

Report on the 4th year of monitoring vegetative succession along the Volney-Marcy
South Power line right of way in Greenwoods Conservancy, Summer 2002

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ABSTRACT

In the 4th year of a continuing project, the vegetative compositions of 2 established belt transects across the 345 kV Volney-Marcy South power line right of way (ROW) maintained by the Power Authority of the State of New York (PASNY) were examined for identification and percent coverage by species. Transect A, with a west-facing aspect and slope of 25%, has not been managed since the establishment of the ROW in 1988. Its floral characteristics can be contrasted with those of Transect B, which has an east-facing aspect and slope of 20% and was clear-cut in 1998. This data can be used to estimate vegetative succession and successional rates, establishment and distribution of “undesirable” species, establishment of non-native species, and assist PASNY in Integrative Vegetative Maintenance (IVM) procedures that emphasize biological control to reduce chemical and physical maintenance regimes that are more costly and more potentially detrimental the environment.

INTRODUCTION

There are over 15,000 circuit miles of overhead electric transmission lines at or above 345 kV in New York State (EEANY, 2002). The Volney-Marcy South power line is a 200 mile long 345 kV line from Marcy to East Fishkill NY and is owned and operated by the Power Authority of the State of New York (PASNY), providing power to the downstate New York area. A section of this power line runs through the Greenwoods Conservancy in Burlington NY, a 1000+ acre nature preserve protected by a conservation easement through the Otsego Land Trust. In 1988 PASNY cleared a corridor through Greenwoods Conservancy, primarily an Eastern deciduous forest ecosystem with wetland areas and a bog, for the Volney-South power line. Clearing the right of way (ROW) underneath the lines is essential for maintenance access and to keep tall trees and shrubs from growing too close to the lines which has the potential for causing a “line to ground fault”, or a “flash-over”. This is an electrical discharge from the electric line through the air to the tree and then to the ground, causing a break in electric service and a dangerous situation on the ground in the vicinity of the high voltage discharge. The area of concern is called the wire security zone- the distance that needs to be clear of wire to avoid a line to ground fault. This distance is dependent on the hang or sag of the conducting wire (between towers), insulation (none in the section of line in Greenwoods), and the power transmitted (345 kV). In the case of the Marcy South 345 kV line, the height of the conductor at minimum sag is around 30 feet. With a 15 foot wire security zone, trees over 15 feet would have to be removed. As a general rule in this situation, PASNY

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would remove any tree or shrub that matures at over 20 feet from the wire zone area of the ROW (McLaughlin, Kevin, 2002).

Historically, ROWs were managed by hand cutting on a 3-4 year schedule. In the 1950s ground applications of herbicides began, and through the 1960s to the 1980s, herbicides were also broadcast from helicopters. In 1980, in response to environmental concerns about wholesale and potentially hazardous pesticide applications, the NYS Public Service Commission provided a regulatory objective in ROW maintenance in New York State:

“The principal ROW management objective is (promoting) the growth of low-growing, relatively stable plant communities that are aesthetically appealing, beneficial to wildlife, compatible with electrical system reliability requirements, and need relatively little maintenance over the life of a ROW”.

This shrub stability approach is based historically on Egler's Initial Floristic Composition Theory (IFC), where forest tree propagules, if removed, will allow old field succession to remain at a relatively stable shrub community stage (Egler, F.E. 1981). A development of this theory, Integrative Vegetative Maintenance (IVM) is the combination of mechanical, chemical, and biological vegetative control measures that remove potentially disruptive tall-growing trees and shrubs while favoring low growing stable shrub communities with the least amount of labor and herbicides. Mechanical methods include selective cutting (chainsaws) and/or using a rotary mower, or brush-hog, to clear cut an entire area. Many species actually increase in population density after mechanical removal due to stem suckering and root suckering. “Grubbing”, another mechanical method, refers to the use of a bulldozer with a root rake to remove all vegetation, including roots, from the ROW. Chemical methods include tree growth regulators (TGRs) and herbicides. TGRs stunt the growth of trees by reducing the production of a hormone in plants that is responsible for cell elongation and reduce crown growth. Herbicides are applied to freshly cut stumps, tree trunk bases, or to the foliage. Although herbicides are more effective than mechanical methods and require less frequent site visits, they are limited in use in environmentally sensitive ecosystems such as wetlands where setback distances of herbicide application are prescribed, and can be costly. Biological control refers to the competition between plants that reduces the growth of undesirable (tall-growing) species. The dominance of a low growing shrub community will reduce sunlight to tree seed germination. Allelopathy (biochemical competition between plants) and herbivory (introducing species that feed on pest trees) are other types of biological control methods that have potential to reduce the presence of larger tree species on ROWs. Combining mechanical, chemical, and biological methods has been shown to be the most effective method to maintain ROWs. Key to the process are utility line managers that are knowledgeable in plant species identification and determining particular plant community trends, and that can make good judgments for the best IVM practices, especially in sensitive habitats (ESF, 2002).

Other ecological concerns about the creation of a ROW or corridor (in this case, about 50 meters wide) are the creation of forest edges and habitat fragmentation affecting the biodiversity of flora and fauna. New shade intolerant species and their related communities move into the corridor, dispersal barriers are created, and the disruption of creating and maintaining the ROW may invite nonnative species to invade (Brothers, 1990). A higher number of non-native species is typical of earlier plant succession. It should be noted that non-native species, in spite of ROW disruption, remain relative few in number in ROWs in upland wooded rural areas compared to their numbers in abandoned agricultural fields. This may be due to the relative isolation of the ROW, the insulation of adjacent woods, the short time frame between disturbance and succession, and the existence of native propagules in the soil (Abranhamson 1998). The number of and type of non-native species on the two transects were documented for comparison.

METHODS

In 1999, 2 transects were established in two different locations perpendicular to the ROW at Greenwoods Conservancy, each approximately 50 meters (the width of the ROW) by 10 meters. (Austin, 1999). Transect A is 100 meters west of Zachow Road and Transect B is 200 meters further west (Figure 1). Each transect was divided into 3 x 10 meter wide quadrats, for a total of 17 quadrats each. The corners of each quadrat were marked with a rebar stake. The stakes on Transect A were replaced in 2002 with 6' stakes for better visibility. The quadrats were numbered from 1 to 17 from North to South along the transect. Transect A has had no IVM since the establishment of the ROW in 1988. It has a west-facing aspect and a 25% slope (Austin, 2000). Transect B was clear cut and herbicides applied according to IVM practices in 1988. Transect B is east-facing with a 20% slope.

Quadrats were cordoned off in order to identify the species in each (Fickbohm, 2000). Species were identified by transect and quadrat over the course of the summer (June-August) relying on field guides, the Greenwoods herbarium, and resources at the Biological Field Station. At the end of August, percent cover of each species was determined using methodology adapted from Mueller-Dombois et al. (1974). Percent cover was determined by independent observers estimating aerial and ground coverage of each species in each quadrat and determining a cover class. When estimates differed, a consensus was reached (Table 1). The mid-point of each cover class determined the percent coverage for that species. This method will result in over 100% total coverage because of the overlapping of the various layers of vegetation. Number of specimens by species that exceeded 10' in height were also recorded by transect and quadrat. Non-native species were also documented by transect (Mitchell, 1997).

A list of "Undesirable Species" (Table 3) is provided to offer consistency for future monitoring studies. To avoid duplication, species were not considered "new" if a generic description (e.g. "Carex sp.") was most likely used for that specimen in previous years, or if a correction of scientific name for a previously listed plant was made (a notation was used to identify these corrections in Table 4). Genera was used when the species present

was unknown or unidentifiable, and therefore may vary yearly depending on the strength of the taxonomist or the plant features (i.e. flowers not available, insufficient size to identify specifically). Species not growing in Quadrats 1 and 17 of either transect, but overhanging in the quadrat were considered in % coverage due to the effect of their cover on plants growing in the transect but were not included in the total number of species (if unique), and noted in Tables 3 and 4.

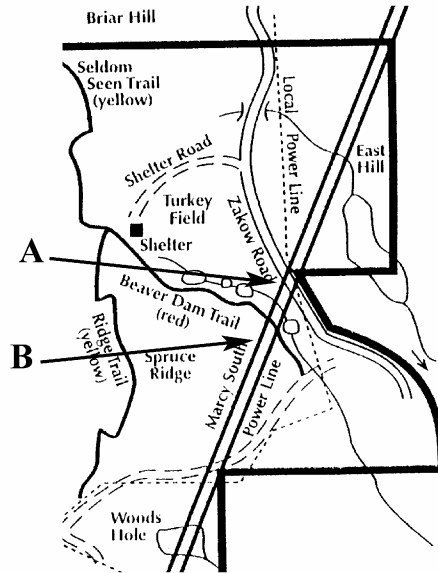


Figure 1. Location of Transects A and B, Greenwood Conservancy, Burlington

| <u>Class</u> | <u>Cover Range (%)</u> | <u>Mid-point</u> |
|--------------|------------------------|------------------|
| 1 | 0-5 | 2.5 |
| 2 | 5-25 | 15 |
| 3 | 25-50 | 37.5 |
| 4 | 50-75 | 62.5 |
| 5 | 75-95 | 85 |
| 6 | 95-100 | 97.5 |

Table 1. Percent cover classes, ranges, and midpoints (Mueller-Dombois, 1974)

RESULTS

Transect A

Transect A, not managed since the establishment of the ROW in 1988, was observed to have little overall change since 2001 in mean percent cover of pteridophytes, dicots, or monocots, with an increase in gymnosperms (Figures 2-5). *Viburnum dentatum* (Arrowwood) was the largest single cover species at 27%, followed by *Spiraea latifolia* (Meadow Sweet) at 13% and *Rubus allegheniensis* (Blackberry) at 10%. The Rosaceae

Plant Group Family Genus and Species Name Common Name

Peridophytes

Mean percent cover

| Dryopteridaceae | | A1 | A2 | A3 | A4 | A5 | A6 | A7 | A8 | A9 | A10 | A11 | A12 | A13 | A14 | A15 | A16 | A17 | 1999 | 2000 | 2001 | 2002 |
|-----------------|-----------------------------------|--------------------|-----|-----|----|----|----|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|
| | <i>Athyrium filix-femina</i> | Lady Fern | | | | | | | | | | | | | | | | | 0.15 | 0 | 0 | 0 |
| | <i>Dryopteris</i> sp. | Wood Fern | 2.5 | | | | | | | | | | | | | | | | 0.07 | 0.15 | 0.15 | 0.15 |
| | <i>Onoclea sensibilis</i> | Sensitive Fern | | | | | | | 2.5 | 2.5 | | | | | | | | | 0.15 | 0.29 | 0.29 | 0.29 |
| | <i>Dryopteris intermedia</i> | Wood Fern | | 0.0 | | | | | | | | | | | | | | | 0 | 0.15 | 0 | 0 |
| | <i>Athyrium thelypteroides</i> | Silvery spleenwort | | | | | | | | | | | | | | | | | 0 | 0 | 0.29 | 0 |
| | <i>Thelypteris noveboracensis</i> | New York Fern | | | | | | | 2.5 | 2.5 | | | | | | | | | 0 | 0 | 0.29 | 0.29 |

Gymnosperms

| Pinaceae | | A1 | A2 | A3 | A4 | A5 | A6 | A7 | A8 | A9 | A10 | A11 | A12 | A13 | A14 | A15 | A16 | A17 | 1999 | 2000 | 2001 | 2002 |
|----------|----------------------|------------|----|----|----|-----|----|-----|----|----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| | <i>Picea rubens</i> | Red Spruce | | | | 2.5 | | | | | | | | | | | | | 0.07 | 0.15 | 0.15 | 0.15 |
| | <i>Pinus strobus</i> | White Pine | | | | | | 2.5 | | | | | | | | | | 37.5 | 0.07 | 0.15 | 0.15 | 2.35 |

