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A Natural Areas Inventory of the Swamp Creak Corridor, Montgomery County, Pennsylvania

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**A Natural Areas Inventory of the Swamp Creak Corridor, Montgomery County,
Pennsylvania**

Title: A Natural Areas Inventory of the Swamp Creak Corridor,
Montgomery County, Pennsylvania

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Date: March 2007

Abstract:

The Swamp Creek Corridor study is part of a larger project commissioned by the Montgomery County Planning Commission to inventory the county's natural areas and create a management plan for those areas. The Swamp Creek Corridor occupies 9,400-acres in central Montgomery County. An inventory of plants within the corridor was undertaken in the summer of 2006. Transects were placed throughout the corridor to obtain quantitative data on forest composition. Two serious threats to the structure of the forest were revealed. Poor seedling regeneration suggests that managing the overabundant deer population should be a high priority. Also, invasive plants such as *Berberis thunbergii* (Japanese barberry), and *Euonymus alatus* (winged euonymus) are beginning their invasions and should be stopped before their populations become less manageable. Other invasive species such as *Microstegium vimineum* (Japanese stiltgrass) and *Rosa multiflora* (multiflora rose) are well-established and would require costly management techniques. The natural diversity of the Swamp Creek Corridor is currently stunted by an overabundant deer population and invasive plants.

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DESCRIPTION

Location

The Swamp Creek Corridor occupies 9,400-acres in northwestern Montgomery County. It includes portions of Douglass, New Hanover, Lower Frederick, Upper Frederick, and Limerick Townships.

Geology

The area is characterized by steep forested slopes formed by hornfels geology and broad, flat floodplains formed by Brunswick shale.

Forest cover

Aerial photography of the corridor reveals that 27% of the region is currently covered by forest. The most densely forested areas are Sunrise Mill Park, Camp Laughing Waters, Camp Joy and Camp Arthur Reeta. Of these sites, only Sunrise Mill Park is currently owned by the county.

Hydrology

Swamp Creek is currently managed by the state to offer trout stocking from February 15th through July 31st. The passage, maintenance, and propagation of migratory fishes are also supported by the state (Pennsylvania Code, Title 25).

Past uses

According to Bean's 1884 History of Montgomery County, the waters of the Swamp Creek Corridor "abounded with fish, and they are yet frequented by lovers of fishing from near and far" (Bean 1884). Bean lists a great diversity of flora, including the American chestnut, which has long been absent from East Coast forests due to the chestnut blight. He also mentions a large species of hickory with huge nuts and a thick shell, which most likely is the shellbark hickory still found along the banks of the creek. Even as early as 1884, however, Bean already believed that the "primitive forest" surrounding Swamp Creek had already "almost entirely disappeared" (Bean 1884). The most mature forests in the region today are not much more than one hundred years old.

The churning waters of Swamp Creek once inspired the construction of mills all along the corridor. In 1884 four grist mills and three saw mills operated along the Creek in New Hanover Township (Bean 1884). In 1736 Henry Antes built a four-story mill on the corner of Fagleysville and Colonial Roads, which stood until 1951 when it was razed. The Sunrise Mill Gristmill, now owned by Montgomery County as part of Sunrise Mill Park, was constructed in 1767 across from a vertical sawmill (Toll 1983).

Protection status

The Swamp Creek landscape includes three previously identified Natural Areas Inventory sites of local significance. New Road Swamp in New Hanover Township is listed with a high county ranking because of its well-developed . It is also noted that this site offers excellent amphibian breeding habitat. Sunrise Mill Park and Camp Laughing Waters are also listed as sites of local significance. Sunrise Mill Park is mentioned because of its hemlock-hardwood forest, its diversity of flora, and its ability to provide habitat for a variety of animal species. Camp

Laughing Waters is listed because of its older growth hemlock forest slopes and its younger sugar maple – shagbark hickory – ash hardwood forest (The Nature Conservancy).

Species of special concern include the great blue heron, as well as *Juncus dichotomus* (Forked rush), which is listed as Pennsylvania Endangered by the PNHP.

Species Inventories

Three-hundred-and-eight native and 86 non-native species of plants were observed. (See Table 1)

Reptiles documented at the site include the Northern ringneck snake, the Eastern garter snake, the Northern water snake, the Eastern painted turtle, and the Eastern box turtle (Corn 2006).

According to the 1984-1989 Pennsylvania Breeding Bird Atlas, 74 species were listed as confirmed or probable breeding within the Swamp Creek Corridor. These sightings include indicators of significant forest interior habitat such as the blue-gray gnatcatcher, the veery, the wood thrush, the yellow-throated vireo, the red-eyed vireo, the ovenbird, the Louisiana waterthrush, and the scarlet tanager. (See Table 2)

A Great Blue Heron rookery, with 35 active nests in 2006, is located in the upper part of the corridor. The great blue heron is a Pennsylvania Natural Heritage Program-listed species.

Although no official mammal studies have been completed for this site, the caretaker of Camp Joy reported seeing six river otters on numerous occasions (Steve Staub, caretaker, personal communication). The river otter is listed by the PNHP as vulnerable to extirpation.

Methods

The list of flora for this report was obtained by surveying the core areas mentioned below during the 2006-2007 seasons. Quantitative data on forest composition were obtained by placing ten 100-meter transects throughout the corridor. These transects were used to take a random sample of the canopy, shrub, and seedling layers. The relative importance value (RIV) for each species observed along the transect was calculated with a formula that includes the overall number of each species observed and the prevalence of the species throughout the transect. The diameter at base height of each representative of a species is also taken into account for the canopy layer RIVs. The data obtained from the transects were used to assign specific forest types to each plant community according to Fike (1999).

CORE AREAS

Sunrise Mill Park

Sunrise Mill Park is located on either side of Swamp Creek just west of the confluence of Swamp Creek and Scioto Creek. The county owns 135.9 acres, the large majority of the property. Limerick Township owns 8.5 acres on the western tip of the park.

Vegetation

Sunrise Mill is characterized by a Northern hardwood forest community along the north-facing slope of the creek, which quickly transitions into a dense hemlock-oak forest community and then back into hardwood forest. The south-facing bank of the creek also slopes dramatically in places and supports a Northern hardwood forest. The vegetation directly along the banks of the creek is characteristic of a highly disturbed successional floodplain terrace (Fike 1999). Surveys during the 2006 and 2007 seasons resulted in a list of 192 native species and 248 species overall.

Oak – Mixed Hardwood forest community

The oak – mixed hardwood forest communities on either side of the creek are suffering from deer browse and exotic plant invasions. The forest on the south-facing slope is currently in an early successional state. This growth stage makes the forest highly susceptible to invasions. Heavy deer browse prevents the forest from moving to a more mature state. The sparse canopy is dominated mostly by sugar maple and red cedar. Box-elder, black walnut, ash, and various hickories are also present. Norway maple, a major invader of hardwood forests, was observed spreading throughout the slope. Very few seedlings, with the exception of black birch, seem capable of growing fast enough to reach beyond the browse line. Scattered dogwood seedlings were observed with severe deer damage.

On the north-facing slope, where the forest is more mature, there is still a diverse community of trees. Sugar maple dominates the highest points along the slope while beech dominates lower regions. Red oak, black birch, ash, and hickory also hold a strong presence with a wide variety of other deciduous trees in smaller numbers. While red oak is present, it is not seen in the large numbers typical of this forest type. The present lack of this tree suggests that heavy logging most likely occurred around 50 years ago. There are very few invasive trees in this canopy layer. Norway maple, while present on the south-facing slope, has not yet reached the other side of the creek.

