Ecological Survey

of the

Forest Communities

at the

University of Vermont
Horticultural Research Center

South Burlington, Vermont

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Introduction

The University of Vermont Horticultural Research Center (Hort. Farm) is a 97-acre research facility, located in South Burlington, Vermont. While most of this facility is devoted to horticultural research, there are four small woodlots of mixed hardwood and conifer forest. These woodlots have historically been under-utilized by both the University and the public.

The objectives of this ecological survey were to inventory and map these forest communities and associated wetlands; and provide recommendations for protection, and management of these areas.

Funding for this project was provided by a grant to "The Friends of the Horticulture Farm" from the Vermont Department of Forests, Parks and Recreation Urban and Community Forestry program. Volunteers from "The Friends" assisted in field data collection and in research on the history of the property.

Project Summary

Located in the Champlain lowlands physiographic region, the Horticultural Research Center (Hort. Farm) sits on deltaic and lacustrine sediments associated with postglacial bodies of water in the Champlain basin. This flat-to-gently sloping terrain is dissected by small drainages. While no bedrock outcrops occur on the property, its mostly sandy soils are influenced by calcareous bedrock in the region.

According to Siccama (1971), presettlement forest of the Hort. Farm area fits into the "northern hardwoods-white pine" category, which contained substantially more beech than the present forest. Four small (0.6-6.0 acres) woodlots are the legacy of this presettlement forest. Each has been heavily influenced by former agricultural activities, including clearing for pasture and in some cases, cultivation. These forest communities have unique ecological characteristics. Ecologically interesting features of these forests include: woodland seeps, small ravine with alluvial terracettes, and a sand blow-out.

A total of at least 190 vascular plants occur in these forest communities, including 32 tree species, 38 shrub and vine species, and 120 groundcover species. While most are native, this flora includes a number of alien species, some of which appear to have escaped from adjacent horticultural fields.

No federally- or state-listed endangered or threatened plants or animals were observed at the Hort. Farm. However, the occupancy of butternut (*Juglans cinerea*) and spicebush (*Lindera benzoin*) at the Hort. Farm is noteworthy, the former undergoing serious decline throughout its range, and the latter being at the very northern extreme of its range.

Four small forest communities were identified and inventoried at the Hort. Farm. These include white pine-hemlock, mixed hardwood-conifer, mixed hardwood, and red oak-red maple. Total acreage for these four woodlots is 13.3 acres. Delineation of these communities was based on species composition, soils, slopes, drainage and past land-use. Within each forest community, an overstory inventory was done, and permanent vegetation plots were established and sampled.

GPS receivers were used to establish precise coordinates of the centers of each permanent plot. Photographs were taken at each plot as a reference for observing changes within each community.

Thirty-two tree species and thirty-one shrub species were identified and labelled for use in the Hort. Farm "Tree Walk" project.

Landscape Context

The Hort. Farm is located in the Champlain Valley, a major physiographic region characterized by low elevations (less than 500 feet above sea level), relatively warm climate, and calcareous soils and bedrock. Shelburne Bay, a major bay on the east side of Lake Champlain, is located approximately one mile west of the Hort. Farm.

Glaciers and their aftereffects are largely responsible for the flat to gently sloping landscape around the Hort. Farm and in the Champlain Valley lowlands in general. Sands and clays laid down in much-enlarged bodies of water occupying the post-glacial Champlain basin are especially prevalent in the region. The Hort. Farm office building and surrounding cultivated fields sit on a flat, sandy terrace at an elevation of 220 feet. This terrace, as well as the surrounding terrain, was formed from deltaic sediments laid down in the marine waters of the "Champlain Sea" during a period approximately 10,000-12,000 years ago. During this time interval, an arm of the ocean reached into the Champlain basin via the St. Lawrence Valley. Gravelly soils of a prior beach formed during a higher stage of the Champlain Sea can be found paralleling Spear Street immediately east of the Hort. Farm property. Clay, which only settles on deep lake bottoms is now the soil we see to the east of Spear Street, and underlies the sand at the Hort. Farm.

Subsequent to the postglacial high waters, three minor drainages have dissected the Hort. Farm terrace. At present these minor drainages having intermittent to very light permanent flows.

While no bedrock outcrops occur on the property, the regional bedrock geology can be sensed from boulders in the soil. Both quartzite and dolomite boulders occur, undoubtedly derived from nearby sources. The deep red quartzite, known as Monkton quartzite, is especially distinctive. Calcareous in nature, the Monkton quartzite and dolomites, as well as nearby limestones, are largely responsible for the nutrient-rich soils found at the Hort. Farm and in the Champlain basin as a whole. Given the late-glacial history of the region as described above, these boulders probably were dropped from chunks of ice floating in Lake Champlain during its expanded stage some ten thousand or more years ago. This process of deposition is call "ice-rafting".

While the landforms we see today in this area of the Champlain Valley have changed little since Lake Champlain receded to its present level several thousand years ago, the landscape we experience today has greatly changed since European settlement roughly two centuries ago. Almost all this land was cleared for agriculture, probably early during settlement period. In the last few decades, especially the last two, the area has changed from agricultural to suburban development. Currently the Hort. Farm is surrounded on all sides by either housing or commercial developments. It is quickly becoming an undeveloped patch in a matrix of developments.

Presettlement Vegetation

Thomas Siccama (1971) constructed a map of the presettlement forest types in Chittenden County based on witness trees recorded in late 18th century town line and lotting surveys. On this map most of South Burlington lies in the "northern hardwoods-white pine" forest association. This association occurred on heavier soils north and south of the sandplain pitch pine-oak forests centered around Colchester and Burlington. In this northern hardwoods-white pine association, as well as elsewhere in the county below an elevation of 2300 feet, beech accounted for 40-50% of the forest trees. This lies in sharp contrast to the present forest vegetation where beech constitutes roughly 12% of the forests.

It is important to point out that Siccama's work describes very generalized forest associations. Changing environmental conditions (e.g. soil type, slope, or moisture), over a landscape lead to sometimes distinct and very localized forest associations, or natural communities. This means particular sites must be evaluated individually. At the Hort. Farm todays pine-hemlock forest area and the flat sandy agricultural fields to the north might have been a pitch pine-oak forest, or "sandplain pine-oak-heath forest" (using the Vermont Nongame and Natural Heritage Program classification) in presettlement times. Given the heavier and sometimes wetter soils found in the other forest units at the Hort. Farm, it is likely that the presettlement forests in these areas had a stronger northern hardwoods component, with a heavy emphasis on beech. Topographic maps onto which Siccama plotted witness trees (courtesy T. Siccama) show all four corner witness trees that fall within or on the Hort. Farm boundaries as beech. These occur in the mixed hardwoods-conifer and mixed hardwoods forest units described in the present report.

Vegetation Sampling Procedures

Forest Community Flora

Within each of the four forest communities, an intensive search was conducted to identify and list all vascular plant species. This list is included in Appendix 1. One specimen from each of the tree and shrub species was tagged and labelled, to be used for educational purposes. This listing is shown in Appendix 2.. The location of each tagged specimen is shown on the Woodlands Map.

Overstory (Tree) Inventory Data

The overstory (canopy) layer was sampled using a ten factor prism (variable radius plots), to ascertain species composition, stocking and mean stand diameter. One to two trees within each site was cored to determine age, and height measurements were recorded. This data, summarized in Appendix 3, was collected to assist in evaluation of each community.

Permanent Vegetation Plots

Permanent sample plots were established in each of the plant communities to further evaluate the existing vegetation, and to be used as an education tool for observing change within each site. Plots were placed subjectively in the interior of each forest community. A metal stake was set in the ground at plot center, and a Global Position System (GPS) receiver was used to establish precise coordinates of each plot center. To visually document vegetation change over time, two photographs were take at each permanent plot (Appendix 4.) Standing at each plot center, photographs were taken facing north and south (magnetic bearing).

