Vegetation Analysis of the City of Keene's Grant Parcel in the Greater Goose Pond Forest Keene, New Hampshire – Spring 2005

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Natural Resource Inventory
Grant Parcel (Lot 15)
05/10/05

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Introduction

The Greater Goose Pond Forest (GGPF) is public recreational land, managed by the City of Keene. The GGPF is located within Cheshire County in southwestern New Hampshire, 4 miles north of Keene, NH. Totaling 1044.9 acres (425.05 ha), the forest is comprised of 15 parcels of acquired land, and is directly managed by the City of Keene Conservation Committee. In 2004, the committee requested that an up-to-date resource inventory be conducted on the property. A Conservation Subcommittee was formed to oversee the implementation of a Natural Resource Inventory (NRI) of the vegetation within the entirety of GGPF. The data for the NRI was collected during April 2005 in cooperation with the City of Keene Conservation Subcommittee, Peter Throop, Leo P. Maslan, Antioch New England graduate students Heidi Brannon and Christopher J. Hilke, and Tom Sintros. The scope of this proposal, however, will focus exclusively on the Grant lot, parcel #15 of the GGPF (Map 1).

Christopher J. Hilke, a student in the Department of Environmental Science at Antioch New England Graduate School, conducted the NRI of the Grant parcel. Field assistance was provided by Antioch student Robert Baranek, as well as Keene High School students Charles Bruch and Nick Sarsfield. Parcel 15 was both qualitatively and quantitatively analyzed, utilizing sampling methods determined by the GGPF NRI investigative members, and modified to include suggested protocols outlined by Antioch New England NRI-Vegetation class, as well as several methods found within *Field and Laboratory Methods for General Ecology* (Brower, Zar, and Ende, 1998). Data collection focused on the quantitative analysis of the upper and middle synusia, with specific emphasis on the delineation of community type, as well as the qualitative assessment of American beech (*Fagus grandifolia*) health within the parcel. The quantitative

evaluation of community type was based upon compositional features, species dominance and frequency. Qualitative determination of community health included the delineation of the extent of beech bark scale disease among American beech within the parcel. The combination of a quantitative and qualitative assessment provided a comprehensive floristic analysis of the dominant community types within parcel 15.

Past Work

Several NRIs have been conducted in the past fifteen years within GGPF. The City of Keene management plan for GGPF was drafted in 1992, and included an incomplete analysis of "Biologically Significant Interest Areas" (BSAI) within the GGPF. Andrew Jennings and Edwin Dehler-Seter, from Antioch New England Graduate School, conducted a "*Winter Mammal and Habitat Survey of the Greater Goose Pond Forest*" submitted in May of 1994. The forest cover types delineated by that NRI included: hardwoods, softwoods, mixed woods, mixed hardwood dominated, and mixed softwood dominated communities. In the fall of 1994, a group of Antioch students, led by Rick Van de Poll, conducted an NRI of "*Four Biologically Significant Interest Areas.*" This was a preliminary investigation for the City of Keene which aimed to update/complete the City of Keene management plan for GGPF. In 1996, the "*Deer Wintering Area and Vernal Pool Assessment*" NRI was conducted, and in 2002 the "*City of Keene Natural Resources Inventory of Greater Goose Pond Forest and Stearns Hill Natural Area*" was conducted by DuBois and King, Inc. DuBois and King delineated four primary cover types: hardwood dominated, softwood dominated, mixed hardwood/softwood dominated, as well as wetland dominated communities.

NRI – Lot 15 – Grant Parcel

The macro-scale ecoregion wherein the Greater Goose Pond Forest is located is classified as Vermont/New Hampshire Upland. The property is specifically located between the Sunapee Uplands and the Hillsboro Inland Hills and Plains (NH Heritage Inventory). The geology of GGPF is characterized by numerous formations of folded Oliverian gneiss, which, after millions of years of erosion of Ammonoosuc volcanics, now lies exposed at the surface throughout much of the GGPF property (Moore 1949). The outlying area includes swaths of New Hampshire Devonian/Littleton formation comprised of low-high grade metasediments and minor metvolcanics (Van Diver 1987). The surficial geology of the GGPF region is composed primarily of glacial till and sedimentary deposition from glacial Lake Ashuelot. As such, lowlands have thick accumulated outwash deposition, while the uplands show signs of lakeshore features including glacial lakeshore terracing (Van Diver 1987).

The *Soil Survey of Cheshire County, New Hampshire* delineates the primary soil types within the Grant parcel as Tunbridge-Lyman Rock Outcrop Complex (8-15% slopes), Tunbridge-Lyman Rock Outcrop Complex (15-25% slopes), Monadnock Fine Sandy Loam (8-15% slopes, very stony), and Monadnock Fine Sandy Loam (15-25% slopes, very stony) (Map 2). Utilizing a modified acreage grid, I estimated the total acres of each of the four soil types found within the boundaries of the parcel. The Tunbridge-Lyman Rock Outcrop Complex (8-15% slopes) accounts for 19.2 acres within the parcel. The Tunbridge-Lyman Rock Outcrop Complex (15-25% slopes) accounts for 25 acres, the Monadnock Fine Sandy Loam (8-15% slopes, very stony) for 34 acres, and the Monadnock Fine Sandy Loam (15-25% slopes, very stony) for approximately 15 acres (Chart 1).

The Grant parcel is composed of 96.7 acres (39.2 ha), and is located to the southeast of Goose Pond proper, and west of Rt. 10. The site is of varied topography, containing sections of three low hilltops (high elevation 342m), with a primary slope orientation of east-southeast (Map 3). The forest within the parcel is a southern mixed hardwood containing: mixed hardwood dominated, hardwood dominated, as well as softwood dominated communities. These general classifications were supported by the results of an NRI conducted by DuBois and King Inc., 2002. They found the mixed hardwood forests to be dominated by red oak (*Quercus rubra*), red maple (*Acer rubrum*), white pine (*Pinus strobus*), American beech, and eastern hemlock (*Tsuga canadensis*) to varying percentages. The softwood communities were found to be dominated by hemlock and white pine, while the hardwood communities were dominated by A. beech, red maple, and to a lesser extent, paper birch (*Betula papyrifera*), black birch (*Betula lenta*), and grey birch (*Betula populifolia*).

There are no buildings, structures, or roads within the property. The parcel is intersected by two state-maintained power-lines which run northeast-southwest, and northwest-southeast respectively (Aerial photo 1). The Grant lot is primarily forested, except for the power-line cuts. There are numerous stone walls within the site, some comprised of only large stones and others containing both large and small stones. The property has only sporadic and shallow (worn) pillow and cradle. These clues, in combination with a number of split-trunk white pine (indicating full sun grown, weevil hit trees), reveal a history of both pasture and agricultural land-use. Decaying remnants of old white pine and red oak stumps, and numerous coppice trunks, indicate a history of timber harvest as well. The disturbances suggest human land use activity dating back to at least the early 1800's.

Another disturbance immediately evident within the Grant parcel is the widespread presence of the fungus *Nectria coccinea*. The disease is a commensalist relationship between a scale insect and the fungus, wherein the fungus is spread from tree to tree by the insect (Wessels 1997). The immediate result is the "pitting" and "cracking" of the beech bark, which provides progressive access to the vulnerable inner-wood for a host of other species, and disrupts internal biochemical processing to the extent that the tree eventually succumbs to stress (Wessels 1997).

Methods

Sampling Design

The data for this study was collected during April of 2005. Utilizing a systematic sampling approach, a 200 x 200ft grid was superimposed on the property. The grid delineates 13 transects (A-M) (Map 4), with a sample point plotted for each line intersection. The layout creates 97 total forested sample points, with transects running southwest and northeast respectively. Given the transition edge imposed by the denuded area occupied by the power-line, the sample points began 50ft past treeline on either side. Data ceased to be collected 200ft from a developed edge on the southern boundary of the parcel (Map 3). An examination of the aerial photo of the property indicated homogeneity in community type, northeast of the power lines (Aerial photo 1). As such, the density of sampling points was scaled down to a 400 x 400ft sampling grid within the area of obvious homogeneity. Given the vegetative homogeneity in conjunction with the proximity of developed land to the south, the total number of informative forested sample points was reduced to 74 (Map 4). The sampling design supported an unbiased approach in that the plot locations along transects were evenly spaced, regardless of the terrain or community type.

