HARVARD FOREST

BULLETIN No. 20

THE HISTORY OF LAND USE IN THE HARVARD FOREST

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HARVARD FOREST,

PETERSHAM, MASSACHUSETTS

1941

PRINTED IN THE UNITED STATES OF AMERICA

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FOREWORD

Both the investigation and the present publication have been supported jointly by the Committee on Research in the Social Sciences of Harvard University, the Arnold Arboretum, and the Harvard Forest. The authors are deeply indebted to many people for assistance and suggestion during the progress of the work and the preparation of the manuscript. Thanks are due particularly to Professor John D. Black of the Department of Economics at Harvard; to Mr. Ward Shepard, former Director of the Harvard Forest, and to Mr. A. C. Cline, its present Director. The following persons have been kind enough to read and criticize the manuscript: Professors A. P. Usher and C. C. Zimmerman of the Departments of Economics and Sociology at Harvard; Dr. Edward D. Ackerman, Mr. H. S. Kemp and Professor Kirk Bryan of the Department of Geology and Geography; Mr. Cline and Dr. P. R. Gast of the Harvard Forest. Mrs. Mabel Coolidge of Petersham, who has for many years been accumulating notes on local history, graciously placed at the writers' disposal her fund of information about people and places in the vicinity. Errors of fact and interpretation are of course inevitable in a work of this kind, and for these the authors assume all responsibility.

INTRODUCTION

Two attitudes of mind commonly dominate direction of management of our New England forests. One of these might be called the agricultural attitude, wherein forest trees are regarded in somewhat the same light as grains and vegetables, and it is assumed that within certain broad limits we can examine the local situation, forecast the demands of the market, and proceed to plant or otherwise seed our lands to such trees as will produce the best return. The second attitude involves the manipulation of the forests to bring them into accord with the natural timber which the land would produce if left to itself, perhaps with judicious modification of stand composition here and there to ensure larger or quicker profits.

There are inherent in these two attitudes of mind, respectively, two corresponding methods of approach to silvicultural research as a whole. The first is an analytical and experimental approach. Such methods as this have been utilized for generations in the study of agricultural production, and it is the hope of many foresters that we will soon be able to analyze the climate and soil of any particular site in such detail and with such understanding that we can grow our tree crops with the precision we use in some of our agricultural pursuits.

The difficulties inherent in this method of approach become at once apparent when we realize, first, that the average life of a hardwood tree, if it is allowed to reach commercial maturity, may be from 80 to 100 years; second, that we know almost nothing about the physiological life history of our common forest trees; and third, that our knowledge of forest soils is still very imperfectly developed. Added to these difficulties is evidence of a relation which has only recently begun to emerge—that our deciduous forest trees live together in communities which may be quite stable and persistent. We have only the haziest of notions as to what holds these communities together; but we can realize that if we tamper with such a natural relation we commit ourselves to the solution of a problem which approaches in complexity that of the reconstitution of any organized society of individuals, and we go into it with the serious handicaps that have already been mentioned. Nevertheless, the evaluation of site by analytical and experimental methods should be our major goal, and there is a large number of students reaching toward it.

Our forests, however, are here now and are growing apace, demand-

ing some sort of reasonable management plan. They cannot wait for an adequate solution to the major problem.

The second method of approach to this research has been the refuge of foresters from time immemorial and is still of first importance. It might be termed the historical method, or even the empirical method. In Europe it has been utilized for a matter of centuries in some of the older managed forests, so that an immense body of information has been accumulated upon which to build management plans. But in America the oldest managed forest has been in existence for scarcely over 30 years. We have, however, in America, an important advantage in that we are much closer in point of time to the original forests which clothed the landscape. These original forests, if we follow this method, must be the basis on which we develop our ideas as to what the land will produce.

There is, of course, no hard and fast line between the two methods of approach. Information derived from the experimental manipulation of natural or semi-natural timber stands is useful to those pursuing analytical methods of site evaluation; and, vice versa, data derived from the growing of trees under completely controlled conditions may be expected to throw light on the observed behavior of the trees in natural forests. A well-balanced program of silvicultural research will constantly make use of such correlations.

If we are to model our Petersham forests upon the natural timber productions of the region, it is essential that careful attention be given to a study of the composition of these primeval forests and their distribution over the land surface, not only in their broad geographic arrangement, but also in terms of their arrangement over hills and valleys in local areas.

A number of complicating factors appear when this study of ancient forests is undertaken. In the first place, there is great scarcity of relic hardwood types; that is, tracts of wood which we can be confident have come down to us without any serious modification. In northern New England, where coniferous forests predominate, it is still possible to find some old timber. Here the forest was of spruce and balsam, with a heavy mossy cover on the ground and very light undergrowth. Also in places throughout central New England one finds on cold, rocky slopes of northern exposure, or in deep ravines, a mixture of hemlock, northern hardwoods such as beech, maple, red oak and white ash, and occasional white pines. This is also an original type.

Areas of pure primeval hardwoods, however, located on the uplands, are extremely difficult to find. The few remaining tracts give us an entirely new conception of the majesty of the forest through which our ancestors traveled in the early days of New England. The trees are tall, straight-boled, free of branches for 50 feet or more above the ground.

The undergrowth is rather slight, and one may walk through the woods with comparative ease. One of the very few such areas which remain is in the town of Winchester, in southern New Hampshire.[1] We are confident that this forest is almost untouched by man, and that it gives us some inkling of how the original timber types were disposed over the hills. In places the composition is almost entirely of beech and hard maple, but in others it is somewhat more varied, with basswood, ironwood, and some white ash. On still other sites there are forests of ancient red oaks growing to a size and form not to be seen in any of our recent second-growth woodlands.

Farther south in New England relic stands of old hardwoods are almost completely absent. This is particularly true in the oak and hickory region of Connecticut, where such a tract, if it could be found, would now be particularly valuable in the study of forest potentiality.

Another major complication has arisen as a result of human intervention. In the Slab City Tract of the Harvard Forest, for instance, one sees an exceedingly complex mixture of young second-growth hardwoods and white pine. This hodgepodge of types is widespread in central New England. In the absence of relics of the original timber, complexes such as this are the only sources of information we have as to what forests the land will produce, and the attempt to unravel their meaning becomes our major task.

A former director of the Harvard Forest posed the problem when he wrote in 1933: ". . . to understand what has happened to 95 per cent of the original forest area, it is necessary to trace the progress of the use of land down to the present day." (Fisher, '33, p. 216). The present study was undertaken, therefore, to throw some light on this problem as well as on the character of the pre-colonial forest. The methods used were, first, the reconstruction of land-use history for the areas in question, and second, the analysis of existing stands of timber in the light of the various uses to which the land has been applied. The information derived from this analysis, supplemented by early descriptions, has made possible some concrete suggestions as to the general composition and local distribution of the pre-colonial forest. The aim has not been a detailed study of past and present land values and products so much as a classification of land use into such broad categories as "woodland," "pasture," or "cultivated land."

Some correlation between the evolution of soils and the development and decline of agriculture and lumbering would be extremely desirable, but the technical difficulties involved have prevented any attempt to bring it into the scope of the present investigation. Attention should be drawn

[1] This old timber was almost completely destroyed in the hurricane of September, 1938.

to work done at the Harvard Forest on the influence of the white pine-hardwood succession upon the modification of forest soils, as well as on the relationship between soil fauna and forest types.

There are those who will question the propriety of uniting in one publication the results of what appear to be two separate investigations, one concerned primarily with the economic history of a Massachusetts town, and the other with the problems of management in the forests of the town. As the following chapters will demonstrate, the town economy of Petersham, Mass., was primarily agricultural during the first 150 years of its existence. Thus its social and economic history are bound up inseparably with the use of the land. Since the patterns of the original, natural vegetation have been masked by the multiform results of land use, the reconstruction of these patterns must wait upon an analysis of the history.

From the point of view of the social scientist the work here recorded represents a useful and perhaps novel technique in economic history, wherein two widely separated disciplines are brought together, the one intended to support and document the other. As noted above, the central premise of the study is that present-day forest management cannot be carried on effectively without some knowledge of past land use. It follows in turn that land use cannot be understood without some knowledge of the town economy in which forestry, farming, and local industry were interrelated activities. Moreover, these major activities were carried on largely by the same individuals, which suggests the economic problem of allocation of resources. How much of a family's labor and capital was to be applied to farming, and how much to local industry or lumbering? One of the interesting facts revealed by this study is that a certain mobility existed between the proportions to be applied in meeting these competing demands. At one period the larger share of the town's resources was engaged in general farming, while at a later period the proportion changed as the emphasis shifted away from general farming to dairying and local industry. Still later came another shift in the proportions when dairying and lumbering were in the ascendancy while resources were gradually being withdrawn from the local industries which could not meet the competition of large-scale factory production.

Another aspect of this historical approach to the problem of forest management of interest to the social scientist is the attempt to employ statistical data in analyzing the history of the town. This use of statistical materials has proved of great value in supporting and verifying certain conclusions related directly to the problems of forestry. Without reliable data which show the limited amount of clearing in the 18th and early 19th centuries, and which also demonstrate the very small acreages

that were tilled, the investigators would have lacked a useful check on such primary sources as Peter Whitney's History. Thus the statistical reports, which seem reasonably accurate for that period, clearly demonstrate that the forests described by contemporary residents and travelers were the pre-colonial forests undisturbed by the white man's settlements.

The use of quantitative methods in economic history is surely not new, yet the fruitfulness of this technique in the present investigation suggests that future studies, even of small geographical or political units, might profitably be built around quantitative measurable phenomena. In Massachusetts, for example, there is available a large collection of materials on cities and towns derived from state decadal censuses which apparently has never been exploited.