At each plot, groundcover, understory, and overstory vegetation was sampled. An illustration of Plot No.1 is shown in Appendix 5, to assist the reader in visualizing how the plots are laid out. Two permanent plots were established in the Mixed Hardwood-Conifer Forest (Unit 2), to represent variations in this unit. In each of the other three units, there is one plot. Data for each plot is included in Appendix 6. Procedures for each of the three subplots are as follows:

1. Groundcover Plots:
   - Vegetation sampled includes all herbaceous plants, and tree seedlings under 30 cm. tall.
   - Eight separate one meter square plots were established, located at random distances (from one meter to twelve meters), along lines radiating from plot center at 45 degree intervals (north, northeast, east, etc.). For example, the first random number chosen represented the distance, in meters, due north of the center stake, to the lower left hand corner of the plot (see Appendix 5.). The second random number was chosen to determine the distance northeast of the center stake, for the second plot. This procedure was repeated so that a total of eight sub-plots were established at each Permanent Vegetation Plot.
   - Percent cover was estimated for each species present within the 1 m^2 plot.

2. Understory Plot
   - Vegetation sampled includes all shrubs and woody plants, except tree seedlings under thirty centimeters tall.
   - Area sampled was within a four meter radius of plot center (50 m^2).
   - Percent cover was estimated for each species present within the 50 m^2 plot, segregated into 4 height categories: less than 1 meter tall, 1 to 3 meters tall, 3 to 5 meters tall, and greater than 5 meters tall.

3. Overstory Plot
   - Vegetation sampled includes all woody stems greater than 10 cm diameter at 4.5 feet above the ground (DBH).
   - Area sampled was within a 12.6 meter radius of plot center (500 m^2).
   - Each tree within the plot (above 10 cm DBH) was given a number, with tree #1 being the first tree encountered in a clockwise direction from a north bearing.
   - Numbers were painted on several trees within each plot, to assist in future measurements.
   - Data recorded for each tree include:
     -species
     -diameter (DBH)
     -Crown Position
     -Notes: brief description of health, form, condition, etc.

Forest Community Descriptions

The four principal forested areas at the Hort. Farm have different forest vegetation which might loosely be construed as distinct natural communities, or habitats. These are small forest patches, ranging from 0.6 to 6.0 acres in size, separated from each other by agricultural fields, orchards,

and meadow. While described as "natural communities", these forests are far from pristine, having been heavily impacted by past agricultural activities. The four forest communities, named for their dominant canopy types, are: pine-hemlock forest, mixed hardwood-conifer forest, mixed hardwood forest, and red oak-red maple forest. Based on field notes, vegetation plot data, and timber cruise data, the following descriptions will hopefully provide basic ecological information about these forest communities.

Pine-Hemlock Forest

Located along the south property boundary, this 4.5-acre forest consists of a narrow strip of flat to very gently sloping sandy soil terrain, with an east-west running draw, or small ravine, generally separating it from the agricultural fields to the north. This small draw, varying from 8 to 20+ feet deep, originates off the property near the southeast corner, and exits the property at the southwest corner. Three short tributary draws enter the main draw from the south while a single major tributary enters from the north. Below the confluence of the north tributary, the main draw's slopes become less steep and its bottom widens. In this lower stretch of the main draw a small terracette of alluvial soil occurs.

In the middle of this unusually dry summer (1995), the main draw lacked surface water flow. Its bottom was moist to wet, with a few small stagnant pools. A trickle flow was observed in the north tributary. Both the flats, and the draw slopes, appeared uniformly dry this summer.

The soils in this forest vary with topographic position. The flats, which lie on the same plane as the Hort. Farm office building flats, are poorly developed loamy fine sands, at least 1.5m deep. Such sandy soil is prone to drought. In contrast, the bottom of the lower main draw has less than a foot of saturated, gravelly sand over dense, gray clay. The draw slopes have a shallow layer of loamy sand covering clay. The sand depth increases going up the slope. As such, the underlying clay almost mirrors the surface in landform. The small alluvial terracette in the lower main drain bottom has loamier textured soil, probably a fine sandy loam, which lacks signs of permanent saturation.

Mature white pine and hemlock dominate the overstory on the flats. These 70-80 foot high, 55-75 year-old trees form a nearly closed canopy. Much of the pine is poorly formed (white pine weevil damage), and there is a small amount of red rot (*Fomes pini*). There is scattered beech, particularly around the perimeter of the stand. Most of the beech is infected with the beechbark disease (*Nectria coccinea*), a fungus that can cause mortality. The understory is quite open, with 1-5+m hemlock regeneration prominent. The groundcover is sparse, with star-flower (*Trientalis borealis*), Canada mayflower (*Maianthemum canadense*), and patridge-berry (*Mitchella repens*) the most common species. There is a small concentration of upland sedges at the east end of the flats. A total of 38 plant species were noted on the flats.

With its saturated soils, the draw bottom is dominated by wetland species, primarily ferns (*Onoclea sensibilis, Osmunda cinamomea, and Matteucica struthiopteris*) and touch-me-not (*Impatiens capensis*). Considering how luxuriantly vegetated wetlands can be, this draw bottom is rather sparsely vegetated. The dense hemlock and birch (yellow and black) shade might be responsible for the general dearth of groundcover. Likewise, there is little shrubcover. The exception to this lack of vegetation occurs at the mouth of the north tributary where a

combination of canopy opening and rich, alluvial soil produces flush of vegetation. Interestingly, there is a thicket of sugar maple regeneration here. A total of 36 plant species were observed in this draw bottom.

The slopes of the main draw have a heavy canopy of hemlock, white pine, and yellow and black birch. The understory is poorly developed for the most part, with hardwood regeneration and witch-hazel the most notable. The slopes have sparse groundcover for the most part. Ferns, primarily *Thelypteris phagopteris, Dryopteris intermedia, and Thelypteris noveboracensis* are concentrated along the lower slopes, presumably because of increased moisture and nutrient status. Because of its steep, elevation position, the upper slopes have patches of mineral soil exposed. With a total of 53 plant species, the slopes have the highest plant diversity in this pine-hemlock forest.

While not fully explored, the disturbance history of this forest includes at least a heavy logging, and possibly pasturing and/or cultivation. Scattered, well-rotted, conifer stumps up to 60cm in diameter, are evidence of logging many (50?) years ago. The uniformity in canopy tree size, combined with the lack of dead wood (especially logs of different ages) suggest that the forest grew from a cleared condition.

Potential streamflow in the main draw is influenced by several disturbances. In the upper main draw there are two crossings. Near the head of this draw is a sand-fill crossing lacking a culvert. Located a short distance down the draw, the second sand-fill crossing is larger and breached. The water flow in the lower main draw is affected by the three impoundments on the north tributary.

Mixed Hardwood-Conifer Forest

Located in the southeast corner of the Hort Farm, this 6.0 acre forest lies on a smooth, west-facing slope with a very gentle gradient. The lower portion of the slope has several short and shallow (roughly 1 meter deep) swales which drain to the west.

This forest has a mull soil whose texture varies from a fine sandy loam or loamy fine sand on the upper slope, to a loamier textured loam or silt loam on the lower slope. A mull soil is a fertile soil characterized by rapid leaf litter decomposition, i.e. where each year's leaf litter is essentially composted by the next growing season. Hence, exposed mineral soil is not uncommon during the growing season. Clay underlies these soils at a depth of less than one meter. This dense clay likely produces an elevated water table, and is responsible for giving this forest its mesic character.

The vegetation of this forest is not uniform. In general terms there is more of a hardwood mix to the south and east in this unit, while pine and hemlock gain importance to the north and west. There are several distinct groves of trees in this forest, including a quarter-acre of closed-canopy poplar in the southwest corner, and small groups of mature hemlock at the north end of the forest. Open-grown white pine occur along the north boundary of the forest. The canopy is from 55 ft. to 80 ft. tall, and 50-75 years old.

The moderate amount of understory of this forest is largely composed of tree saplings, with a scattering of low- to moderate-sized shrubs, such as prickly gooseberry (*Ribes cynosbati*),

viburnums (*Viburnum* spp.), and dogwoods (*Cornus* spp.). Sugar maple, hemlock, bitternut hickory and birch (yellow and/or black), are the most common sapling types.

