ARCHIVES
A-21

TUG HILL FOREST RESOURCE INVENTORY

BY: Ernestine V. Baumann
Assistant Resource Planner



FEBRUARY 1977

TEMPORARY STATE COMMISSION ON TUG HILL

Members

George E. Carlo, Chairman
Camden, Oneida County
Sidney T. Cox, Vice-Chairman
Turin, Lewis County
Richard E. Mark, Secretary
Constantia, Oswego County
John F. Colvin
Copenhagen, Lewis County
James M. Mollahon
Hastings, Oswego County
Joseph A. Goetz
Ice, Oneida County
Urban Karcher
Cauterland, Lewis County
Livingston Lansing
Boonville, Oneida County
A. Milair Smith
Watertown, Jefferson County

Ex Officio Members

Stanley Steingut
Speaker of the Assembly
Warren M. Anderson
Temporary President of the Senate
Burton G. Hecht
Chairman, Assembly Committee on Ways and Means
John J. Marchi
Chairman, Senate Committee on Finance
Perry B. Duryea
Minority Leader of the Assembly
Manfred E. Ohrenstein
Minority Leader of the Senate
Willis H. Stephens
Ranking Minority Member, Assembly Committee on Ways and Means
Jeremiah B. Bloom
Ranking Minority Member, Senate Committee on Finance

Benjamin F. Coe
Executive Director

ACKNOWLEDGEMENTS

The following individuals assisted in developing the study design and in providing background material for this report. I am thankful for their help.

Dr. Richard Lea, Dr. Donald Koten, Dr. John Berglund, Dr. Richard Mark and Dr. Ralph Nyland; SUNY College of Environmental Science and Forestry, Syracuse.

Dr. Ernest Hardy, Department of Natural Resources, Cornell University, Ithaca.

Mr. Fred Johnson and David Lum, Department of Environmental Conservation, Region 6, Lowville.

Mr. Dich Garrett, Department of Environmental Conservation, Region 7, Cortland.

Also, acknowledgement is made with gratitude for the loam of equipment for the timber cruise by Dr. Dan Castignozzi of the Wanakena Campus, SUNY College of Environmental Science and Forestry, and Leigh Blake and Scott Grey of the Department of Environmental Conservation, Region 6.

Special thanks are extended to the men who braved the Tug Hill insects and wetlands to do the timber cruise.

Bruce Hoskins, Lyons Falls
John Kashorek, Bath
Daniel Mahns, Rochester
Gary Martinek, Wanakena
Eric Morrow, Croghan
Dan Richter, Natural Bridge

THE TUG HILL FOREST RESOURCE INVENTORY

Introduction

How good is the Tug Hill forest for timber and other wood fiber production? As a 48 year old Tug Hill logger said recently, "They told me the timber wasn't worth anything but I've been cutting ever since."[1] It would be expected that in a geographic area beset by a short growing season of as few as 103 days[2] at higher elevations, and severe winter conditions which yield much storm damage, and shallow soils which are largely underlain by hardpan, that tree growth would be limited.

Two types of studies were undertaken by the Tug Hill Commission in the summer of 1975 to answer questions of economic viability and management for the Tug Hill forest. The studies concentrated in the nine central towns of the plateau. It was hoped that useful information would be provided to the Cooperative Tug Hill Planning Board in their prototype effort in resource-based land use planning. Whether "good" or "poor," the forest and the associated watersheds are the major economic resource posessed by the people of Tug Hill.

Background for the Studies

In the summer of 1974, the Tug Hill Commission had a sample of the Tug Hill area mapped by stand-size class and type. This means that kilometer square areas were randomly picked and the area inside them was mapped from aerial photographs. The areas were classified as follows:[3]

For forested areas: Stand-size classes:

Sawtimber - live commercial species of trees that are at least the following diameter at breast height (DBH): Hardwoods - 11" and Softwoods - 9".

Poletimber - live commercial trees that are at least 5" DBH but smaller than sawtimber.

20 year pre-commercial - a stand which needs approximately 20 years to reach commercial size.

50 year pre-commercial - a stand which needs at least 50 years to reach commercial size.

---

[1] L. Bumpus to R. P. Trickey, interview 11/13/76.

[2] Ferree, Miles J., and Hagar, Robert K. Timber Growth Rates for Natural Forest Stands in New York State, Technical Publication 78. State University of New York, College of Forestry at Syracuse, 1956, p. 9, Figure 1.

[3] Vaughn, Robert and Checksfield, Gary, "Tug Hill Timber Resource Study," prepared for the Temporary State Commission on Tug Hill, 1974, pp.2-3.

....and Types:

Hardwoods - stands which are primarily stocked with broad-leaved deciduous trees.

Softwoods - stands which are primarily stocked with coniferous trees.

Mixed wood - Stands which include at least 1/3 of one of the above types in conjunction with the other type.

Non-forested areas such as farms and villages were grouped together as Other. Swamps were called wetbrush, as long as the trees, if any, were less than 30' tall. In the thirty-nine towns which make up the Tug Hill Commission's region, 252 kilometer squares were mapped, constituting a 5% sample of the region's acreage. Acreages by stand-size class and type were expanded and reported by town. As the sample size was so limited, there was a question of the accuracy of the town figures. This is one of the reasons for undertaking a 100% area mapping of the nine central towns.

In that study an attempt was also made to assign site classes (productivity assessments) to the area by an indirect method.[4] The fact that a town of greater than 50,000 acres was assigned a single site class, and that soil information for some towns is only available on a very broad scale, indicated that more work ought to be done to discovering what site classes existed on the hill. These became some of the reasons for the timber cruise, as well as to evaluate actual timber volumes in the Tug Hill forest. Except for the indirect attempt to estimate site class based on soil associations in the 1974 study, no publicly available timber volume or site class date exists expressly for Tug Hill. Two publications published in 1956[5] and 1970[6] respectively give figures for cull percentages, timber volumes, and site classes for northern New York hardwoods, but Tug Hill is not treated separately from the western Adirondacks. There is reason to believe, however, that though both geographic regions are covered by a northern hardwood climax forest, that they differ in timber characteristics.

The Studies

1. Stand-size Class and Type Mapping.

The mapping was done using aerial photographs taken in April 1968 for the NYS Office of Planning Coordination. The same methods were used for this mapping as were used in the sample mapping done in 1974 and described earlier in this paper. Additional comments on the procedure are to be found in appendix A. The results of the mapping are to be found in Tables 1 and 2, and the map which follows.

---

[4] Ibid, pp. 5-7.

[5] Ferree and Hagar, p. 19.

[6] The Timber Resources of New York. USDA Forest Service Resource Bulletin NE-20. Northeastern Forest Experiment Station, Upper Darby, Pa. 1970.

