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American Midland Naturalist, Vol. 68, No. 2. (Oct., 1962), pp. 409-423.

Stable URL:
http://links.jstor.org/sici?sici=0003-0031%28196210%2968%3A2%3C409%3ATFCOTC%3E2.0.CO%3B2-1

American Midland Naturalist is currently published by The University of Notre Dame.

The Forest Cover of the Catskill Mountain Region, New York, as Indicated by Land Survey Records[1]

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ABSTRACT: Surveyor's records antedating the General Land Survey of the public domain are utilized to assess the 18th-century forest composition of the Catskill Mountain region of New York. Although more difficult to compile they provide a reasonable quantitative evaluation of the principal tree species present before extensive occupation and disturbance of the area by European settlers. The principal tree components in the lower and mid-altitudes (below 3,000 feet) were beech 49%, hemlock 20%, sugar maple 13%, birch spp. 7%. Such information is useful in providing a base for modern quantitative studies of forest composition.

INTRODUCTION

Modern studies of vegetation are almost invariably interpreted with the troubled consciousness that historical events of indefinite magnitude and undetermined frequency and chronology have markedly influenced the present state of the vegetational cover. Such events are commonly considered as "natural" if initiated by nonhuman agents such as hurricanes, lightning-set fires, glaciers, landslides, floods or nonhuman organisms. Human industry or events which are initiated by human activity are commonly excluded and, by inference, are "unnatural." An area which has been free of human influence has a putative primeval or virgin status. Frequently, the unwarranted assumption is made that primeval or virgin conditions are those which existed at the time European man arrived on the scene.

Since [European] man, especially the breed known as ecologists, are recent arrivals over most of the earth's surface it is frequently difficult to dissociate the "natural" from the "unnatural" factors which have influenced vegetational development and distribution and, if anything, more difficult to segregate with precision the effects of pre-European human populations from those of European invaders. Current studies of vegetation are commonly interpreted against a backdrop formed by reconstruction of the so-called primeval vegetation, or at least an earlier type of vegetation. Sometimes this reconstruction is based on interpolation between isolated tracts of old-growth and presumably virgin stands. Extensive and prolonged human activity in an area makes such reconstruction difficult, if not impossible, and the interpretation is often tenuous.

Historical information is rarely adequate to permit sufficiently precise statements about past vegetation of an area so that detailed comparisons may be made with modern quantitative ecological studies.

[1] This work is part of a study supported by National Science Foundation Grant G-10328.

However, certain kinds of information are sometimes available which are useful in elucidating the vegetational cover at a prior period. These may be categorized as pre-historic, especially data given by fossil pollen studies, and historic, that derived from records of early travelers, and surveyors (Bromley, 1935). More recently the historical-developmental method illustrates a direct means of analyzing the previous composition of a single forest stand (Stephens, 1955).

Historical records in the form of detailed descriptions for the northeastern United States, and the Catskill Mountain region in particular, are rare (Braun, 1950). The character of the northeastern forest at the time of European settlement has been widely misunderstood due, in part, to an inadequate understanding of the effect of the American Indian on the forest. Day (1953) has done much to clarify the influence of the Indian on the forest and to rectify the concept of the forest at the time of European settlement.

The best source of quantitative information on previous forest composition has been the records of land surveys. Most of the studies using this source have been based on the records of the General Land Office survey of the public lands initiated in 1785 (Shanks, 1953). Bourdo (1956) gives an excellent review of the survey, methods of utilizing data from it, and studies based on Land Office Survey data. Relatively few studies have exploited the records of early land surveys made on private lands. Lutz (1930) and Gordon (1940) used survey data of private land companies to reconstruct forest cover of areas in northwestern Pennsylvania and southwestern New York, respectively. Spurr (1951) calls attention to the survey notes of George Washington. Smith (1954) based his description of the vegetative cover of New York in part on early private land surveys. One of the reasons for limited use of such records is that they are widely scattered and difficult of access. The data are also more variable and difficult to tabulate and interpret for there is no common plan as in the General Land Office surveys. Nonetheless, much useful information may be derived from these records.