Angiosperms

Dicots

| Ranunculaceae | | A1 | A2 | A3 | A4 | A5 | A6 | A7 | A8 | A9 | A10 | A11 | A12 | A13 | A14 | A15 | A16 | A17 | 1999 | 2000 | 2001 | 2002 |
|---------------|-----------------------------------|-----------------------|-----|-----|-----|-----|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|
| X | <i>Ranunculus acris</i> | Tall Buttercup | 2.5 | 2.5 | | | | | | | | | | 2.5 | | | 2.5 | 2.5 | 0.22 | 0.15 | 0.59 | 0.74 |
| | <i>Clematis virginiana</i> | Virgin's Bower | | | 2.5 | 2.5 | | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | | | | | | | 1.47 |

| Fagaceae | | A1 | A2 | A3 | A4 | A5 | A6 | A7 | A8 | A9 | A10 | A11 | A12 | A13 | A14 | A15 | A16 | A17 | 1999 | 2000 | 2001 | 2002 |
|----------|--------------------------|---------|-----|-----|----|-----|-----|----|----|----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|
| | <i>Fagus grandifolia</i> | Beech | | | | 2.5 | | | | | | | | | | | | | 0.07 | 0.29 | 0.15 | 0.15 |
| | <i>Quercus rubra</i> | Red Oak | 2.5 | 2.5 | | | 2.5 | | | | | 2.5 | 2.5 | 2.5 | | | 2.5 | 2.5 | 0.51 | 0.59 | 1.03 | 1.18 |

| Betulaceae | | A1 | A2 | A3 | A4 | A5 | A6 | A7 | A8 | A9 | A10 | A11 | A12 | A13 | A14 | A15 | A16 | A17 | 1999 | 2000 | 2001 | 2002 |
|------------|---------------------|----------------|----|-----|----|----|----|----|----|----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|
| | <i>Alnus incana</i> | Speckled Alder | | 2.5 | | | | | | | | 2.5 | | | | | | | 5.15 | 0.29 | 0.29 | 0.29 |

| Polygonaceae | | A1 | A2 | A3 | A4 | A5 | A6 | A7 | A8 | A9 | A10 | A11 | A12 | A13 | A14 | A15 | A16 | A17 | 1999 | 2000 | 2001 | 2002 |
|--------------|-------------------------|--------------|----|----|----|----|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|
| X | <i>Rumex acetosella</i> | Sheep Sorrel | | | | | | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | | | | | | | 0 | 0 | 0.15 | 0.74 |

| Clusiaceae | | A1 | A2 | A3 | A4 | A5 | A6 | A7 | A8 | A9 | A10 | A11 | A12 | A13 | A14 | A15 | A16 | A17 | 1999 | 2000 | 2001 | 2002 |
|------------|-----------------------------|-----------------|-----|-----|-----|----|----|----|----|----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|
| X | <i>Hypericum perforatum</i> | St. John's Wort | 2.5 | 2.5 | 2.5 | | | | | | | 2.5 | 2.5 | | | | | | 0 | 1.03 | 0.47 | 0.74 |

| Salicaceae | | A1 | A2 | A3 | A4 | A5 | A6 | A7 | A8 | A9 | A10 | A11 | A12 | A13 | A14 | A15 | A16 | A17 | 1999 | 2000 | 2001 | 2002 |
|------------|----------------------------|---------------|------|-----|-----|----|----|----|----|----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|
| | <i>Populus tremuloides</i> | Quaking Aspen | 15.0 | 2.5 | 2.5 | | | | | | | | | | | | | | 0.66 | 0.29 | 0.59 | 1.18 |

| Onagraceae | | A1 | A2 | A3 | A4 | A5 | A6 | A7 | A8 | A9 | A10 | A11 | A12 | A13 | A14 | A15 | A16 | A17 | 1999 | 2000 | 2001 | 2002 |
|------------|----------------------------------|------------------------|----|----|----|----|----|----|----|----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|
| | <i>Circaea lutetiana</i> * | Enchanter's Nightshade | | | | | | | | | | | | | | | | 2.5 | 0 | 0 | 0.15 | 0.15 |
| | <i>Oenothera perennis</i> | Sundrops | | | | | | | | | | 2.5 | | | | | | | | | | 0.15 |

Table 3. Summary of mid-point percentage cover by quadrat (A1-A17) of species observed on transect A, 2002, and mean percent cover, 1999-2002. See Table 1 for cover class midpoints. New species in bold. X = non-native.

| Ericaceae | | A1 | A2 | A3 | A4 | A5 | A6 | A7 | A8 | A9 | A10 | A11 | A12 | A13 | A14 | A15 | A16 | A17 | 1999 | 2000 | 2001 | 2002 |
|------------------------------------|---------------------|------|------|------|------|------|------|-----|------|------|------|------|------|------|------|------|------|-----|-------|-------|-------|-------|
| <i>Vaccinium angustifolium</i> | Low Bush Blueberry | | | | | | | | | 2.5 | | | | | | | 2.5 | 2.5 | 0 | 0.44 | 0.44 | 0.44 |
| Grossulariaceae | | A1 | A2 | A3 | A4 | A5 | A6 | A7 | A8 | A9 | A10 | A11 | A12 | A13 | A14 | A15 | A16 | A17 | 1999 | 2000 | 2001 | 2002 |
| <i>Ribes glandulosum</i> | Skunk Currant | | | | | | | | | | | | | | | | | | 0.15 | 0 | 0 | 0 |
| Rosaceae | | A1 | A2 | A3 | A4 | A5 | A6 | A7 | A8 | A9 | A10 | A11 | A12 | A13 | A14 | A15 | A16 | A17 | 1999 | 2000 | 2001 | 2002 |
| <i>Crataegus</i> sp. | Hawthorn | 2.5 | | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | | 2.5 | 2.5 | 2.5 | 1.54 | 1.76 | 1.76 | 2.21 |
| <i>Fragaria virginiana</i> | Common Strawberry | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | | 2.5 | 2.5 | 8.6 | 3.82 | 2.06 | 2.35 |
| <i>Geum</i> sp. | Avens sp. | | | | | | | | | | | | | | | | | 2.5 | 0 | 0 | 0.29 | 0.15 |
| <i>Geum canadense</i> | White Avens | 2.5 | | | | | | | | | 2.5 | | | | | | 2.5 | 2.5 | 0 | 0.44 | 0.44 | 0.59 |
| <i>Malus pumila</i> | Common Apple | 15.0 | | | | | | | | | | | | | | | | 15* | 1.1 | 0.88 | 0.88 | 1.76 |
| <i>Potentilla simplex</i> | Common Cinquefoil | 2.5 | 2.5 | 2.5 | | | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | | 2.5 | 2.5 | 0.51 | 3.09 | 3.09 | 2.06 |
| <i>Potentilla canadensis</i> | Canadian Cinquefoil | | | | | | | | | | | | | | | | | | 0 | 0 | 0.29 | 0 |
| <i>Prunus serotina</i> | Black Cherry | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 15.0 | 2.5 | 15.0 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | | 2.5 | 2.5 | 2.5 | 9.9 | 2.35 | 2.35 | 3.82 |
| <i>Prunus virginiana</i> | Choke Cherry | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.13 | 2.35 | 2.35 | 2.5 |
| <i>Prunus pennsylvanica</i> | Fire Cherry | | | | | | | | | | | | | | | | | | 4.25 | 32.5 | 0 | 0 |
| <i>Rubus allegheniensis</i> | Blackberry | 15.0 | 15.0 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 15.0 | 15.0 | 37.5 | 37.5 | 15.0 | 2.5 | 17.65 | 10.21 | 10.32 | 10.29 |
| <i>Rubus idaeus</i> | Red Raspberry | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 15.0 | 15.0 | 2.5 | 9.56 | 12.56 | 21.00 | 3.97 |
| <i>Spiraea latifolia</i> | Meadow Sweet | 2.5 | 2.5 | 15.0 | 37.5 | 15.0 | 15.0 | 2.5 | 15.0 | 15.0 | 15.0 | 15.0 | 15.0 | 2.5 | 37.5 | 15.0 | 2.5 | 2.5 | 32.65 | 11.82 | 13.88 | 13.24 |
| <i>Spiraea tomentosa</i> | Hardhack | | | | | | | | | | | | | | | | | | 0 | 0 | 0.29 | 0 |
| <i>Rubus flagellaris</i> | Dewberry | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 0 | 1.91 | 3.24 | 2.5 |
| <i>Amerlanchier</i> spp. | Shadbush | 2.5 | 2.5 | | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | | | | | | | | 2.5 | 2.5 | 0 | 0.88 | 0.79 | 1.32 |
| <i>Sorbus americana</i> | Mountain Ash | | | | | 2.5 | | | | | | | | | | | | | 0 | 0.44 | 0 | 0.15 |
| Cornaceae | | A1 | A2 | A3 | A4 | A5 | A6 | A7 | A8 | A9 | A10 | A11 | A12 | A13 | A14 | A15 | A16 | A17 | 1999 | 2000 | 2001 | 2002 |
| <i>Cornus alternifolia</i> | Dogwood | | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | | | | | | | 2.5 | 0.22 | 1.03 | 0.44 | 1.32 |
| Vitaceae | | A1 | A2 | A3 | A4 | A5 | A6 | A7 | A8 | A9 | A10 | A11 | A12 | A13 | A14 | A15 | A16 | A17 | 1999 | 2000 | 2001 | 2002 |
| <i>Parthenocissus quinquefolia</i> | Virginia Creeper | | | | | | | | | | | | | | | | | | 0 | 1.03 | 0 | 0 |
| Aceraceae | | A1 | A2 | A3 | A4 | A5 | A6 | A7 | A8 | A9 | A10 | A11 | A12 | A13 | A14 | A15 | A16 | A17 | 1999 | 2000 | 2001 | 2002 |
| <i>Acer rubrum</i> | Red Maple | 2.5 | | | 2.5 | 15.0 | 15.0 | 2.5 | 15.0 | 2.5 | 2.5 | 2.5 | 2.5 | 2.6 | 2.5 | 2.5 | 2.5 | 2.5 | 4.04 | 2.21 | 2.97 | 4.42 |
| <i>Acer saccharum</i> | Sugar Maple | | | | | | | | | | | | | | | | | 2.5 | 0.22 | 0.29 | 0.15 | 0.15 |
| Araceae | | A1 | A2 | A3 | A4 | A5 | A6 | A7 | A8 | A9 | A10 | A11 | A12 | A13 | A14 | A15 | A16 | A17 | 1999 | 2000 | 2001 | 2002 |
| <i>Arisaema triphyllum</i> * | Jack-in-the-pulpit | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | | | | | | | | | | | 2.5 | 2.5 | 0 | 0.29 | 0.88 | 1.03 |

Table 3 (cont.). Summary of mid-point percentage cover by quadrat (A1-A17) of species observed on transect A, 2002, and mean percent cover, 1999-2002. See Table 1 for cover class midpoints. New species in bold. X = non-native.