The forest understory on both the northern and southern slopes is almost entirely decimated by deer browse. While saplings and seedlings of the dominant trees were observed, their numbers were far too few to sustain a healthy forest. (See Table 3)

Oak – Hemlock forest community

The oak–hemlock forest community, which dominates the north-facing slope of the park, maintains a healthy canopy layer. Hemlock and chestnut oak create a dense shade for the understory. The future of this hemlock stand, however, is in serious danger. Not a single seedling of hemlock, or any other tree species, was observed along our transect of the region. Intense winter deer browse is resulting in a total lack of forest regeneration. (See Table 4)

Disturbed successional floodplain terrace

This community runs along the banks of the creek and includes a large island just east of where Neiffer Road crosses the creek. The canopy layer of the community is extremely diverse. Sixteen species were observed in a 100-meter transect of the region. Bitternut hickory, white ash, American elm, and white oak are the dominant native tree species. The strong presence of ash indicates that the forest is currently in a successional state. Unfortunately, Norway maple is also a dominant tree, making up 12.9% of the forest.

Below the canopy, the floodplain understory is the most disturbed region of the park. Deer browse is so intense that in places even the multiflora rose and spice bush, two shrubs usually not palatable to deer, are suffering. Another threat to the floodplain swamp community is the growing presence of invasive earthworms. Castings from these worms extend far beyond the banks of the creek and in some places are three inches deep. There is almost no leaf litter layer where the worms are active and some regions of the creek bank are now barren mudflats. (See Table 5)

Deer status

The most biologically diverse regions of Sunrise Mill Park remain the areas with the steepest slopes and the rockiest terrain. Any region reachable by deer is totally decimated by over browsing.

Invasive plants

Multiflora rose, Japanese honeysuckle, Japanese stilt grass, and garlic mustard are the most ubiquitous invasives in Sunrise Mill Park. With the exception of garlic mustard, all have been reported in the park as early as 1975 (Newbold 1975). Tree-of-heaven has been growing in Sunrise Mill Park for at least the past twenty years, but is still at a manageable stage of invasion (Newbold 1975). Norway maple is only present north of the creek, but will likely spread if not checked. Mile-a-minute, Japanese barberry, and winged euonymus are all highly invasive plants that are just beginning their invasions of Sunrise Mill Park. They are scattered throughout, but have not yet reached great numbers.

Camp Joy

Camp Joy covers 60.7 acres in Limerick Township on Swamp Creek Road, just west of Sunrise Mill Park. The geology of the property is composed primarily of hornfels formations with the dominant soil type being sandy and well-drained. The remains of barbed wire and electrical fencing litter the property, suggesting that the entire site was once pastured.

Vegetation

The vegetation along the creek is characteristic of a *Platanus occidentalis* – *Fraxinus americana* – *Acer negundo* floodplain forest. Above the floodplain, the forest transitions into dry oak–mixed hardwood (Fike 1999). Surveys during the 2006 and 2007 seasons resulted in a list of 93 native species and 106 species overall.

Platanus occidentalis – Fraxinus americana – Acer negundo floodplain forest community

The floodplain canopy layer is dominated by our native sycamore. Unfortunately, analysis of the shrub and seedling layers suggests that the future of the sycamore at this site is threatened. Sycamores make up 50% of the canopy layer, but only 4% of the sapling layer. Not a single sycamore seedling was observed. In place of the sycamore, spice bush, multiflora rose, and poison ivy are spreading aggressively. Deer browse is the most likely cause of this drastic shift in forest composition. The integrity of the floodplain biodiversity is also threatened by an active invasive earthworm population. Shellbark hickory, which is on the PNHP suggested watch list, was observed along the creek. (See Table 6)

Dry oak – Mixed hardwood

The Camp Joy upland forest is extremely rich. White oak makes up 31% of the canopy layer with red oak and bitternut hickory each making up 15%. Within a 100-meter transect of the region, eleven species were observed including the chestnut oak, shagbark hickory, and sugar maple. Unfortunately, Norway maple is scattered throughout the forest. It is in an early stage of invasion, however, and is currently only making up about 5% of the canopy layer. The future of this diverse forest, much like the future of the floodplain, appears endangered. While oaks make up about 50% of the canopy, they only make up 5% of the sapling layer. Not a single oak seedling was observed.

The shrub and sapling layer remains diverse despite the lack of oaks and the heavy deer browse. Twenty-three different species were observed including dogwood, red maple, basswood, hop-hornbeam, and shagbark hickory.

The ground layer is also still diverse in spots. The most ecologically interesting area is the uplands area running above the creek along the roadside. Naked-flowered tick-trefoil, pipsissewa, hepatica, Solomon's seal, and Virginia snakeroot were all observed growing in close proximity to each other and the road. (See Table 7)

Deer status

The deer in Camp Joy are suppressing the oak population and dramatically altering the future composition of the forest canopy.

Invasive plants

Japanese stilt grass is the only invasive herb fully dominating the region. There are, however, a few patches of mile-a-minute vine that will soon take over if not kept in check.

Camp ArthuReeta

The Camp ArthuReeta property consists of 140.9 acres just east of Sunrise Mill Park. The creek splits and turns throughout this area creating a number of islands and wet ground conditions, which makes an excellent amphibian breeding area. The geology of the region is primarily diabase.

Vegetation

A northern hardwood forest rises above the creek on the north and south-facing slopes of Camp ArthuReeta. A *Platanus occidentalis* – *Acer saccharum* – *Carya cordiformis* floodplain terrace community dominates along the banks of the creek and on numerous small islands (Fike 1999). Surveys during the 2006 and 2007 seasons resulted in a list of 103 native species and 121 species overall.

Northern hardwood forest

The canopy layer of this hardwood forest is primarily sugar maple, beech, and white ash, all indicators of a wet forest floor. This area is one of the few regions in the corridor where the shrub and seedling layers closely reflect the canopy layer. Sugar maple and beech dominate the forest. Ash is also dominant as a canopy species, but is entirely absent from the understory. Ash is a successional species. When found in smaller and smaller numbers, it marks the progression of a maturing forest. Its complete absence, however, reflects an active deer population. Red oak and white oak are also present in the canopy layer, but entirely absent from the understory. Oaks, like ash, are a favorite of deer. (See Table 8)

This area is unusual in that, despite the heavy deer browse, there are not a lot of invasive species moving into the understory. One notable region is entirely white wood aster and wreath goldenrod.

***Platanus occidentalis* – *Acer saccharum* – *Carya cordiformis* floodplain terrace**

The presence of sugar maple and bitternut hickory in the region suggests that the land is elevated slightly above the water line. While still a floodplain, the region is just dry enough to sustain non-floodplain species. Also, in a floodplain forest, sycamore will thrive throughout the floodplain. Here, in a floodplain terrace, sycamore remains bound to the stream banks. The understory, as in the slopes above the floodplain, closely reflects the canopy. Sugar maple and bitternut hickory dominate. Sycamore is absent along the dryer region where our transect was laid, but remains prevalent along the stream banks. (See Table 9)

***Carya laciniosa* community**

The islands within the ArthuReeta property are the most disturbed regions of the camp. There are a few spice bushes and scatterings of multiflora rose and Japanese barberry, but beyond these isolated instances, no understory exists. The canopy layer, however, on one of these islands is notable for a large grove of shellbark hickory, a PNHP plant suggested for the watch list. No regeneration of this tree, however, was observed.

Deer status

The total lack of oak and ash in the hardwood forest suggest that deer are impacting even the steep slopes above the banks of Swamp Creek. The islands and banks of the creek, however, are suffering from the greatest impact. Here, the understory has all but disappeared.

Invasive plants

The invasive plants in Camp ArthuReeta follow the deer browse. In regions sufficiently disturbed by deer, such as the island areas, invasive plants take over. Multiflora rose and Japanese barberry are the most persistent invasive species.

Camp Laughing Waters

Camp Laughing Waters covers 573.1 acres just east of New Hanover Square Road where Swamp Creek splits into Swamp Creek and Minister Creek.

Vegetation

The forest types include hemlock forest, dry oak–mixed hardwood forest, and bottomland oak–hardwood palustrine forest (Fike 1999). There is also a large 100 foot wide sewage line clearing that is mowed regularly. Surveys during the 2006 and 2007 seasons resulted in a list of 166 native species and 213 species overall.