PREVIOUS WORK

Earlier studies of land-use history in this region may be divided roughly into four categories. The first of these is to be found in various studies of general agricultural and industrial development. Such volumes as Bidwell and Falconer's *History of Agriculture in the Northern United States, 1620-1860,* Bidwell's article on *Rural Economy in New England at the Beginning of the Nineteenth Century,* and various papers contained in the American Geographical Society's *New England's Prospect, 1933,* have summarized and correlated a vast amount of material which has proved of inestimable value in orienting the work done at Petersham. Frequent reference to some of these papers will be found in the following pages.

A second type of land-use investigation is that which attempts to describe the geographic settings of individual towns or groups of towns in New England. Most of these studies have depended for their historical data upon local town histories, and a few of them have drawn upon tax returns and census figures. Good examples of such work are A. J. West's *The Land Utilization of the Town of Paxton, Worcester County, Massachusetts,* or Van Royen's *Geographic Studies of Population and Settlements in Worcester County, Massachusetts.* Although these studies, when fitted together, give a rather comprehensive picture of economic and social development in the towns, they have contributed very little, either in materials or methods, to the problems of forest history.

A third kind of investigation consists of attempted reconstruction of vegetational history, either by the analysis of existing forests in the light of known general trends in land-use history, or by attempts to work out the relation of the present and past forest cover on the basis of the general theory of plant succession. The first has reached its highest development in studies carried out at the Harvard Forest during the past fifteen or twenty years, and, for Southern New England, by those at the Yale School of Forestry. They have been adequately summarized by the late Professor R. T. Fisher in his brief paper on *New England Forests: Biological Factors.* The analysis of New England forests on a successional basis has not progressed nearly so far as have similar projects in the interior of the continent. One of the major reasons for this is that modern successional theory depends very largely upon the concept of "climax," and the New England forest climaxes have been greatly obscured, not

only by their inherent complexity but also by inadequate evidence as to the character of the original forest. The most important contributions toward an understanding of New England forest successions have been made by the late G. E. Nichols in his studies of *The Vegetation of Connecticut,* by foresters who have gone far enough with the study of silvicultural problems to arrive at some concept of climax, and by a few students who have attempted to correlate forest communities and successions with various soil types. Such papers as those by Professor Fisher and various students at the Harvard Forest should be mentioned here as well as studies of old field forests in Connecticut by H. J. Lutz. The last type of investigation may be illustrated by the papers of Cunningham on *The Relation of Forest Invasion and Succession to the Major Soil Types of the Central Massachusetts Upland,* of Briarly on *The Effect of Paxton and Sutton Soils upon the Character of Vegetation Types in Worcester County, Massachusetts,* and of Beishlag on the *Effect of Slope on Forest Succession on the Charlton Soils of the Central Massachusetts Upland.* None of these investigations has gone far enough into the actual use of specific pieces of ground to satisfy the needs of the present investigation; furthermore, they rest very largely upon a concept of the primeval forest inferred on theoretical grounds, rather than upon one which has been substantiated by documentary evidence.

The fourth type of land-use study involves the actual reconstruction of old surveys and a general assemblage of data from all available sources on the character of the country first seen by the settlers, and on the uses to which they put it. The nearest approach to this, so far as the writers are aware, is in the investigations of Dr. J. W. Goldthwait in the town of Lyme, New Hampshire, and of Dr. E. N. Torbert in the town of Lebanon, New Hampshire. Both of these utilized early maps and road surveys for their source material, rather than deeds to individual properties, and both give a far more adequate picture of the general development and decline of land use in New England towns than has been possible heretofore. A map of trees in the original forest of the town of Lebanon constructed by Torbert from early town surveys is enlightening, although the original forest was probably of such a mixed nature that conclusions as to the local distribution of species or types are subject to large error. The writers have found this to be the case in Petersham. A great many trees, of different species, were used as boundary markers in early surveys, but the original forest appears to have had so much stem-wise variation that a rational analysis of the data becomes almost impossible, even when it is projected upon a map of the topography. In other words, any given stand in the primeval forest probably contained so many species of secondary significance that there was a good chance of one or

more of these species being selected as boundary markers; and if they were selected they would give an entirely erroneous idea of the general character of the woods.

The methods used in the present investigation were tried out by the senior author in 1934-35, in a study of the early uses of land now in the Arnold Arboretum, at Jamaica Plain, Mass. The area of the Arboretum is much smaller (only about 260 acres), but the plan of the project was similar to that used in Petersham.

METHODOLOGY

The initial task in the project was to establish a succession of land titles to those parts of Petersham which now comprise the Harvard Forest, about 2300 acres (Fig. 1). The investigation entailed the construction of abstracts of titles from 1907, when Harvard University first acquired most of the land, back to 1733, when the original grants were made to the first settlers in the plantation of Nichewaug.

The field work on the titles was done during the summer of 1938. Notes on the composition of various stands of timber in the Forest were made during the same season, but were supplemented with data gathered by the senior author between 1933 and 1937, as well as with material from the accumulated records at the Forest office. It should be noted that nearly all of the field work was done, fortunately, before the hurricane of September 21, 1938. No attempt is made to evaluate the effects of the hurricane in terms of forest history, but the changes caused by it in the areas designated as old forest will be noted briefly.

The primary source materials used in the study of titles were two. First, the Registry of Deeds for Worcester County, located in the County Courthouse, Worcester, Mass., contains bound records of old deeds registered in the county back to about 1730. The bound volumes are catalogued in a master index and classified by both grantor and grantee, which facilitates the search for individual deeds. Serious difficulties arose, however, when the index was incomplete or the deeds had not been registered, with the result that a few inconsequential gaps still remain in the history of some parcels. The second primary source was the *Proprietors' Record,* a volume in the possession of the town clerk of Petersham, which was begun in 1733, when the town was originally laid out by the General Court. It contains descriptions of most of the original grants, including surveys of each parcel as drawn by lot. A small portion of the Harvard Forest lies in the town of Phillipston, but after careful search the writers were unable to locate the Proprietors' Record for that town; nevertheless, the original grants of that section were reconstructed from deeds recording the early transfers of land.

These major sources were supplemented by frequent reference to the Probate Records for Worcester County, also located in Worcester, Mass., local sources in Petersham, and genealogical records to be found in the American Antiquarian Society, Worcester, the New England Historic

Genealogical Society, Boston, Mass., and other libraries. The State Archives in the State House at Boston contain some early maps of Petersham which show the progress of settlement. One of these maps, prepared in 1830 and reproduced here as Figure 2, has proved to be of first importance, as it has the forested areas shown by symbols. This map served, throughout the investigation, as a check upon findings in the deeds; and, in turn, the verification of its accuracy by the latter should render it of considerable significance if it should ever be desirable to extend the investigation to other parts of the township. Early tax returns proved disappointing due to the paucity of descriptive material which they contained. A report on the valuation of towns, made in 1771, proved to contain some valuable figures on acreages in various types of usage, especially when correlated with the information found in the deeds.

The methods employed to reconstruct the former property lines in the Forest provided for alternate periods of title searching, study of the descriptions so obtained, and field work to check the accuracy of the descriptions and to establish the boundaries on the land itself. As these particular techniques proved most successful in attacking the problem, they may be briefly outlined. The descriptive portions of the deeds were copied out in some detail, especially when they recorded surveys of the land. Actual and concise information about land use exists in these records only in scattered items; thus it was necessary, after having identified the properties, to read all the descriptions of them with great care, so as not to miss the incidental words which would give clues as to the use of the land.

Unfortunately many of the deeds contain no surveys but simply describe the land by metes and bounds. However, it usually was possible to find a survey somewhere in the line of succession, and armed with these data giving dimensions and compass bearings, the next step was to draw a picture of the tract, using some convenient scale. When a number of these sketches had been made they were fitted together like the pieces of a jigsaw puzzle, until bit by bit the contemporary land lines of an entire area were reconstructed. Here the field work, the third step in the process, was begun; and with compass and chain the woods were searched in an effort to establish the lines on the land. Many of the descriptions would read: "A tract of land beginning at a heap of stones and running South about 50 rods more or less to a small maple tree, thence Northeasterly 15 rods to a chestnut stump, then turning and running North 45 rods to a brook . . ."; needless to say, most of these bounds had been obliterated after 50 or 100 years. However, the stone walls, remains of ancient rail fences, and old abandoned roadways still discernible in the forest were of great assistance in following the descriptions and locating the property lines.

After the old property lines had been laid down on maps of the three large tracts into which the Harvard Forest is divided, namely, Tom Swamp, Prospect Hill, and Slab City, the properties were numbered for each tract and a consecutive history of ownership was constructed for each parcel. The data thus accumulated have become so voluminous that their complete publication is not feasible; consequently only a "sample," taken from a part of the Slab City Tract, will be included in this report (Fig. 3). The remainder of the data will be found as manuscript in the Harvard Forest Library at Petersham.

Two maps of each tract have been prepared (Figs. 4-9). The first in each case shows the boundaries of the original grants, and due to the fact that the grants were not all made at once but scattered through several "divisions" from 1733 to 1770 (a few dating from after 1800), the outlines of properties are not all contemporaneous. They show, however, how the original surveys were planned and how common land was subsequently divided among the inhabitants. The second series of maps gives the arrangement of properties in 1850, together with what information is available on land use. This date was selected because it represents the period of the highest development of agriculture in the town, and accordingly the period in which the largest acreage was cleared of forest. As will be noted below, the sequence of events in the development and decline of settlement, agriculture and industry in the town was such that the period centering around 1850 was the most critical in forest history. If a piece of woodland were in existence in the early 1800's and survived the period of most extensive agriculture between 1830 and 1850, it may usually be regarded as having continued as woodland throughout the period of settlement. It will be noted that in cases where tracts were described as "Pasture and Woodland," or as "Farms" whereon it is known that some woods existed, the wood lots have been tentatively located on the maps. This was done by interpretation of the existing forest types. Areas of old hardwood or mixed stands occurring on such tracts were usually taken to mark the positions of the wood lots of 1850.