HISTORY OF THE CATSKILL REGION

Considering the fame of the Catskill Mountain region and of the early settlements in the vicinity there is a surprising paucity of reference to the vegetation. There are occasional comments on the vegetation of the area along the Hudson River. An early one is found in Henry Hudson's Journal, in an entry made in 1609 at a point 12 days sail up the Hudson River. "We rode still and went on land to walke of the west side of the River, and found goode grounde (sic) for corn and other garden herbs, with great store of goodly oakes (sic) and walnut-trees and Chestnut trees, ewe (sic) trees and trees of sweet-wood in great abundance," (Sylvester, 1880). Cadwallader Colden's "Observations," in the year 1738, is quoted describing the timber of

Old Ulster as follows: "The southern part of the country, that is from the sea on both sides of Hudson's River to within 20 miles of Albany is generally covered with oaks of several sorts intermixed with wallnuts (sic), chestnuts and almost all sorts of Timber (sic) according to the difference of the soil in several parts." (Brink, 1905). Peter Kalm travelled through this region in the mid-eighteenth century but his references to the vegetation of the Catskill or Blue Mountains as he termed them are slight and he apparently never entered the mountains proper (Benson, 1937).

That the Hudson Valley was relatively open and markedly influenced by long Indian settlement is apparent from comments of the early settlers. Van Buren (1923), in a history of the early Dutch settlements along the Hudson, quotes the settlers on the Esopus Creek concerning their difficulties with the Indians. These quotations describe Indian villages and forts surrounded by extensive corn fields. Sylvester (1880), in a history of Ulster County, records that the lowlands near the Esopus Creek were untimbered and mentions that the Indians commonly set fire to the woods and fields each year. Parker (1920) comments that there are no traces of aboriginal occupation in the Catskill Mountains. Permanent Indian settlements were largely confined to the Hudson and Delaware River valleys, although the Indians certainly traversed the mountains via the valleys of the Esopus and Schoharie Creeks.

During the long colonial period of settlement in the Hudson valley by the Dutch, and later the English, there is little indication of the nature of the Catskill Mountain forests only a few miles distant and even postcolonial and modern descriptions are uncommon and inadequate (Braun, 1950). Buttrick (1933) surmises that, in Hudson's time, hemlock was probably the commonest tree of the Catskills. The view of an extensive, even a pure, hemlock forest as the presettlement forest is widespread. Recknagel (1923) says of the forests of New York in the time of Champlain and Hudson, "In contrast with present day conditions, the forest was chiefly pine." Although European settlements were founded along the Hudson River, not far from the Catskills, as early as 1652 or 1653 it was not until 1770 that the first settler was established in Woodstock immediately at the foot of the mountains (Schutze, 1930). Evers (1958), writing of Overlook Mountain, which rises just north of Woodstock in the eastern portion of the range, comments that little evidence exists to indicate that the mountain was ever visited, prior to 1809, by white men other than surveyors.

In 1830, Lucas Elmendorf of Batavia wrote to General Jacob Morton in relation to establishing a road into the southern Catskills for opening and settling the area although some settlement had already begun.

Timothy Dwight (1822) made a trip, in 1804, through the northern Catskills from Durham to Stamford. He describes several of the

townships of the region as almost absolute forest and mentions a magnificent growth of white pines (one measured at 247 feet). He stated, "This cluster is the only considerable one composed of full grown trees, of this kind, which I had seen."

The valley of the Schoharie Creek, in the northern Catskills, was settled quite early. In 1820, H. E. Dwight records that the town of Hunter, on the Schoharie Creek, contained 600 to 700 inhabitants and "most of the inhabitants spend much of their time in converting their trees into lumber." According to Dwight, maple and beech were most common on the slopes of the mountain and he states: "Most of the vallies (sic) which lie between the ridges of these mountains, are covered with hemlock, with birch, beech and cherry trees scattered amoung them." To the west and at higher altitudes the evergreens were less common according to Dwight's account.