Hemlock forest

Much like the hemlock forest in Sunrise Mill Park, the Camp Laughing Waters hemlock forest is profoundly impacted by deer. Because hemlock is one of the few available food sources for deer in the winter, hemlock seedlings are among the first trees to suffer from a large deer population. At Camp Laughing Waters, 75% of the hemlock forest canopy is hemlock and 21% is white oak. But despite dominant canopy populations, not a single hemlock or oak sapling or seedling was observed along our transect. Black birch, sugar maple, and spice bush are quickly replacing the hemlock and oak populations. (See Table 10)

Bottomland oak – hardwood palustrine forest

Because the palustrine areas are flatter, they are more easily accessible to deer and therefore more susceptible to deer browse. This bottomland oak – hardwood palustrine forest is, unfortunately, an excellent example of heightened deer browse in easily accessible areas. While 63% of the forest canopy is pin oak, there was not a single pin oak sapling observed along our transect. With the aid of deer browse, multiflora rose is quickly becoming the dominant woody plant. (See Table 11)

Dry oak – mixed hardwood forest

The hemlock forest transitions into this dry oak-mixed hardwood forest and the deer browse continues. While 30% of the canopy is white oak, only 7% of the sapling layer is oak. Sugar maple, which also makes up 30% of the canopy layer, is disliked by deer. By not eating it, the deer are helping sugar maple to out-compete other trees. Currently, sugar maple dominates 56% of the sapling layer. (See Table 12)

Sewage line Clearing

The pipeline clearing appears to be regularly mowed. With proper management, this area could be permitted to grow into a wet meadow, which would be an excellent corridor for birds and butterflies. The management necessary to achieve this goal, however, would be intense. Simply cutting back on mowing would encourage invasive plants like multiflora rose. The invasive plants would then have an easy entrance to the surrounding forest interior.

New Road Swamp

New Road Swamp is a privately-owned property located west of New Hanover Square Road between Route 73 and New Road. The property was listed by the previous NAI as a site of high county significance because of its rich vegetation and amphibian breeding habitat.

Vegetation

The open fields on the eastern portion of the property are edged with oak, elm, red cedar, Russian olive, red maple, and ash. In the late summer New York iron weed, milk weeds, and golden rods are abundant throughout the fields. Deer tongue and reed canary grass are the dominant grasses. The fields do not appear to be actively used for hay, although they are mown occasionally.

In three significant zones, the fields give way to a swampy landscape composed primarily of panicum grasses, cattails, and sweet flag. Russian olive surrounds large portions of these communities.

The wooded area to the west of the fields represents a significant Pin oak – elm – white ash – red maple dominant floodplain forest community. In the summer, these woods are severely overrun with poison ivy. In the spring, however, the herbaceous layer is more diverse and plants such as Jack-in-the-pulpit, spring beauty, May apple, trout lily, and wood geranium can be found lining the numerous deer paths throughout.

Invasive plants

The most significant threats to the biodiversity of the New Road Swamp landscape are Russian olive and reed canary grass. The Russian olive is both dominating the shrub layer of the forest edge and creeping into the open fields. The reed canary grass is extremely dense in places and limits the growth of native grasses.

Heron Rookery

A significant heron rookery has been present in New Hanover Township for the past twenty or more years. Currently, plans are being made to place a Heritage 55+ retirement community and nursing home within close proximity to the rookery. Because of the elusive nature of the great glue heron, care must be taken to minimize disturbance to the rookery. The Pennsylvania Game Commission is overseeing the protection of the herons' nesting site and a 100-meter buffer has been agreed upon. The closest disturbance to the nests will be a water easement that comes right up to the buffer zone. The noise, air, and light pollution caused by this construction process are major concerns. The Game Commission, therefore, is requiring that the construction be phased around the breeding season, which lasts from February through July.

RECOMMENDATIONS

Connectivity and Land Protection Priorities

1. Extend Sunrise Mill Park to include the now privately-owned slopes beyond the park. These areas offer a significant level of biodiversity and are too steep for development.
2. Encourage conservation easements for all camp properties.
3. Elicit the support of Camp Joy to place a public trail running from Sunrise Mill Park through Camp Joy.
4. Create trail a corridor along the sewage line at Camp Laughing Waters.
5. Connect core areas through conservation easements to create continuous riparian corridor.

Management Priorities

1. Reduce deer population by allowing greater hunting access.
2. Actively manage invasive species by first targeting species in early stages of invasion. In most of Swamp Creek's core areas, these plants would include:
 - a. Norway maple
 - b. Winged euonymus
 - c. Japanese barberry
 - d. Tree-of-heaven
 - e. Mile-a-minute vine

Garlic mustard, Japanese stilt grass, and non-native honeysuckles are also impacting the integrity of the forest ecosystem. The removals of these invasive plants, however, would be extremely costly. It is therefore recommended that management begin with targeting the less established invasive species. Also, multiflora rose dominates the shrub layer throughout the corridor. Removal of this shrub would be extremely costly. Luckily, there is a virus currently spreading throughout the east coast that is attacking multiflora rose and is predicted to wipe out the invasive nearly entirely.

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APPENDICES

Table 1. Flora of Swamp Creek

Species	Sunrise Mill Park (192 Native)	Camp Joy (93 Native)	Camp ArthuReeta (103 Native)	New Road Swamp (54 Native)	Camp Laughing Waters (166 Native)	Native
Acer negundo	X	X	X		X	Y
Acer nigrum	X		X		X	Y
Acer platanoides	X	X				N
Acer rubrum	X	X	X	X	X	Y
Acer saccharum	X	X	X	X	X	Y
Acer sacharinum	X	X	X		X	Y
Acorus calamus	X			X		N
Actea pachypoda	X		X			Y
Aethusa cynapium	X					N
Agrimonia parviflora	X			X		Y
Agrimonia perennans						Y
Agrimonia sp.	X	X	X			Y
Agrimonia striata	X					Y
Agrostis perennans	X				X	Y
Ailanthus altissima	X	X	X		X	N
Albizia julibrissin	X					N
Alisma subcordatum				X	X	Y
Alliaria petiolata	X	X			X	N
Allium canadense	X					Y
Allium tricoccum			X		X	Y
Allium vineale	X		X		X	N
Alnus sp.					X	Y
Amaranthus albus	X					N
Ambrosia artemisifolia	X				X	Y
Ambrosia sp.	X					Y
Ambrosia trifida	X			X	X	Y
Amelanchier arborea	X					Y
Amphicarpa bracteata	X	X	X		X	Y
Anagallis arvensis				X	X	Y
Andropogon virginicus			X			Y
Anemone virginiana					X	Y

<i>Apocynum cannabinum</i>				X	X	Y
<i>Aralia nudicaulis</i>	X		X			Y
<i>Aralia racemosa</i>	X		X			Y
<i>Arisaema triphyllum</i>			X	X	X	Y
<i>Aristolochia serpentaria</i>		X				Y
<i>Arthraxon hispidis</i>			X	X	X	N
<i>Asarum canadense</i>	X		X			Y
<i>Asclepias incarnata</i>				X	X	Y
<i>Asplenium platyneuron</i>	X					Y
<i>Aster macrophyllus</i>		X				Y
<i>Athyrium filix-femina</i> var. <i>angustum</i>			X			Y
<i>Berberis thunbergii</i>	X		X		X	N
<i>Betula lenta</i>	X	X	X		X	Y
<i>Betula nigra</i>	X	X			X	Y
<i>Bidens bipinnata</i>	X					Y
<i>Bidens comosa</i>	X					Y
<i>Boehmeria cylindrica</i>	X			X	X	Y
<i>Botrychium dissectum</i>			X			Y
<i>Botrychium virginianum</i>	X		X			Y
<i>Callitriche heterophylla</i>					X	Y
<i>Calystegia hederacea</i>				X		N
<i>Cardamine concatenata</i>	X					Y
<i>Cardamine hirsuta</i>	X					N
<i>Cardamine impatiens</i>	X					N
<i>Carex amphibola</i> var. <i>amphibola</i>					X	Y
<i>Carex annectens</i>					X	Y
<i>Carex appalachica</i>					X	Y
<i>Carex caroliniana</i>					X	Y
<i>Carex cephalophora</i>					X	Y
<i>Carex crinita</i>	X				X	Y
<i>Carex davisii</i>					X	Y
<i>Carex frankii</i>				X	X	Y
<i>Carex grayi</i>	X	X			X	Y
<i>Carex intumescens</i>					X	Y
<i>Carex laxiculmis</i> var. <i>laxiculmis</i>					X	Y
<i>Carex lupulina</i>	X					Y
<i>Carex lurida</i>					X	Y
<i>Carex normalis</i>					X	Y
<i>Carex pellita</i>						Y
<i>Carex pensylvanica</i>	X				X	Y