HISTORY OF LAND DIVISIONS

The New England colonies during the early 18th century were usually hard pressed financially to meet the costs of frequent military expeditions against the French and Indians, and the payment of volunteer soldiers was a perennial problem. The earlier policy of the colonies had been democratic and farsighted, designed to bring about a methodical occupation of open land by actual settlers rather than to encourage speculative profits for a few. Grants by the Colony to individuals were rarely large and in the aggregate were but a small part of the total area (Bidwell & Falconer, '25, p. 49). Most of the grants were made to corporate communities, usually formed by splitting off several families from one of the older settlements. A distinct change in policy was made by Massachusetts about 1725, when it began making town grants, not for the primary purpose of settlement, but for paying its soldiers and other creditors. Thus large townships, of which Petersham was one, were sold to grantees who intended not to settle themselves but to resell the land at a profit (Ibid, p. 72).

In 1733 when this new policy was being formulated, a group of 67 soldiers who had served in the current French and Indian war petitioned the General Court for a grant of land to compensate them for services rendered. The petition was granted, the list of proprietors increased to 71 and the new township was temporarily named Volunteers Town. Shortly thereafter the name of a local Indian settlement, Nichewaug, was adopted and continued until the town's incorporation in 1754 as Petersham.

The original grantees, called "Proprietors," held complete title to the township; and through purchase, marriage and inheritance these proprietary rights tended to concentrate in fewer hands (Ibid. p. 54). Thus a few large landed properties were accumulated by both resident and non-resident owners. Expenses of administration, surveys, the minister's salary, repair of fences, roads and like services were met by assessing the cost to the proprietors in proportion to their holdings. Occasionally the large speculative owners could not pay these assessments and portions of their land would be sold at auction to meet such charges.

The distribution of the township to the individual proprietors, or to those who had acquired a proprietary right, was made in 5 separate divisions or "dividends." The first division was that of the "House lots," and

it was voted in November, 1733, to draw 72 of these lots (*Proprietors' Record,* p. 24). They varied in size from 55 to 100 acres and were laid out along the ridge which runs north and south through the center of the township, usually contiguous to the main roads. Presumably this first division pre-empted some of the choicest upland farm sites and contained land of more or less uniform quality and topography.

The second division, which consisted of tracts of about 100 acres each, was made in September and October of 1738, and each holder of a house lot was entitled to "pitch" his division in whatever way he chose, adjacent to his first division (*Proprietors' Record,* p. 54).

It was thus expected that each farm would consist of one large piece rather than a series of tracts scattered all over the township. Twenty-four of the proprietors, representing 33 house lots, chose contiguous parcels; and for the others, presumably the absentee owners, second division lots were laid out and numbered by a surveyor appointed by the proprietors. The numbers were then drawn by lot and one was assigned to each of the remaining 39 original house-lot rights. This was the procedure followed in each of the subsequent divisions and a given tract would thereafter be known, for instance, as "second division lot number 8 laid out to house lot number 11 on the original right of Jeremiah Perley."

The third division, of tracts of about 100 acres each, was voted in September, 1739, to be pitched in May, 1740 (*Proprietors' Record,* p. 82). Seventeen of those holding proprietary rights "pitched" their third division lots at the prescribed time so as to adjoin their house lot or second division. For the others, the tracts were again surveyed, numbered and drawn by lots, each house lot being entitled to one drawing, and proprietors owning several house lots drawing a corresponding number. These lots were subsequently identified in deeds, as, for example, "third division lot number 44 laid out to house lot number 72 on the original right of Jonas Houghton."

In December, 1753, the proprietors voted to make a fourth division consisting of tracts varying in size from 40 to 60 acres each, though on this occasion all lots were numbered and drawn instead of allowing the individual proprietors to make their own "pitch" as had been done in earlier divisions (*Proprietors' Record,* p. 231). This device was probably expedient because the holdings had already begun to break up, and frequently different individuals owned the various divisions to the same house lot, while in other cases the proprietary right had been separated from the original house lot and sold, along with the second or third division tract, to some new settler. These new tracts were identified, for example, as "fourth division lot number 68 drawn on the original right of Jethro Eames"; thus they were still tied to the original proprietary

right though no longer associated with any given house lot. (A complete table of these four separate divisions in relation to the original proprietary rights is included in the Appendix.)

With the fourth division in 1753, just one year before the town was incorporated as Petersham, most of the upland had been distributed and the remaining common land consisted largely of wet meadows and swamp. It was not until May, 1770, that the proprietors again met to declare a fifth and last division "to lay six acres of common land to every original right." (*Proprietors' Record*, p. 323.) Prior to this there had been a few small divisions of "upland" so-called, consisting of from 3 to 6 acres each, laid out in the 'forties and 'fifties. These small tracts apparently filled in any gaps between the larger divisions which might have occurred from errors in surveying or for any other reason. The fifth division was primarily for meadow and mowing land, though it also disposed of any upland areas lying between the meadows and land already laid out. This final distribution was made over the ensuing period of 25 to 30 years, though there was still some common land as late as 1820.

GROWTH OF POPULATION

The early influx of population into Petersham was substantial and for a while the community gave promise of becoming one of the leading towns in Worcester County. As agriculture expanded, local industry sprang up and provided full and part-time employment for many, the wages thus received supplementing the income derived from farming operations.

Census figures (see p. 21) show a steady though declining rate of growth through 1840. The sharp drop in 1810 appears because the new town of Dana was set off from Petersham in 1801. The turn downward in 1850 was the first suggestion that the zenith was passed and that factors of rural decay had already set in. It is interesting to note that the adjoining town of Athol, now a city of 11,000, lagged far behind Petersham in its early growth and even as late as 1840 counted a population of only 1,591 as against 1,775 for Petersham. The building of the railroad through the Millers River valley did more than any other factor to establish Athol and to bring about the atrophy of Petersham.

One of the interesting though subsidiary questions arising from this study was that of immigration. Whence did these early immigrants come to settle in Petersham? Where did they go in subsequent generations? The physiographic factors at work seem evident. There are four fundamental type areas in New England (Wright, '33, p. 19): (1) mountain residuals, (2) dissected uplands, (3) interior lowlands and (4) coastal lowlands. The coastal lowlands occupy a substantial fringe along the ocean and Long Island Sound and for nearly 100 years all settlements were made in this region. Here communication by water and land was easy and the proximity of neighbors offered protection, while the more rugged uplands of central Massachusetts discouraged the settler.

By 1713 this coastal area was well populated. People had penetrated up into the Connecticut lowland even before 1637, and by 1675 the valley was comfortably settled. It was about this time that the speculative land-grant period began, and many were prompted to leave the coastal settlements and seek new opportunities in the central upland country where Petersham is located. Moreover, there was always that species of restlessness that would not let men live within a mile of their nearest neighbors. As one observer in 1747 put it: "Many move that they may have

POPULATION OF PETERSHAM

1765	707	1865	1,428
1776	1,235	1870	1,335
1790	1,560	1875	1,203
1800	1,794	1880	1,109
1810	1,490*	1885	1,032
1820	1,623	1890	1,050
1830	1,696	1895	952
1840	1,775	1900	853
1850	1,527	1905	855
1855	1,553	1910	757
1860	1,465		

* The drop in 1810 occurs because the town of Dana was set off from Petersham in 1801.

more room, thinking that we live too thick." (Bidwell and Falconer, '25, p. 70.)

Most of the early inhabitants of Petersham came west from the coastal lowlands, though some probably came up from the Connecticut valley. After living in Petersham for a generation some of the children pushed northward into the more rugged upland of Vermont and New Hampshire, or westward to western Massachusetts. Often one or more of the sons would remain to operate the family homestead, and some family names persist in the records from the first settlement to the end of the 19th century. In an effort to gather more precise information on the sources of immigration and the ultimate disappearance of old families, genealogies were consulted. The families examined settled in Petersham between 1743 and 1790, and came from such widely scattered towns in Massachusetts as Shrewsbury, Sterling, Gloucester, Sutton, Worcester, Easton, Watertown, Greenwich, Lancaster, Newport (R.I.), Marlboro, Scituate, Dartmouth and Wrentham.

The dispersion of children born in Petersham from these same families in one or two generations was even wider. Many settled in adjacent towns while others went to Canada, Florida, Louisiana and Georgia. Some went north to the Vermont towns of Westminster, Jamaica, Hartland, Rutland and Gilford; some to Rindge, N. H.; and in Massachusetts to Heath, Gill, Montague, Worcester, Grafton and Boston. Still others joined the westward movement in the early 19th century before the railroads were built, going to Marietta (Ohio), Oswego and Binghamton (N. Y.), Chicago and points in Michigan. This ebb and flow of population is reflected in the land transactions recorded in the deeds. In one

generation, certain names are prominently featured in the buying and selling of land, whereas after an interval these disappear and a whole new set of names appears in the records. Likewise the successive accumulation and break-up of large holdings of land, as shown in the tract maps, reflect in part the ever-changing constituency of Petersham's population.