A large part of the Catskills is included in the grant of land, made by Queen Anne in 1703, known as the Hardenburgh Patent (Fig. 1). Ebenezer Wooster first surveyed this patent in 1749. Subsequent surveys of various subdivisions of the Hardenburgh Patent were made by diverse surveyors, notably James Cockburn, and also of adjacent patents which include part of the Catskill Mountains. The surveyors' notebooks, and/or maps made from them, showing the bearing or witness trees recorded by the surveyors provide a considerable record

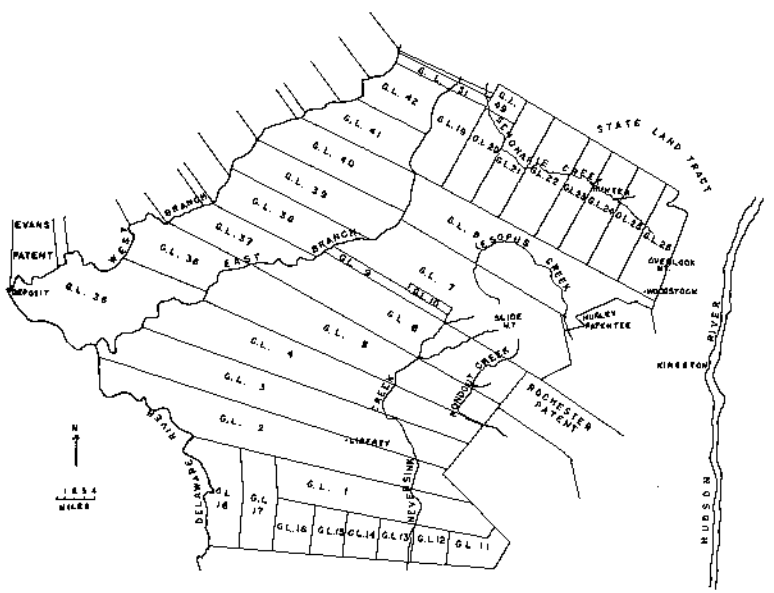

Fig. 1.—Map of the Hardenburgh Patent and adjacent areas showing boundaries of the Great Lots and various places referred to in the text.

TABLE I.—Locations of field books and maps from which survey data was taken (Mix, 1859)

1. Division of Lands and Forests, State of New York, Conservation Department, Albany	(Cockburn and Wistance Collections)
2. Office of the Secretary of State, Albany New York State	5. New York State Historical Library New York, New York
3. Office of General Services, Albany New York State	6. Senate House Library Kingston, New York
4. New York State Library, Albany Manuscript Room	7. County Clerks Offices Ulster Co. — Kingston, New York Delaware Co. — Delhi, New York

Acknowledgments.—Many persons in the unduly maligned bureaucracy were most helpful in making available the source materials for this study. Personnel of the several state and county offices listed in Table I were invariably helpful. The author wishes particularly to acknowledge his indebtedness to Mr. Edward G. West and Mr. Jerry Rider of the Division of Lands and Forests, New York State Conservation Department. Mr. Sydney L. Marks of Liberty, New York, graciously made available field books of Great Lot No. 5 of the Hardenburgh Patent which are in his possession.

of the forest of the area ca. 1750 and 1800. Bearing tree refers to compass bearing and is the term applied by the surveyors to the trees locating each survey corner. The field books and maps used in this study are to be found at several places of record (Table I).