Carex radiata					X	Y
Carex rosea					X	Y
Carex scoparia					X	Y
Carex squarrosa				X	X	Y
Carex stipata					X	Y
Carex tribuloides					X	Y
Carex trichocarpa		X			X	Y
Carex virescens	X					Y
Carex vulpinoidea var. vulpinoidea					X	Y
Carpinus caroliniana	X	X	X		X	Y
Carya cordiformis	X	X	X		X	Y
Carya glabra	X					Y
Carya laciniosa	X	X	X		X	Y
Carya ovata	X	X	X	X	X	Y
Carya sp.			X			Y
Carya tomentosa					X	Y
Castanea dentata	X					Y
Catalpa sp.	X					N
Celastrus orbiculatus	X		X			N
Celtis occidentalis	X	X				Y
Cephalanthus occidentalis	X				X	Y
Cerastium arvense var. arvense	X					Y
Cercis canadensis	X					Y
Chamaecrista nictitans	X		X			Y
Chamaesyce maculata						Y
Chamaesyce nutans	X					Y
Chelidonium majus	X					N
Chelone glabra	X		X		X	Y
Chenopodium album var. album					X	N
Chenopodium ambrosioides	X					N
Chimaphila maculata	X	X				Y
Chimaphila sp.	X					Y
Cichorium intybus					X	N
Cicuta bulbifera					X	Y
Cicuta maculata var. maculata					X	Y
Cimicifuga racemosa			X			Y
Cinna arundinacea	X	X	X	X		Y
Circaea lutetiana	X	X			X	Y
Cirsium arvense					X	N
Claytonia virginica	X					Y

<i>Clematis virginiana</i>	X				X	Y
<i>Collinsonia canadensis</i>	X		X	X		Y
<i>Commelina communis</i>	X	X	X		X	N
<i>Cornus amomum</i>	X			X	X	Y
<i>Cornus florida</i>	X	X	X		X	Y
<i>Cornus racemosa</i>				X	X	Y
<i>Coronilla varia</i>	X				X	N
<i>Corydalis flavula</i>	X					Y
<i>Crataegus crus-galli</i>				X	X	Y
<i>Cryptotaenia canadensis</i>	X	X	X		X	Y
<i>Cunila organoides</i>	X					Y
<i>Cuscuta gronovii</i>	X			X	X	N
<i>Cyperus brevifolioides</i>			X			Y
<i>Danthonia spicata</i>					X	Y
<i>Daucus carota</i>					X	N
<i>Dennstaedtia punctilobula</i>	X			X	X	Y
<i>Desmodium canescens</i>			X			Y
<i>Desmodium nudiflorum</i>	X	X				Y
<i>Desmodium paniculatum</i>	X		X			Y
<i>Digitaria ciliaris</i>	X					N
<i>Dioscorea villosa</i>			X			Y
<i>Dryopteris carthusiana</i>	X				X	Y
<i>Dryopteris marginalis</i>	X		X		X	Y
<i>Duchesnea indica</i>					X	N
<i>Echinochlea crusgalii</i>				X		N
<i>Echinocytis lobata</i>		X				Y
<i>Elaeagnus sp.</i>			X			N
<i>Elaeagnus umbellata</i>	X			X	X	N
<i>Eleocharis erythropoda</i>					X	Y
<i>Eleocharis obtusa</i> var. <i>obtusa</i>			X		X	Y
<i>Elymus hystrix</i>	X	X	X		X	Y
<i>Elymus riparius</i>	X				X	Y
<i>Epifagus virginiana</i>	X		X			Y
<i>Epilobium sp.</i>				X		Y
<i>Equisetum sylvaticum</i>	X					Y
<i>Eragrostis pectinacea</i>	X					Y
<i>Erechtites hieraciifolia</i>	X					Y
<i>Erigeron strigosus</i> var. <i>strigosus</i>					X	Y
<i>Erythronium americanum</i>	X			X		Y
<i>Euonymus alatus</i>	X	X	X		X	N

<i>Eupatorium fistulosum</i>	X					Y
<i>Eupatorium maculatum</i>	X					Y
<i>Eupatorium perfoliatum</i>				X		Y
<i>Eurybia divaricata</i>	X	X	X		X	Y
<i>Eurybia macrophylla</i>		X				Y
<i>Euthamia graminifolia</i>	X		X	X		Y
<i>Fagus grandifolia</i>	X	X	X		X	Y
<i>Festuca elatior</i>					X	N
<i>Festuca obtusa</i>					X	Y
<i>Floerkea proserpinacoides</i>	X					Y
<i>Fraxinus americana</i>	X	X	X	X	X	Y
<i>Fraxinus pennsylvanica</i>		X			X	Y
<i>Galium aparine</i>	X					Y
<i>Galium circaezans</i>	X		X		X	Y
<i>Galium sp.</i>	X					Y
<i>Gaura biennis</i>		X				Y
<i>Geranium maculatum</i>	X			X	X	Y
<i>Geum canadense</i>	X	X		X	X	Y
<i>Glechoma hederacea</i>	X		X			N
<i>Gleditsia tricanthos</i>	X	X		X	X	Y
<i>Glyceria septentrionalis</i>					X	Y
<i>Glyceria striata</i>			X	X	X	Y
<i>Goodyera pubescens</i>	X					Y
<i>Gratiola neglecta</i>					X	Y
<i>Gymnocladus dioicus</i>	X					Y
<i>Hamamelis virginiana</i>	X	X				Y
<i>Hedeoma pulegioides</i>	X					Y
<i>Hedera helix</i>	X	X				N
<i>Helenium autumnale</i>	X					Y
<i>Helianthus decapetalus</i>	X	X	X			Y
<i>Hemerocallis fulva</i>	X	X	X		X	N
<i>Hepatica nobilis</i>		X			X	Y
<i>Hesperis matronalis</i>	X				X	N
<i>Heteranthera reniformis</i>					X	Y
<i>Hieracium venosum</i>	X					Y
<i>Houstonia caerulea</i>					X	Y
<i>Humulus japonicus</i>	X				X	N
<i>Hydrangea arborescens</i>	X					Y
<i>Hydrophyllum virginianum</i>	X					Y
<i>Hypericum punctatum</i>					X	Y