Table 1

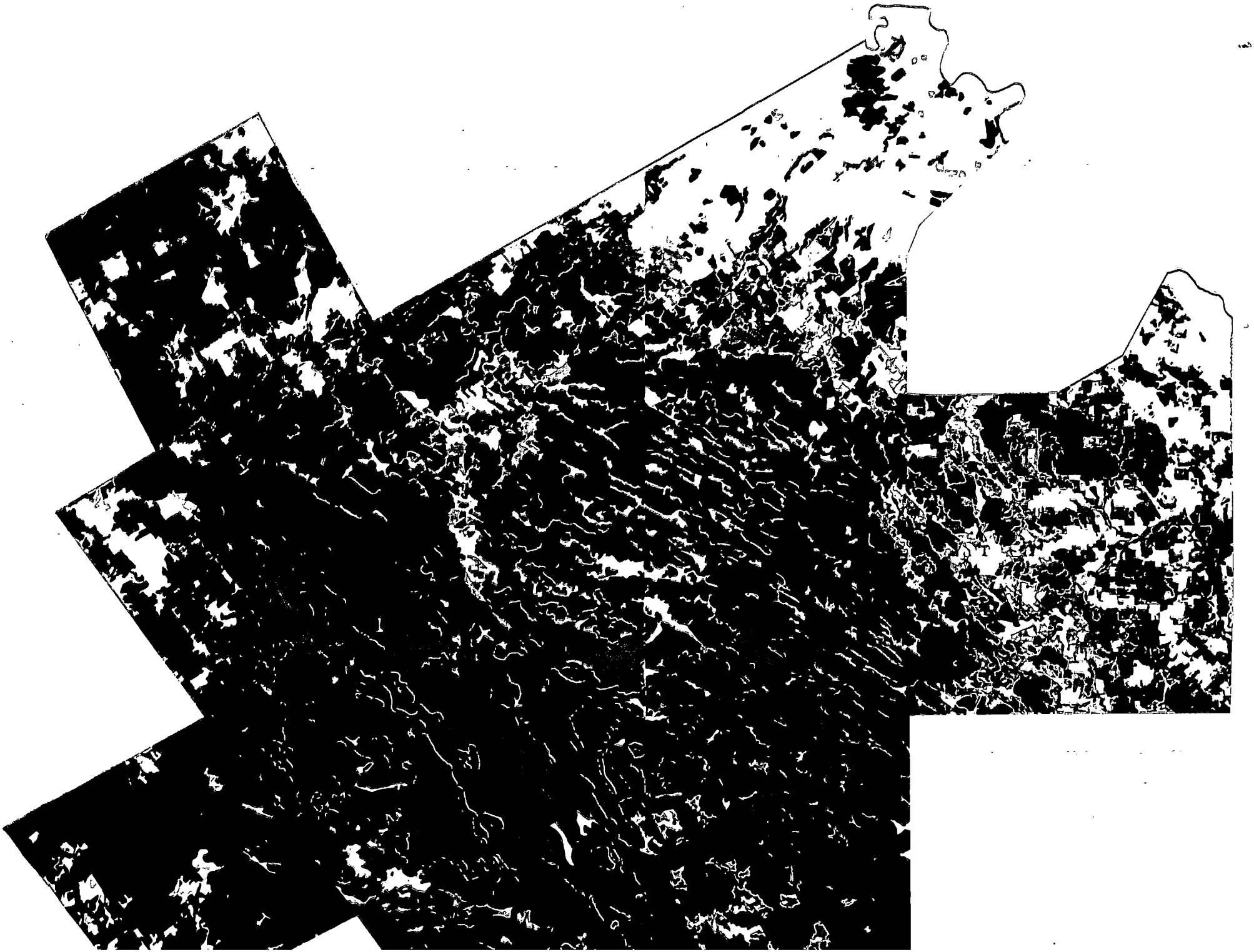
Acreage By Stand Size Class

TOWN	COUNTY	TOTAL ACRES	NON-FOREST	% OF TOT.	WET-BRUSH	% OF TOT.	SAW-TIMBER	% OF TOT.	POLE-TIMBER	% OF TOT.	20 YR. PRE.	50 YR. PRE.	PRE. % OF TOT.
Boylston	Oswego	23,959	1,877		454		5,387		12,286		872		
Florence	Oneida	35,568	4,243		650		345		22,855		684		
Martinsburg	Lewis	48,906	23,559		2,512		3,199		21,450		2,411		
Montague	Lewis	41,266	1,633		4,013		8,046		21,841		336	5,054	
Osceola	Lewis	55,103	1,196		1,621		24,412		24,807		360	2,689	
Pinckney	Lewis	26,429	6,249		578		470		11,594		1,044		
Redfield	Oswego	60,292	3,586		680		28,782		22,256		444	4,117	
West Turin	Lewis	66,939	12,550		4,001		5,909		26,079		3,507		
Worth	Jeff.	26,934	3,052		304		8,737		11,337		257	3,247	
Total		385,354	57,945	15%	14,813	4%	85,287	22%	174,505	45%	9,915	42,889	14%

Table 2

Forested Acreage By Stand Size Class and Type

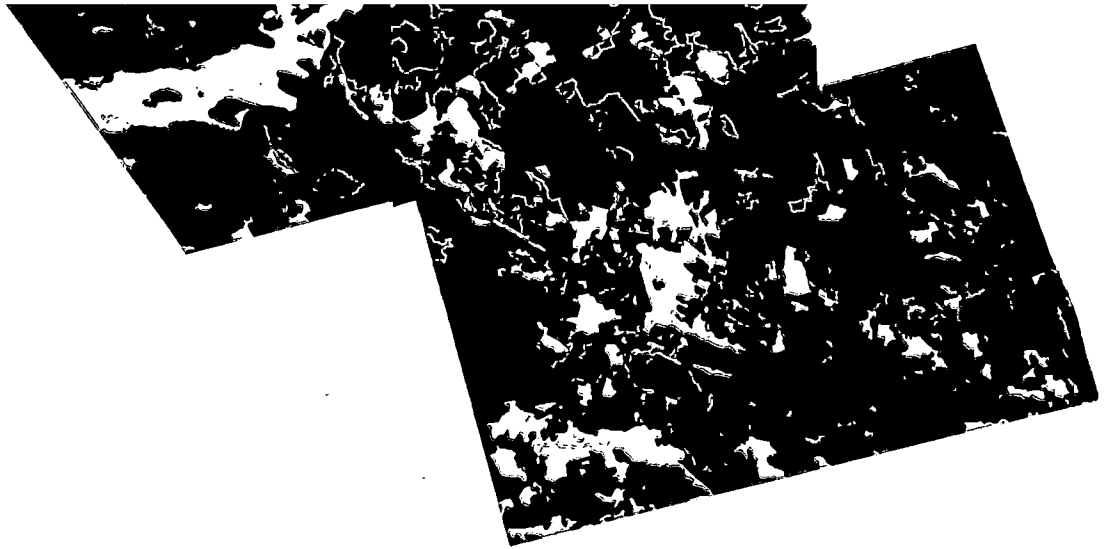
TOWN	TOT. FOR. ACRES	HDWD. SAW.	SOFTWD. SAW.	MIXWD. SAW.	TOT. SAW.	SAW % OF FOR. AC.	HDWD. POLE.	SOFTWD. POLE.	MIXWD. POLE.	TOT. POLE.	POLE % OF FOR. AC.	20 YR. PRE.	50 YR. PRE.	ALL. PRE. % OF FOR. AC.
Boylston		5,387	0	0	5,387		10,162	2,023	101	12,286		872		
Florence		341	0	5	345		17,905	4,461	489	22,855		684		
Martinsburg		3,199	0	0	3,199		8,522	832	1,371	21,450		2,411		
Montague		8,046	0	6	8,046		18,812	1,843	1,186	21,841		336	5,054	
Osceola		24,389	0	25	24,412		22,390	1,233	1,184	24,807		360	2,689	
Pinckney		470	0	0	470		7,842	3,431	321	11,594		1,044		
Redfield		28,782	0	0	28,782		20,996	877	383	22,256		444	4,117	
West Turin		5,909	0	0	5,909		19,906	2,700	3,473	26,079		3,507		
Worth		8,737	0	0	8,737		8,844	2,446	47	11,337		257	3,247	
Total	312,596	85,257	0	30	85,287	27%	135,379	19,846	8,555	174,505	56%	9,915	42,899	17%



FOREST CLASSIFICATIONS

LEGEND

- SAW TIMBER HARDWOOD
- SAW TIMBER SOFTWOOD
- SAW TIMBER MIXED
- POLE TIMBER HARDWOOD
- POLE TIMBER SOFTWOOD
- POLE TIMBER MIXED
- 20 YEAR PRE-COMMERCIAL HARDWOOD
- 20 YEAR PRE-COMMERCIAL SOFTWOOD
- 20 YEAR PRE-COMMERCIAL MIXED
- 50 YEAR PRE-COMMERCIAL HARDWOOD
- 50 YEAR PRE-COMMERCIAL SOFTWOOD
- 50 YEAR PRE-COMMERCIAL MIXED



TUG HILL
COOPERATIVE PLANNING AREA

SCALE

0 1 3/4 3 1/2 5 1/4 7 miles

N

As can be seen from these tables, the top of the Tug Hill Plateau is primarily wooded, and the predominant stand-size class is poletimber. The predominant type is hardwoods. Poletimber covers nearly half of the nine town acreage. It is important to note that the wetbrush class may seem smaller than one would expect because of the abundance of wetlands on the hill, but this is because all wet woods with trees of at least 30' in height were classed in the appropriate wooded category.

Several implications can be drawn from the predominance of pole-sized timber. From what is known of the history of the area, some of this land represents transition back to forest after having been cleared for agricultural use. Some of the lands have been heavily cut over around the turn of the century and are still regenerating themselves at their slow growth rate. Some of the lands are wet and forest growth is inhibited, which results in stands of limited size trees.

2. Timber Cruise.

The timber cruise consisted of timber inventory taken on 186 one-fifth acre plots in the Towns of Montague and Osceola in Lewis County and Redfield in Oswego County. The number of randomly selected plots assigned to each of the towns was based on its percentage of the nine towns' forested acreage. It was hoped that 500 plots could be done altogether but funds ran out before that could be accomplished. Access to each plot is referenced to the nearest road intersection or other identifiable landmarks. A hand compass and 2 chain trailer tape were used to locate the plots. A white stake was placed at the plot center to permit checking and possible further study at a later date.

On each plot, a two man crew tallied all the trees greater than 5" DBH. For trees larger than 9" for softwoods and 11" for hardwoods, a height estimation was made in 16' logs and recorded. Percent merchantability[7] and resources for any cull deduction[8] were recorded for each tree. From these measures, gross and net board footage were calculated for sawtimber size trees using form class volume tables. Cubic volumes were calculated for all trees using tables prepared by Dr. Richard Lea of the College of Environmental Science and Forestry, Syracuse.[9] See Appendix E.

Board feet volumes for sound cull portions of sawtimber size trees were converted to cubic footage (500 board feet = 1 cord - 80 cubic feet)[10] to show the additional cubic volume of wood that might be used for wood chips. Net cubic volume for poletimber sized trees were calculated by applying the merchantable percent to their gross cubic volumes.

---

[7]Martin, Charles, Forest Mensuration for the Forest Technician, SUNY College of Environmental Science and Forestry, Wanakena, 1970, p. 127.

[8]Silverborg, Savel, Northern Hardwoods Cull Manual, SUNY, College of Environmental Science and Forestry, 1954.

[9]Based on sampling in the Towns of Diana in Lewis County, and Antwerp in Jefferson County and Pitcairn in St. Lawrence County, 1958-1959.