VALIDITY OF THE SAMPLE

The basic assumption in utilizing land surveys is that the trees cited are taken to represent a sample of the forest cover. Bourdo (1956) considers the problems of evaluating bias in the surveys of the General Land Survey and suggests several methods of determining the validity of the data used. These are not readily applicable to the data from older surveys. The General Land Survey normally recorded 2 or 4 bearing trees at each section corner. The trees were set in different compass quadrants and the species, size, compass bearing and distance from the corner were recorded. In addition, quarter corners were marked by two trees and occasional line trees noted. The surveys made on private lands before the general practices of the General Land Survey were established did not follow a set pattern of a grid of sections one mile square. The lots were of various sizes and shapes. Occasionally the surveyor used a stake or stake and stones to mark the corner and gave no bearing trees. Commonly only one bearing tree was recorded at each corner, and the compass direction was given only in general terms; e.g., northeast or simply north, so that in most cases it is impossible to determine which quadrant of the compass a bearing tree is in. The distance to the bearing tree is

TABLE II.—Species recognized by the surveyors as bearing trees (nomenclature follows Gleason, 1952)

Scientific Name	Surveyor's Name
Abies balsamea	Fir
Acer pensylvanicum	Elkwood, Moosewood
A. rubrum	Soft Maple, Swamp Maple
A. saccharum	Rock Maple, White Maple, Sugar Maple
Alnus sp.	Alder
Amelanchier sp.	Mayberry, Shadbush, Juneberry
Betula lenta	Black Birch
B. lutea	Yellow Birch
B. papyrifera	White Birch
Carpinus caroliniana	Water Beech
Carya sp.	Hickory
Castanea dentata	Chestnut
Cornus florida	Dogwood
Crataegus sp.	Thornbush, Hawthorne
Fagus grandifolia	Beech
Fraxinus americana	Ash, White Ash
F. nigra	Water ash
Juglans cinerea	Butternut
J. nigra	Walnut
Larix laricina	Tamarack
Liriodendron tulipifera	Whitewood
Nyssa sylvatica	Pepperidge
Ostrya virginiana	Ironwood, Hornbeam
Picea rubens	Spruce
Pinus rigida	Pitch Pine
P. strobus	White Pine
Platanus occidentalis	Buttonwood
Populus sp.	Poplar
Prunus serotina	Cherry, Black Cherry
Rhododendron maximum	Laurel
Quercus alba	White Oak
Q. borealis	Red Oak
Q. prinus	Rock Oak
Q. velutina	Black Oak
Sassafras albidum	Sassafras
Sorbus sp.	Mountain Ash
Tilia americana	Basswood
Tsuga canadensis	Hemlock
Ulmus sp.	Elm
Uncertain or Unknown	
	Moonbeam Tree
	Indian Willow
	Mountain Willow
	Roseboom Oak
Prunus nigra	Plum
Liriodendron tulipifera	Skimmelboss = white wood

given regularly by only a few surveyors and its size is not recorded although a tree may be described as large, small or sapling.

Two questions which are commonly considered are the ability of the surveyors to recognize tree species and possible bias of the surveyors towards certain species in selection of bearing trees. The surveyors recorded a large number of the indigenous tree species as bearing trees (Table II). The recognition of even the relatively uncommon trees of the region argues that the surveyors generally were competent woodsmen with an excellent knowledge of the trees. The common species which would be the basis of any interpretation, viz., beech, hemlock, sugar maple, are readily recognizable and not likely to be confused.

In the Colonial and Revolutionary period land was the principal form of wealth. Surveying was an essential activity commonly done by men of considerable ability and good reputation. It seems reasonable that the records available are a good accounting of the area covered. Gordon (1940) suggests that the surveyors may have had a preference for beech as a bearing tree. Beech is easy to carve on with a timber scribe or knife. Lutz (1930) states that the choice of trees was more or less arbitrary and notes the opinion of an old land surveyor that gum (Nyssa), oaks and sugar maple made good witness trees. Bourdo (1956) comments that medium-sized trees were preferred. He suggests a number of ways of evaluating bias in the selection of bearing trees by the application of probability theory. These statistical approaches cannot usually be rigorously applied to the data from land surveys considered here.