| Oxalidaceae | | | A1 | A2 | A3 | A4 | A5 | A6 | A7 | A8 | A9 | A10 | A11 | A12 | A13 | A14 | A15 | A16 | A17 | 1999 | 2000 | 2001 | 2002 |
|------------------|-------------------------------|------------------------|-----|-----|------|------|------|------|------|------|------|------|------|------|------|-----|-----|------|------|-------|-------|-------|-------|
| | <i>Oxalis montana</i> | Common Wood Sorrel | | | | | | | | | | | | | | | | | | 0.29 | 2.21 | 0 | 0 |
| | <i>Oxalis stricta</i> | Yellow Wood Sorrel | 2.5 | 2.5 | | 2.5 | 2.5 | | | | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | | 2.5 | 2.5 | 0.15 | 1.47 | 1.35 | 1.76 |
| Balsaminaceae | | | A1 | A2 | A3 | A4 | A5 | A6 | A7 | A8 | A9 | A10 | A11 | A12 | A13 | A14 | A15 | A16 | A17 | 1999 | 2000 | 2001 | 2002 |
| | <i>Impatiens capensis</i> | Jewel Weed | 2.5 | | | | | | | | | | | | | | | | 2.5 | 0 | 0 | 0.15 | 0.29 |
| Apiaceae | | | A1 | A2 | A3 | A4 | A5 | A6 | A7 | A8 | A9 | A10 | A11 | A12 | A13 | A14 | A15 | A16 | A17 | 1999 | 2000 | 2001 | 2002 |
| | <i>Daucus carota</i> | Queen Anne's Lace | | | | | | | | | | | | | | | | | | 0.37 | 0 | 0 | 0 |
| | <i>Pastinaca sativa</i> | Wild Parsnip | | | | | | | | | | | | | | | | | | 0.15 | 0 | 0 | 0 |
| Gentianaceae | | | A1 | A2 | A3 | A4 | A5 | A6 | A7 | A8 | A9 | A10 | A11 | A12 | A13 | A14 | A15 | A16 | A17 | 1999 | 2000 | 2001 | 2002 |
| | <i>Gentiana clausa</i> | Closed Bottle Gentain | 2.5 | 2.5 | 2.5 | | | | | 2.5 | 2.5 | 2.5 | 2.5 | | | | | | 2.5 | 2.28 | 1.18 | 1.03 | 1.18 |
| Lamiaceae | | | A1 | A2 | A3 | A4 | A5 | A6 | A7 | A8 | A9 | A10 | A11 | A12 | A13 | A14 | A15 | A16 | A17 | 1999 | 2000 | 2001 | 2002 |
| X | <i>Clinopodium vulgare</i> | Wild Basil | 2.5 | 2.5 | 2.5 | 2.5 | | 2.5 | | | | | 2.5 | | | | | 2.5 | 2.5 | 0.22 | 0.74 | 1.47 | 1.18 |
| X | <i>Galeopsis tetrahit</i> | Hemp-Nettle | 2.5 | 2.5 | | | 2.5 | | 2.5 | 2.5 | | | | | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 0.07 | 1.178 | 0.59 | 1.47 |
| X | <i>Prunella vulgaris</i> | Heal-All | 2.5 | | | | | | | | | | | | | | | | | 0 | 0.29 | 0 | 0.15 |
| Oleaceae | | | A1 | A2 | A3 | A4 | A5 | A6 | A7 | A8 | A9 | A10 | A11 | A12 | A13 | A14 | A15 | A16 | A17 | 1999 | 2000 | 2001 | 2002 |
| | <i>Fraxinus americana</i> | White Ash | 2.5 | 2.5 | 2.5 | | 2.5 | | 2.5 | 2.5 | | 2.5 | 2.5 | | | | | 2.5 | 2.5 | 1.69 | 1.76 | 1.91 | 1.47 |
| Scrophulariaceae | | | A1 | A2 | A3 | A4 | A5 | A6 | A7 | A8 | A9 | A10 | A11 | A12 | A13 | A14 | A15 | A16 | A17 | 1999 | 2000 | 2001 | 2002 |
| X | <i>Veronica officinalis</i> | Common Speedwell | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | | 2.5 | 2.5 | | 2.5 | 2.5 | 1.02 | 1.76 | 1.62 | 2.06 |
| X | <i>Veronica serpyllifolia</i> | Thyme-Leaved Speedwell | | | | | | | | | | | | | | | | | | 0 | 0.29 | 0 | 0 |
| Rubiaceae | | | A1 | A2 | A3 | A4 | A5 | A6 | A7 | A8 | A9 | A10 | A11 | A12 | A13 | A14 | A15 | A16 | A17 | 1999 | 2000 | 2001 | 2002 |
| | <i>Galium triflorum</i> | Bedstraw | | | | | | | | | | | | | | | | | 2.5 | 0 | 0 | 0.15 | 0.15 |
| | <i>Mitchella repens</i> | Partridge-berry | 2.5 | | | | | | | | | | | | | | | | | 0 | 0 | 0.15 | 0.15 |
| Caprifoliaceae | | | A1 | A2 | A3 | A4 | A5 | A6 | A7 | A8 | A9 | A10 | A11 | A12 | A13 | A14 | A15 | A16 | A17 | 1999 | 2000 | 2001 | 2002 |
| | <i>Viburnum lentago</i> | Nannyberry | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | | | | | 2.5 | 2.5 | | | | 2.5 | 2.5 | 2.5 | 3.09 | 2.21 | 2.35 | 1.47 |
| | <i>Viburnum dentatum</i> * | Nothorn Arrowwood | 2.5 | 2.5 | 37.5 | 37.5 | 37.5 | 37.5 | 62.5 | 15.0 | 37.5 | 37.5 | 62.5 | 37.5 | 15.0 | 2.5 | 2.5 | 15.0 | 15.0 | 22.98 | 18.09 | 20.12 | 26.91 |
| | <i>Viburnum vinca</i> | | | | | | | | | | | | | | | | | | | 0 | 0 | 0.15 | 0 |
| (X) | <i>Lonicera</i> sp. | Honeysuckle | | | | | | | | | | | | | | | | | | 0 | 0 | 0.15 | 0 |

Table 3 (cont.). Summary of mid-point percentage cover by quadrat (A1-A17) of species observed on transect A, 2002, and mean percent cover, 1999-2002. See Table 1 for cover class midpoints. New species in bold. X = non-native.

| Asteraceae | | | A1 | A2 | A3 | A4 | A5 | A6 | A7 | A8 | A9 | A10 | A11 | A12 | A13 | A14 | A15 | A16 | A17 | 1999 | 2000 | 2001 | 2002 | |
|-----------------|---------------------------------|-------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| X | Arctium minus | Burdock | | | | | | | | | | | | | | | | | 2.5 | | | | 0.15 | |
| | <i>Aster</i> sp. | Wood Aster sp. | | | | | | | | 2.5 | | | | | 2.5 | | | 2.5 | 2.5 | 0 | 1.32 | 1.47 | 0.59 | |
| | <i>Aster prenanthoides</i> | Crooked Stem Aster | 2.5 | 2.5 | 2.5 | | | 2.5 | | 2.5 | 2.5 | 2.5 | 2.5 | | | | | | 2.5 | 0 | 0 | 0.59 | 1.32 | |
| | <i>Aster umbellatus</i> | Flat-Topped White Aster | | | | 2.5 | | | | | | | | | | | | | | 0 | 0 | 0.15 | 0.15 | |
| | <i>Aster divaricatus</i> | White Wood Aster | | | | | | | | | | | | | | | | | | 0.15 | 0 | 0 | 0 | |
| | <i>Aster lateriflorus</i> | Calico Aster | 2.5 | 2.5 | 2.5 | | | | | | | | 2.5 | | | | 2.5 | | 2.5 | 0 | 0.88 | 0.88 | 0.88 | |
| | <i>Cirsium discolor</i> | Field Thistle | | | | | | | | | | | | | | | | | 2.5 | 0 | 0 | 0.15 | 0.15 | |
| X | <i>Leucanthemum vulgare</i> | Ox-Eye Daisy | | | | | | | | | | 2.5 | | 2.5 | | | | | | 0.22 | 0.74 | 0.59 | 0.29 | |
| | <i>Euthamia graminifolia</i> * | Flat-Top Goldenrod | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | | 2.5 | 2.5 | 3.6 | 2.35 | 5.88 | 2.35 | |
| | <i>Solidago rugosa</i> | Rough-Stemmed Goldenrod | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 5.44 | 3.53 | 3.24 | 2.5 | |
| | <i>Solidago</i> spp. | Goldenrod | | | | | | | | | | | | | 2.5 | | 2.5 | | 2.5 | 0 | 1.91 | 2.06 | 0.44 | |
| X | <i>Taraxacum officinale</i> | Common Dandelion | | | | | | | | | | | | | | | | 2.5 | 2.5 | 0.07 | 0.29 | 0.44 | 0.29 | |
| (X) | <i>Hieracium</i> spp. | Hawkweed | | 2.5 | | | | | | | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | | | | | 0 | 0.88 | 1.62 | 0.88 | |
| Caryophyllaceae | | | A1 | A2 | A3 | A4 | A5 | A6 | A7 | A8 | A9 | A10 | A11 | A12 | A13 | A14 | A15 | A16 | A17 | 1999 | 2000 | 2001 | 2002 | |
| X | <i>Cerastium</i> spp. | Chickweed | | | | | | | | 2.5 | | | | | | | | | | | 0 | 0.44 | 0 | 0.15 |
| Saxifragaceae | | | A1 | A2 | A3 | A4 | A5 | A6 | A7 | A8 | A9 | A10 | A11 | A12 | A13 | A14 | A15 | A16 | A17 | 1999 | 2000 | 2001 | 2002 | |
| | <i>Tiarella cordifolia</i> | Foam flower | | | | | | | | | | | | | | | | 2.5 | 2.5 | 0 | 0.15 | 0.29 | 0.29 | |
| Juncaceae | | | A1 | A2 | A3 | A4 | A5 | A6 | A7 | A8 | A9 | A10 | A11 | A12 | A13 | A14 | A15 | A16 | A17 | 1999 | 2000 | 2001 | 2002 | |
| | <i>Juncus tenuis</i> | Path Rush | | | | | | | | | | | | | | | | | 2.5 | 0 | 0.15 | 0 | 0.15 | |
| Cyperaceae | | | A1 | A2 | A3 | A4 | A5 | A6 | A7 | A8 | A9 | A10 | A11 | A12 | A13 | A14 | A15 | A16 | A17 | 1999 | 2000 | 2001 | 2002 | |
| | <i>Carex</i> sp. | Sedge sp. | 2.5 | 2.5 | 2.5 | | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | | 2.5 | 2.5 | 1.32 | 3.26 | 1.62 | 2.21 | |
| | <i>Carex lurida</i> | Sedge sp. | | | | | | | | | | | | | | | | | | 1.32 | 0.29 | 0.29 | 0 | |
| | <i>Carex scoparia</i> | Sedge sp. | | | | | | | | | | | | | | | | | | 0 | 2.38 | 0.29 | 0 | |
| | <i>Carex gracillima</i> | Sedge sp. | | | | | | | | | | | | | | | | 2.5 | 2.5 | 0 | 0.29 | 0.44 | 0.29 | |
| | <i>Carex crinita</i> | Sedge sp. | | | | | | | | | | | | | | | | | | 0 | 0.15 | 0 | 0 | |
| Poaceae | | | A1 | A2 | A3 | A4 | A5 | A6 | A7 | A8 | A9 | A10 | A11 | A12 | A13 | A14 | A15 | A16 | A17 | 1999 | 2000 | 2001 | 2002 | |
| (X) | <i>Agrostis</i> spp. | Bentgrass | | 2.5 | 2.5 | | | | 2.5 | | 2.5 | 2.5 | 2.5 | 2.5 | | | | | 2.5 | 0 | 3.12 | 0 | 1.03 | |
| | <i>Agrostis gigantea</i> | Red Top Grass | | | | | | | | | | | | | | | | | | 0 | 0 | 0.15 | 0 | |
| | <i>Anthoxanthum odoratum</i> | Sweet Vernal Grass | 2.5 | 2.5 | 2.5 | | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | | 2.5 | 2.5 | 1.91 | 2.65 | 2.06 | 2.21 | |
| | <i>Danthonia spicata</i> | Poverty Grass | 2.5 | 2.5 | 2.5 | | | | | | 2.5 | 2.5 | | | | | | 2.5 | 2.5 | | | | 1.03 | |
| | <i>Dactylis glomerata</i> | Orchard Grass | | | | | | | | | | | | | | | | | | 0.07 | 0 | 0 | 0 | |
| | <i>Festuca heterophylla</i> | Fescue | | | | | | | | | | | | | | | | | | 0 | 0.15 | 0 | 0 | |

Table 3 (cont.). Summary of mid-point percentage cover by quadrat (A1-A17) of species observed on transect A, 2002, and mean percent cover, 1999-2002. See Table 1 for cover class midpoints. New species in bold. X = non-native.