[10]U. S. Forest Service

Additionally, on each plot, an assessment of stand-size class and type were made in order to serve as an extra field check on the mapping. The guidelines for stand-size classes and types are as follows:

Sawtimber - 66%+ of the tallied trees and crown cover of the plot are sawtimber size.

Poletimber - 66%+ of the tallied trees and crown cover of the plot are poletimber size (greater than 5" DBH but less than sawtimber size).

Other - plots where the trees are smaller than poletimber size or the land is not in forest cover.

Hardwoods - 66%+ of the trees tallied are hardwoods.

Softwoods - 66%+ of the trees tallied are conifers.

Mixed wood - the mix of hardwoods and softwoods is such that the percentage of either one exceeds 33% but is less than 66%.

Also, increment borings were taken on three dominant and codominant (mature) trees on each plot and the length of the last ten years' growth was recorded. This is an indication of the growth rate of these representative trees. It does not, however, give growth rate for the stand, as that must take many other factors into consideration. On these same three representative trees, their height to a 4" top was accurately measured with a topographic Abney. This device allows the technician to figure out the height of the tree by a geometric relationship when he stands at a specific distance back from the tree. The height and diameter relationship of these trees were used to assign the site class (a measure of productivity) to the plot. See appendix B.

The forest in the "core" towns of Tug Hill is composed mostly of northern hardwoods. There are some plantations of softwoods, mostly on former farmland, and poorly drained sites support natural stands of softwoods and a few mixed stands. However, few of the softwood trees are of sawtimber size.

In terms of volume, the cruise data indicate that Tug Hill areas are comparable to other areas of northern hardwoods. Combined volume data for three towns are presented in Table 3, and general volume ranges in Table 4. A detailed explanation of the statistical treatment of the volume data can be found in Appendix C.

The "R" in Table 3 is the standard error; the smaller a number it is, the more dependable is the figure that it is applied to. So, for example, the gross board feet of hardwood sawtimber per acre on site class 1 areas is really between 8584.1 board feet (Int.) and 8555.1 board feet, a relatively narrow range. In contrast, the gross board feet volume of mixed wood sawtimber on site class 2 areas is really between 5540.8 board feet and 5336.8 board feet, a much larger range. This degree of error is related to the number of plots which were used in the calcuations. As can be seen in table, the more plots for a particular category, the more dependable the volume figure (and the smaller the "R").

TABLE 3

Average Volume Per Acre (International 1/4" Scale)
Town of Montague, Osceola and Redfield
By Stand-size Class and Type
(standard error at 95% confidence level)

Stand-size Class/Type	No. Plots	Gross B.F.	R as % of Mean	Net B.F.	R as % of Mean	Pulp Net C.F.	R
SITE CLASS 1							
Sawtimber-hardtimber	38	8569.6	±14.5	3993.3	± 20.9	828.7	±14.2
Poletimber-hardtimber	7	3472.8	±79.0	2013.6	±139.0	885.0	±35.3
SITE CLASS 2							
Sawtimber-hardwood	55	7034.6	± 9.7	2888.6	± 19.2	883.8	± 7.7
Sawtimber-mixed wood	4	5438.8	±102.0	1206.2	±100.0	1075.0	±49.2
Poletimber-hardwood	34	2927.5	±21.2	1261.8	± 28.3	795.0	±11.9
SITE CLASS 3							
Sawtimber-hardwood	15	6919.0	±17.3	3348.8	± 35.6	797.4	±16.2
Poletimber-hardwood	24	3391.4	±27.3	1967.1	± 33.4	750.4	±19.4
Poletimber-softwood	5	1776.0	±11.1	1493.0	±108.0	1072.0	±89.9
Poletimber-mixed wood	4	2241.2	±59.9	1073.8	±114.0	731.0	±82.0

TABLE 4

Gross Timber Volume Per Acre Ranges By
Stand-size Classes for Northern Hardwoods
In Board Feet (International 1/4" Scale)

	Light Poles	Heavy Poles	Light Sawtimber	Medium Sawtimber	Heavy Sawtimber
Site Class 1	0-499	500-1999	2000-4999	5000-9999	10000-19999
Site Class 2	0-199	200-1999	2000-4999	5000-9999	10000-19999

SOURCE: Ferree, Miles J. and Hagar, Robert K., Timber Growth Rates for Natural Forest Stands in New York State, 1956, p. 12, Table 2.

By a comparison of Table 3 and 4, it would appear that the heaviest sawtimber on the hill is in the medium sawtimber range, though isolated plots contained around 10,000 board feet. The poletimber stands, however, have gross volumes in the light sawtimber range. This is not of special concern, as the stand-size class designation of the plots in the field was somewhat subjective.

The reason that the volumes are reported by site class is that site class reflects the ability of the site to grow wood, site class 1 being better in potential than sites 2 and 3. This is apparent in the figures in Table 3. In fact, site class 3 is very poor and usually reflects interference with tree growth caused by unproductive or shallow soil, or conditions of excess wetness. Many of the sample plots in the three towns turned out to be in actual swamps. A swamp, or freshwater wetland, as they are now being called,

can be logged, but the rate at which trees grow back and their low quality makes wet areas poor economic choices for forest management and timber production. These areas are said to "have a long rotation" which means that it will be many years between timber cuttings. Wet areas along the railroad bed in Highmarket (now northern West Turin) and northern Osceola were heavily cut over many years ago, and many acres still do not have even a respectable poletimber stand on them.

A careful look at Table 3 also shows that the cull percentage on Tug Hill is quite high. The cull percentage is that percentage of the trees that are not merchantable were estimated for Tug Hill and published in Timber Growth Rates for Natural Forest Stands in 1956.[11] Table 5 shows a comparison of the cull percentages based on the cruise data and those in the 1956 publication.

Table 5

Cull Percentage by Site Class for Hardwoods on Tug Hill

	Av. Gross B.F./Ac. (Int. 1/4" scale)	Av. Net B.F./Ac.	Cull %	1956 Cull %
SITE CLASS 1				
Sawtimber	8569.6	3993.3	54	42
Poletimber	3472.8	2013.6	42	34
SITE CLASS 2				
Sawtimber	7034.6	2888.6	59	57
Poletimber	2927.5	1261.8	57	57
SITE CLASS 3				
Sawtimber	6919.0	3348.8	52	Not Given
Poletimber	3391.4	1967.1	42	Not Given

The data indicates that the cull percentage on the hill is even higher than was estimated for Site Class I.

The cruise data indicates that the entire spectrum of site classes is found on Tug Hill. It appears that there is a relationship between site class and elevation. One aspect of this relationship is on a gross scale (geographic area-wide) where the higher the elevation of a forest, the shorter is its growing season and the more severe the climate hardships. However, on the microenvironment level (small areas) the reverse situation occurs. Growth is better, and the site class is more likely to be 1 or 2, if the site has a higher elevation. The higher ridges appear to have better growing conditions than the more protected hollows. This relationship is shown in Table 6.

---

[11] Ferree and Hagar, p. 19.

TABLE 6

Average Elevation by Site Class on Tug Hill

Site Class	Town	No. Plots	Average Elevation (feet)
1	Montague	11	1806
	Osceola	22	1530
	Redfield	14	1436
	Total	45	1566
2	Montague	25	1781
	Osceola	37	1609
	Redfield	37	1355
	Total	99	1558
3	Montague	20	1762
	Osceola	24	1588
	Redfield	34	1252
	Total	78	1486

The actual cause of this phenomenon is likely to be soil drainage or lack of it. As the Tug Hill plateau receives an abundance of precipitation, much of it is snow[12] which releases its moisture very slowly, it is quite wet. In fact, it is this overabundance of water, as found in saturated soil, which serves as a limiting factor in tree growth. An employee of the Department of Environmental Conservation who was mapping the plateau's freshwater wetlands from aerial photographs remarked that there are more wetlands here than anywhere else in New York State.[13] They account for about 12% of the area in the nine towns of the Cooperative Tug Hill Planning area.[14]