The groundcover is generally not heavy in this forest. Partridgeberrry (*Mitchella repens*) is abundant, and jack-in-the-pulpit (*Arisaema triphylla*), star-flower (*Trientalis borealis*), and enchanter's nightshade (*Circaea quadrisulcata*) occasional to common. Ferns, notably sensitive fern (*Onoclea sensibilis*) and lady fern (*Athyrium felix-femina*) are prevalent on the lower slope, including some of the swales. Surprisingly, shaded swales in the northwest portion of the forest were essentially devoid of herbs, ferns, or graminoids. The dearth of herbs underneath the mature hemlock in the upland portion of this same area is not surprising given the renowned shading capabilities of hemlock.

All evidence points to this forest unit being open field or pasture around the turn-of-the-century. The forest is generally youthful in character, lacking the age/size diversity typical of old forest. Ring counts of recently cut white ash, roughly 60 cm in diameter, show that the more mature canopy trees in this forest are approximately 80 years old. Likewise, there is a lack of diversity in dead wood, standing or on the ground. Branches and formerly suppressed trees (<20 cm d.b.h.) are the primary types of the dead wood. Except for a couple recently cut white ash, there are no cut stumps from logging. Finally, soil characteristics indicate that the area was formerly plowed. Not only is there what appears to be a plow horizon, but also there is a lack of pit and mound microtopography. Indicative of unplowed terrain, pit and mounds occur when trees are windthrown, a common ecological process in forests.

Presently there are a couple small forest openings in the northwest corner where a couple standing dead canopy trees are overgrown with vines, especially climbing bittersweet (*Celastrus scandens*). Of unknown origin, these openings appear in the 1942 aerial photographs.

Mixed Hardwood Forest

Located north of East Meadow, this 2.2 acre forest occupies the same landscape position and character as the mixed hardwood-conifer forest. Notable features of this forest include the hillock in the southwest quarter with a long east-west axis, and the depositional end of a swale/drainage ditch located in the northeast corner. This forest lacks swales on its lower slope.

It is interesting that the soil survey (Soil Conservation Service, 1989) shows a "blown-out land" area to the north of the hillock, suggesting the hillock might be a dune. Blown-out land occurs where winds shift sandy soil exposed by clearing for agriculture. A piece of evidence to look for to confirm such a feature is wind-sand polished pebbles on the soil surface in the blown-out area (not the dune). Puzzling aspects of this blow-out to consider are: 1. Dune orientation (suggesting a north to northwest prevailing wind), and 2. Dune age (Did it form only from recent events?).

The soil in this forest consists of loamy fine sand and fine sandy loams down to a depth of 1+ meters. The finer textured soil occurs to the north end, which might in part be due to alluvium from the drainage emptying out in the northeast corner. A plow horizon does not occur on the dune, and is not clearly distinguished in other parts of the forest. Mottling 40-65 cm down shows that there is a seasonal high water table in some areas.

There are essentially no conifers in this forest, in the canopy or understory, expect for one small clump (4-5 trees) of hemlock near the southwest corner. The overstory varies from a hardwood mix in the southeast, composed of maturing (ca. 40 cm d.b.h.) bitternut hickory, basswood, black cherry, butternut and sugar maple; to nearly pure, young (5-30 cm d.b.h.) sugar maple to the north. A grove of mature (20-40 cm d.b.h., 70 ft. high) black locust is restricted to the southwest corner of the forest. There are three or four large (ca. 60 cm d.b.h.), open-grown sugar maple on the west side.

The understory in most of this forest is overwhelmingly dominated by sugar maple saplings, 1-5+ meters in height. There is no black locust regeneration. Except for the southeast corner and along the western margin, most of the forest has a very sparse groundcover during the summer. In the spring, however, trout lily (*Erythronium americanum*) is abundant throughout and large-flowered (white) trillium (*Trillium grandiflorum*) occurs in scattered patches. The southeast corner is unique not only for its impressive displays of large-flowered trillium, but also for its diversity of herbs and sedges, including several rich woods indicators, such as wild ginger (*Asarum canadense*) and early meadowrue (*Thallictrum dioicum*). These species do not occur elsewhere on the Hort. Farm.

As mentioned above in the discussion of blown-out land, this forest area was undoubtedly cleared for agriculture less than a century ago. As described for the mixed hardwoods-conifer forest, both forest structure (youthful) and soil characteristics indicate clearing and probable plowing. Of unknown origin, a small clearing in this forest unit is shown in the 1942 aerial photographs. This might or might not correlate to a present-day small clearing at the east end of the dune. Another tidbit of evidence for past ecological process is the charcoal bits found on and just under the soil surface on top of the dune. More sleuth work in the field might reveal a cause for this former fire.

Another feature of ecological interest in this hardwoods forest is the dead wood in the northeast part of the unit. Having cast off bark and large limbs, or fallen altogether, moderate-to-large American elm snags occur in this area. They probably succumbed to the Dutch elm disease ten or more years ago. Note that these trees, which appear to have grown in open conditions, are being replaced by sugar maple and other hardwoods, not elms. These dead elms might also be site indicators. American elms frequently grow in very moist, or even wet, soils. It just so happens that a small drainage from the east, visible on the 1942 photographs, empties into this area. This drainage likely increases moisture and delivers fresh alluvium, both conditions favorable for elms and box elder.

Red Oak- Red Maple Forest

This wooded area, located immediately north of the big equipment shed along the north property boundary, is so small (0.6-acre) that it can hardly be called a forest. Its vegetation, including the adjacent wetlands, is quite different. It lies on the same gentle, west-facing slope as the two preceding forest units. Unique to this unit are the two very short seepage swales which empty into a significantly larger, semi-alluvial wetland.

Like the other forest communities, the upland soil here is composed of loamy fine sands to a depth of 1+ meter. Even in this summers droughty conditions, the sands became noticeably wet about one meter down, indicating an elevated water table. In contrast, the soil in the seepage

swale has a thin layer of black muck overlying saturated medium sand, first reduced, or gleyed (gray-colored), then oxidized (orange). In the primary drainage on the west side of this unit, the wetland soil has a very thin layer of alluvial sand covering a 20cm-thick muck layer, which in turn overlies sand with some silt.

The upland vegetation is characterized by a overstory of large red oak on the east half and mature red maple on the west half, and along the east side of the alluvial wetland. The understory is very open, having scattered clumps of saplings and a few shrubs, such as common buckthorn (*Rhamnus cathartica*) and alternate-leaved dogwood (*Cornus alternifolia*). The striking feature of this areas vegetation is the dense fern cover. Bracken fern (*Pteridium aquilinum*), hay-scented fern (*Dennstaedtia punctilobula*), sensitive fern (*Onoclea sensibilis*), lady fern (*Athyrium felix-femina*), interrupted fern (*Osmunda claytoni*), and cinnamon fern (*Osmunda cinamomea*) all occur here in abundance. A quick glance at the permanent vegetation plot data shows that the groundcover species diversity in this upland area is clearly greater than in comparable areas in the other units. Adding to the diversity are the many weedy species that occur around the units edges.

In contrast to the other units, the seepage draws in this unit are luxuriantly vegetated with a diverse mix of fern, sedges, graminoids, and herbs. The dominant species is a sedge (*Carex scabrata*) which is highly characteristic of forest seeps. The partially shaded larger wetland has an even greater diversity of plants, including quite an array of grasses and sedges. Speckled alder (*Alnus rugosa*) forms a light canopy near the pond to the south.

The land use history of this unit is probably different than the other units. Although impressive in their own right, the large red oaks are 75-85 years old. The simple fact that several have multiple trunks suggest that they originated from stump sprouts. While this forest has undoubtedly been cut, it appears as though the soil was not cultivated. The plant composition and diversity suggests this. Furthermore, from a farmer's point of view, this unit is like a small island, hence not worth cultivating. It is bounded on two sides by wetland drainages, and on another side (to the north) is a property boundary. In the 1940's, and perhaps more recently, a much more extensive forest extended to the north of this unit. Presently a housing development occupies this former forest.