| | | | | | | | | | | | | | | | | | | | | | | |
|--------------------------------|-----------------------|-----|-----|-----|----|----|-----|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|
| <i>Panicum clandestinum</i> | Deer-Tongue Grass | 2.5 | 2.5 | 2.5 | | | | | | | | | | | | | 2.5 | 2.5 | 0 | 0.15 | 0.29 | 0.88 |
| <i>Poa</i> sp. | Grass sp. | | | | | | | | | | | | | | | | | | 2.57 | 1.03 | 1.32 | 0 |
| Liliaceae | | A1 | A2 | A3 | A4 | A5 | A6 | A7 | A8 | A9 | A10 | A11 | A12 | A13 | A14 | A15 | A16 | A17 | 1999 | 2000 | 2001 | 2002 |
| <i>Maianthemum canadense</i> | Canadian May Flower | | | | | | 2.5 | | | | | | | | | | | 2.5 | 0 | 0 | 0.44 | 0.29 |
| <i>Uvularia sessilifolia</i> * | Sessile-leaf Bellwort | | | | | | | | | | | | | | | | 2.5 | 2.5 | 0 | 0 | 0.29 | 0.29 |
| Iridaceae | | A1 | A2 | A3 | A4 | A5 | A6 | A7 | A8 | A9 | A10 | A11 | A12 | A13 | A14 | A15 | A16 | A17 | 1999 | 2000 | 2001 | 2002 |
| <i>Sisyrinchium</i> sp. | Blue-eyed Grass | | 2.5 | 2.5 | | | | | 2.5 | 2.5 | 2.5 | 2.5 | | | | | | 2.5 | 0 | 0.15 | 1.18 | 1.03 |

Table 3 (cont.). Summary of mid-point percentage cover by quadrat (A1-A17) of species observed on transect A, 2002, and mean percent cover, 1999-2002. See Table 1 for cover class midpoints. New species in bold. X = non-native.

*Corrections: *Arisaema triphyllum* (Jack-in-the-pulpit)- previously listed under Family Aceraceae

Circaea lutetiana (Enchanter's Nightshade)- previously listed as *Solanum physalolium* under Family Solanaceae

Euthamia graminifolia (Flat-Top Goldenrod)- previously listed as *Solidago graminifolia* (Lance-Leave Goldenrod)

Viburnum dentatum (Arrowwood)- previously listed as *Viburnum recognitum*

Uvularia sessilifolia (Sessile-leaf Bellwort)- previously listed under Family Araceae

Spelling errors corrected without notation

^ Not located in transect, but included in % coverage due to overhanging branches on edge of ROW

X Not native to New York State (X) Not native in part (Mitchell, 1997)

New species in **bold type**

Plant Group Family Genus and Species Name Common Name

Pteridophytes

Mean percent cover

| Dryopteridaceae | | B1 | B2 | B3 | B4 | B5 | B6 | B7 | B8 | B9 | B10 | B11 | B12 | B13 | B14 | B15 | B16 | B17 | 1999 | 2000 | 2001 | 2002 |
|-----------------------------------|----------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|
| <i>Athyrium filix-femina</i> | Lady Fern | | | | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | | | | | | | | 0 | 0.15 | 0 | 1.03 |
| <i>Dryopteris</i> sp. | Wood Fern | | | | | | | | | | | | | | | | | | 2.65 | 1.47 | 0 | 0 |
| <i>Onoclea sensibilis</i> | Sensitive Fern | | | | | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | | | | | 2.5 | 2.5 | | | 1.03 | 0 | 0.74 | 1.03 |
| <i>Dryopteris intermedia</i> | Wood Fern | | 2.5 | 2.5 | 2.5 | | 2.5 | 2.5 | | 2.5 | | | | | | | | | 0 | 0.74 | 0.59 | 0.74 |
| <i>Dryopteris carthusiana</i> | | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | | | | | | 2.5 | | | 2.5 | 2.5 | 2.5 | 2.5 | 0 | 0 | 1.03 | 1.47 |
| <i>Dryopteris cristata</i> | Crested fern | | | | | | 2.5 | 2.5 | 2.5 | | | | | | | | | | 0 | 0 | 0.15 | 0.44 |
| <i>Thelypteris noveboracensis</i> | New York Fern | | | 2.5 | 2.5 | | | | | | | | | | | 2.5 | 2.5 | | 0 | 0.74 | 0.59 | 0.59 |

Gymnosperms

| Pinaceae | | B1 | B2 | B3 | B4 | B5 | B6 | B7 | B8 | B9 | B10 | B11 | B12 | B13 | B14 | B15 | B16 | B17 | 1999 | 2000 | 2001 | 2002 |
|----------------------|-------------------|-----|----|----|----|-----|-----|-----|-----|----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|
| <i>Picea rubens</i> | Red Spruce | 2.5 | | | | 2.5 | 2.5 | | 2.5 | | | | | | | | | | 0 | 0.15 | 0.29 | 0.59 |
| <i>Pinus strobus</i> | White Pine | | | | | | | 2.5 | | | | | | | | | | | | | | 0.15 |

Angiosperms

Dicots

| Ranunculaceae | | B1 | B2 | B3 | B4 | B5 | B6 | B7 | B8 | B9 | B10 | B11 | B12 | B13 | B14 | B15 | B16 | B17 | 1999 | 2000 | 2001 | 2002 |
|----------------------------|-----------------------|----|----|----|----|----|-----|----|----|----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|
| X <i>Ranunculus acris</i> | Tall Buttercup | | | | | | | | | | 2.5 | 2.5 | | | 2.5 | | | | 0.44 | 0.15 | 0.15 | 0.44 |
| <i>Clematis virginiana</i> | Virgin's Bower | | | | | | 2.5 | | | | | | | | | | | | | | | 0.15 |

| Fagaceae | | B1 | B2 | B3 | B4 | B5 | B6 | B7 | B8 | B9 | B10 | B11 | B12 | B13 | B14 | B15 | B16 | B17 | 1999 | 2000 | 2001 | 2002 |
|--------------------------|---------|-----|-----|-----|----|----|----|----|----|----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|
| <i>Fagus grandifolia</i> | Beech | 2.5 | | | | | | | | | | | | | | | | | 0 | 0 | 0.15 | 0.15 |
| <i>Quercus rubra</i> | Red Oak | 2.5 | 2.5 | 2.5 | | | | | | | | | | | | | | 2.5 | 0 | 0.29 | 0.15 | 0.59 |

| Betulaceae | | B1 | B2 | B3 | B4 | B5 | B6 | B7 | B8 | B9 | B10 | B11 | B12 | B13 | B14 | B15 | B16 | B17 | 1999 | 2000 | 2001 | 2002 |
|---------------------|----------------|-----|----|----|----|----|-----|----|----|----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|
| <i>Alnus incana</i> | Speckled Alder | | | | | | 2.5 | | | | 2.5 | | | | | | | | 0 | 0 | 0.44 | 0.29 |
| <i>Betula lenta</i> | Black Birch | | | | | | | | | | | | | | | | | | 0.15 | 0 | 0 | 0 |
| <i>Betula lutea</i> | Yellow Birch | 2.5 | | | | | | | | | | | | | | 2.5 | | | 0 | 0 | 0.15 | 0.29 |

| Polygonaceae | | B1 | B2 | B3 | B4 | B5 | B6 | B7 | B8 | B9 | B10 | B11 | B12 | B13 | B14 | B15 | B16 | B17 | 1999 | 2000 | 2001 | 2002 |
|-----------------------------|-----------------|----|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|
| X <i>Rumex acetosella</i> | Sheep Sorrel | | | | | | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | | | | | 0.44 | 0.29 | 0.74 | 1.18 |
| <i>Polygonum sagittatum</i> | Tearthumb | | | | | | | | | | | | 2.5 | | | | | | 0 | 0.15 | 0.74 | 0.15 |
| <i>Polygonum scandens</i> | False Buckwheat | | | 2.5 | 2.5 | 2.5 | 2.5 | | | | | | 2.5 | 2.5 | | | | | 0 | 0 | 0.59 | 0.88 |
| X <i>Rumex acetosa</i> | Garden Sorrel | | | | | | | | | | | | | | | | | | 0 | 0.15 | 0.15 | 0 |
| X <i>Rumex crispus</i> | Curled dock | | | | | | | | 2.5 | | | | | | | | | | 0 | 0 | 0.29 | 0.15 |

Table 4. Summary of mid-point percentage cover by quadrat (B1-B17) of species observed on transect B, 2002, and mean percent cover, 1999-2002. See Table 1 for cover class midpoints. New species in bold. X = non-native.

| Clusiaceae | | | B1 | B2 | B3 | B4 | B5 | B6 | B7 | B8 | B9 | B10 | B11 | B12 | B13 | B14 | B15 | B16 | B17 | 1999 | 2000 | 2001 | 2002 |
|---------------|--------------------------------|---------------------|------|------|------|------|------|------|-----|------|------|------|-----|------|------|------|------|------|-----------------|------|-------|-------|-------|
| X | <i>Hypericum perforatum</i> | St. John's Wort | 2.5 | | | | | | | 2.5 | | | | | 2.5 | | | | | 0.74 | 2.9 | 1.76 | 0.44 |
| Saxifragaceae | | | B1 | B2 | B3 | B4 | B5 | B6 | B7 | B8 | B9 | B10 | B11 | B12 | B13 | B14 | B15 | B16 | B17 | 1999 | 2000 | 2001 | 2002 |
| | <i>Tiarella cordifolia</i> | Foam Flower | 2.5 | | | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | | 2.5 | 2.5 | 2.5 | | 2.5 | 2.5 | 2.5 | 0 | 0 | 0.29 | 1.91 |
| Salicaceae | | | B1 | B2 | B3 | B4 | B5 | B6 | B7 | B8 | B9 | B10 | B11 | B12 | B13 | B14 | B15 | B16 | B17 | 1999 | 2000 | 2001 | 2002 |
| | <i>Populus tremuloides</i> | Quaking Aspen | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | | | | | | | | 15 ^A | 0.88 | 1.32 | 1.32 | 1.47 |
| Ericaceae | | | B1 | B2 | B3 | B4 | B5 | B6 | B7 | B8 | B9 | B10 | B11 | B12 | B13 | B14 | B15 | B16 | B17 | 1999 | 2000 | 2001 | 2002 |
| | <i>Pyrola minor</i> | Lesser Pyrola | | 2.5 | 2.5 | | | | | | | | | | | | | | | 0.17 | 0 | 0.29 | 0.29 |
| | <i>Vaccinium angustifolium</i> | Low Bush Blueberry | 2.5 | 2.5 | | | | | | | | | | | | | | | | 0.95 | 0.29 | 0.29 | 0.29 |
| | <i>Vaccinium corymbosum</i> | High Bush BlueBerry | | | | | | | | | | | | | | | | | | 0.59 | 0 | 0 | 0 |
| Rosaceae | | | B1 | B2 | B3 | B4 | B5 | B6 | B7 | B8 | B9 | B10 | B11 | B12 | B13 | B14 | B15 | B16 | B17 | 1999 | 2000 | 2001 | 2002 |
| | <i>Crataegus</i> sp. | Hawthorn | 2.5 | | | | | | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | | 2.5 | 2.5 | 2.5 | 2.5 | | 0.15 | 1.03 | 1.32 | 1.47 |
| | <i>Fragaria virginiana</i> | Common Strawberry | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 15.0 | 15.0 | 2.5 | 2.5 | 15.0 | 15.0 | 2.5 | 2.5 | 2.5 | | 2.72 | 8.53 | 3.82 | 5.29 |
| | <i>Geum aleppicum</i> | Yellow Avens | | | | | | | | | | 2.5 | | 2.5 | | | | | | 0.15 | 0 | 0.59 | 0.29 |
| | <i>Geum canadense</i> | White Avens | 2.5 | | | | | | 2.5 | 2.5 | | | | | | | | | | 0.15 | 0.88 | 0.74 | 0.44 |
| | <i>Geum laciniatum</i> | Rough Avens | | | | | | | | | | 2.50 | | | | | | | | 0.29 | 0 | 0 | 0.15 |
| | <i>Potentilla simplex</i> | Common Cinquefoil | 2.5 | 2.5 | 2.5 | | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | | 2.5 | | | | 0.44 | 2.06 | 2.94 | 1.91 |
| | <i>Potentilla norvegica</i> | Rough Cinquefoil | | | | 2.5 | | 2.5 | 2.5 | | | 2.5 | | | | | | | | 0 | 0.44 | 0.88 | 0.59 |
| | <i>Prunus serotina</i> | Black Cherry | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | | | | 2.5 | 2.5 | | | | | 2.5 | | 0.15 | 0.88 | 1.03 | 1.32 |
| | <i>Prunus virginiana</i> | Choke Cherry | 2.5 | 2.5 | 2.5 | | 2.5 | | 2.5 | | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | | | 15.0 | 1.19 | 0.88 | 1.03 | 2.65 |
| | <i>Prunus pensylvanica</i> | Fire Cherry | | | | | | | | | | | | | | | | | | 0.29 | 0.15 | 0 | 0 |
| | <i>Rubus allegheniensis</i> | Blackberry | 15.0 | 15.0 | 2.5 | 2.5 | 15.0 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 15.0 | 62.5 | 62.5 | 2.5 | | 1.4 | 4.26 | 9.21 | 12.35 |
| | <i>Rubus idaeus</i> | Red Raspberry | 2.5 | 15.0 | 15.0 | 15.0 | 15.0 | 15.0 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 15.0 | 15.0 | 37.5 | 2.5 | 3.38 | 19.79 | 16.44 | 9.71 |
| | <i>Spiraea latifolia</i> | Meadow Sweet | | | | | 2.5 | | | 2.5 | | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | | | 0.74 | 0.88 | 1.03 | 1.18 |
| | <i>Rubus flagellaris</i> | Dewberry | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | | 0 | 2.35 | 1.62 | 2.35 |
| | <i>Amerianchier</i> sp. | Shadbush | 2.5 | | 2.5 | | | | | | | | 2.5 | 2.5 | 2.5 | | | | | 0 | 0 | 0.44 | 0.74 |
| Fabaceae | | | B1 | B2 | B3 | B4 | B5 | B6 | B7 | B8 | B9 | B10 | B11 | B12 | B13 | B14 | B15 | B16 | B17 | 1999 | 2000 | 2001 | 2002 |
| X | <i>Mellilotus alba</i> | White Sweet Clover | | | | | | | | | | | | | | | | | | 0.29 | 0 | 0 | 0 |
| X | <i>Trifolium aureum</i> | Hop-clover | | | | | | | | | | | | | | | | | | 0 | 0.74 | 0.29 | 0 |