<i>Ilex opaca</i>	X					Y
<i>Ilex sp.</i>			X			Y
<i>Ilex verticillata</i>			X			Y
<i>Impatiens capensis</i>	X	X		X	X	Y
<i>Impatiens pallida</i>	X	X			X	Y
<i>Juglans nigra</i>	X	X		X	X	Y
<i>Juncus dudleyi</i>					X	N
<i>Juncus effuses</i>	X				X	Y
<i>Juncus marginalis</i>					X	Y
<i>Juncus tenuis var. tenuis</i>					X	Y
<i>Juniperus virginiana</i>	X		X	X		Y
<i>Kalmia latifolia</i>	X	X	X			Y
<i>Lactuca Canadensis</i>		X		X	X	Y
<i>Laportia canadenses</i>	X	X	X		X	Y
<i>Leersia virginica</i>	X			X	X	Y
<i>Leonurus cardiaca</i>					X	N
<i>Lepidium campestre</i>				X		N
<i>Lespedeza repens</i>			X			Y
<i>Lespedeza violacea</i>	X					Y
<i>Ligustrum obtusifolium</i>	X					N
<i>Lindera benzoin</i>	X	X	X	X	X	Y
<i>Liriodendron tulipifera</i>	X		X			Y
<i>Lobelia cardinalis</i>	X	X				Y
<i>Lobelia siphilitica</i>	X	X				Y
<i>Lolium perenne</i>					X	N
<i>Lonicera japonica</i>	X	X	X		X	N
<i>Lonicera maackii</i>	X				X	N
<i>Lonicera morowii</i>	X			X	X	N
<i>Ludwigia alternifolia</i>				X		Y
<i>Ludwigia palustris</i>	X		X		X	Y
<i>Lycopus americanus</i>	X			X		Y
<i>Lycopus uniflorus</i>					X	Y
<i>Lycopus virginicus</i>			X			Y
<i>Lygodium palmatum</i>			X			Y
<i>Lysimachia ciliata</i>	X	X			X	Y
<i>Lysimachia nummularia</i>	X	X	X		X	Y
<i>Lythrum salicaria</i>			X		X	N
<i>Maclura pomifera</i>		X				N
<i>Maianthemum canadense</i>	X	X				Y
<i>Malus sp.</i>				X		N

<i>Matricaria matricoides</i>					X	N
<i>Mertensia virginica</i>	X					Y
<i>Microstegium viminium</i>	X	X	X	X	X	N
<i>Mimulus alatus</i>	X			X		Y
<i>Mimulus ringens</i>				X		Y
<i>Mitchella repens</i>	X	X	X		X	Y
<i>Monotropa uniflora</i>	X				X	Y
<i>Morus alba</i>				X		N
<i>Muhlenbergia sobolifera</i>	X					Y
<i>Muscari sobolifera</i>	X				X	N
<i>Nuphar advena</i>	X				X	Y
<i>Nyssa sylvatica</i>			X		X	Y
<i>Oenothera biennis</i>	X		X	X	X	Y
<i>Oenothera fruticosa</i> ssp. <i>fruticosa</i>					X	Y
<i>Onoclea sensibilis</i>	X		X	X		Y
<i>Osmorhiza longistylis</i>	X					Y
<i>Osmunda regalis</i>			X			Y
<i>Ostrya virginiana</i>	X	X	X		X	Y
<i>Oxalis stricta</i>					X	N
<i>Panicum acuminatum</i>	X					Y
<i>Panicum clandestinum</i>	X			X	X	Y
<i>Panicum dichotomiflorum</i>	X					Y
<i>Paronychia canadensis</i>	X				X	Y
<i>Parthenocissus quinquefolia</i>	X	X	X	X	X	Y
<i>Penstemon digitalis</i>	X				X	Y
<i>Penthorum sedoides</i>					X	Y
<i>Phalaris arundinacea</i>				X	X	N
<i>Phegopteris hexagonoptera</i>			X			Y
<i>Phleum pratense</i>					X	N
<i>Phlox paniculata</i>	X					Y
<i>Phragmites australis</i>	X					N
<i>Phryma leptostachya</i>		X	X			Y
<i>Physalis subglabrata</i>	X					Y
<i>Phytolacca americana</i>	X	X			X	Y
<i>Picea abies</i>	X				X	N
<i>Pilea pumila</i>	X	X	X		X	Y
<i>Pinus strobus</i>	X					Y
<i>Pinus sylvestris</i>	X					N
<i>Pinus virginiana</i>		X				Y
<i>Plantago lanceolata</i>	X					N

<i>Platanus occidentalis</i>	X	X	X		X	Y
<i>Poa trivialis</i>					X	N
<i>Podophyllum peltatum</i>	X			X	X	Y
<i>Polygonatum pubescens</i>	X	X			X	Y
<i>Polygonatum biflorum</i> var. <i>biflorum</i>					X	Y
<i>Polygonum arenastrum</i>					X	N
<i>Polygonum arifolium</i>	X				X	Y
<i>Polygonum caespitosum</i>	X	X	X		X	Y
<i>Polygonum convolvulus</i>					X	N
<i>Polygonum cuspidatum</i>					X	N
<i>Polygonum orientale</i>	X		X			N
<i>Polygonum pensylvanicum</i>	X	X				Y
<i>Polygonum perfoliatum</i>	X	X	X		X	N
<i>Polygonum punctatum</i>	X	X	X			Y
<i>Polygonum sagittatum</i>	X			X	X	Y
<i>Polygonum scandens</i> var. <i>dumetorum</i>	X					N
<i>Polygonum virginianum</i>	X	X	X	X	X	Y
<i>Polypodium virginianum</i>	X				X	Y
<i>Polystichum acrosticoides</i>	X	X	X		X	Y
<i>Populus grandidentata</i>			X			Y
<i>Potentilla norvegica</i> ssp. <i>monspeliensis</i>					X	Y
<i>Potentilla simplex</i>	X					Y
<i>Prenanthes altissima</i>			X			Y
<i>Prunella vulgaris</i>				X	X	N
<i>Prunus avium</i>	X	X	X		X	N
<i>Prunus serotina</i>					X	Y
<i>Prunus virginiana</i>					X	Y
<i>Pycnanthemum tenuifolium</i>				X	X	Y
<i>Pyrola americana</i>			X			Y
<i>Pyrola elliptica</i>	X					Y
<i>Quercus alba</i>	X	X	X		X	Y
<i>Quercus bicolor</i>				X		Y
<i>Quercus montana</i>	X		X		X	Y
<i>Quercus palustris</i>				X	X	Y
<i>Quercus rubra</i>	X	X	X	X	X	Y
<i>Quercus velutina</i>	X		X			Y
<i>Ranunculus abortivus</i> var. <i>abortivus</i>	X		X			Y
<i>Ranunculus ficaria</i>	X		X	X		N

Rorippa palustris	X					Y
Rosa carolina			X	X		Y
Rosa multiflora	X	X	X	X	X	N
Rosa palustris					X	Y
Rubus allegheniensis					X	Y
Rubus occidentalis	X	X			X	Y
Rubus pensilvanicus					X	Y
Rubus phoenicolasius	X	X	X		X	N
Rubus sp.						N
Rudbeckia laciniata	X	X			X	Y
Rumex obtusifolius					X	N
Sagittaria latifolia	X		X			Y
Salix fragilis	X					N
Salix nigra	X	X			X	Y
Sambucus canadensis					X	Y
Sanguinaria canadensis	X	X				Y
Sanicula marilandica		X				Y
Sassafras albidum	X		X			Y
Saururus cernuus	X	X	X		X	Y
Saxifraga virginiana					X	Y
Scirpus cyperinus				X	X	Y
Scirpus georgianus				X	X	Y
Scrophularia marilandica	X	X				Y
Sedum sarmentosum	X					N
Setaria faberi	X					N
Sicyos angulatus	X				X	Y
Smilacina racemosa	X	X	X		X	Y
Smilax rotundifolia	X		X			Y
Solanum nigrum					X	N
Solidago altissima					X	Y
Solidago bicolor	X					Y
Solidago caesia	X	X	X			Y
Solidago canadensis	X	X	X	X	X	Y
Solidago flexicaulis	X	X	X			Y
Solidago gigantea	X			X	X	Y
Solidago juncea	X					Y
Solidago rugosa				X	X	Y
Solidago ulmifolia	X	X				Y
Sonchus asper	X				X	N
Staphylea trifolia	X	X				Y