HISTORY OF AGRICULTURE

The first arrivals in Petersham probably found a few open areas in the forest where the trees had been killed by fire, or perhaps occasional abandoned maize fields of the Indians, where they could erect a crude cabin and begin the laborious task of making farms. The typical settler might clear from one to three acres a year, while those exceptionally energetic, or with larger families, might do substantially more (Bidwell and Falconer, '25, p. 81). In clearing, the first step was to cut down, grub out and burn the underbrush. Then the heavier trees were felled or girdled and the resulting piles of logs burned. In many parts of Petersham the large numbers of rocks covering the land provided a further problem and it must have taken years of toilsome labor to clear the stone and pile it neatly into the walls which surrounded the cultivated fields.

On the land thus cleared the first crops were grains, usually Indian corn, though rye and wheat were occasionally sown. Indian corn, important in southern New England of the 17th century, was still the major cereal at the close of the 18th century and provided the principal food staple of the settlers. In the Massachusetts valuation returns of 1801 for Worcester County, Indian corn comprised 64% of the total grain crop in the county while oats and rye provided only 17 and 12% respectively (Bidwell and Falconer, '25, p. 90). Rye, though less important in the aggregate, was grown on practically every farm, being limited mainly to sandy and gravelly soils. Rye flour, combined with Indian meal, made the standard "rye and Injun" bread of the farm families.

Hay was cut chiefly from natural meadows where large quantities of coarse forage could thus be obtained with little effort. As livestock needs increased and systematic crop rotation was adopted, the tilled uplands were often seeded with timothy (locally known as herd's-grass), red clover and other English forage plants of the 18th century. This provided the farm animals with a necessary addition to the inadequate grazing which obtained in the woodlands and weedy fields. The first crop report on record is that of 1771, when 958 acres of "upland mowing" yielded 635 tons of "English hay"; and 256 acres of meadow produced 220 tons of "meadow hay," a total of 855 tons. By 1845, the next available year, the total hay crop in Petersham had increased to 3,634 tons; in the 1855 report the English hay is again distinguished from wet meadow or

swale hay; 2,717 acres were sown and yielded 2,911 tons of English hay, while from the natural meadows 767 additional tons were cut. In 1865 statistics are more complete and Petersham had 3,015 acres in mowing, which yielded 2,300 tons of English hay, together with 757 acres in wet meadow, from which 545 tons of hay were obtained. The volume of hay grown and cut remained relatively constant at this figure for the next 30 years.

Cattle, horses, hogs, sheep and poultry were introduced at an early date. The cattle brought by the first settlers were triple-purpose animals, providing power for ploughing and hauling as well as meat and dairy products. Together with sheep, they furnished the raw materials for some local industries. Thus when wool growing was booming throughout New England, Petersham had in 1837 a total of 695 sheep, including 252 high-grade Merino and Saxony breeds (Massachusetts Statistics of Branches of Industry, 1837); the products of these sheep provided 40% of the raw materials used by the one woolen mill then situated in Petersham. In the same year there were three tanneries operating in Petersham, which produced 2,100 hides.

Butter and cheese were made on all farms for domestic consumption and in later years substantial amounts were exported to near-by localities, as the latter became more industrialized.

Yields per acre were relatively low in the early days of the settlement and unfavorable contrasts were made with English husbandry of the same period. Frequently these early farms were too large, not so much in acreage as in relation to the available supply of labor and farm equipment. The farmer relied chiefly on his own labor and that of his family, while the quantity and quality of farming implements was a major limitation on his productivity. Moreover, the farmer was engaged in producing capital goods; clearing new land, erecting buildings, and constructing roads required the greater part of his time and energy, so that in terms of immediate consumable goods his efforts seemed less productive.

It is particularly important for the thesis of this report to consider the extent to which primeval forest land had been cleared by the settlers to make way for farming. The question may be asked: How much of the town was ever sufficiently cleared to permit of cultivation or pasturage? Fairly complete data are available on acreage cultivated, except for one gap of 30 years, which, unfortunately, comes at the peak of the town's development, at a time when land under crops was presumably at a maximum. In September, 1771, an inventory of land was taken for the Province of Massachusetts (Massachusetts Valuation Returns for 1771) and Petersham reported the following:

Pasture	845 acres
Tillage	443 "
Upland mowing	958 "
Meadow	256 "
	2,502

Of course, the fifth division of meadow and upland was still to be made by the Proprietors, but excluding this, it may be assumed that the remainder of the township, some 24,000 acres, remained in forest.

The next period of time is covered in the following table giving the percentage of land cultivated to total land in the town (Woolsey, '29, p. 53.)

Year	*Acres Tillage*	%	*Pasturage, Meadow and Mowing*	%	*Woodland, Unimproved and Unimprovable*	%	*Total*
1781	533	2.2	3,807	15.9			
1791	289	1.2	2,827	11.8			
1801	753	3.2	7,565	32.5	12,594	52.6	21,112
1811	865	3.6	8,286	34.7	12,333	51.6	21,484
1821	771	3.2	8,234	34.4	12,299	51.5	21,304
1831	958	4.0	13,667	57.2	9,270	38.8	23,895

The figures for 1791 are probably not correct or represent partial estimates, for there is no reason to expect such a sharp decrease in arable land and pasture at this time when population was growing.

In 1771 (see table on p. 54) a one-hundred-acre farm might contain four to six acres of land in crops, 8 or 10 acres of upland mowing, which would be ploughed occasionally, a similar amount in natural meadow, and the great bulk of the farm, 70 to 80 acres, would consist of pasture and woodland, depending upon the local topography. The distinction between pasture and woodland in the above records is not always clear. No doubt the farmers would sometimes graze their cattle in the woods, and old fields exhausted by repeated cultivation would revert to forest, meanwhile being used as pasture.

Comparison of the figures for 1831 with the map of Petersham prepared in 1830, which marked the woodland areas, reveals a substantial discrepancy. The woodland area on the map is much less than 38.8 per cent of the whole township. This discrepancy may very well be accounted for by the farmers having reported all their small wood lots, which could not appear on the rather small-scale map of 1830.

No more classification of acreage can be found until the period from 1865 to the end of the time interval which this study covers.

Year	Cultivated Acres	Uncultivated Acres	Woodland	Total
1865	4,412	15,555	3,385	23,352
1875	4,586	11,498	4,547	20,633
1885	6,181	11,579	6,391	24,152
1895	3,777	7,466	10,484	21,727
1905	4,001	6,728	13,151	23,881

The cultivated acres may in turn be broken down according to use:

Year	Acres in HAY	Acres in CROPS	Acres in ORCHARD
1865	3,772	640	?
1875	3,886	508	188
1885	5,383	658	137
1895	3,104	502	156
1905	3,584	346	56

The most striking conclusion to be drawn from this array of data is that a very large portion of Petersham has never been touched by a plough. In the absence of specific information on land utilization during the peak 1840's, it can probably be said that the maximum amount of land being tilled at any one time did not exceed 1,500 acres. If this be true, and if one assumes an equal acreage to lie fallow or under grass during the rotation of crops, one conclusion seems inescapable, namely, 85 per cent of the land has never been tilled, though a large part of it was cleared for pasture. It is possible that some of the acres in pasture may have been ploughed, used to grow crops for a short period, and then seeded back to grass for an indefinite period. But that this program did not cover a large acreage is indicated by some evidence on the ground, to be noted below.

The deeds often described as a "farm" any area ranging from 50 to 400 acres, although this obviously included cultivated land, pasture, mowing, meadow and woods. However, noting the descriptions of the various parcels which were transferred when these large estates were broken up, it was occasionally possible to identify certain areas of pasture. Those which lie in the Harvard Forest are indicated on the 1850 tract maps.

It was less easy to identify cultivated land, for one could never be sure that a "farm," however small, was actually tilled land and not pasture or upland mowing. It might be argued that the farmers would not attempt to clear their pasture land very thoroughly of rocks, whereas if they expected to plough the acres, greater amounts of this back-breaking toil would be bestowed upon the land. The pasturage policy of the farmers was rather indifferent anyway, and often the cattle were simply

turned into the woods to forage as best they could. From all this it may be concluded that some unmistakable alignments of stone walls, especially when grouped around cellar holes or scraggy remnants of old orchards, and with soil relatively free from rock, offer prima facie evidence of cultivated ground. An examination of the Harvard Forest tract maps shows at once that northern Slab City and portions of Prospect Hill were almost certainly cultivated.

It was not until the Revolutionary period that any regular succession of crops was followed (Bidwell & Falconer, '25, p. 86). In the early years of settlement the land was allowed to lie fallow from 7 to 15 years after exhaustion, depending upon the farmer's judgment; but with rotation of cereals and grasses and the introduction of organic fertilizers, the period of fallow was reduced to one or two years. After being in grass the land would be ploughed again and thereafter cropped for three years.

Accessory occupations frequently engaged the farmer, and two of these were common in Petersham: lumbering and making potash. There are several small areas in Petersham designated in the deeds as potash or pearlash meadow. When saw-logs could not be shipped conveniently to mills, or unmerchantable timber was on hand, the farmer would burn them in these meadows and gather up the ashes. These ashes would be brought to a "potash house" and treated by the simple and inexpensive process of pouring water over them until a lye solution of sufficient strength was obtained (Bidwell & Falconer, '25, p. 80). This water was then boiled off, leaving a black salt called black potash. Sometimes the fire was continued until various elements in the potash were driven off, leaving a gray substance which was packed in barrels for sale. Pearlash is potash purified by calcination, that is, by burning the potash in a special kiln for about an hour. These products, potash and pearlash, were used in the household for soapmaking, scouring, and bleaching or dyeing cloth, although the larger part was sold for fertilizer and glassmaking, and was exported to other regions. It was one of the first "cash crops" that a settler could offer in exchange for the outside commodities he needed to buy, notably rum, powder and shot, bars of iron, kettles, molasses, etc.