Table 4 (cont.). Summary of mid-point percentage cover by quadrat (B1-B17) of species observed on transect B, 2002, and mean percent cover, 1999-2002. See Table 1 for cover class midpoints. New species in bold. X = non-native.

| Cornaceae | | B1 | B2 | B3 | B4 | B5 | B6 | B7 | B8 | B9 | B10 | B11 | B12 | B13 | B14 | B15 | B16 | B17 | 1999 | 2000 | 2001 | 2002 |
|------------------------------------|----------------------------|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|-----|------|------|------|------|
| <i>Cornus alternifolia</i> | Dogwood | 2.5 | 2.5 | | 2.5 | 2.5 | 2.5 | | | | | | | | | | 2.5 | | 0.44 | 0 | 0.59 | 0.88 |
| Vitaceae | | B1 | B2 | B3 | B4 | B5 | B6 | B7 | B8 | B9 | B10 | B11 | B12 | B13 | B14 | B15 | B16 | B17 | 1999 | 2000 | 2001 | 2002 |
| <i>Parthenocissus quinquefolia</i> | Virginia Creeper | | | | | | | | | | | | 2.5 | | | | | | 0.15 | 0.29 | 0.15 | 0.15 |
| <i>Vitis riparia</i> | Frost Grape | | | | | | 2.5 | 2.5 | | | | | | | | | | | | | | 0.29 |
| Asclepiadaceae | | B1 | B2 | B3 | B4 | B5 | B6 | B7 | B8 | B9 | B10 | B11 | B12 | B13 | B14 | B15 | B16 | B17 | 1999 | 2000 | 2001 | 2002 |
| <i>Asclepias syriaca</i> | Common Milkweed | | | 2.5 | | | | | | | | | | | | | | | | | | 0.15 |
| Aceraceae | | B1 | B2 | B3 | B4 | B5 | B6 | B7 | B8 | B9 | B10 | B11 | B12 | B13 | B14 | B15 | B16 | B17 | 1999 | 2000 | 2001 | 2002 |
| <i>Acer rubrum</i> | Red Maple | 15.0 | 2.5 | 2.5 | | | | 2.5 | | | 2.6 | 2.5 | 2.5 | | | 2.5 | 2.5 | | 0.44 | 0.59 | 0.74 | 2.06 |
| <i>Acer saccharum</i> | Sugar Maple | 2.5 | 2.5 | | | | | | | | | | | | | | | | 0.15 | 0.29 | 0.29 | 0.29 |
| Araceae | | B1 | B2 | B3 | B4 | B5 | B6 | B7 | B8 | B9 | B10 | B11 | B12 | B13 | B14 | B15 | B16 | B17 | 1999 | 2000 | 2001 | 2002 |
| <i>Arisaema triphyllum</i> * | Jack-in-the-pulpit | | | | | 2.5 | | | | | | 2.5 | | 2.5 | | | | | 0 | 0 | 0.15 | 0.44 |
| Anacardiaceae | | B1 | B2 | B3 | B4 | B5 | B6 | B7 | B8 | B9 | B10 | B11 | B12 | B13 | B14 | B15 | B16 | B17 | 1999 | 2000 | 2001 | 2002 |
| <i>Rhus glabra</i> | Smooth Sumac | | | | | | | | | | | | | | | | | | 0.29 | 0 | 0.29 | 0 |
| Oxalidaceae | | B1 | B2 | B3 | B4 | B5 | B6 | B7 | B8 | B9 | B10 | B11 | B12 | B13 | B14 | B15 | B16 | B17 | 1999 | 2000 | 2001 | 2002 |
| <i>Oxalis montana</i> | Common Wood Sorrel | | | | | | | | | | | | | | | | | | 0.29 | 2.21 | 0 | 0 |
| <i>Oxalis stricta</i> | Yellow Wood Sorrel | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | | | | 1.4 | 0 | 2.06 | 2.06 |
| Balsaminaceae | | B1 | B2 | B3 | B4 | B5 | B6 | B7 | B8 | B9 | B10 | B11 | B12 | B13 | B14 | B15 | B16 | B17 | 1999 | 2000 | 2001 | 2002 |
| <i>Impatiens capensis</i> | Jewel Weed | | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | | | | 2.6 | | | | 2.5 | 15.0 | 15.0 | 2.5 | 0.29 | 0 | 0.88 | 2.95 |
| Gentianaceae | | B1 | B2 | B3 | B4 | B5 | B6 | B7 | B8 | B9 | B10 | B11 | B12 | B13 | B14 | B15 | B16 | B17 | 1999 | 2000 | 2001 | 2002 |
| <i>Gentiana clausa</i> | Closed Bottle Gentain | | | | 2.5 | | | | | | 2.5 | 2.5 | 2.5 | | | | | | 0 | 0.59 | 0.44 | 0.59 |
| Lamiaceae | | B1 | B2 | B3 | B4 | B5 | B6 | B7 | B8 | B9 | B10 | B11 | B12 | B13 | B14 | B15 | B16 | B17 | 1999 | 2000 | 2001 | 2002 |
| X | <i>Clinopodium vulgare</i> | | | | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | | | 0.29 | 0.44 | 1.18 | 1.76 |
| X | <i>Galeopsis tetrahit</i> | | | | 2.5 | | | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | | 2.5 | 2.5 | | 2.5 | | 0.29 | 0.29 | 0.59 | 1.32 |
| X | <i>Prunella vulgaris</i> | | | | | | | | | | | | | | | | | | 0 | 0.59 | 0 | 0 |

Table 4 (cont.). Summary of mid-point percentage cover by quadrat (B1-B17) of species observed on transect B, 2002, and mean percent cover, 1999-2002. See Table 1 for cover class midpoints. New species in bold. X = non-native.

| Oleaceae | | B1 | B2 | B3 | B4 | B5 | B6 | B7 | B8 | B9 | B10 | B11 | B12 | B13 | B14 | B15 | B16 | B17 | 1999 | 2000 | 2001 | 2002 |
|------------------|--------------------------------|--------------------------------|-------|------|-----|------|------|------|------|------|------|------|------|------|-----|------|------|------|------|-------|-------|-------|
| | <i>Fraxinus americana</i> | White Ash | 37.50 | 2.5 | 2.5 | 15.0 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 15.0 | 97.5 | 2.87 | 9.44 | 10.18 | 11.62 |
| Scrophulariaceae | | B1 | B2 | B3 | B4 | B5 | B6 | B7 | B8 | B9 | B10 | B11 | B12 | B13 | B14 | B15 | B16 | B17 | 1999 | 2000 | 2001 | 2002 |
| X | <i>Verbascum thapsus</i> | Mullein | | | 2.5 | | | | | | | | | | | | | | 0.29 | 1.18 | 0 | 0.15 |
| X | <i>Veronica officinalis</i> | Common Speedwell | 2.5 | | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | | 1.99 | 9.56 | 2.06 | 1.91 |
| X | <i>Veronica serpyllifolia</i> | Thyme-Leaved Speedwell | | | | | | | | | | | | | | | | | 0.74 | 0 | 0 | 0 |
| Rubiaceae | | B1 | B2 | B3 | B4 | B5 | B6 | B7 | B8 | B9 | B10 | B11 | B12 | B13 | B14 | B15 | B16 | B17 | 1999 | 2000 | 2001 | 2002 |
| | <i>Galium triflorum</i> | Bedstraw | | | | 2.5 | 2.5 | | | | | 2.5 | | | | 2.5 | | | 0.15 | 0 | 0.59 | 0.59 |
| Caprifoliaceae | | B1 | B2 | B3 | B4 | B5 | B6 | B7 | B8 | B9 | B10 | B11 | B12 | B13 | B14 | B15 | B16 | B17 | 1999 | 2000 | 2001 | 2002 |
| | <i>Viburnum lentago</i> | Nannyberry | | | | 2.5 | | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | | | | | | | 2.35 | 1.03 | 0.88 |
| | <i>Viburnum dentatum</i> * | Northern Arrowwood | 15.0 | 15.0 | 2.5 | 2.5 | | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 15.0 | 15.0 | 2.5 | 15.0 | 2.5 | 2.5 | | 5 | 2.65 | 6.03 |
| | <i>Sambucus canadensis</i> | Elderberry | | | 2.4 | 2.5 | 2.5 | 2.5 | 2.5 | | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | | | 0.44 | 0.29 | 1.76 |
| Asteraceae | | B1 | B2 | B3 | B4 | B5 | B6 | B7 | B8 | B9 | B10 | B11 | B12 | B13 | B14 | B15 | B16 | B17 | 1999 | 2000 | 2001 | 2002 |
| | <i>Anaphalis margaritacea</i> | Pearly Everlasting | | | 2.5 | 2.5 | | | 2.5 | | 2.5 | 2.5 | 2.5 | 2.5 | | | | | 0.15 | 0.44 | 0.59 | 1.03 |
| | <i>Aster</i> sp. | Wood Aster sp. | | | | | | | | | | | | | | | | | 0.15 | 0.44 | 1.18 | 0 |
| | <i>Aster divaricatus</i> | White Wood Aster | | 2.5 | | | | | | | | | | | 2.5 | | | | 0 | 0.15 | 0 | 0.29 |
| | <i>Aster lateriflorus</i> | Calico Aster | 2.5 | 2.5 | | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | | | | | 0 | 2.06 | 0.29 | 1.62 |
| | <i>Aster prenanthoides</i> | Crooked Stem Aster | 2.5 | 2.5 | 2.5 | | 2.5 | 2.5 | | | 2.5 | 2.5 | | 2.5 | 2.5 | | | | 0 | 0 | 0.44 | 1.32 |
| | <i>Aster puniceus</i> | Purple-Stemmed Aster | | | | 2.5 | | | | | | | | 2.5 | | | | | | | | 0.29 |
| | <i>Aster umbellatus</i> | Flat-Topped White Aster | | | | | | | | | | | | | 2.5 | | | | | | | 0.15 |
| | <i>Cirsium discolor</i> | Field Thistle | 2.5 | | 2.5 | | | | 2.5 | | 2.5 | 2.5 | | | | | | | 1.03 | 1.47 | 0.29 | 0.74 |
| X | <i>Leucanthemum vulgare</i> | Ox-Eye Daisy | 2.5 | | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | | | | 1.03 | 1.62 | 1.32 | 1.76 |
| | <i>Euthamia graminifolia</i> * | Flat-Top Goldenrod | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 15.0 | 15.0 | 2.5 | 15.0 | 37.5 | 15.0 | 15.0 | 2.5 | | 2.5 | | 0 | 10.59 | 16.32 | 7.94 |
| | <i>Solidago rugosa</i> | Rough-Stemmed Goldenrod | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 15.0 | 15.0 | 2.5 | 15.0 | 2.5 | 2.5 | 2.5 | 2.5 | | 2.5 | 2.5 | 3.75 | 4.85 | 1.91 | 4.56 |
| | <i>Solidago</i> spp. | Goldenrod | 2.5 | 2.5 | 2.5 | 2.5 | 15.0 | 37.5 | 37.5 | 15.0 | 15.0 | 15.0 | 2.5 | 2.5 | 2.5 | 2.5 | | | 0 | 7.79 | 5.18 | 9.26 |
| X | <i>Taraxacum officinale</i> | Common Dandelion | 2.5 | 2.5 | | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | | 2.5 | 2.5 | | | | | 0 | 0.44 | 0.59 | 1.32 |
| X | <i>Rudbeckia hirta</i> | Black-Eyed-Susan | | | | | | | | | | | | | | | | | 0 | 0.15 | 0 | 0 |
| (X) | <i>Heracium</i> sp. | Hawkweed | 2.5 | 2.5 | | 2.5 | | | | 2.5 | | | | 2.5 | | | | | 0 | 0 | 0.15 | 0.74 |