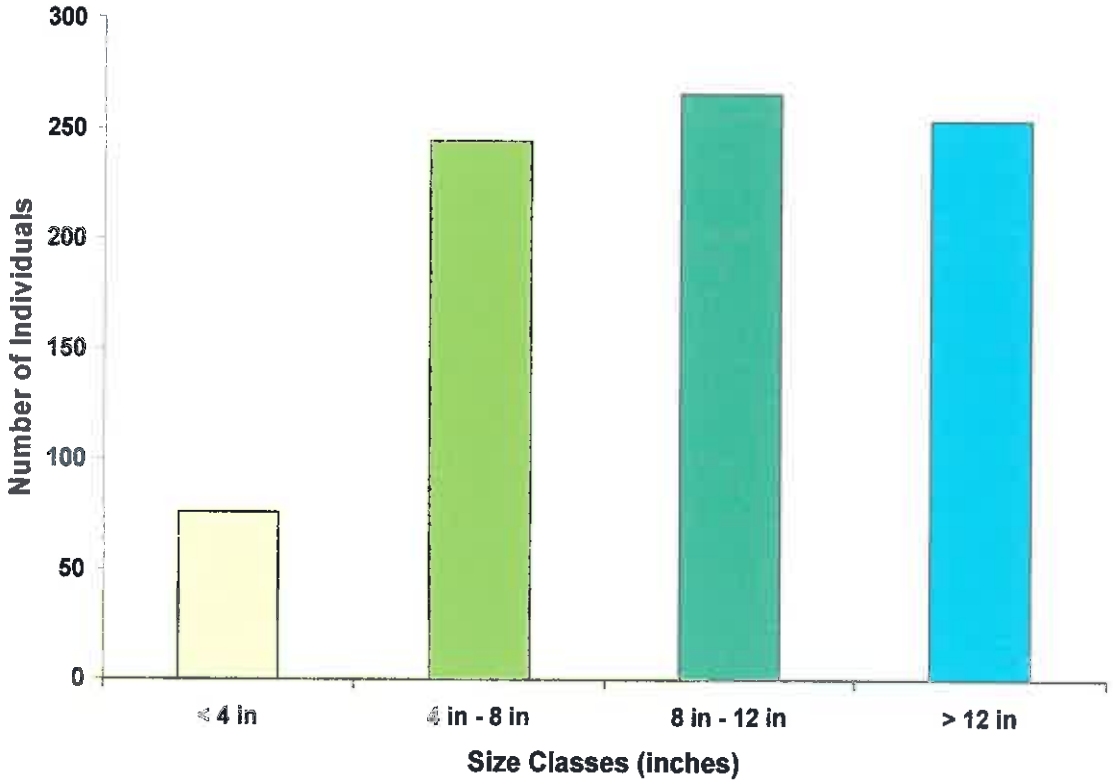
Data Collected

Given the time of year, data collection focused primarily on woody plants within lot 15. Stand data was acquired using the variable radius plot (VRP) (Avery and Burkhart 2002). Trees > 4" (dbh) were defined as woody vegetation, while saplings consisted of all woody vegetation between 1" – 4" dbh. In utilizing a 10 Basal Area Factor (BAF) prism (10 square ft of basal area per acre per tallied tree), the VRP data in combination with dbh measurements (diameter at breast height), allowed for the calculation of the individual total basal area (ft^2/acre) per species, the number of trees per acre, and mean stand diameter distributions throughout the parcel. These measurements provided the ability to estimate frequency, density, and coverage, which ultimately allow for the calculation of an importance value for each species. The importance value is a comprehensive categorization that facilitates comparative analysis between species as well as between communities. Apart from the VRP data, every measured American beech was identified as either infected or not infected with beech bark scale disease With this information, I was able to calculate what percentage of the measured trees were beech, and what percentage of the beech were infected. Determining the extent of the disease within the parcel is one way of describing stand health, and aids in forecasting the successional direction of the delineated community.

Results

The collected data indicates that the Grant parcel contains an average of 334.3 stems/acre and 110 ft^2/acre of total basal area. The upper synusium (trees ≥ 4in), made up 90% of the total number of trees measured. The 738 measured individuals of the upper synusium had an average dbh of 10.95 ± 4.8in, while the saplings (trees > 4in), which accounted for 10% of the trees measured, had an average dbh of 2.07 ± 0.8in. As such, the majority of trees on the property fell within the 8 – 12in dbh size class (Figure 1).

Figure 1. Total size class distribution for trees within the Grant Parcel, Greater Goose Pond Forest, May 2005.



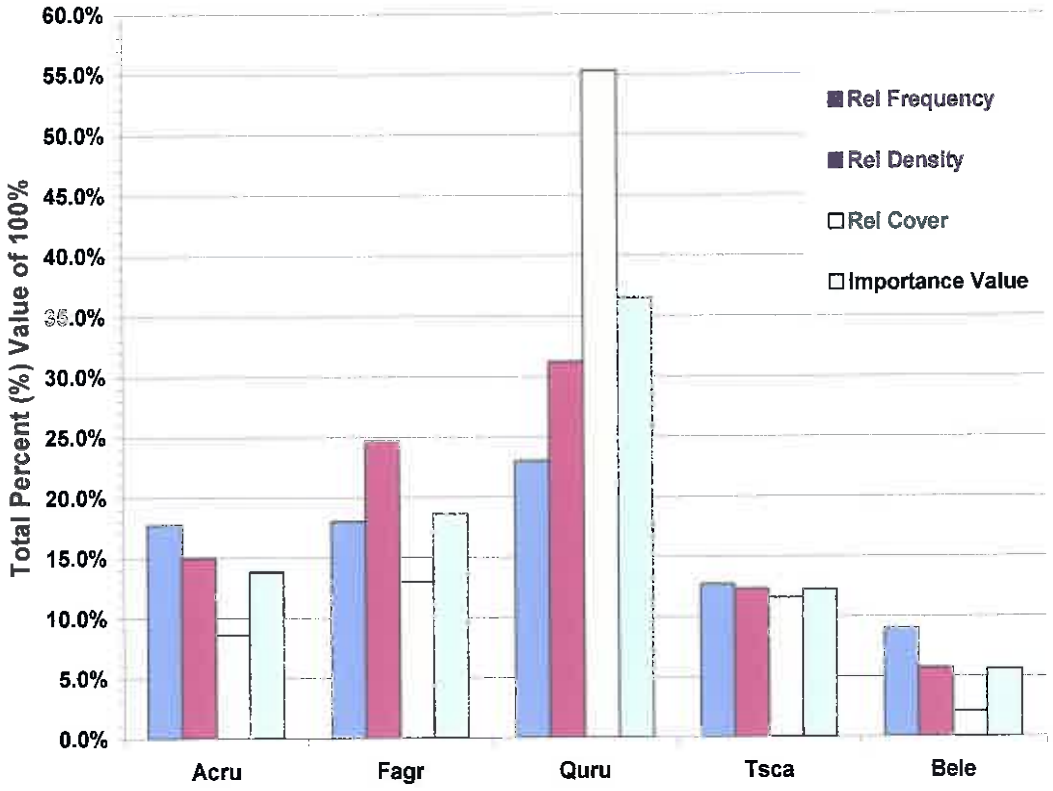
The largest tree recorded was a red oak, with a dbh of 42in. The largest trees on the property were also the most frequently occurring (Table 2). Red oak accounted for 31.2% of the total number of trees calculated, and had an average dbh of 14.5 ± 4.8in. The next most frequently occurring were the beech, which constituted 24.8% of the total, and red maple which included 14.9% of the total number of trees. The most frequently occurring species also yielded the higher significance values (Figure 2). Red Oak is the most important species (IV=36.5%), having the highest relative density at 31%, the most number of occurrences (n = 254), and the greatest relative cover (RC = 53%). American beech was the next most important species (IV=18.6%), even though its relative frequency of 18.1% was lower than that of red maple (RF = 18.8%) (Figure 2).

Table 2. Total distribution of species occurrence and average dbh with standard deviation. Five most frequently occurring species are highlighted.

Species	Occurrences	Mean dbh (in) and Standard Deviation (in)
Acpe	8	1.4±0.6
Acru	122	8.2±2.8
Acsa	10	3.6±1.1
Beal	8	7.3±3.0
Bele	46	6.0±3.6
Bepa	27	8.6±2.1
Bepe	3	7.8±1.6
Bepo	1	7.5±0.0
Fagr	201	7.3±4.1
Fram	1	8.5±0.0
Frax?	7	9.7±1.8
Osvi	1	4.5±0.0
Pist	24	14.7±6.5
Qual	1	10.5±0.0
Quru	254	14.5±4.7
Tsca	100	10.2±4.5
Totals:	**815**	**8.1±3.0**

With only 12.9% relative cover in the upper synusium, A. beech dominated the middle synusium (trees < 4in) with 46.7% relative cover, 50% relative density, and an importance value of 47%. Black birch (*Betula lenta*) followed in importance with 16.3%. Striped maple (*Acer pensylvanicum*), sugar maple (*Acer saccharum*), and eastern hemlock (*Tsuga canadensis*), while fluctuating in density, frequency, and cover, all shared similar overall importance values (IV = 8.7 – 9.1%) within the parcel. Of the 103 total trees < 4in, 49% were American beech 15% were black birch, and 9.7% were red maple. The overall parcel sapling layer is clearly dominated by beech and black birch.

Figure 2. Total distribution of significant values per five most frequently occurring species within Grant Parcel, Greater Goose Pond Forest, May 2005.