The transition period in New England agriculture is usually placed about 1830-40, when communities began to expand from a self-sufficient economy to commercial agriculture. It is probably correct to say, however, that much of this movement passed over Petersham and left it unchanged, in so far as its agricultural self-sufficiency was concerned. Its upland location left it isolated from the new transportation systems. The first railroads were built through the lowlands farther south, and, together with the Erie Canal, which was completed in 1825, opened the eastern

markets to cheaper western produce from New York and Ohio. Moreover, the lack of working capital was a serious limitation in any expansion of agriculture, for it made difficult the purchase of new labor-saving machinery or improved livestock, and the hiring of additional labor required for more intensive cultivation. It was during this period and the years following that industrial towns began to expand and draw labor away from the farms; at the same time the need for farm labor was increasing.

The complete information on the succession of ownership obtained from the deeds and probate records for all the parcels of land which go to make up the Harvard Forest throws some light on the financial development of the town. A cursory survey of the ownership sequence for any block in the Forest suggests at once that there were two periods of land speculation in the history of Petersham (See Fig. 3). These eras of speculation were characterized by the rapidity of turnover in land titles and the increased use of mortgages to effect transfers of land between individuals.

As noted in an earlier chapter, Petersham was first laid out to pay a debt of the Province of Massachusetts to some soldiers who had served in the French and Indian Wars. This came at the time when provincial land was no longer being distributed to prospective settlers, but as a payment to creditors, who would presumably sell the land rather than settle it themselves. The very genesis of Petersham was thus part of a speculative project which continued through the first thirty or forty years of its history. The large proportion of absentee owners was indicated whenever a division of common land was made; for example, out of seventy-one proprietors, twenty-four participated in laying out the second division in 1738, and only seventeen were on hand at the third division in 1740. These large divisions of land were sold from one person to another until about 1760-70 when actual settlers began holding their land for substantial periods and started the laborious process of clearing the forest and making farms. From this time on many tracts of land remained in single families for several generations, or under a single owner for as long as fifty years.

This era of relative stability continued until about 1850, when Petersham began to decline and the second of the two speculative periods was brought on. In connection with this second period it is interesting to note the apparent absence of much currency or circulating medium in the town. It is the writers' conviction, gleaned from casual references in the deeds, that at no time was there anything like an adequate supply of money which might be used for buying and selling land. To be sure, the local industries in the town provided some ready cash but hardly enough to pay for large land transactions. The community was largely

self-sufficient and the few commodities it was obliged to import were probably handled through the town's general store on a credit basis.

Consequently this second period of speculation was characterized by a large number of mortgages which were frequently assigned and reassigned until finally the land would come into the possession of some new owner. Whole farms, of course, were not abandoned at once, but the margin of utilization was gradually drawn in, as the less valuable portions were dropped from cultivation or abandoned as pastures. During this time one owner after another would step in for a while, attempt to operate a farm, and finally give it up. Thus land values were in a continuous decline and the parcels were shuffled about as individual owners tried to escape with minimum losses.

There were no banks in this area until the comparatively late date of 1854, when the Millers River State Bank (incorporated as Pequoig State Bank) was opened in Athol, the next town north of Petersham.[1] In 1865 it received a charter under the National Bank Act, but still did little or no mortgage business and restricted itself to the usual commercial functions. It was not until 1867, when the Athol Savings Bank was started, that any agency for making mortgage loans was available to the residents of Petersham. By that time, of course, the abandonment of farms was proceeding rapidly and the downward speculative trend had been effective for twenty years. In the absence of banks, a few residents of Petersham who had accumulated modest fortunes from local industries often provided the funds necessary for liquidating farms or other enterprises which were being abandoned. Thus large holdings of land were accumulated by single owners who acquired the several parcels by purchase and mortgage. Another element in this second speculative period was the fact that several large manufacturers of wood products, such as the Diamond Match Company, sent representatives into the town to buy up the remaining timber and promising lots of old field pine which could be used in their factories.

The competition of cheaper western cereals brought a revolution in New England agriculture in the direction of dairy products and the production of fruit and vegetables for consumption in the rapidly growing urban areas. Statistics in value figures are available for state census years in Petersham, even when output data in terms of physical units may not be had. Because of the wide fluctuations in price levels over the period 1865-1905, the value statistics cannot be compared year for year and no suitable deflating index for local agricultural prices in this period is known. To avoid this difficulty, a series of ratios has been computed to indicate the changing trends in the type of commodities produced by

[1] Personal communication from Mr. William G. Lord of Athol, Massachusetts.

Petersham farmers. This ratio is the percentage of each product to the total value of all agricultural products. For the five census years they are as follows:

PERCENTAGE OF AGRICULTURAL PRODUCT TO TOTAL VALUE OF ALL AGRICULTURAL PRODUCTS IN PETERSHAM

	1865	*1875*	*1885*	*1895*	*1905*
Animal Products	1*	6	6	3	5
Dairy Products	10*	19	24	20	41
Poultry Products	1*	3	4	5	6
Wood Products	6	11	6	25	6
Cereals	10	5	6	2	**
Hay	46	36	34	30	27
Vegetables	7	7	5	7	6
Meat and Game	15	9	8	3	3
Fruits	3	3	4	2	4

* Statistics are only partial. Complete data would raise these percentages.
** Less than 1 per cent.

There is one limitation in this method and that is the possibility that the value of one commodity may have risen or fallen more than other values, in which case the percentages would give a distorted view of its significance in the total volume of farm products. With this caveat in mind, an examination of the table, reading horizontally, reveals striking trends. On the one hand, cereals, hay and prepared meats steadily decline in importance; on the other hand, poultry rises slowly and dairy products increase rapidly to a dominant position in the town economy, wherein they presumably engaged the major share of the farmer's time and energy. The slight break in dairy products for 1895 represents a relative and not an absolute decline in importance, for the percentage necessarily reflects the tremendous spurt that took place in lumbering about that time.

Potatoes were introduced relatively early into the Petersham fields and by the last half of the 19th century they had replaced corn as the major food staple of domestic consumption. This large annual potato crop is probably the reason for the more or less constant behavior of the "vegetable" group in the table of ratios.

The wood products group includes shingles, firewood, charcoal and sawed timber, and it is the irregularity of the latter that gives the wide fluctuations in 1875 and especially in 1895, when the local industry was enjoying prosperity. Much second-growth timber, mainly old field pine, had reached merchantable size in this period and was being cut. A brief

review of the lumber operations over this 50-year period is contained in the following table.

Years	*Feet of Lumber*	*Cords of Firewood*
1845	223,096	710
1855	1,195,000	1,218
1865	560,000	691
1875	720,000	2,893
1885	102,000	2,113
1895—Data in physical units not available		
1905— " " " " " "		

LOCAL INDUSTRIES

Many of the inhabitants of Petersham practiced a trade in addition, and usually incidental, to their farming; there were brick makers, clothiers, cordwainers, tanners, blacksmiths, house carpenters, joiners, millers, curriers and not a few Jeffersonian politicians. Doubtless this variety of skills was frequently utilized in building the town, erecting houses and barns, repairing farming implements and a host of miscellaneous tasks incidental to frontier farm life. Besides this fund of individual trades there grew up with the town a series of small local industries which presumably provided full-time occupation for a few, and part-time employment for many others.

Three locational factors were at work bringing these early industries to Petersham. First, there was the close proximity to adequate supplies of raw materials yielded by forest and field; this was a major consideration in those days of costly transportation of bulky commodities over poor roads. Second, there were resources of waterpower available at strategic points along the several streams flowing through the town, notably the East Branch of the Swift River. Finally, the steady growth of population furnished a body of occasional labor which could be utilized at low wages and which at the same time afforded a local demand for the finished commodities.

There is evidence in the deeds that saw and grist mills using waterpower were built very early, and a valuation report in 1771 lists five such mills owned and operated by residents of the town. This assured a supply of lumber for building houses when the rapid influx of population came in the last quarter of the 18th century. Detailed statistics have not been found prior to 1837 and by that time the local industries were well under way. In that year there was one woolen mill with a complete set of machinery for making woolen cloth. It employed eight people, used 5000 pounds of wool annually and represented a capital investment of $5,000. Three tanneries were operating, employing nine hands and tanning 2100 hides annually, using a capital investment of $4,200. There was also one establishment for manufacturing chairs and cabinet ware which employed nine hands.

In addition to these "factories" there were two major household industries flourishing in Petersham: boots and shoes and the weaving of palm-leaf hats. This is a type of industrial organization known to economists

as the "putting-out" system. The merchant-employer owns the raw materials which he "puts out" into the individual homes, and the members of the household work on them in their leisure hours. In the case of the palm-leaf hats, the agent would make his rounds in the fall to those households desiring employment and provide them with a quantity of straw. During the ensuing winter months members of the family—usually the women—would weave the straw into hats. A normal winter's work was 250 hats, for which they were paid at the rate of ten cents each. Then in the spring the agent would return, collect his hats and pay off his employees. This institution provided a small but steady supplementary income in cash to many farm families and continued into the first decade of the 20th century. In 1836, 130,525 palm-leaf hats were made in Petersham.