Table 4 (cont.). Summary of mid-point percentage cover by quadrat (B1-B17) of species observed on transect B, 2002, and mean percent cover, 1999-2002. See Table 1 for cover class midpoints. New species in bold. X = non-native.

| | | | B1 | B2 | B3 | B4 | B5 | B6 | B7 | B8 | B9 | B10 | B11 | B12 | B13 | B14 | B15 | B16 | B17 | 1999 | 2000 | 2001 | 2002 | |
|-----------------------|-----------------------------|----------------|-----|-----|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| Boraginaceae | | | | | | | | | | | | | | | | | | | | | | | | |
| (X) | <i>Myosotis</i> sp. | Forget-Me-Not | | | | | | | | | | | | | | | | | | | 0 | 1.76 | 0 | 0 |
| Onagraceae | | | | | | | | | | | | | | | | | | | | | | | | |
| | <i>Epilobium</i> sp. | Willow Herb | | | | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | | 2.5 | 2.5 | 2.5 | | | | | | | 0 | 0.59 | 1.18 | 1.18 |
| | <i>Oenothera perennis</i> | Sundrops | | | | | | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | | | | | | | | 1.18 | |
| Primulaceae | | | | | | | | | | | | | | | | | | | | | | | | |
| X | <i>Primula</i> sp. | Primrose | | | | | | | | | | | | | | | | | | | 0 | 0.44 | 0 | 0 |
| | <i>Trientalis borealis</i> | Starflower | | | | | | | | | | 2.5 | 2.5 | | | | | | | | | | 0.29 | |
| Solanaceae | | | | | | | | | | | | | | | | | | | | | | | | |
| X | <i>Solanum dulcamara</i> * | Nightshade | | | | | 2.5 | | | | | | | | | | | | | | 0 | 0.15 | 0.29 | 0.15 |
| Cerastium | | | | | | | | | | | | | | | | | | | | | | | | |
| X | <i>Cerastium fontanum</i> | Chickweed | | | | | 2.5 | 2.5 | 2.5 | 2.5 | | 2.5 | | 2.5 | | | | | | | 0 | 0.15 | 0.29 | 0.88 |
| Phytolaccaceae | | | | | | | | | | | | | | | | | | | | | | | | |
| | <i>Phytolacca americana</i> | Pokeberry | | | | | | | | | | | | | | | | | | | 0 | 0.15 | 0 | 0 |
| Verbenaceae | | | | | | | | | | | | | | | | | | | | | | | | |
| | <i>Verbena hastata</i> | Blue Vervain | | | | | | | 2.5 | | 2.5 | 2.5 | | 2.5 | 2.5 | | | | | | 0 | 0.29 | 0.29 | 0.74 |
| Campanulaceae | | | | | | | | | | | | | | | | | | | | | | | | |
| | <i>Lobelia inflata</i> | Indian Tobacco | | | | 2.5 | 2.5 | 2.5 | 2.5 | | | | | 2.5 | | | | | | | 0 | 1.32 | 0.29 | 0.74 |
| Monocots | | | | | | | | | | | | | | | | | | | | | | | | |
| Juncaceae | | | | | | | | | | | | | | | | | | | | | | | | |
| | <i>Juncus effusus</i> | Soft Rush | | | | | | | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | | | | | | | | 0.15 | 0 | 0.15 | 0.74 |
| | <i>Juncus tenuis</i> | Path Rush | 2.5 | | | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | | | | | | | 0.59 | 0 | 0 | 1.62 |
| Cyperaceae | | | | | | | | | | | | | | | | | | | | | | | | |
| | <i>Carex</i> sp. | Sedge sp. | | | | | 2.5 | | | | | 2.5 | 2.5 | | 2.5 | | | | | | 0 | 2.35 | 0.44 | 0.59 |
| | <i>Carex lurida</i> | Sedge sp. | | | | | | | | | | | | | | | | | | | 3.53 | 0 | 0 | 0 |
| | <i>Carex scoparia</i> | Sedge sp. | | 2.5 | | | 2.5 | | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | | | | | | 1.03 | 0.29 | 0.88 | 1.32 |
| | <i>Carex stricta</i> | Sedge sp. | | | | | | | | | | | | | | | | | | | 1.47 | 0 | 0 | 0 |
| | <i>Carex gracillima</i> | Sedge sp. | 2.5 | 2.5 | | | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | | 2.5 | 2.5 | | | | | | | 0 | 0 | 0.74 | 1.32 |

Table 4 (cont.). Summary of mid-point percentage cover by quadrat (B1-B17) of species observed on transect B, 2002, and mean percent cover, 1999-2002. See Table 1 for cover class midpoints. New species in bold. X = non-native.

| Poaceae | | B1 | B2 | B3 | B4 | B5 | B6 | B7 | B8 | B9 | B10 | B11 | B12 | B13 | B14 | B15 | B16 | B17 | 1999 | 2000 | 2001 | 2002 |
|---------|------------------------------|--------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|-------|------|------|
| (X) | <i>Agrostis</i> spp | Grass sp. | 2.5 | | | | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | | 2.5 | | | | | | 0 | 9.41 | 1.03 | 1.03 |
| X | <i>Agrostis gigantea</i> | Red Top Grass | | | | | | | | | | | | | | | | | 0.59 | 0 | 0 | 0 |
| | <i>Anthoxanthum odoratum</i> | Sweet Vernal Grass | 2.5 | 2.5 | 2.5 | | | | | | | 2.5 | 2.5 | 2.5 | | | | | 1.03 | 0.29 | 0.74 | 0.88 |
| | <i>Dactylis glomerata</i> | Orchard Grass | | | | | | | | | | | | | | | | | 0.15 | 0 | 0 | 0 |
| X | <i>Festuca heterophylla</i> | Fescue | | | | | | | | | | | | | | | | | 0.29 | 0 | 0 | 0 |
| | <i>Glyceria striata</i> | Fowl Manna Grass | | | | | | | | | | | | | | | | | 0.6 | 0 | 0 | 0 |
| | <i>Panicum clandestinum</i> | Deer-Tongue Grass | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | | | | 0.44 | 14.56 | 0 | 2.06 |
| (X) | <i>Poa</i> sp. | Grass sp. | | | | | | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | | | | | | 0 | 10.15 | 6.91 | 0.88 |
| X | <i>Poa pratensis</i> | Kentucky Bluegrass | | | | | | | | | | | | | | | | | 0.44 | 0 | 0 | 0 |
| | <i>Danthonia spicata</i> | Poverty Grass | 2.5 | | | | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | | | | | | | | 0 | 0.15 | 0.15 | 0.88 |

| Liliaceae | | B1 | B2 | B3 | B4 | B5 | B6 | B7 | B8 | B9 | B10 | B11 | B12 | B13 | B14 | B15 | B16 | B17 | 1999 | 2000 | 2001 | 2002 |
|-----------|------------------------------|---------------------|-----|-----|-----|----|----|----|----|----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|
| | <i>Trillium</i> sp. | Trillium | | | | | | | | | | | | | | | | | 0.15 | 0 | 0 | 0 |
| | <i>Maianthemum canadense</i> | Canadian May Flower | 2.5 | 2.5 | 2.5 | | | | | | | | | | | | | | 0 | 0 | 0.15 | 0.44 |

| Iridaceae | | B1 | B2 | B3 | B4 | B5 | B6 | B7 | B8 | B9 | B10 | B11 | B12 | B13 | B14 | B15 | B16 | B17 | 1999 | 2000 | 2001 | 2002 |
|-----------|------------------------|-----------------|-----|----|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|
| | <i>Sisyrinchium</i> sp | Blue-eyed Grass | 2.5 | | | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | | | | | 0.74 | 0.59 | 1.91 | 1.62 |

Table 4 (cont.). Summary of mid-point percentage cover by quadrat (B1-B17) of species observed on transect B, 2002, and mean percent cover 1999-2002. See Table 1 for cover class midpoints. New species in bold. X = non-native.

* Corrections: *Anisaema triphyllum* (Jack-in-the-pulpit)- previously listed under Family Aceraceae
Solanum dulcamara (Nightshade)- previously listed as *Solanum physafolium*
Euthamia graminifolia (Flat-Top Goldenrod)- previously listed as *Solidago graminifolia* (Lance-Leave Goldenrod)
 Spelling errors corrected without notation

^ Not located in transect, but included in % coverage due to overhanging branches on edge of ROW

X Not native to New York State (X) Not native in part (Mitchell, 1997)

New species in **bold type**

that exceeded 3 m (10') in height. 8 species of which are considered undesirable (Table 5, Figure 6). These were located on the edges and center of the transect. There were 13 non-native species identified.

| | Quadrats | | | | | | | | | | | | | | | | |
|----------------------------|----------|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 |
| <i>Acer rubrum</i> | 1 | | | | 2 | 1 | 2 | 3 | 1 | 1 | 1 | 1 | 1 | | | | |
| <i>Malus pumila</i> | 2 | | | | | | | | | | | | | | | | |
| <i>Populus tremuloides</i> | 1 | | | 1 | | | | | | | | | | | | | |
| <i>Viburnum lentago</i> | | | 2 | 3 | | | | | | | | | | | | | |
| <i>Prunus virginiana</i> | | | | 1 | | 4 | | | | 1 | | | | | | | |
| <i>Prunus serotina</i> | | | 1 | | 1 | | 2 | 3 | 1 | 1 | 3 | | | 1 | | | |
| <i>Viburnum dentatum</i> | | | | | 1 | 3 | 4 | 4 | 3 | 2 | 1 | 1 | | | | | |
| <i>Crataegus sp.</i> | | | | | | | | | | 1 | | | | | | | |
| <i>Amelanchier sp.</i> | | | | | | | | | | 1 | | | | | | | |
| <i>Alnus incana</i> | | | | | | | | | | | 1 | | | | | | |
| <i>Pinus strobus</i> | | | | | | | | | | | | | | | | | 1 |

Table 5. Numbers of species of trees exceeding 3 m (10') in height in transects along quadrat A.