Initial observations made from the aerial photos of the Grant parcel suggested that the property consisted of multiple communities (Aerial photo 1). The collected measurement data, in conjunction with numerous ground-referencing trips to the parcel, confirmed this suspicion. The Grant parcel is composed of 3 distinct communities (Map 5). The 250ft-wide, denuded, power-line strip running NE-SW through the parcel acts as a physical boundary between the two primary communities. The south half of the parcel consists of an oak, beech, maple, hardwood community with a hemlock component that comprises approximately 39.7 acres (16.1ha), composing the majority of the. This section of the property is topographically less severe than the northern section and has one small stream and two seasonal drainage routes running SW through the community. The north end of the parcel is designated as an oak, beech, maple upland, including approximately 37 acres (14.9ha). The north end of the property is primarily dry upland, apart from a moist lowland area to the east end of the parcel. The third community is a small subsection of the upland oak, beech, maple community, within 4.98 acres (2ha) atop the ridgeline at the far north end of the property. The habitat within this area is more of a dry, rocky upland.

Oak, beech, maple, hemlock community

The oak, beech, maple, hemlock community (OBMH) consisted of 50 sampling plots, and 613 total measured individuals. The OBMH community is dominated by red oak, American beech, red maple, and hemlock. The community contains 141 trees/acre and 122 ft^2/acre of basal area. Of the 613 total trees sampled, 28% were American beech, 26% were red oak, 14% hemlock, and another 14% red maple. The upper synusium included 530 individuals of which oak (IV=32.6%) and beech (IV=20.7%) were the most important, facilitating a dominant/co-

dominant role in the upper synusium (Figure 3). Eastern hemlock and red maple were prevalent to a lesser degree, with 85 and 89 occurrences respectively. The mean dbh of the upper synusium was 10.4 ± 43in, with the largest trees being composed primarily of red oak (Figure 4). The hemlock component to this community included 85 individuals >4in, that had an average dbh of 10.8 ± 4.2in, and culminated in an importance value of 15.9% The saplings were dominated by American beech, which had a 47.8% relative frequency of, a 50.6% relative density, and a 47.8% relative cover within that size class (Figure 4).

Figure 3. Distribution of significance values per five most occurring species of the oak, beech, maple, hemlock community. Grant Parcel, Greater Goose Pond Forest, May 2005.

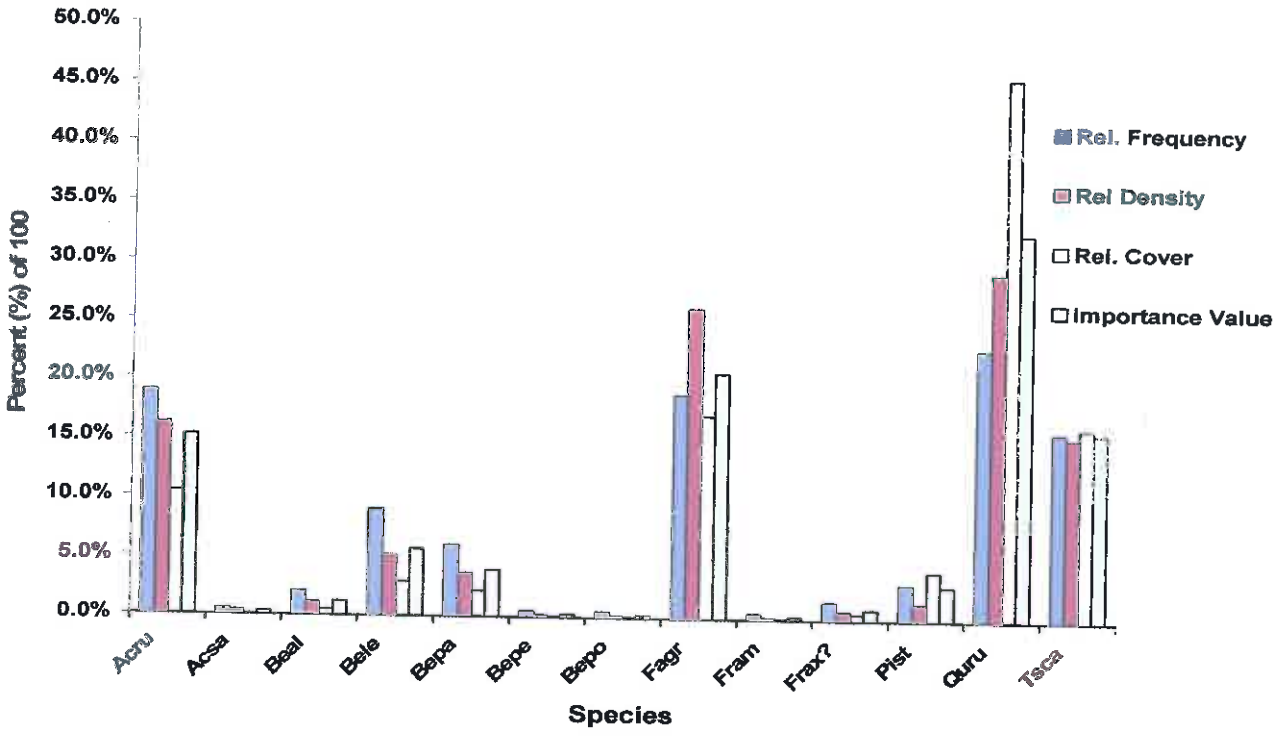
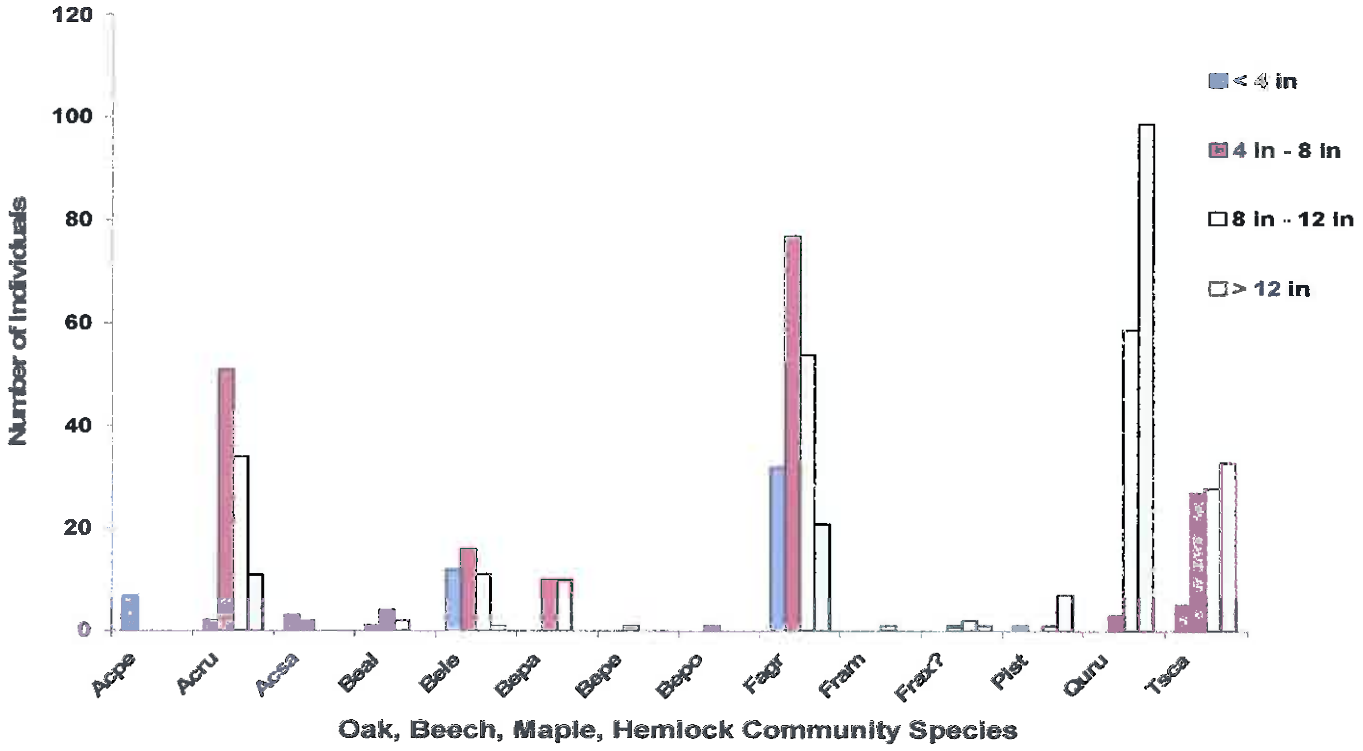


Figure 4. Size distribution within oak, beech, maple, hemlock community. Grant Parcel, Greater Goose Pond Forest, May 2005.



American beech was overwhelmingly the most dominant species of the lower synusium, with an importance percentage of 47.3% that vastly exceeded other IV values. The next most important species was black birch (IV=14.8%).