The making of boots and shoes was the second major domestic industry managed on the "putting-out" system. Agents delivered shoe materials, uppers, soles, linings, etc., and the farmers assembled the shoes in their homes, returning the finished commodities to the agent on his return trip. In 1836, 11,000 pairs of boots and shoes were processed by this method and in a local factory employing 35 hands. The system continued for several decades until finally the invention of machinery transferred the process to village factories, where a few employees on full time could produce shoes more economically. Some writers argue that such systems of domestic industry made farming of secondary importance (Woodworth, '33, p. 180). The farmer would continue to live on the farm, maintain a garden and some stock, but would not clear any new land for cultivation. Such a result, however, does not always follow. It seems clear that in Petersham at least, farming continued to be the major occupation, while these side lines simply provided supplementary income which could be earned in the leisure of winter hours. This inference becomes true, *a fortiori,* if one recognizes that much of the supplementary work was done by the women members of the household.

The report of 1845 on *Branches of Industry* compiled from returns of local assessors, lists:

1 woolen mill	8 employees
1 plough manufactory	1 employee
4 establishments for manufacture of railroad cars and other vehicles	4 employees
1 chair and cabinet manufactory	2 employees
1 tinware manufactory	1 employee
2 tanneries	3 employees

Other activities and persons employed were:

brick making	2 employees
lumber preparation	18 employees
firewood	4 employees

The next decade, 1845-55, marks the downturn in the growth of Petersham both in population and in industry. There were two immediate causes. First, the coming of the railroads which boomed Athol, the next town to the north of Petersham, had attracted new manufacturing establishments to that town. Second, there was a disastrous fire in 1847 which destroyed the woolen mill and other factories, the owners of which simply closed up business and left instead of rebuilding their properties.

The *Branches of Industry* report for 1855 names the one tinware factory and two tanneries remaining from earlier years, together with some new enterprises. These were: one establishment for the manufacture of casks, with a capital of $3,000 ready to begin operations June 1, 1855, and two establishments to manufacture boxes for cloth and hats, employing three people. Other industrial occupations were listed as:

brick manufacturing	1 employee
charcoal manufacturing	3 employees
lumber prepared	12 employees
firewood	3 employees
ladder manufacturing	1 employee

The processing of palm-leaf hats and boots and shoes continued, though on a reduced scale. Statistics in terms of physical units are not available and value figures are virtually meaningless because of fluctuating currencies.

After another decade the picture had not changed much. The 1865 statistics indicate a blacksmith shop with one employee and a tanning and a currying establishment, also with one employee. Apparently a one-man factory for making palm-leaf braid had now been set up, together with a substantial "establishment" for manufacturing palm-leaf hoods. The latter employed 10 people and produced 5,000 dozen Shaker hoods. The industry for making wooden casks had now increased to 3 factories engaging a total of 8 employees, while the factory for manufacturing wooden boxes was still functioning. For the first time in these returns sawmills are included, and one finds that there were eight such mills in operation employing only four people. This one example should indicate that the employment figures reported are not accurate or else refer

to full-time operators, excluding the large amount of part-time labor that surely was utilized. Firewood preparation and charcoal making are listed separately, with three and one employees respectively; the report also lists one ladder manufactory. Boots and shoes are not mentioned, which may indicate that this business had left Petersham by 1865, although the people continued in the palm-leaf business, making 23,076 hats, 22,830 "webs" and 69,278 "binds."

1865 was the last year in which reports on the *Branches of Industry* were given in this form. The state census of 1895 gives a few summary figures which are of interest in tracing the industrial vicissitudes of Petersham. By this date new sources of power were being utilized, namely: five steam boilers with an aggregate of 155 horsepower, and 5 steam engines totaling 148 horsepower. Five water wheels were still employed, which produced 135 horsepower. There were 17 different "establishments" in the town: five for building, two for food preparations, 5 for lumber (probably the old sawmills), 3 for metals and metallic goods and two for making wooden goods (probably casks and boxes). The census lists the dates when these 17 enterprises were set up, and oddly enough none goes back of 1865, and 16 were presumably established since 1870. As the mills alone go far back in the history of the town, these dates probably refer to the times at which the owner began to operate the enterprises. At any rate, these were still one-man businesses, for they only employed from 22 to 27 persons with total annual wages of $7,381.

Ten years later, in 1905, the number of establishments dropped precipitously to four, though the employment was about the same and the annual wage bill was $8,910. Accompanying the drop in industries, the power equipment was reduced to two steam engines producing 85 horsepower and three water wheels producing 90 horsepower. About this time the last palm-leaf factory, then located in Dana, burned and ended a business which had occupied the spare time of ambitious housewives for a century. This event virtually wrote "finis" to local industry in Petersham.

PETERSHAM IN DECLINE

Petersham had been an organized community for 100 years, with self-sufficing agriculture and little change in the habits of the people. After 1845, as noted in an earlier chapter, a new series of influences became effective, with the building of the railroads (seven trunk lines with numerous branches had been completed in New England by 1851), the westward movement following the opening of the Erie Canal in 1825, and the rise of manufacturing towns. Some towns declined quickly under these new influences while Petersham's decline was slow and uniformly steady. There was an average loss of only 15.5 persons annually down to 1910. (See page 21.)

This emigration, especially to the mill cities, has been the product of the decisions of many young people faced with an apparent lack of opportunity on the old farms at home. It is true, of course, that economic influences have a major effect on the course of a community's life, but there are also human psychological elements, the importance of which is frequently underestimated (Woodworth, '33, p. 183). With a town of small farms widely scattered there is not much stimulus from competition or comparison, and the initiative of the individual is particularly vulnerable to depressions and discouragements such as struck Petersham in this period. Some of the more aggressive farmers were able to adjust themselves to the new situation and changed their types and methods of farming. Orchards were expanded and large quantities of fruit were sold; more emphasis was laid upon dairying, and dairy products soon took the place of those commodities which could not meet western competition. Such farms are being successfully operated in Petersham even today.

But such adaptation was not an easy task and abandonment of the farm land proceeded slowly and inexorably. As these farms were vacated, the tax burden for primary services of the township, roads and schools, fell more heavily upon those who remained and they began to look elsewhere. Thus abandonment tended to be cumulative and one tract after another reverted to forest.

The problem had become so acute in western central Massachusetts by 1890 that a state census of abandoned farms was made in that year and returns were filed by the assessors in each town. The report for Peters-

ham lists 14 farms with buildings thereon totaling 1,217 acres and 7 farms without buildings totaling 663 acres as "abandoned farms." In the aggregate this is 1,880 acres or only 7.78 per cent of total farm acreage in Petersham for 1885 (Bureau of statistics of Labor, 1890, p. 180). This census, however, does not reveal the true situation since it defines an abandoned farm too narrowly, e.g. "farms formerly cultivated but now deserted . . . cultivation abandoned and buildings permitted to decay." If there were merely a change in crop, say, to hay or dairy products, or if the land were classed as woodland, considering wood as a crop, the farm was omitted from the census. Moreover, there were many farms upon which cultivation was at a low ebb as compared with former days, yet technically they were not "abandoned."

A more satisfactory measure of abandonment is the ratio which woodland bears to the total area of the town. This is a relevant criterion since the abandonment of a rural area in this part of the country is usually associated with the reversion of land to forest. Data derived from the decadal censuses of Massachusetts give the following acreages:

Year	*Cultivated Acres*	*Uncultivated Acres*	*Woodland*	*Total* [1]
1865	4,412	15,555	3,385	23,352
1875	4,586	11,498	4,547	20,633
1885	6,181	11,579	6,391	24,152
1895	3,777	7,466	10,484	21,727
1905	4,001	6,728	13,151	23,881

[1] These figures are, of course, only the totals of the census categories, but they approach the actual total area of the town. It should also be noted that the figures given here for acreages under cultivation are probably not all reliable. The table is only intended to show the steadily increasing areas in woodland.

By computing the ratios of woodland to the "total area" as reported in the 5 decadal censuses, it may be clearly seen what was happening during this period:

Year	*Ratio*
1865	14.5%
1875	22.0
1885	26.5
1895	48.0
1905	55.0

Moreover, data on the age of timber are given in the last three censuses so that ages of the woodland acreage can be shown.

Year	*Acres of Timber over 30 years*	*Acres of Timber under 30 years*	*Not Classified*
1885	1,236	5,155	
1895	2,795	7,253	435
1905	3,517	5,184	4,449

This indicates the increasing proportion of old timber in the woods as the old field pine and hardwood stands grew apace.

FOREST HISTORY

Relic Woodlands

As indicated earlier in the paper, the major aims of the present study have been, first, to analyze historically the use of lands now in the Harvard Forest, and second, to throw as much light as possible on the composition and local distribution of the pre-colonial forests. The most significant phase of the land-use investigation, from a silvicultural standpoint, has been the delimitation, on the ground, of the areas which have always remained in woods. The chief results of the studies of land titles and probate records are summarized in the historical maps presented in Figures 4-9. The maps are supplemented, in the following paragraphs, with brief historical descriptions of the three main tracts of the forest, with special reference to the relic wood lots.

Tom Swamp Tract

Only one original house lot is represented in the Tom Swamp Tract. This lot covers all of Compartment I,[1] (Fig. 4, lot 31) and most of it was unquestionably cleared at an early date. Most of the land east of the pond was distributed in the second and third divisions (1738-40), though the northwest corner of Compartment IV was fourth-division land (1753) (Fig. 4, lot 20). Most of the land west of the pond was of the fifth division (1770). That north of Tom Swamp Road was nearly all of the fifth division, except an area on the westerly side, which was granted in the fourth. At least a part of the spruce swamp seems to have remained as common land until 1820 or later.