<i>Stellaria pubera</i>	X	X				Y
<i>Symphyotrichum cordifolium</i>	X	X				Y
<i>Symphyotrichum lanceolatum</i>		X			X	Y
<i>Symphyotrichum lateriflorum</i>	X	X	X		X	Y
<i>Symphyotrichum pilosum</i> var. <i>pilosum</i>			X			Y
<i>Symphyotrichum prenanthoides</i>			X			Y
<i>Symplocarpus foetidus</i>	X				X	Y
<i>Teucrium canadense</i> var. <i>boreale</i>	X				X	N
<i>Thalictrum dioicum</i>	X					Y
<i>Thalictrum pubescens</i>	X				X	Y
<i>Thalictrum</i> sp.		X	X		X	Y
<i>Thalictrum thalictroides</i>	X					Y
<i>Thelypteris noveboracensis</i>			X		X	Y
<i>Thelypteris palustris</i> var. <i>pubescens</i>			X			Y
<i>Tilia americana</i>	X	X	X		X	Y
<i>Toxicodendron radicans</i>	X	X	X	X	X	Y
<i>Tragopogon dubius</i>					X	N
<i>Tridens flavus</i>	X				X	Y
<i>Tsuga canadensis</i>	X	X	X		X	Y
<i>Typha latifolia</i>				X		Y
<i>Ulmus americana</i>	X	X		X	X	Y
<i>Ulmus rubra</i>	X	X		X	X	Y
<i>Uvularia sessilifolia</i>	X					Y
<i>Vaccinium pallidum</i>	X	X				Y
<i>Verbascum blattaria</i>					X	N
<i>Verbascum thapsus</i>	X					N
<i>Verbena hastata</i>				X		Y
<i>Verbena urticifolia</i> var. <i>urticifolia</i>	X					Y
<i>Vernonia noveboracensis</i>				X		Y
<i>Veronica hederifolia</i>	X					N
<i>Veronica officinalis</i>	X					N
<i>Viburnum acerifolium</i>	X	X	X			Y
<i>Viburnum dentatum</i>	X		X			Y
<i>Viburnum prunifolium</i>	X	X	X	X	X	Y
<i>Viburnum recognitum</i>			X			Y
<i>Vicia</i> sp.	X					N
<i>Vinca minor</i>	X					N
<i>Viola labradorica</i>	X	X			X	Y
<i>Viola pubescens</i>	X	X			X	Y
<i>Viola sororia</i>					X	Y

Viola striata	X					Y
Vitis riparia	X				X	Y
Vitis sp.	X					N
Vitis vulpina					X	Y
Xanthium strumarium var. strumarium	X			X		N
Zizia aurea	X			X		Y
TOTAL	247	106	121	78	213	

Table 2. Breeding Bird Survey Results for 1984-1989 for Swamp Creek

confirmed	probable	possible
American Crow	American Kestrel	Acadian Flycatcher
American Goldfinch	Belted Kingfisher	American Woodcock
American Robin	Blue-gray Gnatcatcher	Black-billed Cuckoo
Baltimore Oriole	Bobolink	Cedar Waxwing
Barn Swallow	Broad-winged Hawk	Chestnut-sided Warbler
Black-capped Chickadee	Brown Thrasher	Great Blue Heron
Blue Jay	Chimney Swift	Kentucky Warbler
Blue-winged Warbler	Eastern Screech-Owl	Orchard Oriole
Brown-headed Cowbird	Grasshopper Sparrow	Ruby-throated Hummingbird
Canada Goose	Great Crested Flycatcher	Turkey Vulture
Carolina Chickadee	Great Crested Flycatcher	Wood Duck
Carolina Wren	Great Horned Owl	Worm-eating Warbler
Chipping Sparrow	Louisiana Waterthrush	Yellow-billed Cuckoo
Common Grackle	Prairie Warbler	
Common Yellowthroat	Red-eyed Vireo	
Downy Woodpecker	Red-tailed Hawk	
Eastern Bluebird	Rose-breasted Grosbeak	
Eastern Kingbird	Scarlet Tanager	
Eastern Meadowlark	Veery	
Eastern Phoebe	Warbling Vireo	
Eastern Towhee	Willow Flycatcher	
Eastern Wood-Pewee	Yellow-throated Vireo	
European Starling		
Field Sparrow		
Gray Catbird		
Green Heron		
Hairy Woodpecker		
House Finch		
House Sparrow		
House Wren		
Indigo Bunting		

Killdeer		
Mallard		
Mourning Dove		
Northern Cardinal		
Northern Flicker		
Northern Mockingbird		
Northern Rough-winged Swallow		
Ovenbird		
Pileated Woodpecker		
Red-bellied Woodpecker		
Red-winged Blackbird		
Ring-necked Pheasant		
Rock Pigeon		
Song Sparrow		
Tree Swallow		
Tufted Titmouse		
Upland Sandpiper		
White-breasted Nuthatch		
White-eyed Vireo		
Wood Thrush		
Yellow Warbler		