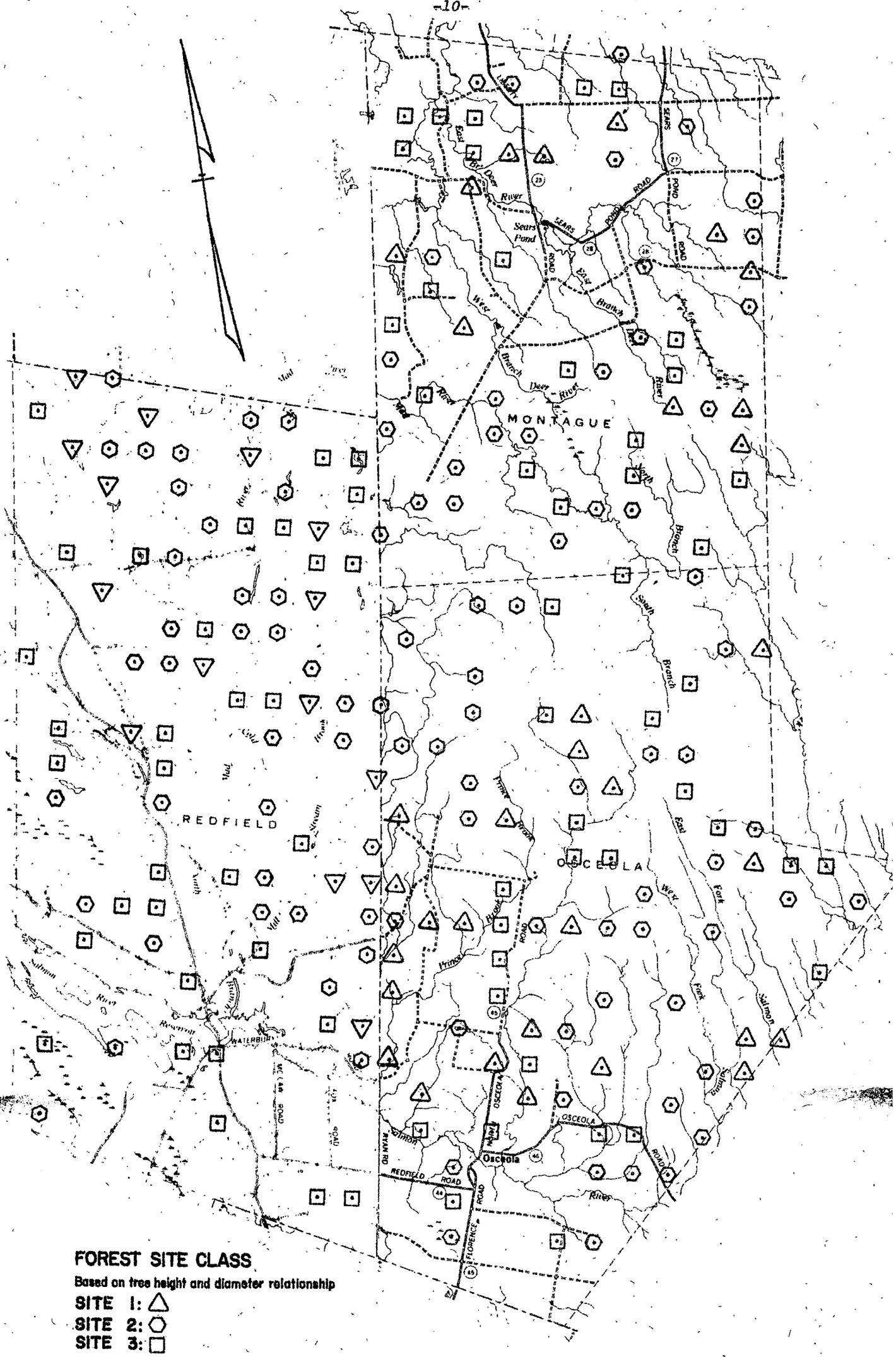
Though there are areas of site class 1 on Tug Hill, they are not as productive as some site class 1 areas elsewhere. Site class in the cruise was assigned the height of trees to a 4" top, measured by a topographic Abney, of three dominant or codominant trees per plot, and their diameter, by species. A complete listing of these trees can be found in Appendix D. By this method several plots were classed as site 1. However, as can be seen in Table 7, the average height of the trees in 16' logs is not comparable to those in the Adirondacks and Catskills. A map of the site classes found on the sample plots can be seen on the next page.

---

[12] Resources of the Tug Hill Region, prepared for the Temporary State Commission on Tug Hill by the State University of New York, College of Environmental Science and Forestry, 1974, p. 72, fig. 28.

[13] C. Gardner to P.J. Jerome, conversation 3/76.

[14] Smyth, Patrick J., Land Use Analysis, Cooperative Tug Hill Planning Board, Report No. 1 , 1975, Table A-1.



FOREST SITE CLASS

Based on tree height and diameter relationship

SITE 1: △

SITE 2: ⬡

SITE 3: □

Dot indicates plot center

TABLE 7

Average Height of Hardwoods in 16' Logs by Site Class

	Tug Hill	Adirondacks/Catskills
Site Class 1	1-1/4	3
Site Class 2	1	2 - 2-1/2
Site Class 3	1	1-1/2

SOURCE: For Adirondack/Catskills figures, unpublished, data from the NYS Board of Equalization and Assessment.

Therefore, using the measure of site class used by NYS - BEA, none of the Tug Hill plots would have been classed better than site 3. This would seem to be unlikely. The economic and management implications of this situation will be discussed later.

The importance of the volume figures in Table 3 becomes obvious when the acreage in each stand-size class in the nine towns is considered. As they are mostly forested, from Table 1 one sees that there are 85,287 acres of sawtimber, and 174,505 acres of poletimber. Table 8 was developed by multiplying the volume per acre figures by the acreage in each category computed after the area was mapped.

The economic value of this timber can be roughly estimated using stumpage prices from State timber sales.[15] The price range varies from a low of $20-25/1000 board feet for beech to a high of $110/1000 board feet for sugar maple, cherry, and yellow birch. The average stumpage value for hardwoods is about $60/1000 board feet. This means that there is a sizeable economic potential in the timber resources on the hill. Adverse factors, such as inaccessibility, market fluctuations, and other economic variables cloud the picture, but if the economy improves, the valuable resources will be available.

Conclusions and Recommendations

Recommending a forest management plan for the Tug Hill towns is difficult in that it would be hard to justify any expenditure for timber stand improvement if there was no hope of recovering the investment. This does not mean, however, that forest land owners should ignore the possibility of managing their stands. There is free help available for forest lands meeting certain criteria in the Forest Practice Act program administered through the NYS DEC. There is also a federal cost-sharing program for certain eligible lands for certain timber stand improvement work available through county ASCS offices. It is also important to note that through judicious harvesting/thinning, and even careful preparation of timber sales contracts, the overstocking and poor quality characteristics of many of the stands could be improved.

---

[15] F. Johnson, District Forester, Region 6, Department of Environmental Conservation to E. Baumann, 7/14/76.

TABLE 8

Timber Volumes by Town

Town	Stand Size Class & Type	Volume in Board Feet (Int. 1/4" Scale) Gross	Net	Net Pulpwood in Cubic Feet
Boylston	Sawtimber Hardwood	40,443,979	18,370,747	4,506,764
	Poletimber Hardwood	33,167,751	17,758,095	8,232,236
	Poletimber Softwood	3,592,848	3,020,339	2,168,656
	Poletimber Mixed-Wood	226,361	108,454	73,831
	Total	77,430,939	39,257,635	14,981,487
Florence	Sawtimber Hardwood	2,560,125	1,162,878	285,076
	Sawtimber Mixed-Wood	27,194	6,031	5,375
	Poletimber Hardwood	58,440,129	31,288,987	14,504,840
	Poletimber Softwood	7,922,736	6,660,273	4,782,192
	Poletimber Mixed-Wood	1,095,947	525,088	357,459
	Total	70,046,131	39,643,257	19,934,942
Martinsburg	Sawtimber Hardwood	24,017,132	10,909,229	2,676,283
	Poletimber Hardwood	27,814,955	14,892,195	6,903,672
	Poletimber Softwood	1,477,632	1,242,176	891,904
	Poletimber Mixed-Wood	3,072,685	1,472,180	1,002,201
	Total	56,382,404	28,515,780	11,474,060
Montague	Sawtimber Hardwood	60,406,954	27,438,469	6,731,284
	Poletimber Hardwood	61,400,486	32,873,970	15,239,601
	Poletimber Softwood	3,273,168	2,751,599	1,975,696
	Poletimber Mixed-Wood	2,658,063	1,273,527	866,966
	Total	121,807,440	64,337,565	24,813,547
Osceola	Sawtimber Hardwood	183,105,290	83,171,367	20,403,837
	Sawtimber Mixed-Wood	135,970	30,155	26,875
	Poletimber Hardwood	73,078,721	39,126,525	18,138,139
	Poletimber Softwood	2,189,808	1,840,869	1,321,776
	Poletimber Mixed-Wood	2,653,581	1,271,379	865,504
	Total	261,163,370	125,440,295	40,756,131

TABLE 8 (cont.)

Timber Volumes by Town

own	Stand Size Class & Type	Volume in Board Feet (Int. 1/4" Scale) Gross	Net	Net Pulpwood in Cubic Feet
inckney	Sawtimber Hardwood	3,528,619	1,602,794	393,202
	Poletimber Hardwood	25,595,503	13,703,895	6,352,804
	Poletimber Softwood	6,093,456	5,122,483	3,678,032
	Poletimber Mixed-Wood	719,425	344,690	234,651
	Total	42,417,003	20,773,862	10,658,689
edfield	Sawtimber Hardwood	216,086,620	98,152,376	24,079,021
	Poletimber Hardwood	68,528,844	36,690,510	17,008,859
	Poletimber Softwood	1,557,552	1,309,361	940,144
	Poletimber Mixed-Wood	813,556	398,789	265,353
	Total	286,986,572	136,551,030	42,293,377
Vest Turin	Sawtimber Hardwood	44,362,999	20,150,871	4,943,469
	Poletimber Hardwood	64,971,193	34,785,735	16,125,850
	Poletimber Softwood	4,795,200	4,031,100	2,894,400
	Poletimber Mixed-Wood	7,783,688	3,729,307	2,538,763
	Total	121,913,080	62,697,013	26,502,482
Worth	Sawtimber Hardwood	65,594,774	29,794,917	7,309,374
	Poletimber Hardwood	28,865,931	15,454,890	7,164,524
	Poletimber Softwood	4,344,096	3,651,878	2,622,112
	Poletimber Mixed-Wood	105,336	50,469	34,357
	Total	98,910,137	48,952,154	17,130,367

Cull removal and releasing should be given the highest priority in forest management plans for the lands on the hill. Cull removal involves eliminating trees often of sawlog size, but unmerchantable due to rot or poor form. This improves the composition and vigor of the stand and opens the tree canopy to encourage reproduction of desired trees species.