Rare and Uncommon Plants and Animals

Given its fragmented and disturbed nature, the Hort. Farm is not a likely location for rare, threatened or endangered species. No federally- or state-listed endangered or threatened plants or animals were observed at the Hort. Farm. Furthermore, the Vermont Nongame and Natural Heritage Program, which tracks these species, has no record for rare species at the site. There are, however, a couple plants of special note.

Butternut (*Juglans cinerea*) is under consideration (Category 2) for federal listing under the Endangered Species Act. Although a widespread tree in eastern United States, butternut has undergone serious decline in the last 10-15 years due to die-back caused by a fungal pathogen known as butternut canker *(Sirococcus clavigignenti-juglandacearum*). The butternut at the Hort. Farm, which appear healthy, should be evaluated for potential disease resistance. See Ostry, et al (1994) for more information on the disease and management guidelines.

The other plant of note is spicebush (*Lindera benzoin*). This species reaches its northern limit in Vermont, occurring only occasionally in southern Vermont and rarely in northern Vermont. The lone plant found in permanent plot #2 might be the very northern-most individual in Vermont.

Perhaps the best chance for a rare species would be an invertebrate. Invertebrates were not inventoried in our work.

Management Recommendations

We believe these forest communities have inherent educational and recreational values as "natural areas", for both the university community and the public. Given the quality and small size of these woodlands, we do not feel these are appropriate sites for vegetation manipulation, e.g. timber harvesting, experimental plantings. We do not recommend any type of interference in natural processes, except for safety considerations or for trail clearing.

Recommendations for continued research and monitoring are listed below:

1. The Flora list (Appendix 1.) is probably not 100% complete. Continued search of species in the woodlots, along water courses and around ponds is encouraged.
2. Selection of some tree and shrub specimens for labelling was based on proximity to proposed Tree Walk trail. There may be more appropriate or impressive individuals elsewhere on the property.
3. Consider sources of streams and drainages, and how they may effect Hort. Farm wetlands.
4. Minimize foot traffic in southeast corner of Unit No. 3, where there is a high diversity of herbs and sedges.
5. Recommend continued monitoring of butternut health, as most individuals appear to be free of the butternut canker and may be genetically resistant to this disease. Contact with UVM forest pathologist (Dr. Dale Bergdhal) is suggested.
6. Encourage more thorough research of Hort. Farm land use history, including past ownership.
7. Discontinue stump/slash dump on north bank of stream, at west of Unit No. 1.
8. Exotic (non-native) plant species occur in the woodlots, and will continue to invade these areas. We do not feel that control measures are necessary, as many of these exotic species will disappear as the forest matures. For example, the mature black locust in Unit No. 3 shows no signs of regeneration.
9. Recommend re-sampling of permanent vegetation plots every 3-5 years.
10. Trail system might be expanded to include Unit. No. 1. The vegetation in this unit is quite different from other units.

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Appendix 1. Flora of the Forest Communities

This flora contains a list of 190 vascular plant species noted during the 1995 ecological inventory of the forested areas at the Hort. Farm. It does not include species found in the fields, ponds (aquatic or shoreline), or in the drainages not associated with the forested areas. Nor does this list include planted, horticultural varieties.

The list is divided by broad physiognomic types: groundcover species, shrubs and vines, and trees. It is organized alphabetically by scientific name. Species' notes include: general description of abundance (rare, uncommon, occasional, common, abundant), specific locations and habitats, and number of unit (=forest community - see map) in which species occurs. Other than a few sedges, this list is not vouchered with plant specimens. Names in parentheses are those not positively identified. Genus name followed by "sp." refers to species not identified.

GROUNDCOVER SPECIES

(Acalypha rhomboidea) - uncommon in perm. plot #3, unit 2.
Actaea rubra - uncommon (2,3)
Agrimonia sp. - uncommon. Draw bottom of 1. Also in 2.
Agropyron repens - uncommon in 4 wetland.
Agrostis sp. - 4 wetland
Amphicarpa bracteata - locally common along upper draw in 1.
Anemone quinquefolia - uncommon (3)
Apocynum androsimaefolium - occasional in 4.
Aralia nudicaulis - occasional (1)
Arisaema triphyllum - common (1,2,3)
Asarum canadense - rare. SE corner of 3.
Aster divaricatus - occasional (1,2,3)
Aster puniceus - occasional, draw bottom
Aster sp. *(simplex?)* - uncommon. Draw bottom at 1 & 4.
Athyrium felix-femina - common (1,2,3,4)
Athyrium thelypteroides - uncommon. Slopes of draw in 1.
Bidens (frondosa) - 4 wetland.
Caltha palustris - occasional in 4 wetland
Cardamine pensylvanica - uncommon. Draw bottom in 1.
Carex arctata - occasional (1,2)
C. blanda - uncommon. SE corner 2.
C. bromoides - uncommon. Wetlands of 4.
C. communis - occasional (1,2)
C. comosa - uncommon in 4 wetland.
C. crinata - uncommon. SE corner 2. Draw bottom in 1.

Appendix 1. (cont.)

C. cristatella - uncommon in 4 wetland.
C. deweyana - occasional (1,2,3)
C. digitalis - occasional (1)
C. gracillima - occasional (1,2,3,4)
C. intumescens - occasional (3)
C. (lurida) - uncommon. Draw bottom of 1 & 4.
C. pallescens - uncommon (1)
C. pedunculata - uncommon (1)
C. pensylvanica - occasional (1,2,3). Locally forming mat or _lawn".
C. prasina - occasional in 4 wetland.
C. projecta - uncommon in draw bottom
C. rosea - uncommon (1,2,3)
C. scabrata - locally abundant in drainage at 4.
C. stipata - uncommon (1,4). Draw bottoms.
C. tenera - occasional s. edge of 3.
C. virescens - occasional (1,3)
C. vulpinoidea - uncommon. SE corner of 2.
C. (laxiflora) - uncommon (1,3)
Caulophyllum thalictroides - uncommon (2)
Chelone glabra - uncommon. Draw bottom in 1 & 4.
Circaea (quadrisulcata) - common (1,2,3,4)
Clintonia borealis - uncommon (4)
Cystoperis fragilis - rare. Mossy bank of draw tributary.
Dactylis glomerata - uncommon edge of 4.
Dauca carota - uncommon (4)
Dennstaedia punctiloba - occasional (1,4)
Diervilla lonicera - uncommon (1,4)
Dulchimara sp. - occasional (1,2,4) Wet areas, especially in shady drainages.
Dryopteris carthusiana - uncommon (2,4)
Dryopteris intermedia - uncommon (2)
D. marginalis - uncommon (2)
Epilobium sp. - uncommon in 4 wetland.
Epifagus virginiana -- uncommon (1)
Epipactis helleborine - uncommon (1,4)
Equisetum arvense - uncommon (1)
Erigeron sp. - occasional in 4 wetland.
Erythronium americanum - occasional (2)
Festuca obtusa - uncommon (4)
Fragaria sp. - uncommon (2)
Galium sp. - occasional in 4 wetland.
Geum canadense - common in 2.
Geum rivale - occasional (2)

Appendix 1. (cont.)