Oak, beech, maple upland community

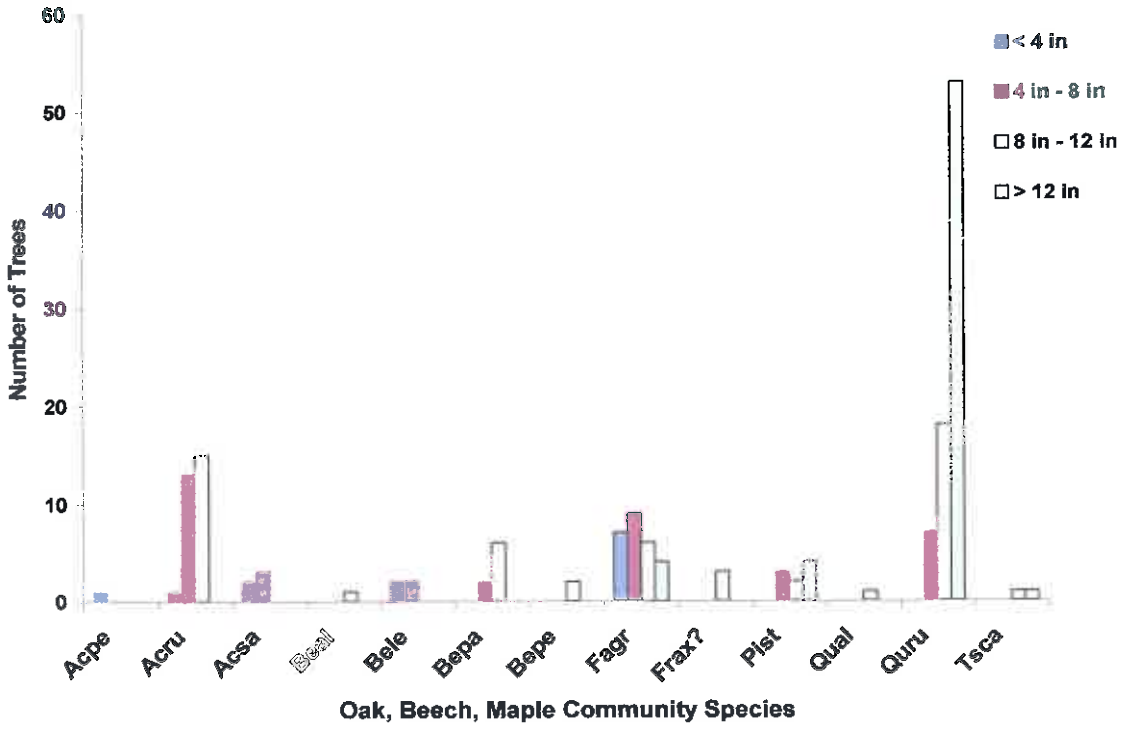
The oak, beech, maple upland community is to the north of the power-line, and included 19 sampling points and 162 measured individuals. The community had 598.8 stems/acre, with 85 ft^2/acre of total basal area. Of the trees in the upper synusium (≥ 4in), red oak was by far the most dominant species, totaling 46.9% of the measured trees, and having an average dbh of

15.7 ± 5in. (Figure 5). Red oak is the most frequently occurring (RF = 28%), has the greatest density (46.9%), the most cover (74.8%), and is the most important species within the upper synusium of community B (IV = 49.9%). American beech and red maple play an equal secondary role, with very similar density, frequency, and coverage values (beech IV = 14.4%, red maple IV = 13%) (Table 3).

Table 3. Significance values of the lower synusium of the oak, beech, maple upland community, Grant Parcel, Greater Goose Pond Forest, May 2005.

Species	Rel. Frequency	Rel.Density	Rel. Cover	Importance Value
Acpe	9.9%	8%	2%	6%
Acru	9.9%	8%	8%	9%
Acsa	19.9%	15%	14%	16%
Bele	19.9%	15%	20%	19%
Fagr	39.7%	54%	56%	50%

Figure 5. Size distribution within the oak, beech, maple upland community. Grant Parcel, Greater Goose Pond Forest, May 2005.



The sapling layer is dominated primarily with American beech, which accounted for 53.8% of the total number of trees < 4in, and had an importance value of 50%. The next most important saplings in this size class are black birch (IV = 19%), and sugar maple (IV = 16%), which each accounted for 15.4% of the total number of individuals measured (Table 3).

Table 4. Total oak, beech, maple upland community species significance values, with the three most important species highlighted. Grant Parcel, Greater Goose Pond Forest, May 2005.

Species	Mean dbh and SD	tree ba	Rel. Freq	Rel.Density	Rel. Cover	Importance
Acpe	2.0±0.0	0.02	1.6%	0.6%	0.0%	0.7%
Acru	7.7±2.0	9	17.2%	16.0%	5.9%	13.0%
Acsa	3.8±1.5	0.42	6.2%	3.1%	0.3%	3.2%
Beal	12.0±0.0	0.79	1.6%	0.6%	0.5%	0.9%
Bele	4.8±2.1	0.59	4.7%	2.5%	0.4%	2.5%
Bepa	9.3±1.3	3.35	7.8%	4.3%	2.2%	4.8%
Bepe	8.8±0.4	0.83	1.6%	1.2%	0.5%	1.1%
Fagr	7.3±4.2	10.28	20.3%	16.0%	6.7%	14.4%
Frax?	10.0±0.9	1.64	1.6%	1.9%	1.1%	1.5%
Pist	12.9±6.1	8.71	4.7%	4.9%	5.7%	5.1%
Qual	10.5±0.0	0.6	1.6%	0.6%	0.4%	0.9%
Quru	15.7±5.5	114.68	28.1%	46.9%	74.8%	49.9%
Tsca	14.5±3.5	2.37	3.1%	1.2%	1.5%	2.0%

Oak, pine, hemlock upland community

The oak, white pine, hemlock community is a subcomponent of the oak, beech, maple upland that is relegated to < 5 acres on a rocky ridge top on the north end of the Grant parcel. Initially, I was not going to include the small area of difference as a separate community. However, after ground-referencing and collecting data on two sample points within that area, I decided to add two more sample points as a means of capturing that difference. While a small area, and only consisting of 4 sample points, the community represents a significant departure from the surrounding area. The first primary difference was the lack of a smaller size class (Figure 6). Only 6.8% of the total number of individuals sampled were < 4in dbh.

Figure 6. Distribution of tree size within the oak, pine, hemlock community, Grant Parcel, Greater Goose Pond Forest, May 2005.

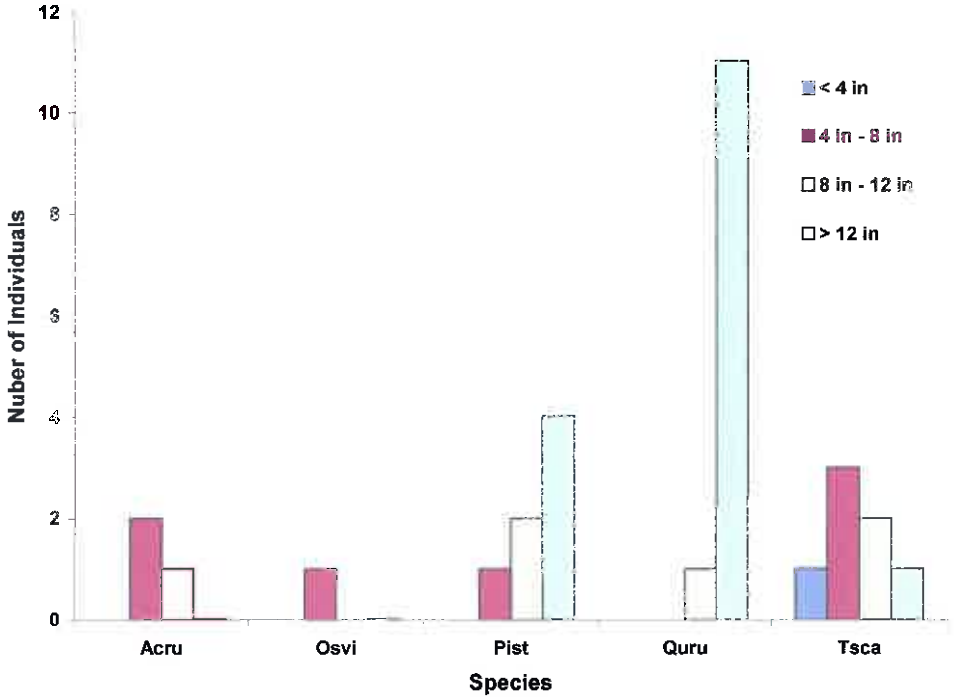
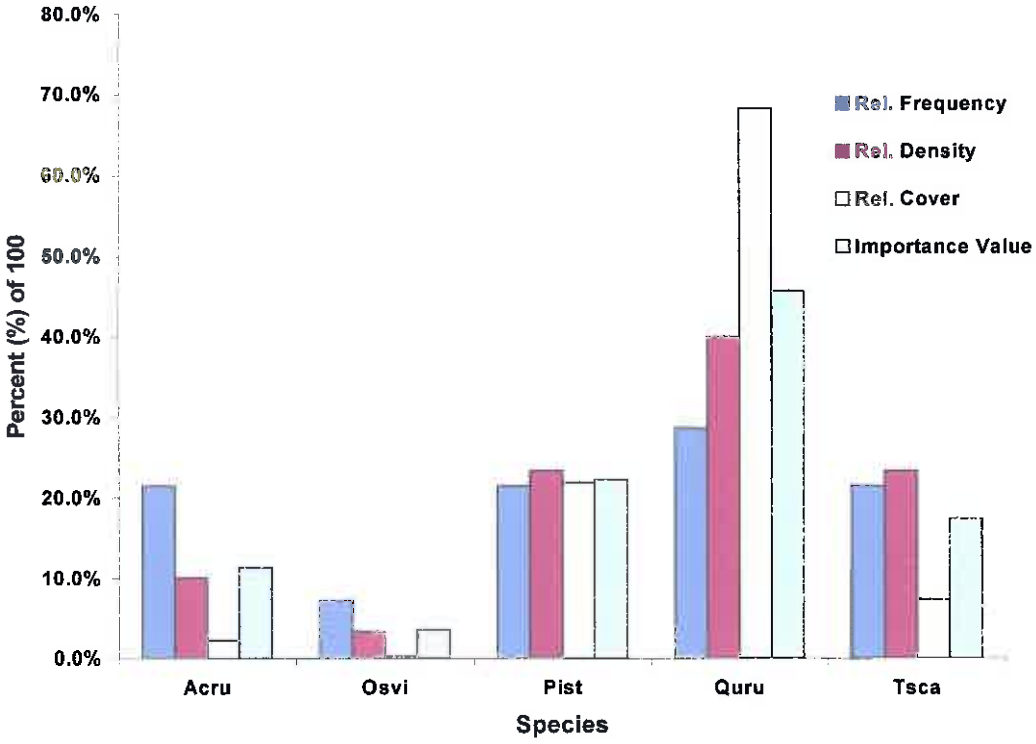