Transect B

Transect B, clear-cut in 1998, experienced increased growth in pteridophytes, gymnosperms, and dicots, with a leveling off in monocot percent coverage (Figures 2-5). The predominant species in coverage were: *Rubus allegheniensis* (blackberry)-12%, *Fraxinus americana* (white ash)-12%, and *Rubus idaeus* (raspberry)-10%. The combined species of *Solidago* and *Euthamia* (goldenrod) added up to 22% coverage. There were 87 species identified, up from 78 in 2001, with compositional change evident in undesirable species, having 22 % coverage compared to 16 % coverage in 2001. There were 30 specimens of 7 species (5 considered undesirable in terms of ROW management) exceeding 3 m (10') in height, most being located primarily on the edges of the transect (Table 5, Figure 7). There were 15 non-native species identified. Table 4 represents the summary of mid-point coverage, by quadrat, of each species in Transect B.

DISCUSSION

Because no IVM practices have been exercised on Transect A since 1988, the ROW is reaching a later successional stage characterized by trees, such as *Prunus serotina* (black cherry), and *Acer rubrum* (red maple) emerging out of the dominant shrub community of *Viburnum* (arrowwood and nannyberry), *Rubus* (blackberry and raspberry), and *Spiraea latifolia* (meadowsweet), which together represent a climax shrub community with over 50% of the coverage on the transect. The number of undesirable

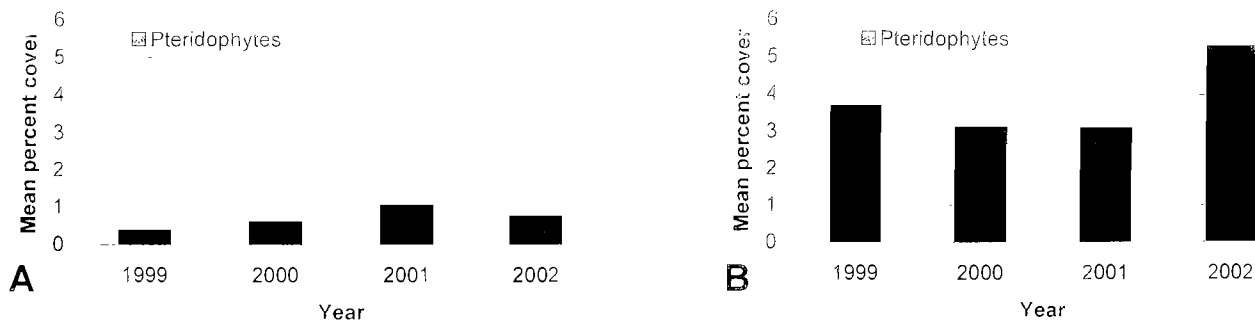


Figure 2. Mean percent cover, 1999-2002, of pteridophytes (ferns), Transects A and B.

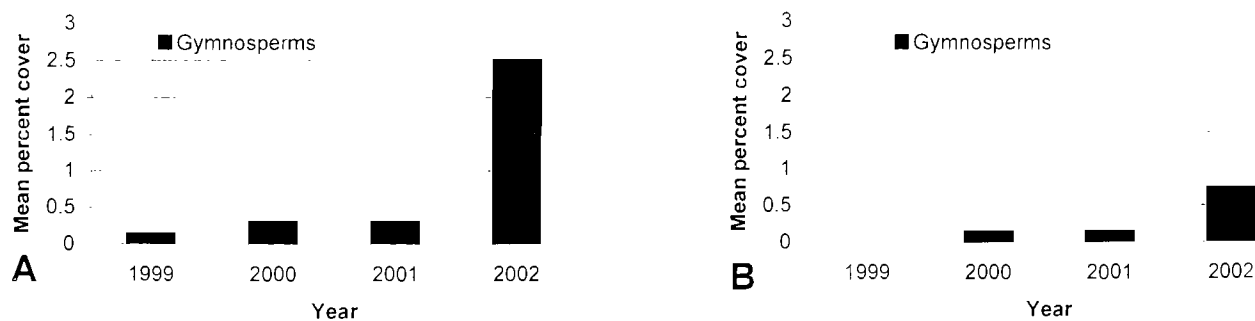


Figure 3. Mean percent cover, 1999-2002, of gymnosperms (conifers), Transects A and B.

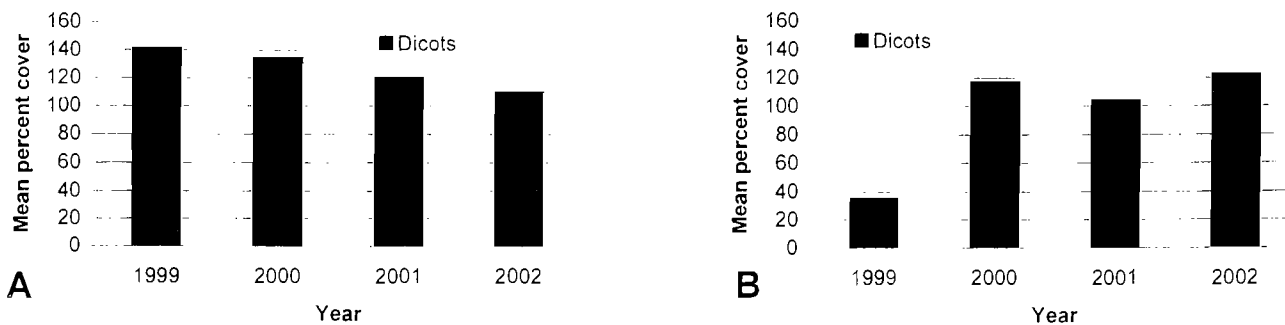


Figure 4. Mean percent cover, 1999-2002, of dicots, Transects A and B.

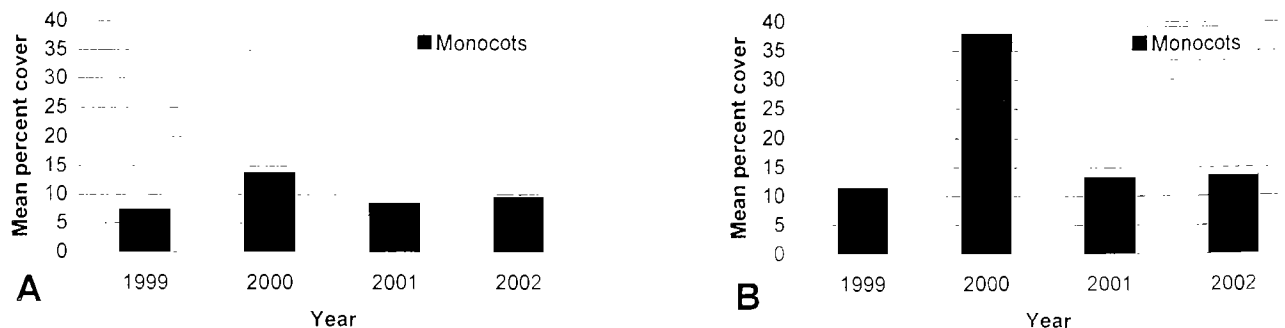


Figure 5. Mean percent cover, 1999-2002, of monocots, Transects A and B.

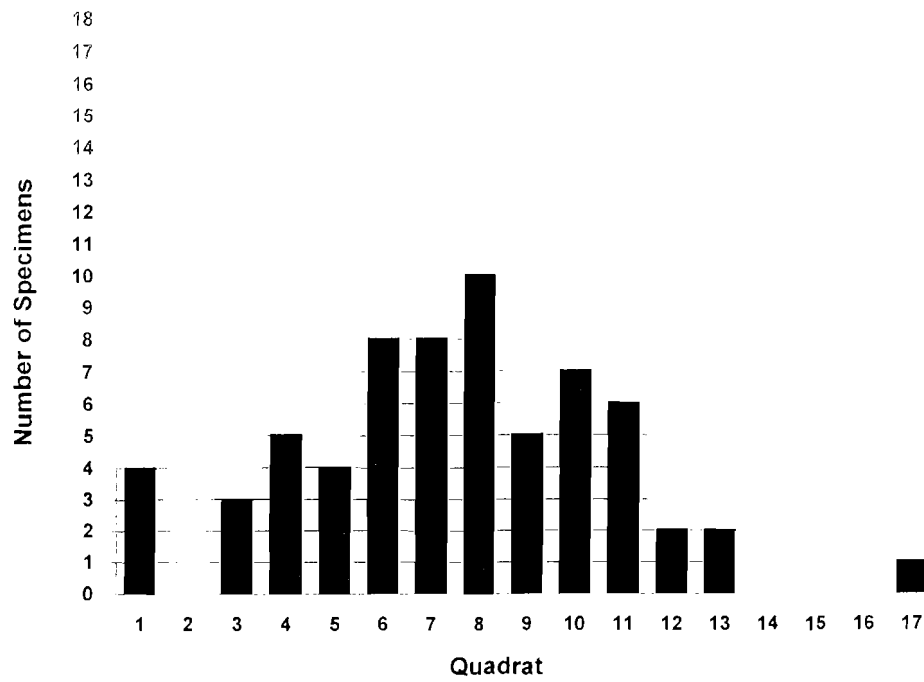


Figure 6. Numbers of trees exceeding 3 m in transects along quadrat A.

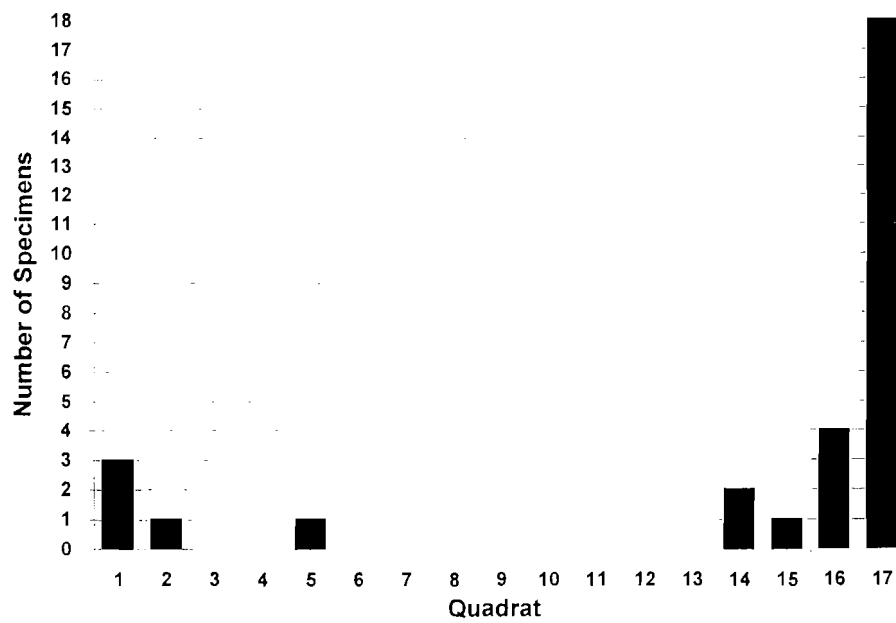


Figure 7. Numbers of trees exceeding 3 m in transects along quadrat B.

| | Quadrats | | | | | | | | | | | | | | | | |
|----------------------------|----------|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 |
| <i>Acer saccharum</i> | 1 | | | | | | | | | | | | | | | | |
| <i>Acer rubrum</i> | | | | | | | | | | | | | | | | | |
| <i>Populus tremuloides</i> | | | | | | | | | | | | | | | | | |
| <i>Viburnum lentago</i> | | | | | | | | | | | | | | | | | |
| <i>Prunus virginiana</i> | | | | | | | | | | | | | | | | | 3 |
| <i>Prunus serotina</i> | | 1 | | | | | | | | | | | | | | | |
| <i>Viburnum recognitum</i> | 1 | | | | | | | | | | | | | | 1 | 1 | |
| <i>Crataegus sp.</i> | | | | | | | | | | | | | | | | | 1 |
| <i>Fraxinus</i> | | | | | 1 | | | | | | | | | 2 | | 2 | 15 |
| <i>Alnus incana</i> | | | | | | | | | | | | | | | | | |
| <i>Quercus</i> | 1 | | | | | | | | | | | | | | | | |

Table 6. Numbers of species of trees exceeding 3 m (10') in height in transects along quadrat B.

trees exceeding 3 m (10') in the center of the transect may reflect the higher amount of sunlight in the center of the ROW where seedlings get a head start over those shaded by the forest edge. However, many factors determine which tree species are most successful in ROW succession. The dominant shrub communities can inhibit seedling growth by shading and root competition. Conversely, it may facilitate seedling growth by moisture protection in drought conditions and protect them from mammalian herbivory.