The estimates of bearings from the corners were not random. In two cases where a sufficient number of bearing trees were recorded by a single surveyor a Chi-square test was applied to the data. In both instances the selection differed significantly from a random distribution. In one, where the surveyor gave only the cardinal compass direction, there was a significant bias for north and south bearings. In another instance, where the surveyor gave bearings in eight compass directions (NE, NW, SE, SW in addition to the cardinal points), there was a bias towards the cardinal points. If the observations of the several surveyors who recorded compass directions are considered, the bias towards the north and south bearings is still significant. Individual vagaries do not cancel each other. This does not indicate a preference for a given tree species, however, as there is no reason to believe that any species will occur more frequently north or south of any point.

Distance from the corner to the bearing tree was sometimes estimated. However, since the size of the tree is not given, Bourdo's method of determining preference as to species and size cannot be used. It is apparent from the frequency distribution of the estimated distances that the classes containing 5, 10, 15, 20 links contain

TABLE III.—Tabulation of the more common trees cited in surveyors' records

	G.L. 1	G.L. 2	G.L. 3	G.L. 4	G.L. 5	G.L. 6	G.L. 7	G.L. 9	G.L. 19	G.L. 20	G.L. 22	G.L. 23	G.L. 24	G.L. 25	G.L. 36	G.L. 39	G.L. 40	G.L. 41	G.L. 42	G.L. 49	Evans Patent	Stateland Tract	Total	% of Total
Beech	40	115	85	180	317	77	28	78	52	46	120	20	46	74	47	94	78	80	135	19	90	34	1855	49.5
Hemlock	33	85	78	96	128	6	18	13	2	14	83	20	20	57	19	12	6	2	3	30	12	24	761	20.3
Sugar Maple	6	13	15	45	97	20	1	6	19	6	42	7	10	18	10	28	20	20	65	6	14	10	478	12.8
Birch spp.	6	14	4	30	84	13	10	9	5	4	16	6	5	7	7	8	7	10	11	5	5	8	274	7.3
Ironwood		2	1	5	9	13			2	1	6	1				2	10	8	14		8		72	1.9
Basswood	1	1	2	7	9	4		1	1		4		1			1	2	1	9	1		3	47	1.3
Soft Maple	5	1		7	7	3	2			1	2				1			3	4		6		42	1.1
Black Cherry		1			6	2					1		1	1	2	2			8	1	8		33	0.9
Moosewood			3	1	4	2		1	2				2		1	1		2	2		2	3	26	0.7
Elm spp.		1			1				1		3		2		2	2	2	1	4			1	20	0.5
Chestnut		2	1		5		7			1				1								2	19	0.5
White Pine		1			1		9			1	3								1		3	1	20	0.5
White Ash	1		2		4						2										2	3	14	0.4
Fir					4			1			2		5	1								1	14	0.4
Black Oak							2								1		2			1	1	1	8	0.2
Buttonwood				2							2				5				1				10	0.3
Butternut				1	1						1				3				1				7	0.2
Spruce				3	3							3											6	0.2
Red Oak		1	1								1												3	0.1
Rock Oak	1				1					2				1									5	0.1
Others	2	3	4	1	1	0	1	1	0	0	1	0	1	0	2	0	1	2	5	0	4	1	30	0.8
																							3744	

materially more trees than others. Thus the surveyors tended to estimate distance in five-link increments.

The area included is approximately 800 square miles. The bearing trees constitute an average sample of only 4-5 trees per square mile. The records found are not homogenously distributed throughout the area and some areas are not included in the records located. Undoubtedly, the greatest limitation on the validity of the survey records as a sample is the sparseness of data from the higher altitudes of the Central Catskills (Great Lots Nos. 7 and 8, Hardenburgh Patent, Catskill Map 1957). Extensive areas including much of the spruce forest of the Catskill Region, were not surveyed in this early period and are not represented in the surveyors' records. The great majority of the points which can be located on topographic maps lie between 1000 and 3000 feet. In relatively complete records found for Great Lot No. 22, Hardenburgh Patent, in the Northern Catskills, 65% of the trees were below 2000 feet, 30% from 2000-3000 and 5% above 3000 feet. This proportion approximates the distribution of land area by altitude classes. The surveyors' records are most representative of the forest cover of the valley areas and the slopes below 3000 feet. There is inadequate representation of the mountain tops and higher ridges which rise to 4000 feet.