Parts of the tract, notably the southeastern sections, nearest the village, were designated in the deeds as farms in the 1780's and in 1800. On the map of 1830 two pieces of woodland are shown in the area south of the Tom Swamp Road. The pond did not exist at that time, but there was a large meadow in its place. One of the tracts of timber occupied the northern half or two-thirds of what is now Compartment IV (Fig. 5, lots 8, 9, part of 13), and the other was a strip running north and south

[1] The locations of compartments will be found on the map in Figure 1. It has been thought desirable to locate the relic wood lots in terms of the compartment boundaries as well as by the old property lines. This will make them more easily referable to existing survey markers on the ground and to other investigations carried on at the Forest

through the western part of Compartment II and the northwest corner of Compartment I (Fig. 5, lots 17, 18, 21). Both are shown as rather dense forest and both occupied rather gentle, rocky slopes of westerly exposure, well down in the lowland that contained the meadow. The deeds and probate records corroborate the existence and positions of these two tracts. The northern one was noted as woods in 1849, 1852, 1854, 1879, 1886, 1899 and 1907. The southern one is noted in a deed written in 1888.

EXPLANATION OF FIGURE 4, SHOWING DIVISIONS, GRANTEES, DATES, AND PAGE REFERENCES TO THE PROPRIETORS' RECORD (PR)

Div.	*Grantee*	*Date*	*PR*
1. 2d and 3rd	Samuel Willard	1741	211
2. 2d and 3rd	Samuel Willard	1741	211
3. 4th, Lot 71	Joshua Willard	1753	315
4. 5th	Joshua Willard	1792	354
5. 5th	Grantees unknown (Part was common land as late as 1820)		
6. 5th	Jonathan Sanderson	1795	345
7. 5th	James Mossman	1770	333
8. 5th	Thomas Rogers	1771	341
9. 5th	Joshua Willard	unknown	
10. 5th	Thomas Frink	1771	337
11. 5th	Thomas Rogers	1793	355
12. 5th	David & Nathaniel Sanderson	1770	334
13. 5th	John Wilder	1770	331
14. 5th	Samuel Willard	1790	353
15. 4th, Lot 69	Beriah Ward	1753	314
15a. 5th	Beriah Ward	1770	332
16. 3rd	Thomas Rogers	1740	254
17. 5th	James Clements	1770	335
18. 5th	Joshua Willard	1770	329
19. 5th	John Chandler	1774	342
20. 4th, Lot 68	Thomas Frink	1753	314
21. 2d	Thomas Rogers	1738	199
22. 5th	Joshua Willard	1770	328
23. Composed of several small meadow lots			
24. 3rd	Samuel Willard	1740	212
25. 2d	Samuel Willard	1738	211
26. 3rd	Isaac Ward	1740	265
27. 2d	John Bennett	1738	184
28. 2d	Timothy Ruggles	1738	202
29. 2d	Ministerial Land	1738	284
30. 2d	Zedekiah Stone	1738	180
31. House Lot 51	Joseph Whitcomb	1733	177

EXPLANATION OF FIGURE 5. THE STIPPLED AREAS INDICATE WOODLAND

1. Curtis Gould	Farm (The southern part of this farm was woodland—see text.)
2. Unknown	Unknown (woodland in 1832.)
3. James J. Sanderson	
4. Theodore Jones	Woodland
5. Samuel Walker	Use unknown
6. Asa Johnson	Use unknown
7. Theodore Clements	Use unknown
8. Constant Southworth	Swamp, Meadow and Woodland (The part east of the meadow is known to have been woodland, but the wood lots west of it are interpreted from existing timber.)
9. Nathaniel Chandler	Woodland
10. Charles Rogers	Use unknown; part of a large farm north of the road
11. Charles Pike	Pasture and Woodland (The location of the woods is interpreted from existing stands.)
12. Unknown	Composed of several small meadow lots
13. Lucretia Pond	Farm (The wood lots are interpreted from existing old woods.)
14. Alanson Lincoln	Farm
15. Paul Peckham	Meadow
16. Silas Hildreth	Use unknown
17. Joel Ballou	Farm (Wood lot interpreted from existing stands and the map of 1830.)
18. Aaron Mann	Farm
19. Alanson Lincoln	Farm
20. Amos Pike	Farm and Sawmill
21. Jonas Howe	Pasture and Woodland (The position of the woodland is based upon the map of 1830 and existing old stands.)

The present timber in the two stands is (or was, before the 1938 hurricane) principally a mixture of hemlock and the hardwoods, beech and sugar maple. There is a scattering of white pines and other hardwoods such as red oak, white ash, chestnut (young saplings), ironwood, yellow birch and red maple. In some places, as on the site of the Fisher Memorial at the northwest corner of Compartment IV, hemlocks have been in the ascendency. In others hardwoods have been predominant.

North of Tom Swamp Road there is a large area of bog and spruce swamp which has probably remained for the most part unchanged since earliest times (Fig. 5, lots 4 and 6 in part). The swamp lies on the

drainage divide between streams leading to Swift River on the south and Millers River on the north. Artificial ponding both north and south of the divide has probably shifted the water table but little on the divide itself.

West of the bog and just north of the road is a group of 5th division lots, and part of a fourth-division piece which originally extended to both sides of the road (Fig. 4, lots 3, 4, 8-13). Very little land-use history has been found in the deeds to these properties, though there is evidence in the present timber that considerable parts were cleared and in pasture. Most of the area is shown as clear on the 1830 map except for some open woods just west of the bog. The terrain is rough, however, with some high rock ledges and steep slopes, so that a certain amount of timber of long standing is to be expected.

There remains to be considered the so-called Adams-Fay Lot, which extends along the northwest side of the bog and west of the Riceville Pond to the Athol town line (Fig. 5, lots 1, 2, 4). It may be divided into two portions: one northwest and the other southeast of a line drawn across the tract about 600 yards southeast of the town line. The northwesterly section was noted as clear on the 1830 map. It was part of a large "farm" along the near-by road and was described as "farm" land in deeds of 1808, 1818, 1836 and 1864.

Southeast of the division line, however, there is a long sequence of descriptions indicating woodland. There were two parts, as shown on the map for 1850 (Fig. 5). Both were parts of large 2d and 3rd division grants to Samuel Willard in 1741. The smaller (Fig. 5, lot 2) remained in the Willard family until 1832, and by that time had been divided into several small parcels of wood lot, distributed among the Willard heirs. These were all brought together again by 1832. Descriptions written in 1823 and 1832 both describe the tract as woodland, but the map of 1830 is rather uncertain here as the property comes at the very edge of a wooded district extending through the valley. Although now badly damaged by the hurricane, it has long been covered with a dense old stand of hemlocks similar to that described on adjacent land by Marshall (see below).

The larger part of the southerly division (Fig. 5, lot 1) was described as woodland in 1808 and again in 1852. It was noted as woodland also on the map of 1830, although here again the map line is somewhat uncertain because the area lies at the boundary of the wooded district. The forest history of this piece has become so well known through the studies of the late Robert Marshall that his conclusions will be briefly summarized and partially quoted here. The Adams-Fay Lot did not come into the possession of the Harvard Forest until 1932, when it was acquired

from the New England Box Company. In 1924, however, the Forest staff marked the timber for cutting and the logging was done in the winter of 1924-25. The woods were "composed of dense, almost pure, white pine and hemlock with very little ground cover or advance growth hardwood. The composition ranged from pure hemlock to nearly pure pine. But of special interest was the fact that the entire area was thickly sprinkled with old pine stumps which clearly testified that years before a heavy softwood cut had been made on the same area." When the hemlocks were felled, it was discovered that each one showed a distinct release after it had acquired a diameter of 1 to 5 inches and had lived perhaps as much as a century. By counting rings on a large number of stumps, scattered over the whole area, the history of early logging operations was pieced together.

There is some indication that a certain amount of cutting was done in 1822, though it was not generally distributed, and the openings may have been made by wind. Logging began in earnest at the northern end of the area in 1833 and continued until 1854, except for a break of about 6 years after 1837. Marshall suggests that this break may be correlated with the great business depression of 1837. "By 1853 the south end of the lot was reached and the next year the quarter-century old operation was completed with the removal of scattered merchantable trees which were left standing throughout the area." The young hemlock understory, not considered commercially valuable, was left standing and grew to form part of the stand operated in 1924-25. Only one other cutting was made after 1853. This was in the northern portion of the tract, in an area previously cut in 1843-45.

Property descriptions, the map of 1830 and the trees themselves all indicate a continuous woodland on the southeastern part of the Adams-Fay Lot. Marshall has shown that since 1822 it has had varied mixtures of white pine and hemlock, depending, apparently, upon the degree of clear cutting. The absence of hardwood advance growth in the timber cut in 1924-25, and the fact that conifers have succeeded conifers at least once in the past, indicate that hardwoods may never have played an important part in the composition. The Adams-Fay Lot differs from the other parts of the Harvard Forest not only in this, but also in its exceedingly sandy soils. Marshall concluded that the porous soils constituted the limiting factor which had kept hardwoods out of the succession; and that the original forest "probably consisted principally of white pine, with considerable hemlock, and a sprinkling of chestnut, beech, yellow birch, and red oak."

Prospect Hill Tract

The only house lot represented here is in the extreme southern part where the first-division lot no. 28 appears in the southern portions of what is now Compartment VIII (Fig. 6, lot 20). Most of the tract (within the town of Petersham) was second-division land laid out in 1738, though some third- and fourth- division parcels are represented north of the Phillipston Road and along the town line in the southeastern part of the tract. Most of the land on the Phillipston side of the town line was of the third division, but the dates for it are not yet fixed due to the absence of a Proprietor's Record in that town. Judging by the earliest deeds found thus far this division was made prior to 1755.