Glyceria grandis - common in wetland at 4.
Glyceria striata - occasional (1,2,4). Wet areas, especially in shady drainages.
Gymnocarpium dryopteris - uncommon (1)
Hypericum (punctiloba) - uncommon (2)
Impatiens capensis - common (1,2,4). Wet areas, especially in shady drainages.
Juncus effusus - occasional in 4 wetland.
Leersia oryzoides - uncommon. Draw bottom of 1.
Leersia (virginicus) - uncommon. Lower section of draw at 1.
Lycopodium dedroidium - uncommon (4)
Lysimachia quadrifolia - uncommon (1,4)
Maianthemum canadense - occasional (2,3,4)
Matteuccia struthiopteris - occasional (1,2,3). Wet woods; draw bottoms. NE corner of 3.
Medeola virginiana - occasional (1)
Mitchella repens - abundant (1,2)
Monotropa uniflora - uncommon (1)
Onoclea sensibilis - common (1,2,3,4). Wet woods; draw bottoms.
Oryzopsis asperifolia - uncommon (3)
Osmunda cinnamomea - occasional (1,2). Wet woods; draw bottoms. Common in 4.
Osmunda claytoniana - occasional (2,3). Wet woods; draw bottoms.
O. regalis - occasional in 4 wetland. Rare in 2.
Oxalis sp. - uncommon (1)
Panax trifolius - localized in 4.
Phalaris arundinacea - uncommon. Draw bottom of 1& 4.
Phleum pratense - uncommon (4)
Pilea pumila - locally abundant in draw bottom of 1.
Poa palustris - occasional in 4 wetland.
Poa pratensis - uncommon (1,4)
Polygonatum pubescens - occasional (1)
Polygonum arifolium - 4 wetland.
Polypodium virginianum - rare. Slope of draw in 1.
Polystichum acrosticoides - occassional (1,2,3)
Prenanthes sp. - uncommon (2,3)
Pteridium aquilinum - common in 4.
Pyrola secunda - uncommon. Perm. plot #2, unit 2.
Scirpus sp. - 4 wetland
Smilacina racemosa - occasional (2,3)
Solidago caesia - uncommon (1,2,3)
Solidago rugosa - uncommon (1,4)
Taraxacum officinale - occasional (1,2)
Thalictrum dioicum - uncommon (1,3). Best in SE corner of 3.
Thallictrum polygamum - uncommon (1)
Thelypteris noveboracensis - occasional (1,4)

Appendix 1. (cont.)

Tiarella cordifolia - rare (2)
Trientalis borealis - common (1,2)
Trillium grandiflorum - common in 2. Rare on draw slope in 1.
Trillium undulatum - uncommon (4)
Tussilago farfara - uncommon (2)
Urtica sp. - 4 wetland
Uvularia sessilifolia - occasional (3,4)
Veronica officinalis - occasional (1,2)
Viola conspersa - rare (2)
V. pubescens - occasional (3)
V. sororia - occasional (3)

Appendix 1. (cont.)

SHRUBS & VINES

Alnus rugosa - (1,4) wetlands
Berberbis sp. -
Celastrus scandans - occasional (2,4)
Cornus alternifolia - uncommon (2,3,4)
C. (racemosa) - uncommon (2)
C. rugosa - rare (2)
C. stolonifera - uncommon (1)
Hamamelis virginiana - uncommon (1,4)
Hydrangea sp. - occasional in 2
Ilex verticillata - rare (4)
Juniperus (virginiana) - rare (4)
Ligusticum sp. - uncommon (2)
Lindera benzoin - rare. Permanent plot #2, unit 2.
Lonicera canadensis - uncommon (4)
Lonicera sp. (alien) - occasional (1,2)
Parthenocissus quinquefolia - (1, 2,3)
Prunus virginiana - occsasional (1,2,3,4)
Rhamnus cathartica - occasional (1,2,3,4). Especially abundant along E. property boundary.
R. frangula - uncommon (1)
Rhus typhina -
R. aromatica - rare.
Ribes cynosbati - occasional (2,3)
R. (sativum?) - in draw, sw corner of 2.
Rosa sp. - uncommon (4)
Rubus alleghaniensis - 2
R. idaeus - uncommon (1,4)
R. occidentalis - uncommon (2)
R. odoratus - occasional (1,2, 3). Especially along forest edges.
Sambucus canadensis -
Sambucus pubens - uncommon (1,2)
Taxus canadensis - rare. One patch above N. branch jct., unit 1.
Toxicodendron radicans - common (2)
Viburnum acerifolium - uncommon (4)
Viburnum alnifolium - rare (4)
V. lentago - uncommon (4)
Viburnum (recognitum) - mixed in with Hydrangea near sw corner of 2.
V. trilobum - mixed in with Hydrangea near sw corner of 2.
Vitus sp. - occasional (2,3,4)

Appendix 1. (cont.)

TREES

Acer negundo - uncommon: NE corner of 3 and wetland W side unit 4
A. pensylvanica - uncommon 1
A. rubrum - common in 4; occasional in unit 1 draw; probably occurs in 2 & 3
A. saccharinum - rare (single saping) in bottom of draw, unit 1
A. saccharum - abundant (3); common (2); occasional in draw (1)
Amelanchier arborea - uncommon in 4; probably occurs elsewhere
Betula alleghaniensis - occasional, especially in draws
B. lenta - occasional (1,2,3)
B. papyrifera - occasional all units
B. populifolia - uncommon (2?)
Carya cordiformis - occasional to common (2,3)
C. ovata - uncommon in 2
Crataegus sp. - uncommon in 2
Fagus grandifolia - uncommon to occasional (1,2,3)
Fraxinus americana - occasional (1,4) to common (2,3). Mature trees in poor health.
Juglans cinerea - occasional (2,3); rare in 1. Healthy.
Malus sp. - uncommon in 2 (and 3?). Non-native
Ostrya virginia - occasional (2,3)
Pinus resinosa - rare. Single mature tree in 1 (died in late 1995)
P. strobus - common in 1 and 2 only
Populus deltoides - single large individual in draw of 1
P. grandidentata - uncommon in 1 and 2
P. tremuloides - occasional in 2
Prunus pensylvanica - uncommon (3?)
P. serotina - occasional in 2 and 3
Quercus alba - rare. One small tree in 4
Q. rubra - common in 4; uncommon in other units
Robinia pseudo-acacia - stand of mature trees in SW corner of 3
Thuja occidentalis - few young trees N. edge of 1 at dam
Tilia americana - occasional to common in 2 and 3
Tsuga canadensis - common in 1; occasional in 2
Ulmus americana - many large snags in NE of 3; scattered saplings in wet soils of all units

Appendix 2. Labelled Tree and Shrub Specimens

Trees

Map No.	Species
1	Silver Maple (Acer saccharinum)
2	Red Pine (Pinus resinosa)
3	Northern White Cedar (Thuja occidentalis)
4	Quaking Aspen (Populus tremuloides)
5	Yellow Birch (Betula alleghaniensis)
6	Shagbark Hickory (Carya ovata)
7	Basswood (Tilia americana)
8	Red Oak (Quercus rubra)
9	Black Birch (Betula lenta)
10	Red Maple (Acer rubrum)
11	White Pine (Pinus strobus)
12	Hophornbeam (Ostrya virginiana)
13	Bitternut Hickory (Carya cordiformis)
14	Butternut (Juglans cinerea)
15	American Beech (Fagus grandifolia)
16	Black Cherry (Prunus serotina)
17	Hawthorn (Crataegus spp.)
18	Black Locust (Robinia pseudoacacia)
19	Sugar Maple (Acer saccharum)
20	American Elm (Ulmus americana)
21	White Ash (Fraxinus americana)
22	Paper Birch (Betula papyrifera)
23	Apple (Malus spp.)
24	Boxelder (Acer negundo)
25	Pin Cherry (Prunus pennsylvanica)
26	Serviceberry (Amelanchier arborea)
27	White Oak (Quercus alba)
28	Gray Birch (Betula populifolia)
29	Eastern Cottonwood (Populus deltoides)
30	Bigtooth Aspen (Populus grandidentata)
31	Striped Maple (Acer pennsylvanicum)
32	Eastern Hemlock (Tsuga canadensis)

Shrubs

Map Letter	Species
A	Canadian Yew (Taxus canadensis)
B	Choke Cherry (Prunus virginiana)
C	Alternate-leaved Dogwood (Cornus alternafolia)
D	Prickly Gooseberry (Ribes cynosbati)
E	Buckthorn (Rhamnus frangula)

Shrubs (cont.)