The great discrepancy among stumpage values by species, as mentioned on page 11, indicates just how important the species mix of the stand is. Cull removal and releasing can be used to improve both the quality of the individual trees, and to an extent determine the species composition of the stand.

Increment borings taken on the timber cruise plots showed that where adjacent trees had been girdled, the remaining trees put on more wood (increased their rate of diameter growth) per year in the seasons after the girdling than in the seasons before their release. From the gross volume figures developed by the timber cruise, it is apparent that Tug Hill can produce reasonable volumes per acre, though probably more slowly than elsewhere, but nearly half of this volume is lost to cull. Releasing, or removal of some of the competing trees, in overstocked (too many stems) stands would be likely to reduce the cull percentage by the time sawlogs are to be harvested.

The delicate balance of timber value to other land values and holding costs is becoming more and more important. Taxation plays a significant role in holding land for timber production. It is the contention of forest land owners nearly everywhere that their land is taxed more heavily than other categories of land use.[16] They also contend that taxation based on "highest and best use" penalizes them severely, particularly when there has been subdivision activity on nearby land. Several states passed laws allowing for assessment based on "present use." Hence, differential treatment of lands, such as forests and farms, for taxation purposes is beginning to gain acceptance. Even refinements of assessments to ones based on productivity may be an improvement over the short-comings of the present assessment system.[17]

When land use planning and regulation is added to the picture, the necessity for accuracy in assessment is made all the more acute. Land which, through State or local regulations, such as the Freshwater Wetlands Act and zoning respectively, has had its development potential affected should be taxed accordingly. Likewise lands whose potential is enhanced by land use regulation should also pay accordingly. Lands which are designated for timber production or agriculture, or other resource protection or open-space uses should be assessed at present use. Without coordination between the taxation and planning powers of governments, land use regulation can not work equitably.

---

[16] Forest Taxation and the Preservation of Rural Values in New York. USDA Forest Service. Agricultural Economic Report 150, 1969, p. 5.

[17] Williams, Ellis T. and Canham, Hugh O., "The Productivity Concept in Forest Taxation," Forest Science, vol. 18, No. 1 (March 1972, pp. 3-20.

The tax picture on Tug Hill is considered by the residents to be particularly difficult because timber growth is so slow,[18] and taxes are high due to the rural nature of the towns which have a low valuation because they lack highly valuable (intensively developed) property with taxable improvements. When the tax picture for forest land is considered, the management implications are clear. In one of the towns in Lewis County for example, 500 acres of forest land in seven parcels (one owner) are taxed at between $1.00 and $2.36 per acre. The return on an acre of land in terms of forest growth/acre/year is only about $1.80 for sawlogs and about 50¢ for pulp. This makes it obvious that the recommendation of intensive forest management is not meaningful for Tug Hill forests.

In conclusion, the planning implications of the timber inventory data are more complicated. On one hand, the data indicates that the overall productivity of the Tug Hill forest is a limited one. However, there are well-drained sites quite capable of producing respectable timber stands. Generally a goal of resource-based planning is to direct development away from areas with high resource potential, such as prime gorests or prime agricultural land.

It would be difficult in this case to justify keeping development out of the Tug Hill forest to prevent loss of a highly productive forest. However, it is important to consider other factors in making such a planning recommendation. Not only does the forest play a significant role in the local economy, in spite of its limited productivity; it covers the top of a plateau that is the source of pure water for four large watersheds; it provides fish and game for local residents and others, and brings revenue that comes from hunting, fishing and winter sports. For these reasons, as well as the severity of the climate, the inability of the soil to absorb waste water, and distance to places of employment and schools, intensive development should still be discouraged in the large areas of the Tug Hill forest.

---

[18] Barwick, James. Property Taxes in Tug Hill. Temporary State Commission on Tug Hill, Watertown, New York, 1976. - Ferree and Hagar, Table 12.
- Ferree and Hagar, Table 12.

APPENDIX A

AIR PHOTO INTERPRETATION OF THE COOPERATIVE TUG HILL PLANNING AREA

The aerial photographs used in the mapping portion of the Tug Hill Study were taken in April, 1968 for the Land Use and Natural Resources Inventory (LUNR) conducted for the NYS Office of Planning Coordination. Since the photographs are already seven years old, and forests are dynamic, certain photo interpretations will not correspond with the actual situation. This is so particularly where the land use has changed, or succession causes a change in classification of a given area. Still, these aerial photos are recent enough to present a reasonable picture of the forest resources of the Tug Hill area.

The LUNR photos were taken during spring conditions, thus the hardwood leaves are for the most part absent and interpretation is relatively easy. Hardwoods reflect more light presenting light and soft tones of grey, while softwoods absorb more light and appear very dark. Sometimes, due to poor picture quality or adverse weather conditions, the contrast is not completely satisfactory. These conditions are not severe enough, however, to alter significantly the ratio of softwoods to hardwoods.

Care must be used in classifying an area as either softwood or hardwood since underestimation of the hardwood proportion often occurs due to the lack of some crowns. Shadows are very useful here, not only for indicating the presence of trees but also gauging their relative sizes. In addition, many softwoods appear to be mixed in with the hardwoods but are in reality undergrowth. Thus a mixture of light and dark tones does not necessarily indicate a mixed stand of pole or saw size trees. It is considered a mixed stand of hardwoods and softwoods when there is between 1/3 and 2/3 of one type present in conjunction with the other type, and the size criteria is met.

Poletimber and sawtimber classification was based primarily on crown size and, when present, size of tree shadows. This is not an infallible method, since pole sized trees may sometimes have large crowns, and saw sized trees may have small crowns. It is accurate, though, within a relatively homogeneous site, particularly when there are a large number of trees in the sample. In cases of mixed stands, the fraction of either poletimber or sawtimber must be between 1/3 and 2/3 of the total.

Precommercial classification was determined mainly by vegetative height and width. Those trees that would take twenty years or less to mature to pole size were placed in the 2Pre category while those that would take more than twenty years were classified in the 5Pre category. This was fairly easy to determine from aerial photos, but again some land use changes since 1968 may result in some mapping errors.

The Wb category of marshes, shrub wetlands, and bogs was detected by the presence of water, which may appear either light or dark, and the shrub-size and smaller vegetation (not exceeding thirty feet in height). Anything larger went into the appropriate woodland category.

All remaining land uses, such as agricultural, residential, or commercial land, fell into the "other" category. Small wooded areas occupying pastures or public facilities land were placed into the "other" category. However, forest

categories were mapped down to 3.7 acres or 1.5 hectares in size. In the case of pastures, evidence of grazing within the trees had to be present for it to be placed in the "other" category. If no detectable grazing occurred in these wooded areas, they were categorized in the appropriate woodlands classification. Trees around residences or actively landscaped areas were also interpreted as being in the "other" category.

The actual photo interpretation was done with stereo glasses, resulting in a magnified three-dimensional image. The boundaries were drawn on the photos and later transfered and labeled on a mylar overlay. A field check was conducted of selected areas on the Redfield topographic quad overlay, but not of any other maps. If more time had been available, field checking of the whole area would have been desirable for maximum accuracy in developing interpretation criteria.

Christina Syrett
Resource Information Laboratory
Cornell University
Ithaca, New York

APPENDIX B

Table 1

Tree Height and Diameter of Dominant and Co-dominant Trees by Species for Determination of Forest Site[1]

Tree d.b.h.	White Pine	Hemlock	Red Spruce	Balsam Fir	Hard Maple	Yellow Birch	Beech	Red Maple	Basswood White Ash	Black Cherry	Red Oak	Aspens
Inches	Site 1 - minimum height in feet											
6	19	12	19	20	21	20	19	21	22	20	20	26
8	35	26	32	35	31	33	32	31	37	34	31	37
10	49	39	43	49	40	40	39	41	48	45	39	45
12	58	50	53	59	47	47	46	48	53	50	45	51
14	64	58	62	69	53	53	48	54	57	54	48	55
16	69	64	68	70	57	55	51	57	60	57	50	57
18	73	68	71	71	60	58	53	59	63	60	52	--
20	76	70	74	--	62	60	54	61	65	62	--	--
22	78	72	--	--	--	--	--	--	--	--	--	--
24	80	74	--	--	--	--	--	--	--	--	--	--
26	81	75	--	--	--	--	--	--	--	--	--	--
	Site 2 - minimum height in feet											
6	16	10	16	16	15	15	14	16	19	18	17	20
8	30	22	27	27	23	25	24	24	29	27	22	30
10	41	33	36	34	34	33	32	34	36	35	30	35
12	47	42	45	40	39	39	38	40	41	40	34	41
14	51	47	49	45	45	42	42	46	45	45	37	45
16	53	49	52	48	49	44	45	49	48	47	40	47
18	55	50	54	50	52	46	47	51	50	49	43	--
20	56	51	55	--	53	47	49	50	52	51	--	--
22	57	52	--	--	--	--	--	--	--	--	--	--

[1] Height is measured to 4-inch top diameter inside bark; d.b.h. is measured outside bark. Trees shorter than site 2 minimum indicate site 3.