RESULTS

The surveyors' records which were found represent complete or partial surveys of 20 Great Lots of the Hardenburgh Patent. Some records were located of the adjacent Evans Patent on the west and the State Land Tract on the north. In addition to these records of areas lying in the Catskill Mountains, records of the Hurley and Rochester Patents which lie in the Hudson Valley to the east were examined for comparison. The data from the Catskill Mountain areas are tabulated in Table III. In every instance, but one, beech is the most common tree and in most of these hemlock is the second most common. Beech comprises nearly 50% of the total density followed by hemlock 20%; sugar maple 13% and birch spp. 7%. The surveyors' records usually simply recorded birch. Of the birches recorded by species 58% were yellow, 37% black and 5% white birch. It is probable that most of the bearing trees recorded as birch spp.

TABLE IV.—A comparison of species percentages in surveyors' records from different portions of the Catskill Mountains

Species	Southern	Northern	Western
Beech	46.4	45.2	63.0
Hemlock	26.4	27.5	8.0
Sugar Maple	11.1	13.0	7.0
Birch spp.	8.7	6.1	5.1
Ironwood	1.1	1.1	5.0
Others	6.3	7.1	11.9

TABLE V.—Species percentages in different portions of Great Lot No. 5 of the Hardenburgh Patent

Species	East	Central	West
Beech	39.5	51.3	49.3
Hemlock	26.5	14.7	15.1
Sugar Maple	14.3	14.7	13.7
Birch spp.	9.5	13.3	14.2
Others	10.2	6.0	7.7

were either the yellow or black birches, which are more common at the lower altitudes than the white birch.

For comparative purposes the surveyors' data were divided into three parts (Table IV) representing the southern Catskills (Great Lots 1-5, Hardenburgh Patent); northern Catskills (Great Lots 19-25 and 49 Hardenburgh Patent and the State Land Tract); and the western Catskills (Great Lots 35, 36, 39-42, Hardenburgh Patent and the Evans Tract). The proportionate distribution of tree species in the north and south portions is very similar. The area west of the East Branch of the Delaware River has a larger proportion of beech and less hemlock and sugar maple than the other areas. Ironwood and several other species are also more prominent in the western area.

Variation in the surveyor's records data was also observed by subdividing the larger samples and, in a few cases, more detailed samples of smaller areas were found. Great Lot No. 5 of the Hardenburgh Patent afforded the largest survey sample of 679 trees. This lot is a long narrow rectangle on a NW to SE axis. When the sample is subdivided into approximately equal parts east, central, and west the tree densities of the west and central portion are quite similar but the east portion has less beech and more hemlock (Table V).

Data on Great Lot 22 was found as 2 separate surveys, one north of the Schoharie Creek surveyed in 1789 and the other south of the Schoharie Creek surveyed in 1795 (Table VI). South of the creek beech is more common than hemlock while north of the creek hemlock exceeds beech. Although this might be due to a vagary of the sample it may be, partially at least, explained by differences in topography. The area north of the Schoharie has only about one-fourth of its total area above 2000 feet while south of the creek a larger proportion is

TABLE VI.—Species percentages in two surveys in Great Lot No. 22 of the Hardenburgh Patent

Species	North	South
Beech	30.9	47.2
Hemlock	41.8	19.7
Sugar Maple	13.6	17.6
Birch spp.	3.6	5.6
Others	10.1	9.9

above 2000 feet. Hemlock, as earlier observers (Dwight, 1820) noted, is more common at lower altitudes. In current studies, stands predominantly of hemlock lie below 2000 feet although hemlock is found at higher altitudes. It is probable that the differences noted are due to the topographical pattern of distribution of tree species in the two areas.