F	Common Buckthorn (Rhamnus carthartica)
G	Barberry (Berberis sp.)
H	Hydrangea (Hydrangea sp.)
I	Blackberry (Rubus allegheniensis)
J	Arrowwood (Vibirnum recognitum)
K	Honeysuckle (Lonicera sp.)
L	Spicebush (Lindera benzoin)
M	Purple Flowering Raspberry (Rubus odoratus)
N	Red Elderberry (Sambucus pubens)
O	Climbing Bittersweet (Celastrus scandens)
P	Privet (Ligustrum sp.)
Q	Black Raspberry (Rubus occidentalis)
R	Staghorn Sumac (Rhus typhina)
S	Panicled Dogwood (Cornus racemosa)
T	Rose (Rosa sp.)
U	Black Elderberry (Sambucus canadensis)
V	Winterberry (Ilex verticilata)
W	Red Raspberry (Rubus idaeus)
X	Mountain Ash (Sorbus americana)
Y	Red Cedar (Juniperus virginiana)
Z	Red Osier Dogwood (Cornus stolonifera)
AA	Maple-leaf Viburnum (Viburnum acerifolium)
BB	Canada Honeysuckle (Lonicera canadensis)
CC	Witch Hazel (Hamamelis virginia)
DD	Hobblebush (Viburnum alnifolium)
EE	Fragrant Sumac (Rhus aromatica)

Appendix 3. Overstory Inventory Data

Unit 1: White Pine-Hemlock Forest

Size: 4.5 acres
Age of Overstory: 55-75 years
Canopy Height: 75-85 feet
Stocking: 188 Ft^2/acre (basal area)
255 trees/acre
Mean Stand Diameter: 11.6 inches DBH

Species Composition (% of stems):				
Hemlock	36%	Beech	3
W. Pine	21	R. Oak	3
R. Maple	21	S. Maple	2
B. Birch	7	Y. Birch	1
P. Birch	6		

Unit 2: Mixed Hardwood-Conifer Forest

Size: 6.0 acres
Age of Overstory: 50-75 years (some trees may be older)
Canopy Height: 55-80 feet
Stocking: 170 Ft^2/acre (basal area)
330 trees/acre
Mean Stand Diameter: 9.7 inches DBH

Species Composition (% of stems):				
W. Pine	40%	B. Birch	3
Hemlock	19	R. Oak	2
P. Birch	12	B. Locust	1
Q. Aspen	6	R. Oak	1
Butternut	5	Ostrya	1
S. Maple	5	W. Ash	1
R. Maple	3	S. Hickory	1

Appendix 3. (cont.)

Unit 3: Mixed Hardwood Forest

Size: 2.2 acres
Age of Overstory: 50-60 years (some trees may be older)
Canopy Height: 65-75 feet
Stocking: 105 Ft^2/acre (basal area)
200 trees/acre
Mean Stand Diameter: 9.8 inches DBH

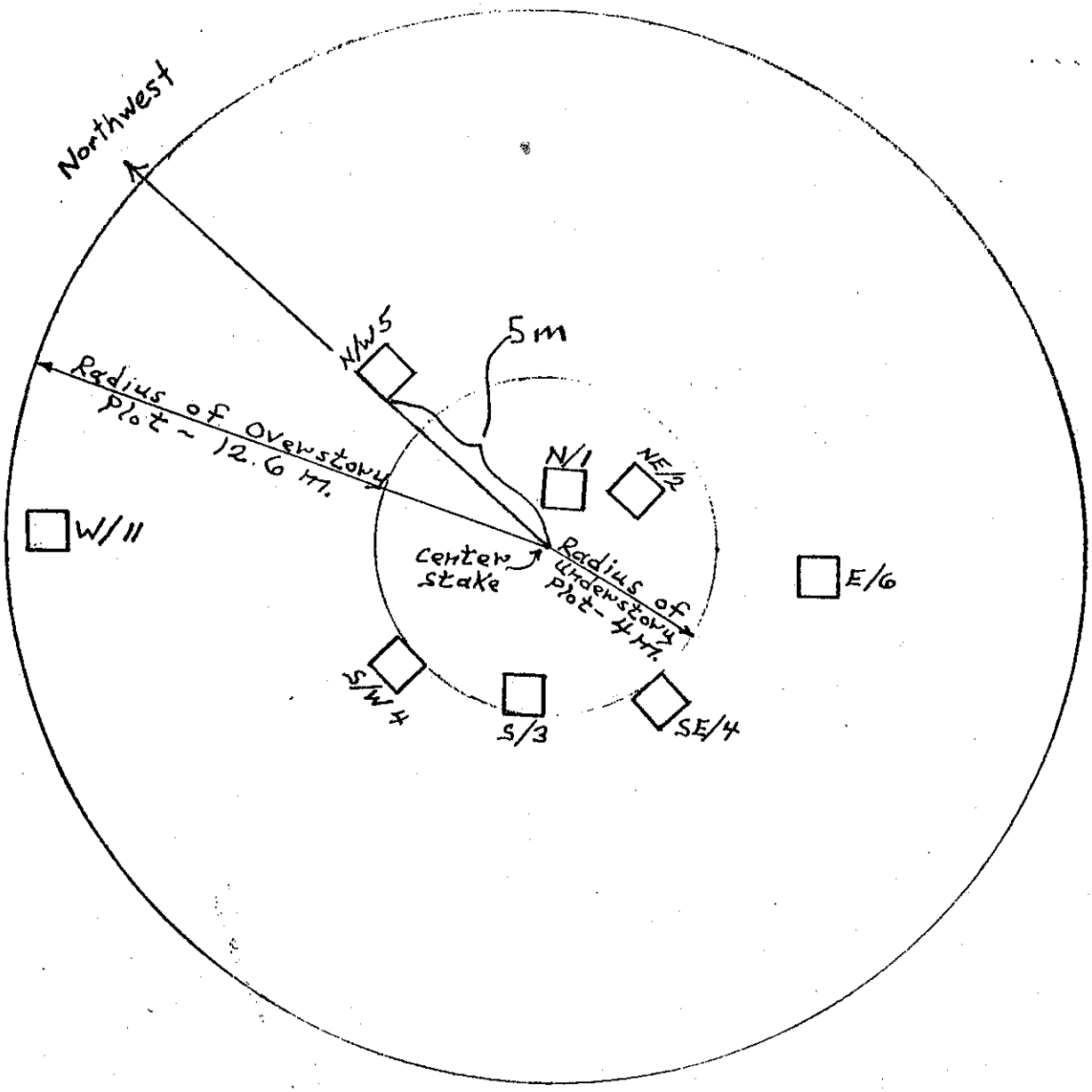
Species Composition (% of stems):				
S. Maple	47%	B. Birch	2
B. Locust	27	B. Cherry	2
P. Birch	10	Hemlock	1
R. Maple	8	Butternut	1
W. Ash	3		

Unit 4 : Red Oak-Red Maple Forest

Size: 0.6 acres
Age of Overstory: 50-85 years (some trees may be older)
Canopy Height: 70-85 feet
Stocking: 200 Ft^2/acre (basal area)
280 trees/acre
Mean Stand Diameter: 11.4 inches DBH

Species Composition (% of stems):	
R. Maple	78%
R. Oak	14
B. Cherry	4
P. Birch	4

Appendix No. 5. Illustration of Permanent Vegetation Plot No. 1



Scale of Diagram: 1 inch = 4 meters

Appendix 6. Permanent Vegetation Plot Data.