SOURCE: Eerree, Miles J., and Hagar, Robert K., Timber Growth Rates for Natural Forest Stands in New York State, Technical Publication 78. State University of New York, College of Environmental Science and Forestry at Syracuse, 1956, p. 9, Figure 1.

APPENDIX C

PROCEDURE FOR THE STATISTICAL TREATMENT OF THE DATE

FOR THE TOWNS OF MONTAGUE, REDFIELD, AND OSCEOLA

The sample plots from the timber cruise conducted in the three towns of Montague, Redfield, and Osceola located on the Tug Hill plateau were presented for statistical treatment. The samples contained various information of which the gross board feet, net board feet, and the net cubic feet of pulpwood per plot were used in the analysis.

The statistical treatment included the determination of the average, the standard deviation, and standard error, and the percent of the standard error from the mean, within 95% confidence limits.

The plots were classed by site and type as indicated on the timber cruise methodology outline. Plots found in the "Other" category, and those that were classified in site type classes with less than four samples, were deleted.

The first town worked was Montague. It contained fifty-seven plots of which ten were in the "Other" category. Initial inspection revealed that, in order to get reliable statistical results, the plots should be classed according to size type only and with site classes be grouped. However, even with this elimination of site classes there were still cases where the number of samples was very small. The results of this treatment are in Table 2.

After completing the statistical analysis on Montague the data from Redfield and Osceola were added. At this point it was realized that the data had to be broken down by site for usefulness. For this to be done, the three towns had to be combined in order to produce meaningful averages for each division. This resulted in combining one hundred-eighty-six plots from the three towns and separating them into their respective site type category. The statistical examination and tests were made using the individual fifth-acre plot volumes. The results of this treatment are given in the work sheets attached.

The last step was computation of the average and the percent of the standard error of the average on a per acre basis at the 95% level.

Robert W. Keller
12/12/75

submitted to
R. V. Lea

APPENDIX D

TREES TALLIED FOR SITE CLASS ASSESSMENT

TOWN: MONTAGUE

Plot #	Plot Site Class	Species	Diameter (inches)	Height to 4" Top (feet)
126	1	Norway Spruce	9	44
		Red Maple	8	33
		Black Cherry	9	40
52	1	Red Maple	8	34
		Red Maple	15	59
		Red Maple	7	33
82	1	Basswood	15	61
		Basswood	20	69
		Sugar Maple	13	59
144	1	Red Maple	6	23
		Sugar Maple	14	45
		Sugar Maple	12	51
135	1	Red Maple	12	54
		Red Maple	10	43
		Red Spruce	11	37
54	1	Yellow Birch	18	39
		Red Maple	10	42.5
		Red Maple	13	53.5
136	1	Sugar Maple	16	78
		Sugar Maple	13	50
		Red Spruce	7	22
108	1	Sugar Maple	10	45
		Beech	14	50
		Sugar Maple	13	46
96	1	Yellow Birch	13	43
		Sugar Maple	10	43
		Sugar Maple	8	38
41	1	Red Maple	13	47.5
		Beech	9	39.5
		Yellow Birch	8	36.5
106	1	Beech	15	50
		Red Maple	8	34
142	2	Aspen	11	43
		Sugar Maple	11	42
59	2	Balsam Fir	13	43
		Black Cherry	10	34
		Red Spruce	9	32
67	2	Red Maple	8	37
		Balsam Fir	13	31
		Balsam Fir	10	41
77	2	Balsam Fir	11	34
		Black Cherry	7	25
		Balsam Fir	12	45
105	2	Red Spruce	12	39.5
		Sugar Maple	11	30
		Yellow Birch	11	45

TOWN: MONTAGUE (cont.)

Plot #	Plot Site Class	Species	Diameter (inches)	Height to 4" Top (feet)
22	2	Red Maple	13	49
		Red Maple	14	57
		Red Spruce	17	61
159	2	Balsam Fir	8	33
		Balsam Fir	8	26
		Red Spruce	7	33
13	2	Red Spruce	9	26
		Balsam Fir	8	36
		Red Maple	7	24
164	2	Balsam Fir	7	24
		Red Maple	8	32
		Black Cherry	9	30
28	2	Sugar Maple	14	50
		Sugar Maple	14	51
		Sugar Maple	14	49
160	2	Balsam Fir	7	28
		Balsam Fir	6	18
		Balsam Fir	7	18
107	2	Red Maple	15	45
		Red Maple	11	37
		Red Maple	13	42
118	2	Black Cherry	12	42
		Sugar Maple	13	42
		Sugar Maple	14	40
51	2	Sugar Maple	15	47
		Sugar Maple	11	39
99	2	Black Cherry	15	40
		Black Cherry	15	48
		Black Cherry	12	48
85	2	Red Maple	14	47
		Yellow Birch	8	34
		Black Cherry	18	52
73	2	Red Maple	14	43
		Black Cherry	7	26
		Beech	17	50
18	2	Yellow Birch	16	40
		Red Maple	10	43
		Sugar Maple	11	34
47	2	Sugar Maple	13	46.5
		Yellow Birch	10	37.5
		Sugar Maple	14	41.5
38	2	Beech	17	53
		Yellow Birch	17	48
		Sugar Maple	17	48
48	2	Sugar Maple	16	51
		Sugar Maple	16	49
23	2	Red Maple	11	42
		Red Maple	12	39
		Beech	12	30

TOWN: MONTAGUE (cont.)

Plot #	Plot Site Class	Species	Diameter (inches)	Height to 4" Top (feet)
53	2	Beech	8	31.5
		Red Maple	24	41.5
		Beech	18	49
27	2	Red Spruce	9	31.5
		Red Maple	9	32
		White Ash	11	28.5
133	2	Sugar Maple	9	42.5
		Sugar Maple	13	40
		Sugar Maple	12	28
149	3	White Spruce	5	7
		Black Cherry	8	10
103	3	Norway Spruce	9	26
		Norway Spruce	11	25.5
		Red Pine	12	48
156	3	White Pine	7	13
		White Pine	7	16
150	3	Red Maple	8	17
		Red Maple	7	20
		Red Maple	11	28
148	3	Balsam Fir	12	37
		Red Spruce	9	21
		Balsam Fir	13	37
68	3	Red Spruce	15	40
		Balsam Fir	11	32
36	3	Red Maple	12	38.5
		Balsam Fir	7	19
		Yellow Birch	17	50
76	3	Red Maple	19	45
		Balsam Fir	7	20.5
137	3	Balsam Fir	9	22
		Balsam Fir	8	20
		Red Maple	8	16
33	3	Red Spruce	13	41
		Red Maple	13	33
65	3	Red Maple	10	29
		Red Spruce	15	53
		Red Maple	14	40.5
44	3	--	--	--
94	3	Yellow Birch	9	36
		Red Maple	16	38.5
		Yellow Birch	14	40
24	3	Red Maple	7	18
		Red Maple	8	23
		Black Cherry	15	38
84	3	Sugar Maple	17	43
		Black Cherry	16	54
		Red Maple	11	31
157	3	Black Cherry	5	7
		Aspen	6	12
		Aspen	5	10

TOWN: MONTAGUE (cont.)

Plot #	Plot Site Class	Species	Diameter (inches)	Height to 4" Top (feet)
61	3	Red Maple	14	46
		Red Maple	12	31.5
		Balsam Fir	9	23
139	3	Black Cherry	17	34
		Black Cherry	8	36
		Red Maple	11	26
30	3	Red Maple	12	38
		Red Maple	15	46
		Red Maple	10	28
117	0	--	--	--
9	3	Red Maple	11	32
		Yellow Birch	11	25
		Red Maple	8	39

TOWN: OSCEOLA

57	1	Red Maple	17	86
		Red Spruce	21	77
		Hemlock	23	55
179	1	Sugar Maple	13	50
		Yellow Birch	15	52
		Sugar Maple	13	56
125	1	Black Cherry	11	45
		Red Maple	13	51
		Black Cherry	12	50.5
148	1	Yellow Birch	14	49
		Sugar Maple	15	60
		Sugar Maple	15	69
45	1	Red Maple	17	58
		Red Maple	23	60
		Red Maple	24	71
130	1	Red Maple	10	27
		Red Maple	13	54
		Red Maple	8	34
50	1	Sugar Maple	10	41
		Sugar Maple	13	54
		Yellow Birch	13	46
54	1	Red Maple	20	61
		Beech	16	53
		Red Maple	11	38
62	1	Beech	23	70
		Red Maple	17	75
		Yellow Birch	19	57
151	1	Sugar Maple	15	56
		Sugar Maple	15	59
		Sugar Maple	12	52
60	1	White Ash	15	60
		Black Cherry	17	67
		Red Maple	16	60.5
99	1	White Ash	14	57
		Red Maple	12	60
		Black Cherry	13	58.5

TOWN: OSCEOLA (cont.)

