensis	0.0	0.1	0.0	0.03
Clintonia borealis	0.1	0.0	0.0	0.03
Corylus cornuta	0.1	0.0	0.0	0.03
Eurybia macrophylla	0.0	0.0	0.4	0.13
Gaultheria procumbens	0.0	0.0	0.1	0.03
Huperzia lucidula	0.0	0.1	0.0	0.03
Lonicera canadensis	0.1	0.1	0.1	0.10
Lycopodium annotinum	0.0	0.0	0.2	0.07
Lycopodium dendroideum	0.0	0.0	0.1	0.03
Maianthemum canadense	0.0	0.1	0.7	0.27
Maianthemum racemosum	0.3	0.0	0.0	0.10
Monotropa hypopithys	0.1	0.0	0.0	0.03
Monotropa uniflora	0.0	0.1	0.0	0.03
Ostrya virginiana	0.1	0.0	0.0	0.03
Populus grandidentata	0.0	0.1	0.0	0.03
Streptopus lanceolatus var. roseus	0.1	0.0	0.1	0.07
Trientalis borealis	1	1	1	1.00
Uvularia sessilifolia	0.6	0.0	0.1	0.23

Plot: 1059

Species	Quadrat Frequency Transect 1	2	3	Mean Quadrat Frequency
Abies balsamea	0.2	0.1	0.1	0.13
Acer spicatum	0.2	0.0	0.0	0.07
Alnus incana ssp. rugosa	0.2	0.0	0.1	0.10
Athyrium filix-femina ssp. angustum	0.2	0.1	0.1	0.13
Calamagrostis canadensis	0.0	0.8	0.5	0.43
Carex arctata	0.1	0.1	0.0	0.07
Carex brunnescens	0.0	0.2	0.2	0.13
Carex communis	0.0	0.0	0.1	0.03
Carex gracillima	0.0	0.4	0.3	0.23
Carex intumescens	0.0	0.1	0.1	0.07
Cornus alternifolia	0.1	0.0	0.0	0.03
Cornus canadensis	0.0	0.1	0.2	0.10
Cornus sericea	0.2	0.0	0.0	0.07
Corylus cornuta	0.1	0.0	0.0	0.03
Cystopteris fragilis	0.2	0.0	0.0	0.07
Dryopteris carthusiana	0.4	0.3	0.0	0.23
Epilobium ciliatum ssp. ciliatum	0.0	0.1	0.0	0.03
Equisetum palustre	0.5	0.4	0.2	0.37
Eurybia macrophylla	0.0	0.4	0.4	0.27
Fragaria virginiana	0.5	0.3	0.5	0.43
Fraxinus nigra	0.0	0.2	0.0	0.07
Geum aleppicum	0.1	0.0	0.0	0.03
Geum macrophyllum	0.0	0.2	0.0	0.07
Glyceria striata	0.0	0.3	0.2	0.17
Matteuccia struthiopteris	0.1	0.0	0.0	0.03
Poa pratensis	0.1	0.0	0.0	0.03
Populus tremuloides	0.0	0.0	0.2	0.07
Pteridium aquilinum var. latiusculum	0.0	0.1	0.4	0.17
Pyrola elliptica	0.3	0.1	0.0	0.13
Ranunculus acris	0.2	0.2	0.0	0.13
Ribes triste	0.7	0.3	0.1	0.37
Rubus idaeus ssp. strigosus	0.0	0.2	0.5	0.23
Rubus parviflorus	0.5	0.0	0.0	0.17
Rubus pubescens	0.9	0.9	0.4	0.73
Sorbus decora	0.2	0.0	0.1	0.10
Symphyotrichum lanceolatum	0.0	0.1	0.0	0.03
Taraxacum officinale	0.1	0.0	0.0	0.03

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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