I. Permanent Vegetation Plot No. 1: Pine Hemlock Forest

A. GPS Data: Northing: 214,490 m Datum: NAD-27
Easting: 96,352 m Coordinate System: VT State Plane

B. Ground Cover Plot No. 1 (Percent Cover in 1 meter x 1 meter area)

	Plot Location								
	N/1	NE/2	E/6	SE/4	S/3	SW/4	W/11	NW/5	Avg.
Species									
Trientalis borealis	2%	3	T					6	1.4
Maianthemum can.	1	1	T		T	1			T
Mitchella repens				T	T	4			T
Acer pennsylvanica				T	T				T
Conifer sp.	T			T	T		T		T
Acer sp.				T		T	T		T

C. Understory Plot No. 1 (4 meter radius from center stake)
Data is Percent Cover for each Species

Species	≤ 1 m tall	1-3 m tall	3-5 m tall	≥5 m tall
Tsuga canadensis	3%	10		20
Fraxinus americana	T			
Acer pennsylvanica	1			

D. Overstory Plot No. 1 (12.6 meter radius from center stake)

Tree No.	Species	Diameter	Crown Position	Notes
*1	W. Pine	40.7 cm	C	Forks w/ #2
2	W. Pine	39.8	C	Small Crown
3	W. Pine	32.4	C	Small Crown
4	W. Pine	44.6	C	Good Form
5	Hemlock	17.4	S	
6	Hemlock	20.0	S	Tight seam 0-6 ft.
7	Hemlock	27.0	I	
8	W. Pine	30.7	C	Forks @ 10 ft. w/#9
*9	W. Pine	22.7	I	Small crown
10	W. Pine	38.7	C	
*11	W. Pine	29.6	C	Poor Form/small crown
12	W. Pine	47.6	C	Good form; large cone crop in 1994
13	W. Pine	36.1	I	Good form/seam 1-4'

D. Overystory Plot No.1 (cont.)

Tree No.	Species	Diameter	Crown Position	Notes
*14	Y. Birch	10.9	I	
15	R. Maple	23.5	C	Good form
16	W. Pine	37.0	C	
17	Hemlock	37.9 cm	C	Forks w/#18; seam to 6'
*18	Hemlock	48.5	D	
19	W. Pine	53.5	C	Rough; forks @ 15'
20	Hemlock	36.5	C	Forks w/ #21
21	Hemlock	18.9	S	
*22	Hemlock	36.1	C	Stump joined w/ #23
23	W. Pine	38.8	C	Some pitch flow
24	Hemlock	12.8	S	
25	W. Pine	49.8	C	
26	W. Pine	50.0	C	Forks w/#27
27	W. Pine	40.6	C	Poor form
28	W. Pine	40.9	I	Poor form
*29	Hemlock	35.5	C	
30	Hemlock	33.9	C	
31	Hemlock	25.0	I	
*32	Hemlock	14.5	S	Scar on butt
33	Hemlock	21.0	S	Poor form
34	Hemlock	41.0	C	Site Index Tree #2
35	Hemlock	37.5	C	

Notes:

1. At each Permanent Sample Plot location, there are eight Ground Cover plots, which are located at random distances (up to 12 meters) from plot center, at 45 degree intervals radiating from plot center (ie., north, northeast, east, etc.). The column headings indicate the direction and distance from plot center. For example, a column heading of "N/1" indicates a plot north of and one meter away from plot center.
2. Under Percent Cover, the symbol T = Trace (under 1%).
3. In Overystory Plot, an asterisk (*) before the Tree Number indicates that the number has been painted on the tree.
4. In Overstory Plot, Crown Position classes are:
   - D- dominant (trees with crowns extending above general canopy layer)
   - C- codominant (trees with crowns forming general canopy layer)
   - I- intermediate (trees with crowns extending into general canopy, but receiving little or no direct sunlight)
   - S- suppressed (trees with crowns entirely below general canopy layer)

Appendix 6. (cont.)

I. Permanent Vegetation Plot No. 2: Mixed Hardwood-Conifer Forest

A. GPS Data: Northing: 214,561 m Datum: NAD-27
Easting: 96,636 m Coordinate System: VT State Plane

B. Ground Cover Plot No. 2 (Percent Cover in 1 meter x 1 meter area)

	Plot Location								
Species	N/11	NE/3	E/6	SE/3	S/3	SW/5	W/3	NW/2	Avg.
Circaea	8%		10			3			2.6
Arisaema	4	3	1	3	2	2	4		2.4
Mitchella repens		T	80	65	45	60	1	80	41.4
Agrimonia sp.			4						T
Athyrium felix-							30		3.7
Pinus strobus	T	T							T
Acer saccharum		T	T						T
Hardwood seedling			T						T
Dryopteris inter.				30					3.7
Acer rubrum				T	T				T
Dryopteris carth.								6	T
Matteuccia struth.							4		T
Caria coriformus							T		T

C. Understory Plot No. 2 (4 meter radius from center stake)
Data is Percent Cover for each Species

Species	≤ 1 m tall	1-3 m tall	3-5 m tall	≥5 m tall
Ribes cynosbati	4%			
Viburnum	1	1		
Fraxinus americana	2			
Acer saccharum	T	4		80
Fagus grandifolia	T			
Prunus serotina	T			
Carya cordiformis	T	1	4	
Tsuga canadensis		3		
Betula alleghaniensis				22

D. Overstory Plot No. 2 (12.6 meter radius from center stake)

Tree No.	Species	Diameter	Crown Position	Notes
*1	R. Maple	50.4cm	C	Forks @ 8 ft., Grape in canopy
2	W. Pine	32.2	C	Small Crown
3	W. Pine	39.0	D	Severe decay w/seam Woodpecker holes
4	W. Pine	13.1	S	Buttrot, open seam
5	Ostrya	11.2	I	
*6	Basswood	18.1	I	
7	Ostrya	15.2	I	
8	P. Birch	39.8	D	Rough form
9	P. Birch	18.8	I	Forks w/ #8
10	P. Birch	14.0	I	Nectria canker @ 6' Forks w/ #8
11	S. Maple	11.8	I	Good form
12	P. Birch	17.7	C	Crown dieback
*14	R. Maple	11.1	I	Good form
15	R. Maple	11.3	S	Very thin crown
16	P. Birch	26.8	C	Rotten butt
17	S. Maple	11.3	S	Good form
18	S. Maple	11.3	I	Good form
*19	R. Maple	10.3	I	Good form
20	Y. Birch	10.7	S	Crooked but healthy
21	Q. Aspen	22.3	C	Rotten butt
22	P. Birch	12.5	C	Good form
23	Y. Birch	12.4	S	Good form
24	S. Maple	19.4	C	Excellent condition
25	R. Maple	17.5	C	Good form
26	P. Birch	20.0	C	Thinning crown
*27	R. Maple	19.1	C	Good form
28	S. Maple	11.2	S	Good form
29	P. Birch	21.6	C	Good form
30	W. Ash	11.9	I	Good form no sign of decline
31	Butternut	38.6	D	Excellent condition no sign of cankers
32	S. Maple	14.3	S	Large seam 3-12'
33	W. Ash	11.4	S	No sign of decline
34	B. Hickory	25.5	D	Site Index Tree #4
35	P. Birch	21.4	C	Good form

Appendix 6. (Cont.)

I. Permanent Vegetation Plot No. 3: Mixed Hardwood-Conifer Forest

A. GPS Data: Northing: 214,620 m Datum: NAD-27
Easting: 96,633 m Coordinate System: VT State Plane

B. Ground Cover Plot No. 3 (Percent Cover in 1 meter x 1 meter area)

	Plot Location							
	N/5	NE/11	E/2	SE/1	S/9	SW/1	W/2	NW/5	Avg.
Species									
Mitchella repens		55%			30	12	6	70	21.6
Circaea					3				T
Arisaema triphyllum	3		3	5	5	5	T	2	2.9
Trientalis borealis		5		15		2	T	2	3.0
Acer saccharum	T					T			T
Acalypha rhomb.	T								T
Fraxinus amer.	T	1						T	T
Carya cordiformis		4						T	T
Pinus strobus			T			T	T		T
Betula papyrifera			4	8					1.5
Fagus grandifolia							T		T

C. Understory Plot No. 3 (4 meter radius from center stake)
Data is Percent Cover for each Species

Species	< 1 m tall	1-3 m tall	3-5 m tall	≥5 m tall
Acre saccharum	1%	2	6	
Fraxinus americana	15	1		
Rhamnus cathartica	T			
Carya cordiformis	1		4	
Amelanchier sp.	T			
Viburnum trilobum	T			
Celastrus scandans	T			
Ulmus americana	1	2		
Prunus serotina	1			
Viburnum sp.	T			