Table 3. Sunrise Mill Northern Hardwood forest Composition

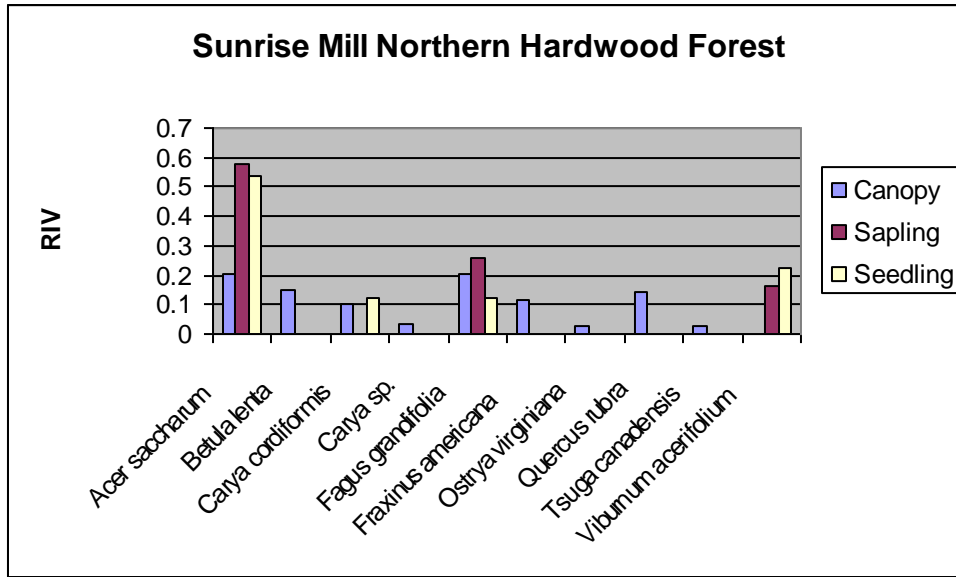


Table 4. Sunrise Mill Hemlock Forest Composition

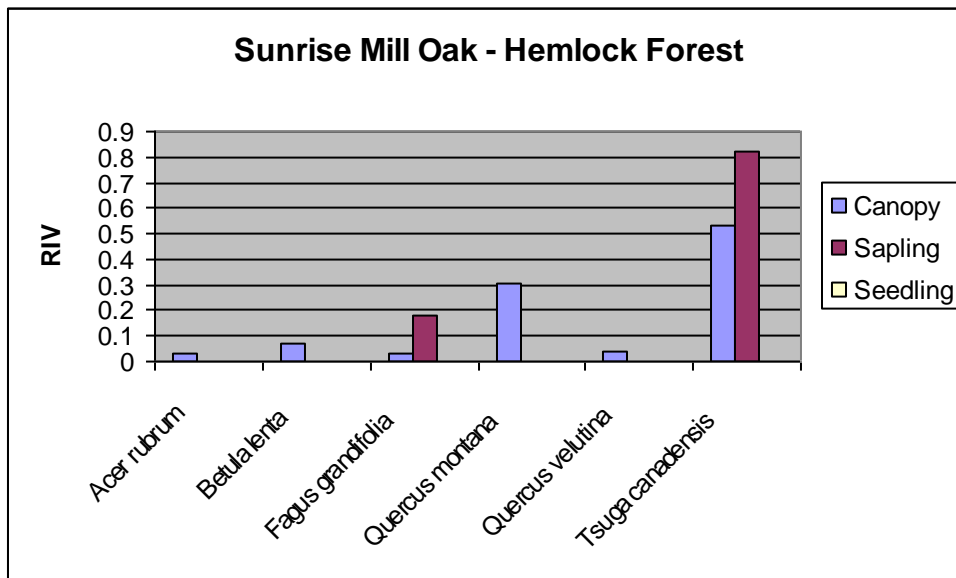


Table 5. Sunrise Mill Floodplain Terrace Composition

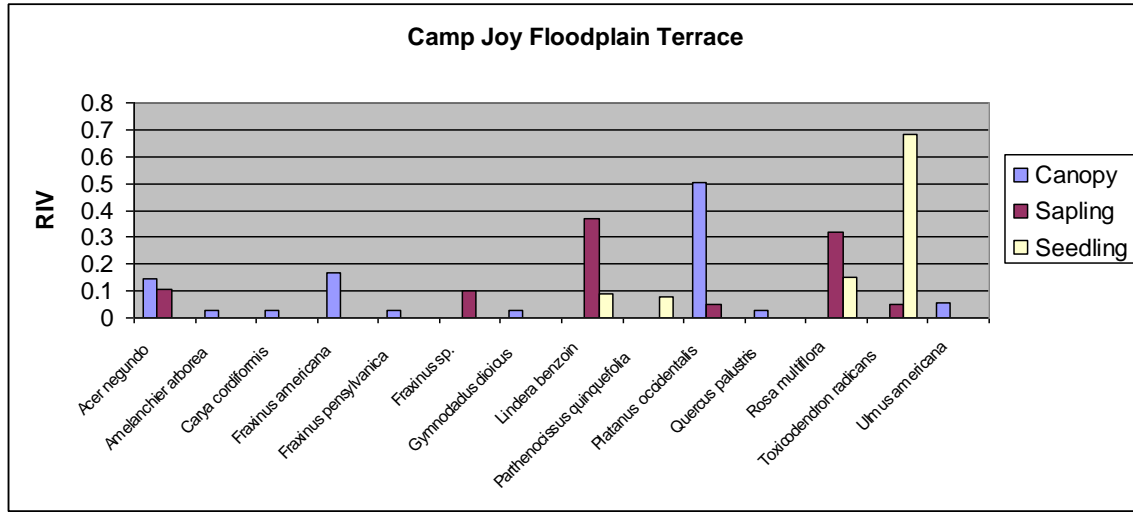


Table 6. Camp Joy Floodplain Forest Composition

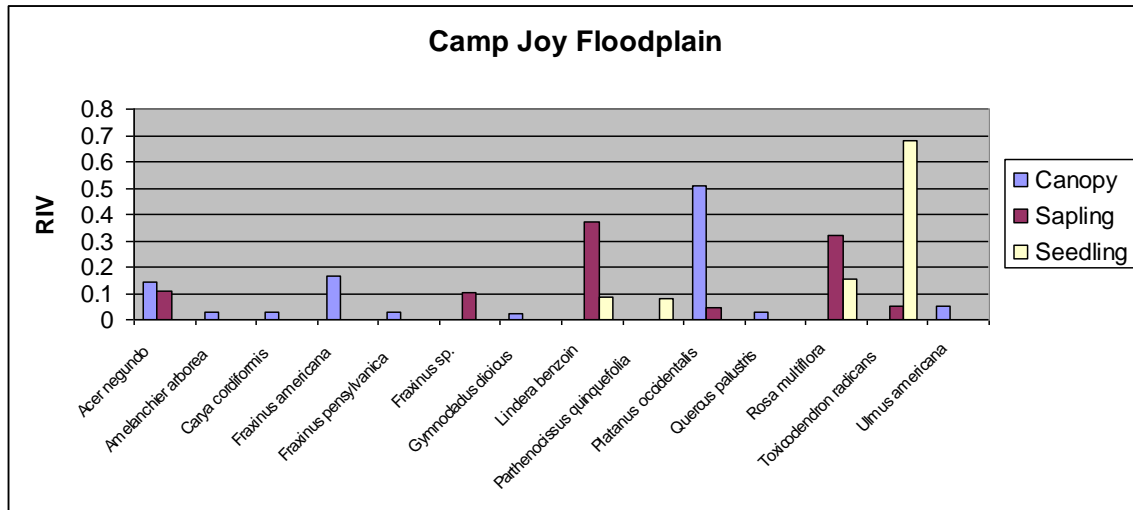


Table 7. Camp Joy Upland Forest Composition

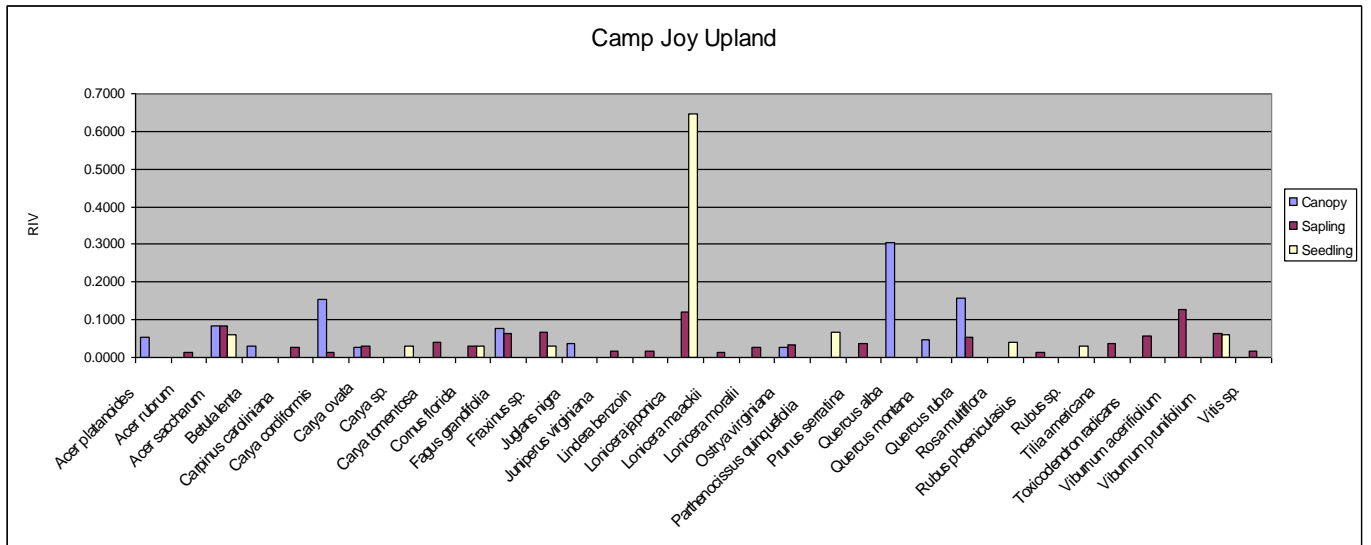