Figure 7. Distribution of species significance within the oak, pine, hemlock community, Grant Parcel, Greater Goose Pond Forest, May 2005.

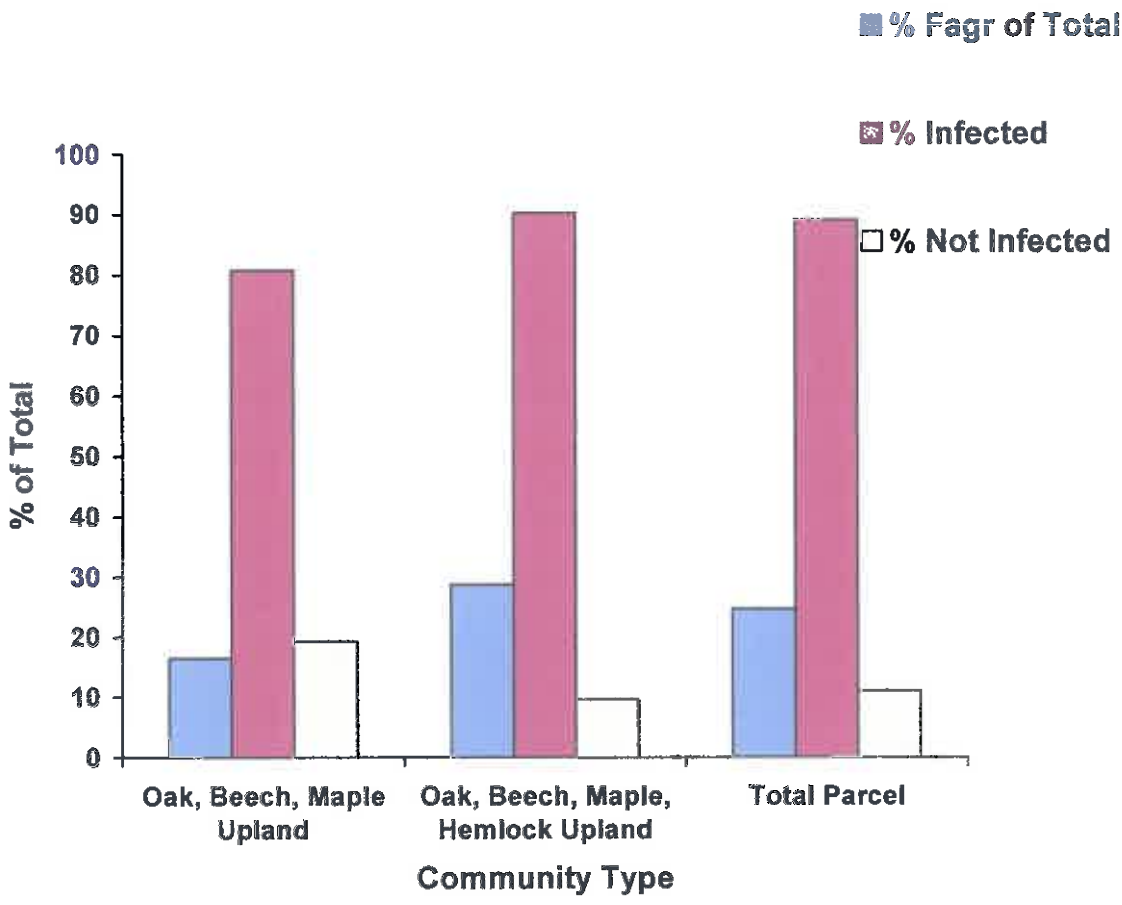


The second difference was the increased importance of white pine and hemlock as evergreen components of this hardwood forest (Figure 7). While red oak remained the dominant species (IV = 45.6%), pine and hemlock provided important compositional components as well (Pist IV = 22.2%, Tsca IV = 17.4%). The two co-dominant species had the same number of individuals sampled, as well as similar frequency and density values, however, they differed in percent cover (pine RC = 21.8%, hemlock RC = 17.3%). This difference can be attributed to the comparatively lower number of hemlocks > 12in dbh, which resulted in lower overall relative coverage.

Fagus grandifolia health

Of the 815 total individuals measured, 201, or 24.7% were American beech. Of that 24%, 89.1% (or 179 individuals), were infected with beech bark scale disease (Figure 8). Within the oak, beech, maple, hemlock community, beech accounted for 28.7% (or 176 individuals), of the total number of measured trees. Of that 28.7%, 90.3% were infected. The oak, beech, maple upland community displayed similarly high numbers, with beech accounting for 16.4% of the measured population, of which 80.8% were infected. Zero beech were measured within the oak, pine, hemlock community. In order to determine if there was a significant difference (P = 0.05) between size classes and the presence or absence of infection, I performed nonparametric analysis utilizing the Wilcoxon signed-rank test for the analysis of matched pairs. There was no significant difference in the distribution of infection among different size classes (Wilcoxon signed-rank, z = -3, P = 0.25). A qualitative assessment regarding the degree of infection of each infected tree indicated that > 65% of the infected trees were severely infected (severely equals > 45% visible exterior damage).

Figure 8. Distribution of infected and not-infected Fagr between the two primary communities within the Grant Parcel, Greater Goose Pond Forest, May 2005.



Discussion

The soils and species composition within the Grant parcel indicate that the forest is a southern, transitional, mixed hardwood, oak, beech, maple acidic upland forest. The oak, beech, maple community to the north of the power-lines, is a clear representation of this categorization. The oak, beech, maple, hemlock community is essentially a more lowland variant of the oak, beech, maple community, with the exception that the shift from the upland Tunbride-Lyman

"outcrop" soils to the lowland sandy loams, provided a substrate more ideal for hemlock germination subsequent to disturbance. Both the oak, beech, maple upland, and the oak, beech, maple, hemlock community, are broadly defined by the NH natural communities classification system as an S5 Hemlock, beech, oak, pine forest. This community type is widely represented in southern New Hampshire, and includes numerous variations depending on the microhabitat and land-use history. The community can vary from hardwood, hardwood-softwood, or mostly softwood dominated stands (Sperduto and Nichols 2004).

The size distributions of trees within the parcel suggest an early to mid successional forest (Figure 1). This is evidenced by the fact that the majority of trees are 8-12 in dbh, as well as the fact that there is a general absence of hemlock (considered a "late successional species") as a canopy species. Furthermore, numerous even-aged red oak with the extensive evidence of past land use history that includes: agriculture, pasturing, and logging as recently as 50 years ago, limits the time of undisturbed succession. The coppiced trunks of red oak and white pine indicate that the property has been logged at least once. Also, the absence of white pine growth after that event suggests that the most recent logging was not a clear-cut, but a selective cut, thus reducing the amount of full sun that is a prerequisite for white pine seedling establishment.

The widespread presence of red oak, in combination with the reduced number of saplings, indicates that the successional direction of the forest is toward an oak-beech dominated canopy, with large scale structural changes initiated only through widespread canopy disturbance. Save human disturbance, the most likely structural fluctuations to occur would be within stands where American beech have particularly high importance values. The prevalence of the fungus *Nectria coccinea* on the property indicates that it is only a matter of time before the canopy opens up as the beech give way to the disease. Given that beech tends to respond to

parasitic disturbance with clonal reproduction, one can expect the middle synusium to be beech dominated for the foreseeable future, possibly hampering the maturation of the present red maple and black birch saplings.