D. Overstory Plot No. 3 (12.6 meter radius from center stake)

Tree No.	Species	Diameter	Crown Position	Notes
*1	P. Birch	28.5 cm	C	Crown dieback
				Sprouts w/#2
2	P. Birch	32.3	D	Crown dieback
3	W. Pine	10.1	S	Very thin crown
4	W. Pine	19.4	S	Very thin crown
5	Hemlock	23.2	S	Fairly vigorus
6	W. Pine	35.8	C	Some pitch flow
7	W. Pine	16.6	S	Thinning crown
8	W. Pine	17.8	S	Double leader @ 12'
				very thin crown
*9	W. Pine	18.9	S	Thin crown
10	Hemlock	10.2	S	Excessive taper
11	W. Pine	14.7	S	Fairly thin crown
12	W. Pine	11.6	S	Very few needles
13	W. Pine	29.3	C	Forks w/#14 at base
14	W. Pine	25.4	C	
15	P. Birch	33.2	D	Butt rot
				Sprouts w/ #16+17
16	P. Birch	36.4	D	Severe butt rot
				Branch stubs/conchs
*17	P. Birch	36.6	D	Similar to #16
*18	R. Maple	10.7	S	Good crown
19	W. Pine	53.5	D	Some pitch flow
20	P. Birch	11.7	S	Tight spiral seam
				thinning crown
21	P. Birch	11.7	S	Forks @ base w/#20
22	S. Maple	14.9	I	Excellent condition
*23	Hemlock	19.0	S	Healthy crown
24	P. Birch	40.5	I	Thinning crown
*25	W. Pine	41.3	C	Minor pitch flow
26	Q. Aspen	33.4	C	Conchs on stem
27	Hemlock	14.5	S	Excessive taper

Appendix 6. (cont).

I. Permanent Vegetation Plot No. 4: Mixed Hardwood Forest

A. GPS Data: Northing: 214,803 m Datum: NAD-27
Easting: 96,645 m Coordinate System: VT State Plane

B. Ground Cover Plot No. 4 (Percent Cover in 1 meter x 1 meter area)

	Plot Location								
	N/8	NE/11	E/1	SE/2	S/5	SW/5	W/4	NW/5	Avg.
Species									
Arisaema triphyllum	T	T	1%	1			2	T	T
Acer saccharum	T	T	T		T	1	T	1	T
Prenanthes sp.			2	8		15			3.1
Prunus serotina							3		T
Trillium grand.				4	12	1			2.1
Onoclea sensibilis			5						T
Athyruim felix-						4			T
Tree seedling		T	T						T
Prunus virginiana						1			T

C. Understory Plot No. 4 (4 meter radius from center stake)
Data is Percent Cover for each Species

Species	< 1 m tall	1-3 m tall	3-5 m tall	≥5 m tall
Tsuga canadensis		4%		
Acer saccharum	T	10	25	10
Ostrya	T			

D. Overstory Plot No. 4 (12.6 meter radius from center stake)

Tree No.	Species	Diameter	Crown Position	Notes
*1	W. Ash	26.3 cm	I	Severe decline
2	W. Ash	26.7	D	Severe decline vine in crown
3	W. Ash	16.0	I	Severe decline
4	R. Oak	22.0	C	Tight seam 0-6'
5	W. Ash	30.5	D	Light decline
6	Beech	14.0	I	Moderate Nectria Open wound @ 6'
7	W. Ash	21.7	D	Severe decline
*8	Beech	26.1	C	Healthy

D. Overstory Plot No. 4 (cont.)

Tree No.	Species	Diameter	Crown Position	Notes
9	W. Ash	16.5	C	Severe decline
10	W. Ashe	24.0	C	Severe decline
11	Ostrya	16.8	I	Healthy
12	Beech	11.1	S	Healthy/forks w/#13
13	Beech	18.1	C	Healthy
*14	B. Locust	26.0	D	Thin crown
15	Beech	21.4	C	Healthy
16	B. Locust	31.8	D	Thin crown
17	P. Birch	20.1	C	Healthy
18	B. Cherry	35.0	D	Some dead branches
19	B. Birch	11.9	S	Branch stub @ base
20	B. Birch	27.6	C	Healthy
*21	B. Birch	22.5	C	Healthy
22	B. Birch	20.3	C	Healthy
*23	B. Birch	17.4	I	Healthy
24	B. Birch	19.5	C	Healthy
*25	Beech	14.0	S	Healthy
26	P. Birch	23.0	C	Healthy
27	R. Maple	19.9	C	Healthy
28	R. Maple	10.9	S	Forks w/#27 @ 2'
29	B. Birch	18.2	C	Healthy
*30	P. Birch	24.0	C	Healthy
31	B. Cherry	33.7	D	Light crown dieback
32	R. Maple	11.5	S	Healthy
*33	B. Birch	21.3	I	Nectria wound @ 2'
34	W. Ash	23.0	D	Light crown dieback

Appendix 6 (cont).

I. Permanent Vegetation Plot No. 5: Red Oak-Red Maple Forest

A. GPS Data: Northing: 214,939 m **Datum: NAD-27**
Easting: 96,410 m **Coordinate System: VT State Plane**

B. Ground Cover Plot No. 5 (Percent Cover in 1 meter x 1 meter area)

	Plot Location								
	N/2	NE/3	E/5	SE/6	S/1	SW/4	W/4	NW/9	Avg.
Species									
Dennstaedia punct.	12%			40	35	25	12	45	21.1
Osmunda cinn.							15		1.9
Pteridium aquilinum				15			25	8	6.0
Lysimachia quad.							5		T
Trientalis borealis			1	7	8	8	4	8	4.5
Aster acuminatus				16	5	10			3.9
Prenanthes sp.	15			T		T		45	7.5
Osmunda clayton.		80							10.0
Apocynum andro.		10							1.2
Maianthemum can.				20				1	2.6
Trillium				20		5			3.1
Uvularia sess.						3	T		T
Athyrium felix-	30	12			35				9.6
Circaea sp.		3							T
Acer sp.		T				T			T
Acer rubrum			T						T
Epipactis helle.			T						T
Pinus strobus				T				T	T
N.Y Fern				3			18	8	3.6
Quercus rubra				1			8		1.1
Lycopodium dedro.						1			T
Fraxinus amer.						2	T		T
Prunus sp.						T	T	T	T

C. Understory Plot No. 5 (4 meter radius from center stake)
Data is Percent Cover for each Species

Species	≤ 1 m tall	1-3 m tall	3-5 m tall	≥5 m tall
Quercus rubra	1%			
Fraxinus americana	2	2		
Juniperus virginiana	T			
Betula lenta	T			
Rhamnus carthartica	T		4	

C. Understory Plot No. 5 (cont.)

Species	< 1 m tall	1-3 m tall	3-5 m tall	>5 m tall
Rosa sp.	1			
Rubus idaeus	T			
Celastrus scandans	T			
Cornus alternifolia		8		
Sorbus americana		2		
Acer rubrum		T		15
Ulmus americana	1			

D. Overstory Plot No. 5 (12.6 meter radius from center stake)

Tree No.	Species	Diameter	Crown Position	Notes
*1	R. Oak	59.6 cm	D	Stump sprout w/2-4
2	R. Oak	52.1	C	
*3	R. Oak	42.5	C	
4	R. Oak	58.9	D	
5	Amalanchier	15.5	S	Thin crown
*6	R. Maple	41.7	I	Forks w/#7 @ 3'
7	R. Maple	14.5	S	Thin crown
8	R. Maple	14.2	S	Thin crown
9	R. Oak	42.6	C	Stump sprout w/#10
*10	R. Oak	46.0	C	
*11	R. Oak	71.1	D	Very healthy
12	R. Oak	34.7	C	Epicormic branches
13	R. Oak	32.0	I	Stump sprout w/#12 Epicormic branches
14	R. Maple	20.6	S	2 small stump sprts. 1 cut sprout/thin crn
15	R. Oak	48.9	C	Site Index Tree #7 2 tight seams
*16	R. Maple	17.7	S	Open seam @ 2'
17	R. Maple	16.6	S	Crown top dying
18	R. Maple	19.1	I	Thin crown
*19	R. Maple	43.5	C	Forks w/#20 @ 3'
20	R. Maple	41.1	C	Small wound @ fork
*21	R. Maple	28.4	I	Butt rott/hollow
22	R. Maple	31.9	C	Swelling @ 2'
23	R. Maple	23.7	I	Thin crown
24	R. Maple	32.0	C	Branch stub @ 2'