Results from Transect B reflect a normal successional change on a ROW after being clear-cut 4 years ago. The greater species diversity compared to Transect A is a result of more recent opening up of the habitat to shade intolerant species. The higher number of non-native species is typical of earlier plant succession (Abranhamson, 1998). The predominance of trees over 3 m (10') on the edge of the ROW in Transect B is typical of early succession.

The differences in Transect A and B are typical of the "patchy" mosaic of ROW communities that result from succession dynamics and variations in ROW management regimes (Canham, 1993). Further studies of undesirable tree seedling establishment and growth over time in the ROW, as well as the establishment and persistence of non-native species, could be also be conducted at these sites. Consistency in identification and methodology is essential for discerning any long-term trends.

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family was the most represented family in the transect with 48.38 % in overall coverage. There was no change in number of species overall (70), but composition changed with “undesirable” (tall-growing) trees and shrubs increasing 52% since 2001. There are 14 species in Transect A considered “undesirable” in terms of ROW IVM practices (Table 2). There were 66 specimens of 11 species in Transect A that exceeded 10’ in height, 8 species of which are considered undesirable. These were located on the edges and center of the transect (Figure 3). 13 non-native species were identified. Table 3 represents the summary of mid-point coverage, by quadrat, of each species in Transect A.

Transect B

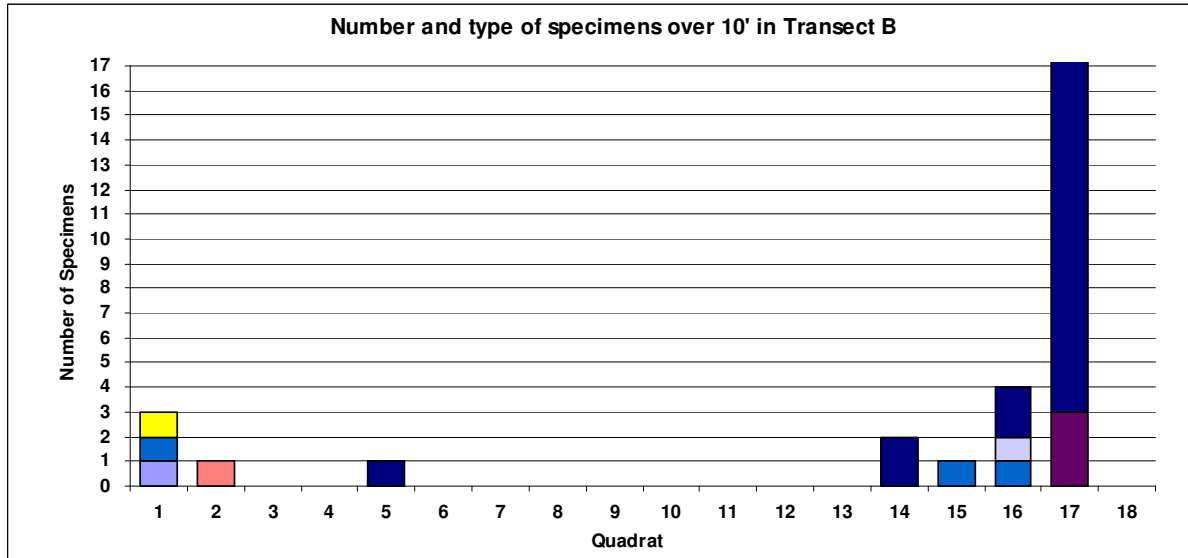
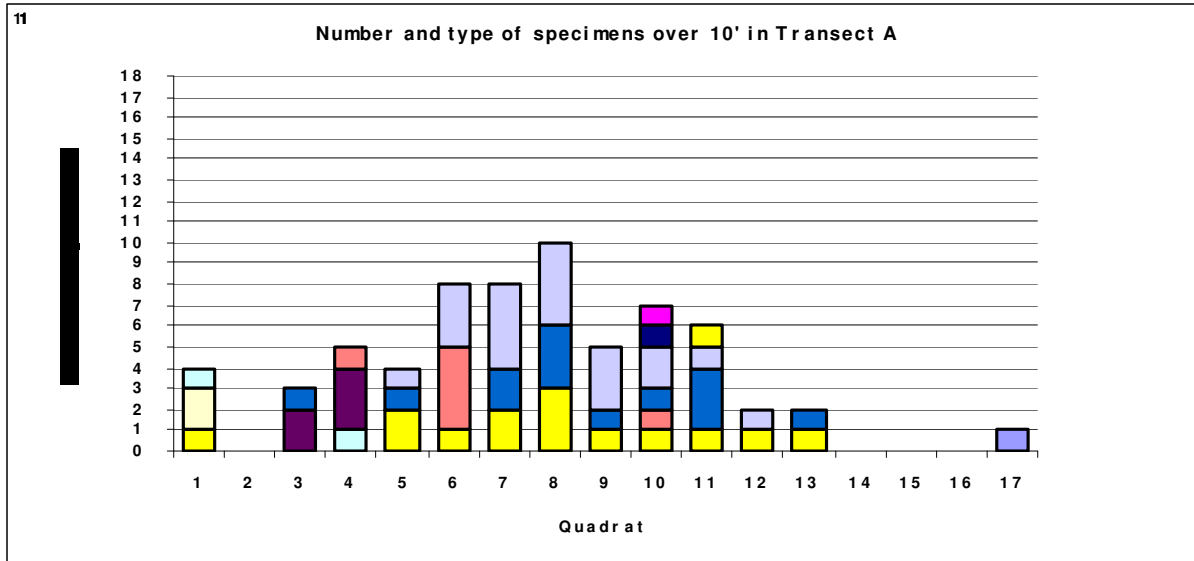
Transect B, clear-cut in 1998, experienced growth in pteridophytes, gymnosperms, and dicots, with a leveling off in monocot percent coverage (Figures 2-5). The predominant species in coverage were: *Rubus allegheniensis* (Blackberry)-12%, *Fraxinus americana* (White Ash)-12%, and *Rubus idaeus* (Raspberry)-10%. The combined species of *Solidago* and *Euthamia* (Goldenrod) added up to 22% coverage. 87 species were identified, up from 78 in 2001, with compositional change evident in undesirable species, 22 % coverage compared to 16 % coverage in 2001, up 37% over 2001. 30 specimens of 7 species (5 considered undesirable in terms of ROW management) exceeded 10’ in height, and were located primarily on the edges of the transect (Figure 3). 15 non-native species were identified. Table 4 represents the summary of mid-point coverage, by quadrat, of each species in Transect B.

Undesirable Trees and Shrubs on ROW – 2002*

| <u>Species</u> | <u>Transect A</u> | <u>Transect B</u> |
|---|-------------------|-------------------|
| <i>Acer rubrum</i> (Red Maple) | X | X |
| <i>Acer saccharum</i> (Sugar Maple) | X | X |
| <i>Alnus incana</i> (Speckled Alder) | X | X |
| <i>Amelanchier</i> sp. (Shadbush) | X | X |
| <i>Betula alleghaniensis</i> (Yellow Birch) | | X |
| <i>Fagus grandifolia</i> (Beech) | X | X |
| <i>Fraxinus americana</i> (White Ash) | X | X |
| <i>Malus pumila</i> (Common Apple) | X | |
| <i>Picea rubens</i> (Red Spruce) | X | X |
| <i>Pinus strobus</i> (White Pine) | X | X |
| <i>Populus tremuloides</i> (Quaking Aspen) | X | X |
| <i>Prunus serotina</i> (Black Cherry) | X | X |
| <i>Prunus virginiana</i> (Choke Cherry) | X | X |
| <i>Quercus rubra</i> (Red Oak) | X | X |
| <i>Sorbus americana</i> (Mountain Ash) | X | |

*Note: Occasionally the following species not on this list may be removed due to individual specimen height, previous management practices (e.g. mechanical removal that stimulated growth), or location on the ROW (directly under wires): *Viburnum lentago* (Nannyberry), *Crataegus* sp. (Hawthorn)

Table 2. Undesirable species in Transects A and B (exceed height requirement).



- | | |
|--|---|
| 1. <i>Acer rubrum</i> (Red Maple) | 8. <i>Crataegus</i> sp. (Hawthorn) |
| 2. <i>Malus pumila</i> (Common Apple) | 9. <i>Amelanchier</i> sp. (Shadbush) |
| 3. <i>Populus tremuloides</i> Quaking Aspen) | 10. <i>Alnus incana</i> (Speckled Alder) |
| 4. <i>Viburnum lentago</i> (Nannyberry) | 11. <i>Pinus strobus</i> (White Pine) |
| 5. <i>Viburnum dentatum</i> (Arrowwood) | 12. <i>Acer saccharum</i> (Sugar Maple) |
| 6. <i>Prunus virginiana</i> (Choke Cherry) | 13. <i>Quercus rubra</i> (Red Oak) |
| 7. <i>Prunus serotina</i> (Black Cherry) | 14. <i>Fraxinus americana</i> (White Ash) |

Figure 3. Number and Type of Specimens over 10' in Transects A and B

DISCUSSION

Because no IVM practices have been exercised on Transect A since 1988, the ROW is reaching a later successional stage characterized by trees, such as *Prunus serotina*

(Black Cherry), and *Acer rubrum* (Red Maple) emerging out of the dominant shrub community of *Viburnum* (Arrowwood and Nannyberry), *Rubus* (Blackberry and Raspberry), and *Spiraea latifolia* (Meadowsweet), which together represent a climax shrub community with over 50% of the coverage on the transect. The number of undesirable trees exceeding 10' in the center of the transect may reflect the higher amount of sunlight in the center of the ROW where seedlings get a head start over those shaded by the forest edge. However, many factors determine which tree species are most successful in ROW succession. The dominant shrub communities can both inhibit seedling growth by shading and root competition, as well as facilitate seedling growth by moisture protection in drought and protection from mammalian herbivory. Multiple stems of a species from a cut basal trunk were counted as a single clump or tree in determining the number of trees over 10' and reflect the multiple shoot growth caused from mechanical methods of IVM. A single *Pinus strobus* (White Pine) in Transect A17, at 37.5% coverage increased the results for gymnosperm coverage (Figure 2).

Results from Transect B reflect a normal successional change on a ROW after being clear-cut 4 years ago. The greater species diversity compared to Transect A is a result of more recent opening up of the habitat to shade intolerant species. The higher number of non-native species is typical of earlier plant succession (Abranhamson, 1998). The predominance of trees over 10' on the edge of the ROW in Transect B is typical of early succession.

The differences in Transect A and B are typical of the "patchy" mosaic of ROW communities that result from succession dynamics and variations in ROW management regimes (Canham, 1993). Further studies of undesirable tree seedling establishment and growth over time in the ROW, as well as the establishment and persistence of non-native species, could be also be conducted at these sites. Consistency in identification and methodology is essential for discerning any long-term trends.

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