New Hampshire's forested landscapes are full of physical indicators evidencing a history of poor logging practices. Even-aged stands lacking diversity within a maze of old logging roads are an abundant reminder of the clear-cutting that took place only a few decades ago. Logging that occurred during that time had few protocols regarding timber harvest within ecologically "sensitive" areas, or concerns regarding issues of erosion within clear-cuts. It is only recently that timber harvests have begun to incorporate ecological considerations into their practices. The primary data provided by this NRI will help to facilitate informed land use management decisions made by the City of Keene, and contribute to baseline data for future ecological studies within the Greater Goose Pond Forest.

Chart 1: Grant Parcel Soils Table

Soils associated with the Grant Parcel (lot 11) of the Greater Goose Pond Forest, Keene, NH

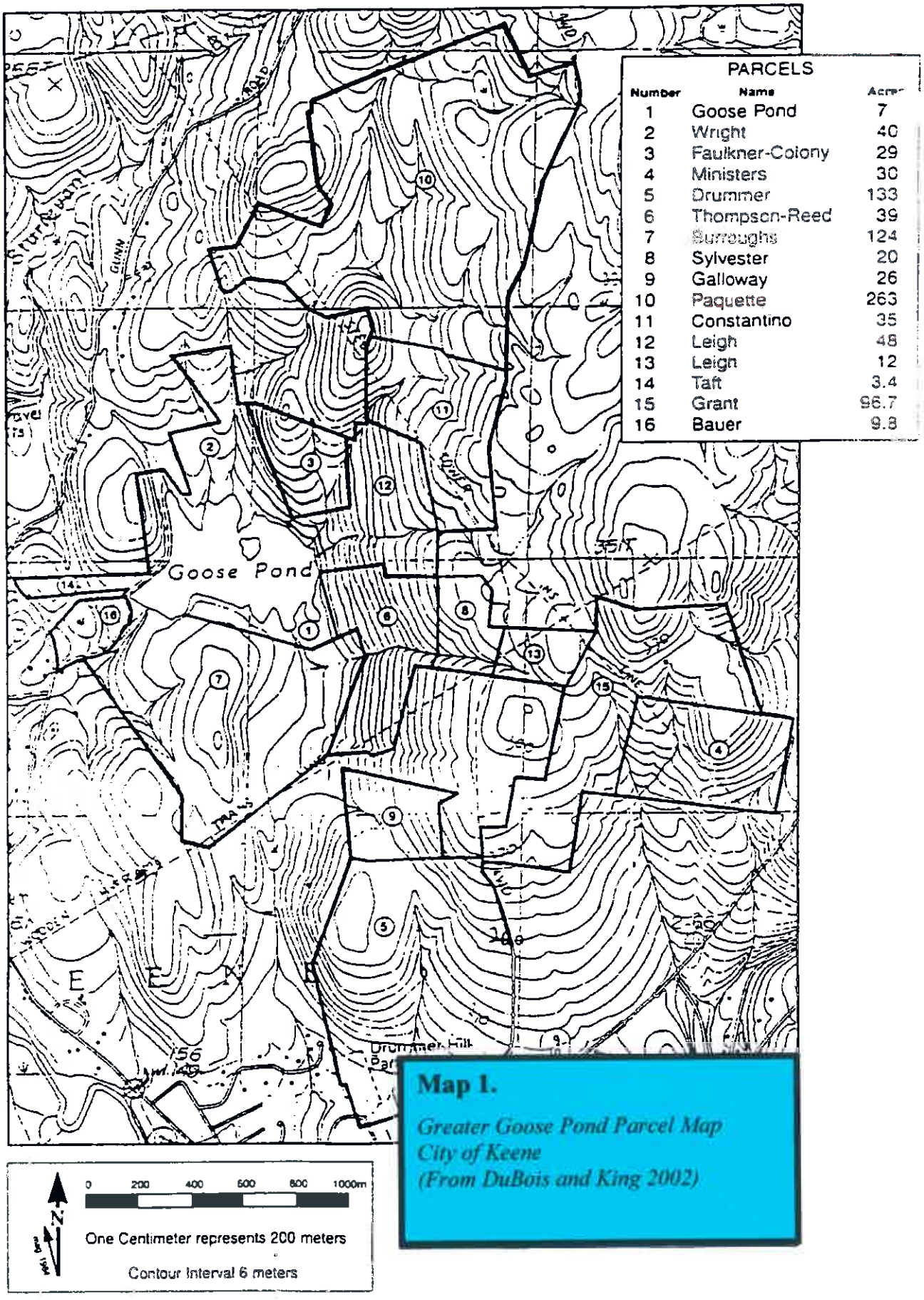
Soil Code	Soil Name	Slope	Acreage	Hardwood and Coniferous Tree Habitat	Management Concerns		Productivity	
					Erosion Hazard[1]	Wind Throw[2]	Species	Site Index[3]
143C	Monadnock fine sandy loam, very stony	8-15%	15.2	Good	Slight	Slight	*P. strobus* *Q. rubra* *P. rubens* *P. glauca*	63 55 60 55
143D	Monadnock fine sandy loam, very stony	15-25%	25.0	Good	Moderate	Slight	*P. strobus* *Q. rubra* *P. rubens* *P. glauca*	63 55 60 55
61C	Tunbridge-Lyman outcrop complex	8-15%	24.9	Good - Tunbridge / Poor - Lyman	Slight	Moderate	*P. strobus* *Q. rubra* *A. saccharum* *P. rubens* *B. alleghaniensis* *P. glauca* *F. americana*	70 70 60 45 55 55 65
61D	Tunbridge-Lyman outcrop complex	15-25%	34.0	Good - Tunbridge / Poor - Lyman	Moderate	Moderate	*P. strobus* *Q. rubra* *A. saccharum* *P. rubens* *B. alleghaniensis* *P. glauca* *F. americana*	70 70 60 45 55 55 65

[1]Erosion Hazard – the probability that erosion can occur as a result of site preparation or cutting.
Slight – no particular measures need to be taken to prevent erosion under normal conditions
Moderate – erosion control measures are needed for silviculture activities
Severe – special precautions are necessary to control erosion in most silviculture activities

[2]Wind Throw – the likelihood that trees will be uprooted by wind
Slight – no trees are normally uprooted by wind
Moderate – moderate or strong winds occasionally uproot trees when soil is wet
Severe – moderate or strong winds may blow down many trees when soil is wet

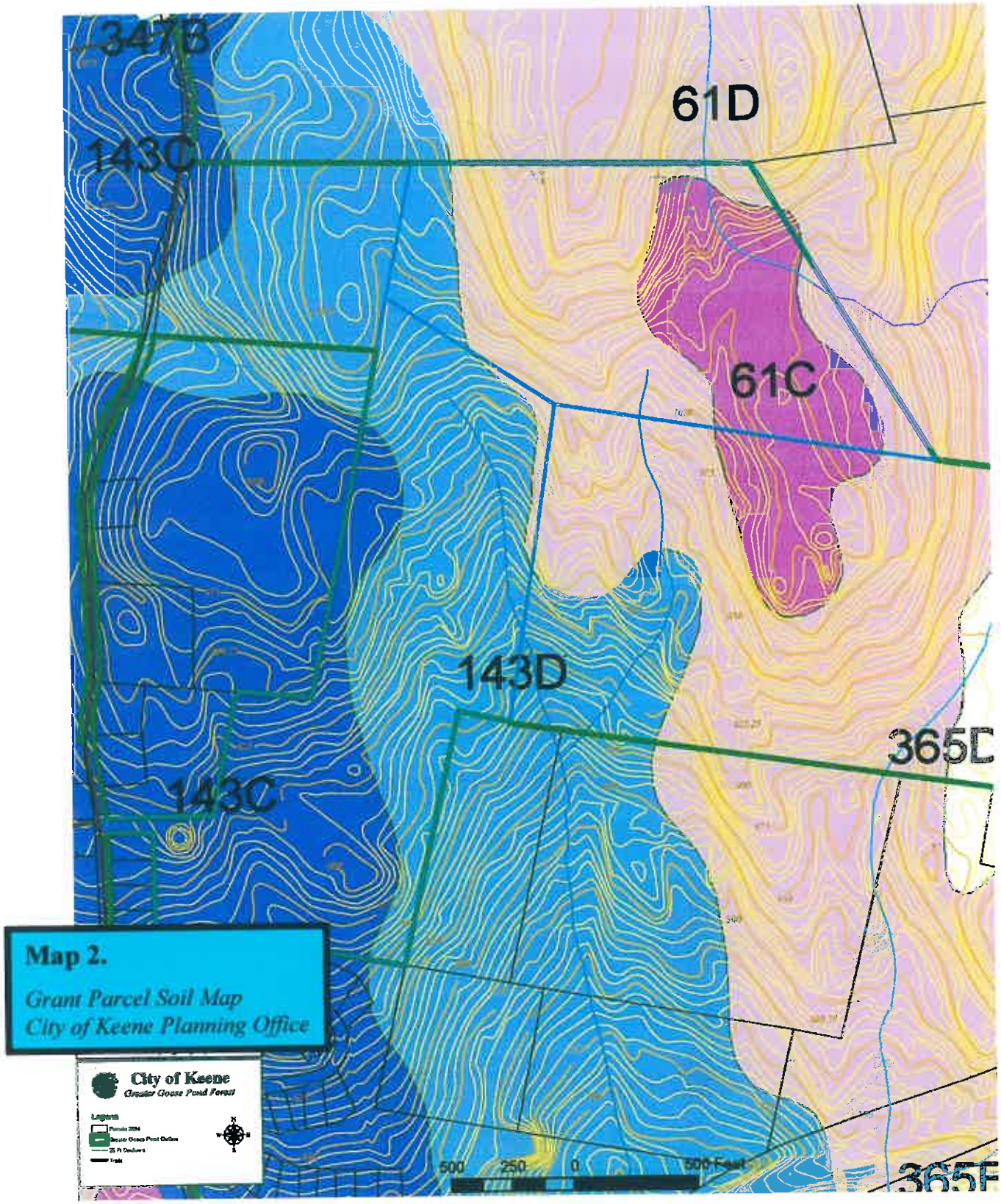
[3]Site Index – average height in feet that a dominant or co-dominant tree can reach in a specified number of years