In two instances surveys of smaller, more compact areas result in a materially larger sample of an area. An 1801 survey of the Spooner Tract in Great Lot No. 4 of the Hardenburgh Patent affords a sample of approximately 9 trees per square mile, nearly double the average. Beech in this tract is 49.6%, hemlock 22.6%, sugar maple 13.1%, birch spp. 5.8%, and other 8.7%. This approximates the proportionate distribution of species in Great Lot No. 4 as a whole. A 1787 survey of the Town of New Stamford (Great Lot No. 42, Hardenburgh Patent) in which the street lines were laid out through the forest gave the following percentages: beech 53.7%, hemlock 0.0%, sugar maple 17.6%, birch spp. 8.8%, ironwood 8.1%, others 11.8%. In this sample 136 trees were recorded in 0.25 square mile giving the most complete sample found of any area. It is unique in being completely free of hemlock but lies in the western area of the Catskills in which fewer hemlocks were recorded by the surveyors.

A more subjective view of the forest is gained from the comments frequently made by the surveyors. They commonly made note of the slope of the land, its soil and water supply and the timber. Of 640 such comments on timber by many different surveyors, 42% described it as beech-maple-hemlock, 20% as beech-birch-maple-hemlock, 9% as beech-maple and 5% as beech-birch-maple. Tree species other than beech were mentioned first in only 4% of the descriptions and hemlock was mentioned first in only 2%. That their descriptions are not entirely a routine notation made by the surveyors is indicated by the diversity of the species combinations which are recorded. Considering the first four trees mentioned, over thirty different combinations were found and mention of less common trees as cherry, various oaks, butternut, chestnut is frequent. Local conditions are sometimes indicated by the surveyor's comments of laurel swamp or tamarack. Particularly in the later surveys, ca. 1800, mention may be made of clearing on part of the lot or of apple trees planted. This is particularly true of Great Lots Nos. 5 and 23 of the Hardenburgh Patent. The latter survey which is the latest included makes the first mention of lots sold to tanneries and marks the beginning of the first large-scale exploitation of the Catskill forest.

Other subjective impressions are given by the descriptions of individual trees. Many surveyors described bearing trees as sapling, small or large. Where this was done, 11.1% of the beeches cited were described as sapling or small and 1.6% described as large. Hemlock bearing trees were described as sapling or small 5.4% of the time and large 8.6% of the time. It is clear that the forest

comprised many smaller and younger beech trees and more larger and older hemlocks. This is substantiated by the average distances to the bearing trees of these two species. In Great Lot No. 2 of the Hardenburgh Patent the average distance to beech trees was 9.7 links, to hemlock 12 links. In Great Lot No. 22 the average distance to beech trees was 14.4 links, to hemlock 17.8 links.

Although no thorough canvas was made for surveyors' records outside of the Catskill mountains, some records for the Hurley and Rochester Patents were found. These lie immediately adjacent to the Hardenburgh Patent in the Hudson River Valley. Much of this area, as mentioned above, was cleared by Indians and early white settlers and subjected to burning by the Indians. In the latter part of the 18th century the forest composition was very different from the mountain forests. The three leading species cited were white oak 15.3%, black oak 13.9%, rock oak 12.6%. Hemlock was fourth with 8.3% and sugar maple fifth with 5.6%. Beech comprised only 3.3% of the trees recorded in these patents.

DISCUSSION

In spite of limitations due to the relative sparseness of the available sample the records of the early land surveys afford an excellent means of assessing the composition of the forest of the Catskill Mountains in the late 18th century. It need not be asserted that this represents a virgin condition or undisturbed climax, only that it is an adequate description of the forests of the period. Certainly such a reconstruction is one of the best means available for providing a base point for study of present-day forests.