Table 8. Camp ArthuReeta Northern Hardwood Forest Composition

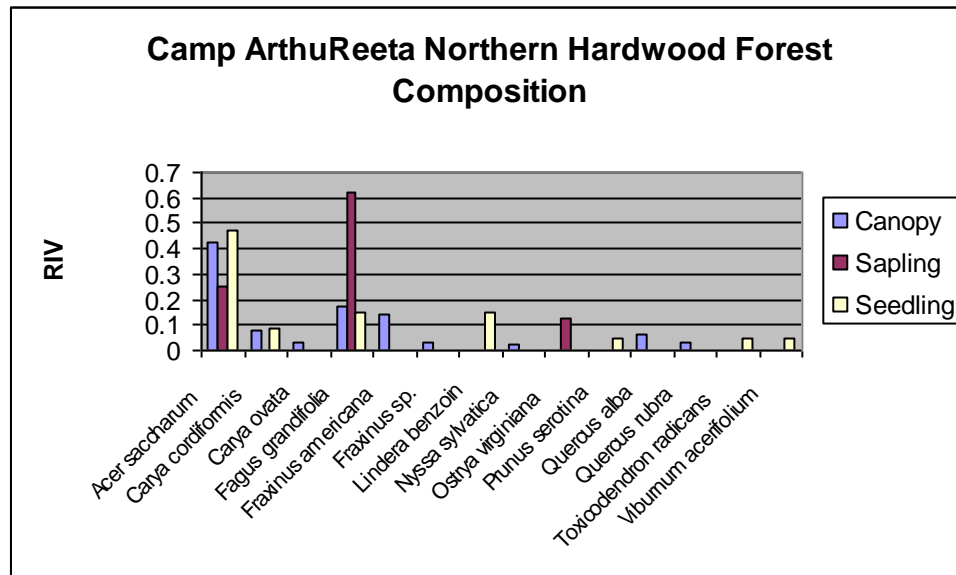


Table 9. Camp ArthuReeta Floodplain Terrace Composition

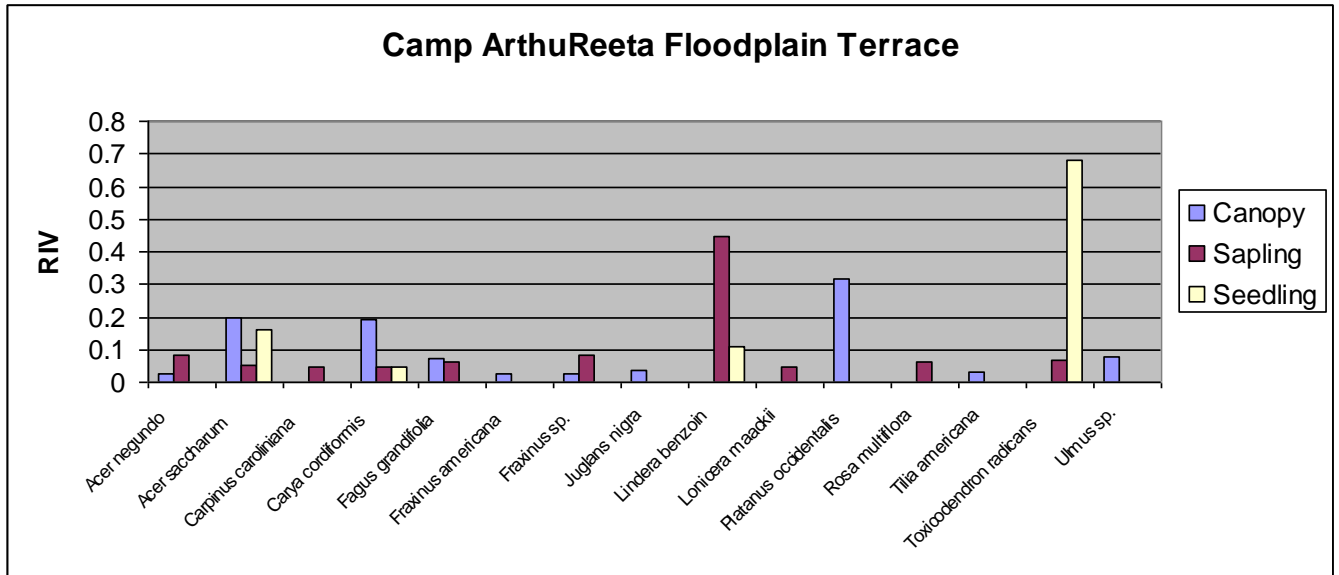


Table 10. Camp Laughing Waters Hemlock Forest Composition

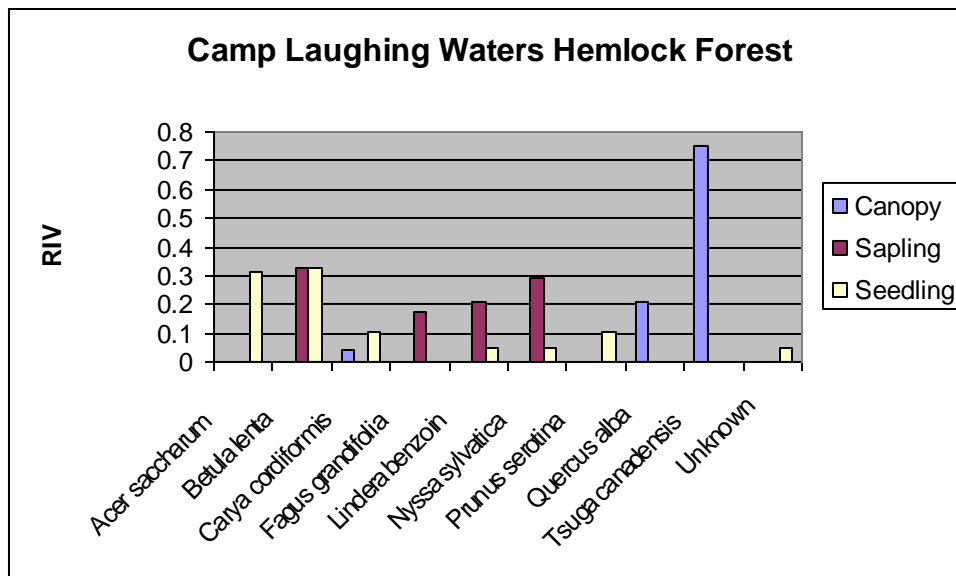


Table 11. Camp Laughing Waters Bottom-Land Oak-Hardwood Palustrine Forest Composition

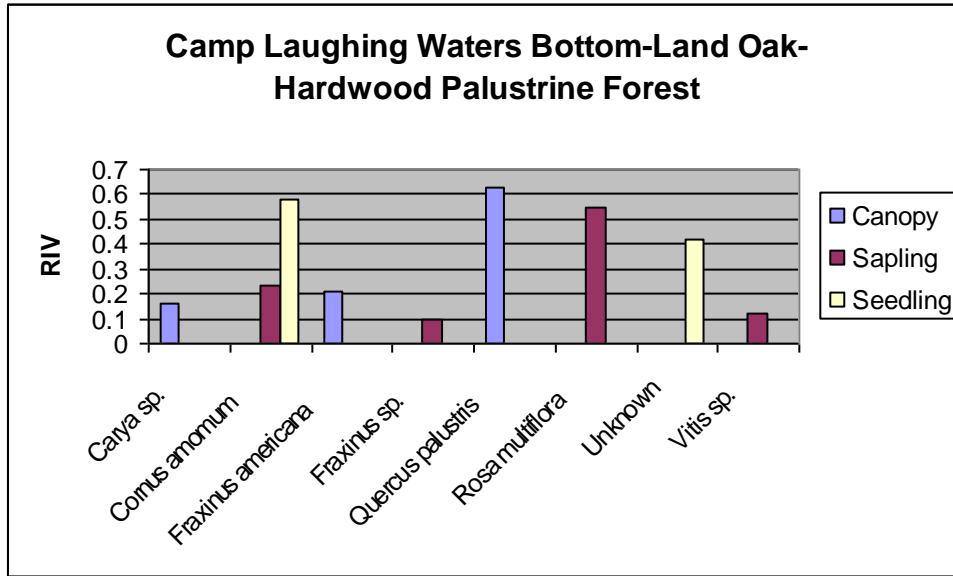


Table 12. Camp Laughing Waters Dry Oak – Mixed Hardwood Forest Composition