*Source: United States Department of Agriculture. 1989. Soil Survey of Cheshire County New Hampshire. National Cooperative Soil Survey (United States Department of Agriculture Soil Conservation Service and New Hampshire Agricultural Experimental Station).



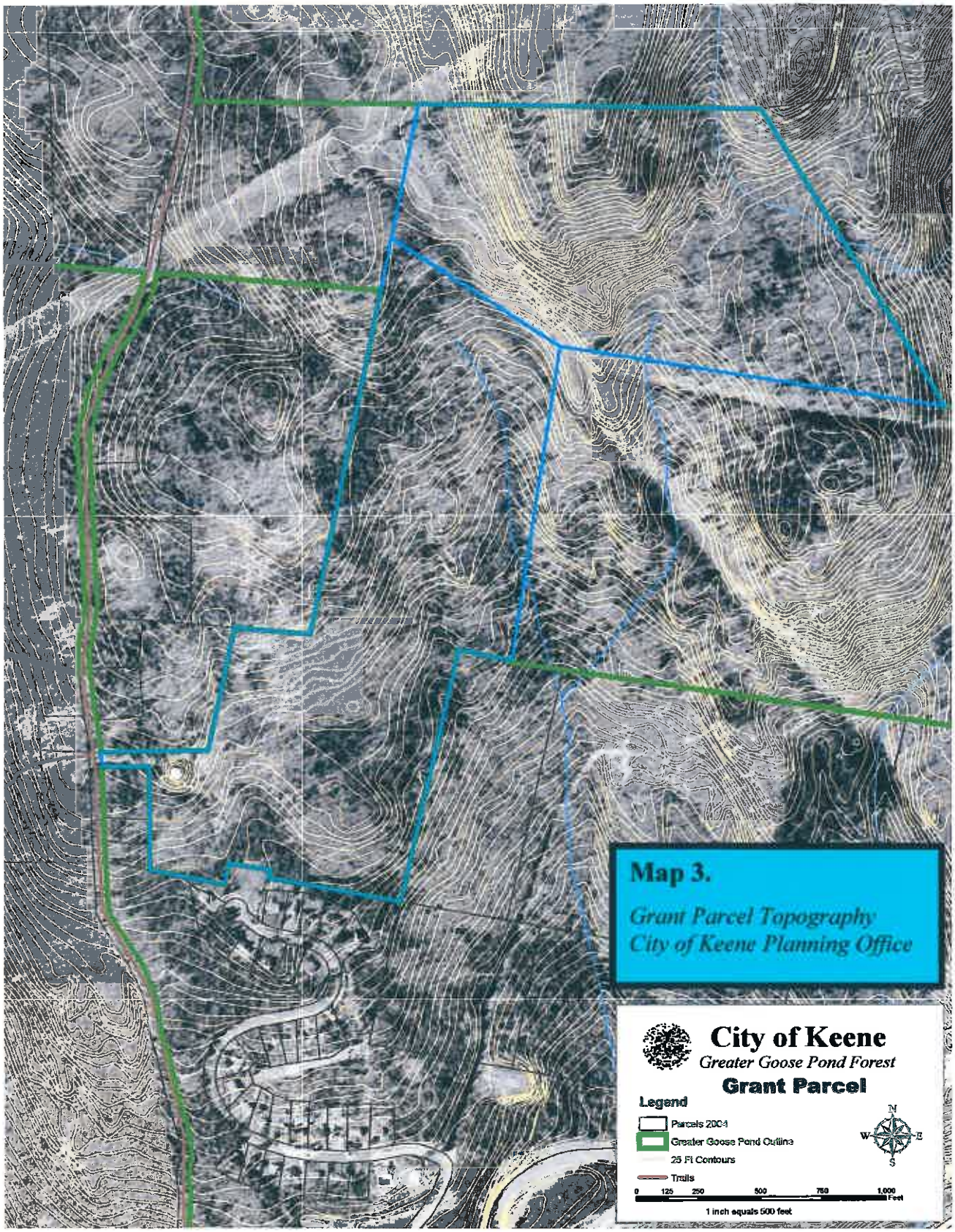
Map 1.

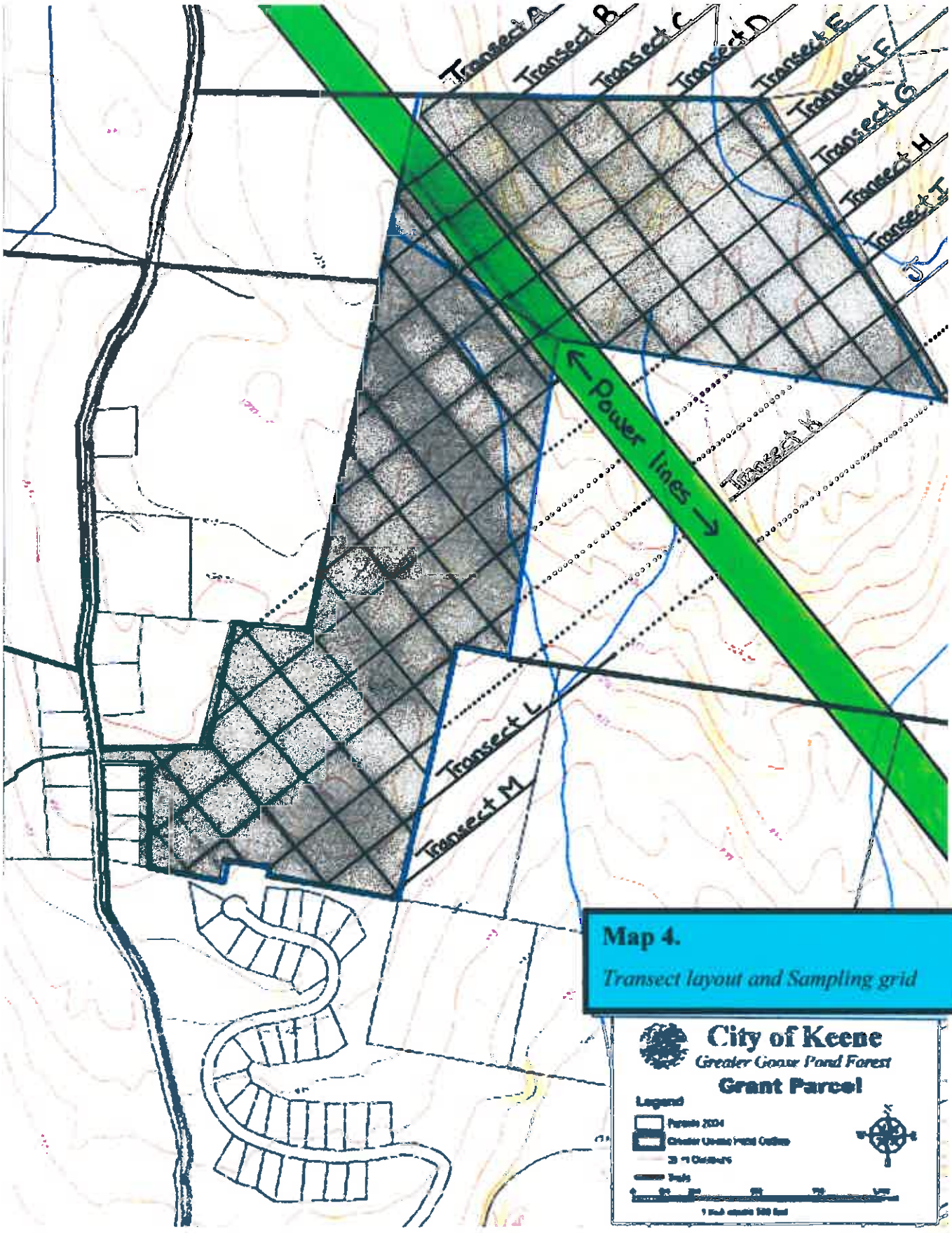
Greater Goose Pond Parcel Map
City of Keene
(From DuBois and King 2002)