Plot #	Plot Site Class	Species	Diameter (inches)	Height to 4" Top (feet)
68	1	Sugar Maple	10	46
		Sugar Maple	12	48
		Sugar Maple	10	37
110	1	Beech	12	40
		Sugar Maple	27	70
		Beech	20	62
196	1	Sugar Maple	10	42
		Black Cherry	10	38
		Sugar Maple	13	51
61	1	Black Cherry	11	40
		Red Maple	7	27
		Sugar Maple	6	30
48	1	Red Maple	15	58.5
		Black Cherry	16	68
		Yellow Birch	17	58
84	1	Sugar Maple	12	40
		Sugar Maple	15	60
		Sugar Maple	10	42
109	1	Beech	17	57
		Sugar Maple	15	57
		Sugar Maple	12	44.5
156	1	Sugar Maple	10	44
		Beech	14	52
		Beech	13	50
106	1	Beech	15	51
		Sugar Maple	12	38.5
		Beech	14	52
9	2	Aspen	12	49
		Red Spruce	10	34
		Black Cherry	9	32
44	2	Basswood	12	53
		Red Maple	21	57
		Red Maple	15	50
51	2	Red Maple	12	44
		Red Maple	13	40
		Red Spruce	8	31
67	2	Red Spruce	12	50
		Red Maple	16	50
		Yellow Birch	12	48
70	2	Black Cherry	11	36
		Red Maple	13	51
		Black Cherry	5	34
141	2	Red Maple	12	49
		Red Maple	12	43
		Red Spruce	10	33
24	2	Sugar Maple	11	45
		Red Maple	19	50
		Sugar Maple	14	49
23	2	Black Cherry	17	53
		Sugar Maple	11	47
		Sugar Maple	21	50

TOWN: OSCEOLA (cont.)

Plot #	Plot Site Class	Species	Diameter (inches)	Height to 4" Top (feet)
13	2	Red Maple	12	42
		Black Cherry	12	44
		Red Maple	8	39.5
206	2	Black Cherry	12	43
		Black Cherry	10	35
		Black Cherry	13	32
215	2	Red Maple	13	43
		Black Cherry	9	39
		Yellow Birch	15	46
193	2	Red Maple	14	47
		Yellow Birch	14	36.5
		Yellow Birch	15	51
102	2	Yellow Birch	21	43
		Yellow Birch	6	32
		Yellow Birch	22	40
28	2	Red Maple	15	49
		Red Maple	13	43
		Red Maple	14	56
112	2	Red Maple	15	39
		Red Maple	17	36
		Beech	19	40
157	2	Yellow Birch	13	37
		Sugar Maple	13	44
		Red Maple	13	46
107	2	Beech	13	46
		Red Maple	12	36
		Yellow Birch	15	52
131	2	Red Maple	8	38
		Red Maple	9	30
		Red Maple	9	32
41	2	Beech	9	33
		Sugar Maple	9	34
		White Ash	10	36
165	2	Yellow Birch	15	33
		Red Maple	6	20
		Red Maple	8	26
220	2	Red Maple	9	37
		Red Maple	21	52
		Black Cherry	14	47
111	2	White Ash	10	38
		Black Cherry	19	58
		Black Cherry	15	56
160	2	Sugar Maple	10	36
		White Ash	14	47
		Red Maple	14	50
182	2	Yellow Birch	13	42
		Sugar Maple	11	39
		Beech	10	38
78	2	Sugar Maple	12	40
		Yellow Birch	19	50
		Sugar Maple	11	40

TOWN: OSCEOLA (cont.)

Plot #	Plot Site Class	Species	Diameter (inches)	Height to 4" Top (feet)
105	2	Sugar Maple	10	45
		Sugar Maple	20	57
		Beech	17	45
197	2	Sugar Maple	13	41
		Beech	8	32
		Beech	12	45
149	2	Sugar Maple	12	49
		Sugar Maple	12	46
		Yellow Birch	11	38
30	2	Sugar Maple	11	37
		Sugar Maple	9	37
		White Ash	8	34
166	2	Sugar Maple	17	46
		Yellow Birch	10	41
		Sugar Maple	15	45
173	2	Sugar Maple	10	38
		Sugar Maple	10	48
		Black Cherry	13	51
22	2	Black Cherry	14	57
		Beech	12	38
		Black Cherry	13	43
214	2	Red Maple	10	41
		Red Maple	11	31
		Red Maple	14	42
114	2	Sugar Maple	14	31
		Red Maple	14	40
		Beech	14	39
118	2	Beech	9	30
		Beech	10	24
		Red Maple	9	36
76	2	Yellow Birch	14	42
		Red Maple	9	34
		Yellow Birch	8	37
104	2	Beech	10	43.5
		Sugar Maple	11	38
		Red Maple	14	51
33	3	Red Pine	16	35
		Black Cherry	10	26
		White Pine	13	29
36	3	White Pine	13	43
		Norway Spruce	12	39
		Norway Spruce	10	27
85	3	Yellow Birch	12	18
		Balsam Fir	11	31
		Balsam Fir	12	33
222	3	Red Maple	8	28
		Balsam Fir	12	34
		Sugar Maple	14	40
108	3	Hemlock	13	28
		Soft Maple	12	47
		Black Ash	13	38

Plot #	Plot Site Class	Species	Diameter (inches)	Height to 4" Top (feet)
38	3	Hemlock	12	26
		White Pine	6	16
		Hemlock	9	25
56	3	Red Maple	5	18
		Red Spruce	11	19
		Red Spruce	7	9
213	3	Yellow Birch	12	33
		White Ash	17	51
		Red Maple	8	23
180	3	Yellow Birch	12	39
		Yellow Birch	9	22
		Red Maple	8	15
128	3	Red Spruce	8	16
		Yellow Birch	19	36
		Red Maple	10	18
10	3	Sugar Maple	14	37
		Red Spruce	9	20
		White Ash	5	15
122	3	Black Cherry	8	24
		Red Maple	7	21
		Hemlock	10	21
129	3	Red Spruce	7	28
		Red Maple	14	38
		Red Maple	8	8
142	3	Red Maple	10	27
		Red Maple	12	38.5
		Balsam Fir	8	32
177	3	Yellow Birch	9	28
		Red Maple	8	28
		Black Cherry	12	33
134	3	Yellow Birch	18	37
		Sugar Maple	8	21
		Yellow Birch	14	45
187	3	Beech	9	26
		Yellow Birch	15	42
135	3	Beech	11	42
		Red Maple	10	30
		Beech	12	25
154	3	Beech	15	35
		Beech	20	57
		Sugar Maple	15	34
20	3	Aspen	10	21
		Aspen	8	28.5
172	3	Sugar Maple	13	47
		Sugar Maple	16	41.5
		Yellow Birch	16	42.5
94	3	Sugar Maple	14	41
		Beech	15	42
		White Ash	17	50
81	3	Yellow Birch	17	43
		Red Maple	19	43
		Red Maple	12	47

TOWN: OSCEOLA (cont.)

Plot #	Plot Site Class	Species	Diameter (inches)	Height to 4" Top (feet)
146	3	Sugar Maple	12	35
		Sugar Maple	11	35
		Black Cherry	9	28
32	3	Sugar Maple	18	43
		Black Cherry	18	46
		Sugar Maple	13	42
168	3	Red Maple	6	15
		Beech	8	22
		Sugar Maple	13	36
3	3	--	--	--
200		no trees		
133		no trees		
88		no trees		
181		no trees		

TOWN: REDFIELD

158	1	Sugar Maple	13	71
		Sugar Maple	12	56
		Beech	19	50
185	1	Sugar Maple	22	65
		Sugar Maple	14	53
		Sugar Maple	16	48
198	1	Red Maple	10	49
		Red Maple	13	48
		Sugar Maple	9	43
116	1	Beech	17	68
		Sugar Maple	17	59
		Sugar Maple	22	72
111	1	Sugar Maple	19	65
		Sugar Maple	19	53
		Basswood	15	63
180	1	Sugar Maple	14	53
		Sugar Maple	10	49
		Beech	14	47
128	1	Sugar Maple	12	46
		White Ash	15	59
		Sugar Maple	13	40
174	1	White Ash	14	50
		Sugar Maple	9	42
		Sugar Maple	11	48
146	1	Black Cherry	14	48
		White Ash	7	40
		Sugar Maple	9	39
140	1	Red Maple	15	65
		White Ash	10	65
		Yellow Birch	16	50
93	1	Sugar Maple	14	55
		Sugar Maple	15	51
		Beech	18	55

TOWN: REDFIELD (cont.)