The descriptions available of the Catskill region (Dwight, 1820; Harshberger, 1905; Bray, 1915; Recknagel, 1923; Braun, 1950; Smith, 1954) afford only general descriptions of the forest. In general they agree on the major forest components although they differ in detail and emphasis. No quantitative data on the composition of recent forest cover are available and information on forests in the colonial period is almost nil.

It is clear that the beech was the most common and widespread tree between altitudes of 1000 and 3000 feet in the Catskill forest in the late 18th century. Its proportionate density varies from place to place but in only one case is it less common than another tree. A common view of extensive stands of hemlock or pine is not substantiated by the data provided by the surveyors' records, nor do the surveyors' descriptions of the timber indicate large stands of pure hemlock. In only two instances of more than 600 does the surveyor cite only hemlock and rarely is hemlock mentioned as the major timber tree present in the lot surveyed. The impression is of a forest dominated by deciduous species, especially beech, with lesser proportions of sugar maple and birch (Smith, 1954). Hemlock was widespread and undoubtedly represented by large individuals which

extended above the deciduous canopy and with proportionately large basal area. White pine was much less common although probably present as large individuals and occasionally locally dominant as suggested by the comments of the surveyors of Great Lot No. 23, Hardenburgh Patent and Timothy Dwight.

Although infrequently cited as bearing trees a number of other species are of particular interest. Red oak was rarely encountered as a bearing tree although it is mentioned in several places in Great Lot No. 22, Hardenburgh Patent and elsewhere. Black oak was occasionally cited as a bearing tree but is infrequently mentioned. It is not unlikely that it and red oak were confused as they often are today. Black cherry is widespread as a small proportion of the forest and is most frequently mentioned in the southern and western surveys. Chestnut is similarly widespread and frequently mentioned by the surveyors. It apparently was present in substantial quantities in the Evans Patent.

Table VII compares the composition of the Catskill forests to that of the forests of northwestern Pennsylvania (Lutz, 1930) and southwestern New York (Gordon, 1940), also determined from surveyors' records. Each of these was the work of a single survey party in a continuous area. Lutz records six thousand trees of 32 species in an area of 271 square miles; Gordon, 741 trees of some 23 species in an area of 182 square miles; as compared to 3744 trees of 36 species in 800 square miles in the Catskill region. In each area beech was the leading species followed by hemlock, sugar maple and birch spp. The most striking difference is the larger proportion of beech recorded in southwestern Pennsylvania. Another notable difference is the larger percentage of chestnut and white pine in the surveyors' data from Pennsylvania. The average proportion of these two species in the Catskill forest was much less and in only one of the separate Great Lots (No. 7) was either present as a substantial percent of the total sample.

Even as late as 1800 it is likely that the forest of the Catskill Mountains had not been extensively disturbed by Europeans. White pine was probably selectively removed and the surveyor's records may

TABLE VII.—Comparison of percentage density of common tree species in the forests of the Catskills, northwestern Pennsylvania (Lutz, 1930) and southwestern New York (Gordon, 1940)

Species	Catskills	Pennsylvania	S.W. New York
Beech	49.5	30.85	61.0
Hemlock	20.3	26.80	7.3
Sugar Maple	12.8	8.07	7.3
Birch spp.	7.3	6.06	2.8
White Pine	0.5	5.99	0.1
Chestnut	0.5	5.57	0.1
Others	9.1	16.66	21.4

underrepresent its presettlement proportion. The valley areas and the southern Catskills were widely occupied by settlers and small farm plots cleared. The large scale cutting of hemlock for the tanneries did not begin until the second and third decades of the nineteenth century and cutting of fuel wood for glass factories and cutting for acid wood also postdated the early surveys cited here. The surveyors' comments only occasionally referred to burned-over areas. More frequently they mention windfall. In one instance most of a lot of over a hundred acres in size is so described. Although the forest was certainly not homogeneous, its major lineaments are clearly indicated by the surveyors' records.

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