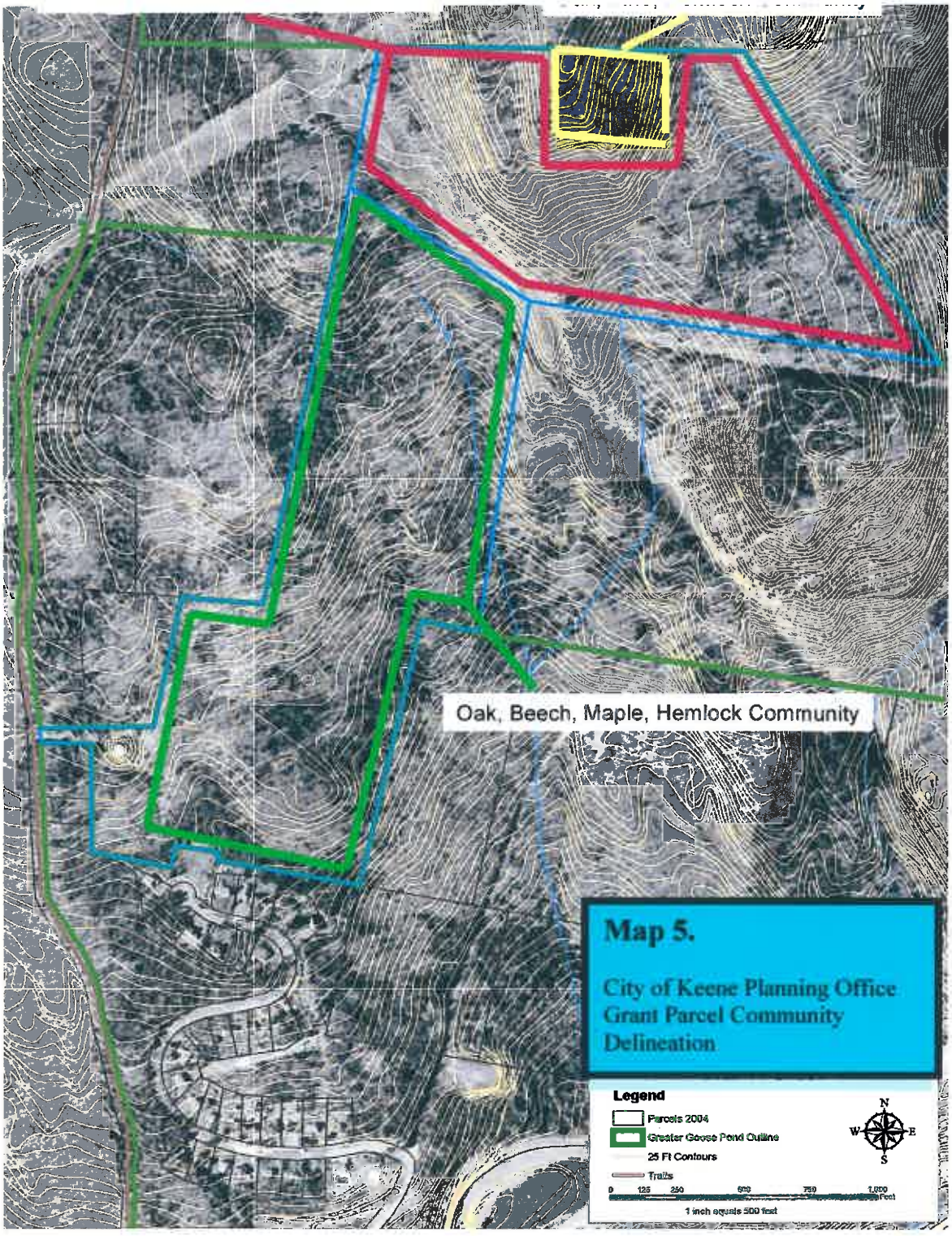


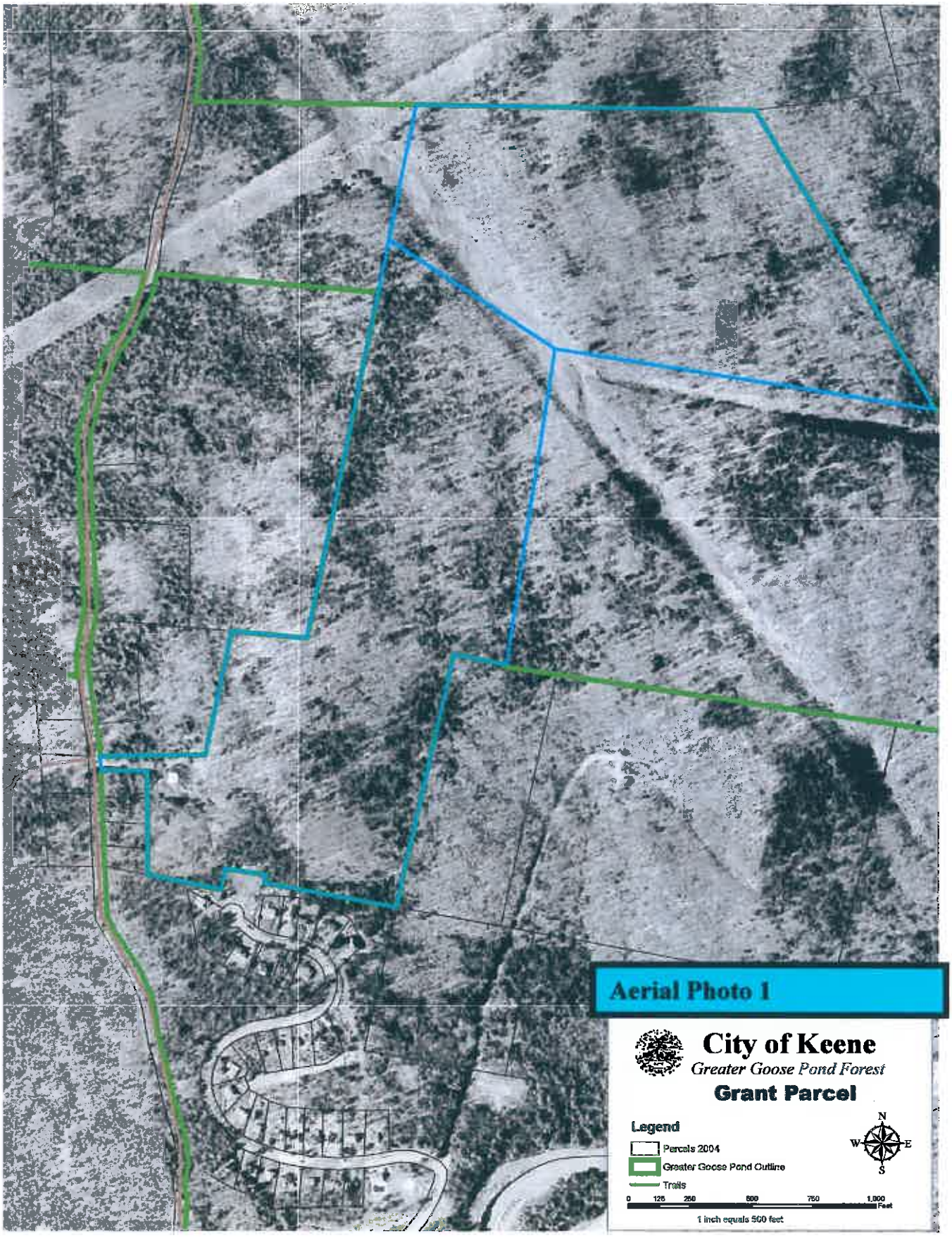
Map 2.

Grant Parcel Soil Map
City of Keene Planning Office


Map 3.
Grant Parcel Topography
City of Keene Planning Office
City of Keene
Greater Goose Pond Forest
Grant Parcel
Legend
Parcels 2004
Greater Goose Pond Outline
25 Ft Contours
Trails
N
W
E
S
0 125 250 500 750 1,000 Feet
1 inch equals 500 feet


Transect A
Transect B
Transect C
Transect D
Transect E
Transect F
Transect G
Transect H
Transect I
Transect J
Transect K
Transect L
Transect M
Power lines
Map 4.
Transect layout and Sampling grid
City of Keene
Greater Goose Pond Forest
Grant Parcel
Legend


Oak, Beech, Maple, Hemlock Community
Map 5.
City of Keene Planning Office
Grant Parcel Community
Delineation
Legend
Parcels 2004
Greater Goose Pond Outline
25 Ft Contours
Trails
N
W
E
S
0
125
250
500
750
1,000
Feet
1 inch equals 500 feet


Aerial Photo 1
City of Keene
Greater Goose Pond Forest
Grant Parcel
Legend
Parcels 2004
Greater Goose Pond Outline
Trails
N
W
E
S
0
125
250
500
750
1,000
Feet
1 inch equals 500 feet

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