Plot #	Plot Site Class	Species	Diameter (inches)	Height to 4" Top (feet)
33	1	Beech	17	60
		Sugar Maple	17	67
		Beech	17	38
65	1	Sugar Maple	9	39
		Beech	13	43
		Sugar Maple	8	36
193	1	Yellow Birch	20	56
		Beech	17	57
		Red Maple	19	66
64	1	Sugar Maple	10	35
		Sugar Maple	7	37
		Red Maple	8	38
130	2	Red Spruce	8	25
		Red Spruce	10	36
		Red Maple	10	39
137	2	Black Cherry	16	54
		Red Maple	14	48
		Red Maple	14	43
88	2	Black Cherry	16	55
		Black Cherry	13	52
		Sugar Maple	12	46
183	2	Yellow Birch	22	52
		White Ash	13	55
		Yellow Birch	19	46
57	2	Sugar Maple	11	44
		Sugar Maple	16	50
		Black Ash	13	45
197	2	Beech	16	40
		Red Spruce	12	55
		Hemlock	18	56
67	2	Red Maple	19	51
		Red Maple	14	51
		Hemlock	12	28
142	2	Hemlock	11	22
		Red Maple	13	50
		Red Maple	11	38
91	2	White Ash	13	48
		Beech	26	58
		Sugar Maple	20	27
15	2	Yellow Birch	10	40
		Silver Maple	18	60
		Yellow Birch	11	35
184	2	Sugar Maple	9	35
		Yellow Birch	18	50
		Sugar Maple	11	45
28	3	Red Maple	5	16
		Aspen	8	28
160	3	Big Tooth Aspen	8	36
		Big Tooth Aspen	13	36
141	2	Sugar Maple	17	55
		Sugar Maple	16	42
		Sugar Maple	19	55

TOWN: REDFIELD (cont.)

Plot #	Plot Site Class	Species	Diameter (inches)	Height to 4" Top (feet)
39	2	White Ash	11	46.5
		Basswood	12	49
		Red Maple	9	44
124	2	White Ash	9	31
		Sugar Maple	14	54
		Sugar Maple	13	43
135	2	White Ash	11	45
		Sugar Maple	15	51
		Sugar Maple	22	62
190	2	White Ash	13	51
		Sugar Maple	15	56
		Sugar Maple	18	54
189	2	White Ash	14	56
		Sugar Maple	13	44
		Yellow Birch	15	50
74	2	Sugar Maple	8	39
		Sugar Maple	11	41
		Sugar Maple	16	47
85	2	White Ash	16	63
		Sugar Maple	14	47
		Sugar Maple	15	48
107	2	Sugar Maple	13	49
		Sugar Maple	14	47
		Beech	11	39
54	2	Sugar Maple	16	44
		Sugar Maple	12	45
		Sugar Maple	18	59
45	2	Black Cherry	12	47.5
		Beech	11	32
		Sugar Maple	11	45
30	2	Black Cherry	10	43
		Red Maple	10	38
		Sugar Maple	9	32
161	2	Yellow Birch	13	41
		Red Maple	13	43
		Red Maple	14	40
62	2	Red Maple	11	33
		Black Cherry	10	45
		Sugar Maple	20	57
24	2	Black Cherry	12	41
		Black Cherry	13	40
		Black Cherry	13	51
153	2	Sugar Maple	19	60
		Sugar Maple	16	52
		White Ash	13	57
129	2	Beech	12	47
		White Ash	12	38
		White Ash	14	45
50	2	Beech	13	45
		Sugar Maple	13	41

TOWN: REDFIELD (cont.)

Plot #	Plot Site Class	Species	Diameter (inches)	Height to 4" Top (feet)
105	2	Beech	12	37
		Beech	10	33
		Beech	12	43
172	2	Black Cherry	11	37.5
		Sugar Maple	16	56
		Sugar Maple	23	56
114	2	Yellow Birch	13	41
		Sugar Maple	14	50
		Yellow Birch	13	39
115	2	Sugar Maple	12	43
		Beech	15	53
		Yellow Birch	11	40
169	2	Yellow Birch	17	53
		Beech	17	47
		Sugar Maple	16	46
182	2	Sugar Maple	13	56.5
		Beech	13	42
		Yellow Birch	11	32
134	2	Yellow Birch	23	44
		Yellow Birch	17	49
		Red Maple	12	52
52	3	White Pine	14	35
		Red Pine	10	33
3	3	Red Pine	12	36
		Red Pine	10	32
		White Pine	13	34
42	3	Black Cherry	12	32
		Red Maple	15	33
155	3	Black Cherry	6	18
		Norway Spruce	11	30
		Norway Spruce	10	28
136	3	Hemlock	15	28
		Hemlock	13	22
		Red Spruce	14	47
68	3	Black Cherry	16	41
		Red Maple	16	33
		Red Spruce	18	45
10	3	Hemlock	16	50
		Hemlock	16	41
		Red Spruce	12	35
118	3	Red Maple	19	40
		Yellow Birch	13	31
		Beech	16	36
60	3	Red Spruce	11	29
		Black Cherry	13	29
		Sugar Maple	16	32
70	3	Sugar Maple	14	32
		Red Spruce	10	40
		Yellow Birch	12	27
167	3	Yellow Birch	27	67
		Red Spruce	12	37
		Yellow Birch	15	40

TOWN: REDFIELD (cont.)

Plot #	Plot Site Class	Species	Diameter (inches)	Height to 4" Top (feet)
99	3	Red Maple	20	51
		Red Maple	20	55
		Red Maple	16	48
29	3	Red Maple	20	46
		Black Cherry	17	48
159	3	Red Maple	13	39
		Yellow Birch	14	43
		Black Cherry	9	28
154	3	Black Cherry	14	40
		Sugar Maple	10	37
		Black Cherry	15	42
131	3	Hemlock	12	26
		Red Maple	12	38
		Hemlock	13	25
102	3	Black Cherry	15	52
		Beech	16	40
		Hemlock	23	49
117	3	Red Maple	19	35
		Red Maple	12	31
		Red Maple	12	30
34	3	Sugar Maple	16	47
		Black Cherry	13	49
		White Ash	12	40
48	3	White Ash	7	16
		Black Cherry	7	22
		Elm	6	12
9	-	Red Maple	5	13
4	3	White Pine	12	35
		White Pine	12	33
		White Pine	13	35
177	3	Beech	15	40
		Beech	18	32
		Beech	11	42
56	2	Sugar Maple	16	58
		Sugar Maple	16	51
		Sugar Maple	14	51
32	3	Yellow Birch	13	45
		Sugar Maple	17	41
		Red Maple	23	50
61	3	Sugar Maple	13	37
		Sugar Maple	19	46
		Sugar Maple	23	50
196	3	Red Maple	17	51
		Black Cherry	12	36
		Red Maple	13	49
166	3	--	--	--
112	3	Black Cherry	17	41
		Black Cherry	19	33
		Red Maple	11	30
148	3	Beech	22	41
		Beech	15	35
		Yellow Birch	13	38

TOWN: REDFIELD (cont.)

Plot #	Plot Site Class	Species	Diameter (inches)	Height to 4" Top (feet)
178	3	Red Maple	23	50
		Beech	18	44
		Black Cherry	17	40
149	3	Beech	7	52
		Black Cherry	12	23
		Beech	13	34
110	3	Sugar Maple	16	42
		Yellow Birch	15	32
		Black Cherry	11	43
76	3	Beech	16	38
		Red Maple	16	40
		Red Maple	14	36

APPENDIX E – Cubic Volume Tables by Species developed by Dr. Richard Lea, SUNY, College of Environmental Science and Forestry based on sample plots in the Towns of Diana in Lewis County, Pitcairn in St. Lawrence County and Antwerp in Jefferson County.

DBH	Spruce/Fir Cubic Feet	Sugar Maple Cubic Feet	Red Maple Elm Cubic Feet	Hemlock Cubic Feet	Black Cherry White Ash Black Ash Basswood Cubic Feet	Beech Hophornbeam Cubic Feet	Yellow Birch Cubic Feet	Poplar/Aspen Cubic Feet
5	1.8	2.0	2.0	0.9	1.5	2.1	1.3	1.3
6	3.0	3.2	3.0	1.9	2.5	3.3	2.5	2.1
7	4.6	4.5	4.0	3.0	4.0	5.0	4.0	4.0
8	6.1	6.5	5.5	4.4	5.5	7.0	6.0	6.0
9	8.0	9.0	7.5	6.7	7.0	9.5	8.0	8.0
10	10.7	11.0	10.0	9.5	9.5	12.0	10.5	10.9
11	14.0	13.5	13.0	12.8	12.0	14.5	13.5	14.0
12	18.3	16.5	16.5	16.3	15.0	18.0	17.0	18.0
13	23.1	19.5	19.5	20.3	18.0	22.0	20.0	22.2
14	28.5	22.5	24.0	24.5	21.0	25.5	24.0	27.2
15	34.0	26.0	28.5	29.4	24.5	29.5	29.0	32.8
16	39.8	30.0	33.5	34.4	28.0	33.5	34.5	38.8
17	45.8	34.5	39.5	39.9	32.5	38.5	40.0	45.0
18	51.5	40.0	46.0	45.4	37.0	43.0	46.0	52.0
19	57.8	45.5	53.0	51.1	41.0	48.0	52.5	59.2
20	64.2	52.0	60.5	57.0	46.0	53.5	59.5	67.0
21	70.3	58.5	68.5	63.5	51.0	59.0	66.5	
22		65.0	77.0	70.0	56.5	64.5	73.5	
23		72.0	86.0	76.8	62.0	70.5	80.5	
24		80.0	95.0		67.5	76.5	87.5	
25		87.0	104.0			82.5	95.0	
26		92.0	113.5			89.0	103.5	
27		102.0	122.5			95.5	111.0	
28		109.5	132.5			102.0	119.0	
29		118.0	142.0			108.5	128.0	
30		129.0	151.5				137.0	
31		133.0					146.5	
32		140.5					156.0	
33		148.0					165.5	
34							176.0	
35							187.0	