As in the other tracts, there is little descriptive material in the deeds until about 1820. However, some of the parcels along the south side of the Phillipston Road and east of the Athol Road were designated as "farms" as early as 1805 and 1806 (Fig. 7, lot 3). Likewise the pieces north of the Pierce Road along the town line were noted as farmland in 1804 (Fig. 7, lot 7). The map of 1830 shows an area of woodland stretching through the central part of the tract. It was noted as rather dense woods in what now are the eastern part of Compartment II and the north part of Compartment VII (Fig. 7, lots 6, 7). Along the town line it spread out rather thinly to reach most of the way between the Phillipston and Pierce roads which bound Prospect Hill on the north and south respectively. All other parts of the tract are indicated as clear at that time. Descriptions found in the deeds corroborate the map.

The long narrow wood lot shown on the map (Fig. 7, lot 6) was first indicated as such in 1820. It occupies a strip off the eastern end of a second-division lot laid out in 1738 to Benjamin Miles (Fig. 6, lot 12). It was first sold as a separate piece (about 15 acres) in 1793. After 1820 it was continuously described as wood lot until it was absorbed in a large tract in 1885. As will be shown below, there is no indication in the present woods that the timber was completely eradicated after 1885.

Explanation of Figure 6, Showing Divisions, Grantees, Dates, and Page References to the Proprietors' Record (PR)

Div.	*Grantee*	*Date*	*PR*
1. 4th, Lot 51		1753	
2. 2d	Timothy Rogers	1738	198
3. 4th, Lot 50		1753	307
4. 3rd	Aaron Jones		
5. Unknown (Phillipston proprietor)			
6. 3rd	Abel Hunt		

Div.	*Grantee*	*Date*	*PR*
7. 3rd	Timothy Rogers	1740	253
8. 2d	Stephen Whipple	1738	204
9. Unknown (Phillipston proprietor)			
10. Unknown (Phillipston proprietor)			
11. 3rd	Benj. Miles	1740	258
12. 2d	Benj. Miles	1738	182
13. 3rd	Samuel Belknap	1740	206
14. 3rd	David Goddard		
15. 3rd	Thomas Adams	1740	208
16. 2d	Thomas Adams	1738	209
17. 2d	Ephraim Puffer	1738	183
18. 2d	Jotham Brigham	1740	277
19. 2d	Joseph Hill	1738	181
20. House Lot 28	John Varnum	1733	205

EXPLANATION OF FIGURE 7. THE STIPPLED AREAS INDICATE WOODLAND

1. Lott Mann	Farm
2. Zuri W. Stone	Pasture
3. William Mann, 2d	Farm
4. Thomas W. Ward	Pasture
5. Joel Richardson	Pasture
6. Asa Clark	Woodland
7. Peter Pierce	Farm (The northern and eastern parts of this farm were probably the woodlands noted in a deed written in 1854. Judging by the character of the terrain, the present forest and the map of 1830, this woodland extended north and east into Nos. 3 and 4.)
8. Josiah Howe	Woodland (The present cover, old field pine, along the road indicates that the woodland was confined to the swampy ground along the stream.)
9. Jonathan Stratton	Farm
10. Asa Clark	Farm (The small southern projection of this piece was long used as a tanyard.)
11. Solomon Holman	Pasture
12. Henry Brooks	Use unknown, probably pasture

Northeast of this area, between it and the town line, is a timbered tract also under woods in 1830. This is on the northern part of what was long known as the Pierce Farm (Fig. 6, lot 8), and the timber was mentioned in a deed written in 1854. Here again there is no indication of subsequent clearing. Between the Pierce Farm and the town line is

a triangular area which was nearly all marked as woods in 1830 (Fig. 6, lot 13, northern part). The subsequent history of this parcel is still obscure, but a considerable part of it is in the rather swampy valley of the brook which flows south and southeast around the base of Prospect Hill, and probably has remained in some form of woodland from earliest times. Just across the town line from this tract is another area which was described as wood lot in several deeds between 1817 and 1856 (Fig. 6, lot 14). Being in Phillipston, the map of 1830 gives us no information about it. A considerable portion of it is also in the valley of the above-mentioned brook and probably has always had a swamp forest.

Areas known to have been in woods during the height of agricultural activity in the town, such as the wood lots noted above, merit further description. The long narrow strip first noted (Fig. 7, lot 6) is on a gently rolling upland surface covered with glacial till. It is highest toward the southern end where there is a low, rounded gravelly knoll. Toward the north there are some swampy areas scattered with many glacial boulders. Large parts of the stand, notably toward the south end, were not seriously damaged by the hurricane. The drier parts of the lower, northern section are clothed with a rather dense stand of large hemlocks. They are accompanied by a few red maples and white birches. There is a scattered young growth beneath, of small hemlocks, beeches and red maples. Wet swamp has a forest of red spruce, black gum and red maple; and a rather dense tangle of swamp shrubs such as *Vaccinium corymbosum, Rhododendron nudiflorum* var. *roseum, Ilex verticillata, Viburnum cassinoides* and *Nemopanthus mucronatus*.

The gravelly knoll at the south end of the area has a rather open stand of red and white oaks, black and gray birches and occasional white pines.

There is evidence of repeated cutting throughout the whole wood lot, but by means of stumps and stump-sprouts it is possible to carry the history back at least a century. Many of the trees which are now 5 to 8 inches in diameter are sprouts that came up either around large stumps or around earlier groups of sprouts. There is no indication of serious modification in composition during a long time past, with the exception of the removal of chestnut. It seems clear that we have here a piece of forest which shows great variation within itself, due to drainage and slope, and which has come down to us from the original forest without ever being completely eradicated. Further, examination of stumps and sprouts indicates that the deciduous trees now growing there are probably the direct vegetative descendants of the trees in the pre-colonial forest.

Slab City Tract

The Slab City tract occupies a part of the valley of a branch of Swift River, southeast of the village of Petersham. In several places it extends to the neighboring upland, so that it exhibits a remarkable range of growing conditions and forest types. For the casual observer it is difficult to conceive of its ever having been so nearly clear of timber as it was toward the middle of the last century, since most of it is now under forest. Reference to the map of 1830 will show the extent to which the clearing had progressed at that time.

Only the northern part of the tract, which is nearest the center of the town, was in the original division of house lots (1733) (Fig. 8, lot 1). The remainder was scattered through the later divisions, some of it to the fourth and fifth. It is of particular interest to the present study that the area along the Swift River, near where the road to Barre crosses it, has been the site of sawmills and grist mills from the earliest settlement of the town. In fact, a definite mill grant involving adjacent land was made to Jonathan Prescott at the second division of lots (1738) (Fig. 8, lot 15). Mills must have been established at an early date, since they are mentioned in deeds written in 1739.

There are three parcels of woodland in the Slab City tract which appear to have an unbroken history as such from pre-colonial times. The first of these is on the west side of the river in what is now the northern two thirds of Compartment III (Fig. 9, lot 7-A); the second is in the north part of Compartment VII, extending westward and southwestward into VIII and eastward across the road into VI (Fig. 9, lots 8, 10, 7-D, 9); and the third is on a strip of land along a brook which flows in a northwesterly direction through the middle of Compartment X (Fig. 9, lot 13).

The first of the old forest tracts to be considered is in the northerly part of Compartment III. There is a steep rocky slope with easterly exposure, extending from the boundary of an old farm at the brow of the hill down to the river. The forest which clothes the hillside was badly damaged by the hurricane of 1938, but notes made previously by the Forest Staff and by the present writers give an adequate picture of its composition. The trees were large and of uncertain age, and the whole stand was long regarded by the Forest management, notably by Professor Fisher, as "old growth." The principal species were hemlock, red oak and formerly chestnut. The abundance of the last, before the blight destroyed it, was indicated by the large number of dead trees still standing in 1938. The relative abundance of hemlock and red oak was variable; in places the former occurred in nearly pure stands, while in

others it was superseded by a rather rich mixture of red oak and other hardwoods, with some white pine. The hardwoods included white birch, red maple, American elm, yellow birch, beech, white oak, white ash, sugar maple, large-toothed aspen and wild black cherry. This forest is clearly related to the hemlock-northern hardwood type of northern and central New England, rather than to the "central hardwoods" of southern New England. It was described as woodland in a series of deeds, mortgages and probate records between 1853 and 1882 when it was bought up, along with many other areas, by J. W. Brooks, who eventually conveyed it to Harvard College. It was designated as woodland on the map of 1830, though as rather open wood. It is presumed that during the height of agricultural activity it was culled severely, and possibly pastured, though it is difficult to see how its rocky slope could have yielded much forage. It was part of a "farm" which passed through several ownerships in the period of clearing after the original grant as second-division land in 1739. That the clearing of this farm had not progressed far by 1771 is shown by the fact that its owner at that time, Henry Chase, had only 6 acres of pasture, 3 of tillage, and 6 of upland mowing out of some 118 acres in his possession.

The second parcel to be considered is on the steep slopes which border the new and old Barre roads in the north part of Compartments VII and VIII and extends eastward to the river. The present road, which approaches the river by an angling course down the valley slopes, was not built until about 1837. Its predecessor was a branch off the Hardwick Road about 1½ miles south of Petersham. This old road took a southeasterly course over a hill and approached the river by a ravine which now lies between Forest Compartments VII and VIII. It is still open, but scarcely passable. The timber with which we are concerned lies chiefly on the steep northeasterly slopes along the two roads and the westerly slope by the old road. In general appearance and composition that on the east-facing slopes looks, or did before the hurricane, much like that described above, being chiefly of northern or transition[1] hardwoods and hemlock, but with red oak very abundant among the hardwoods. White pine is common to occasional. This area was badly damaged by the hurricane.

[1] See Spaeth ('20) for a definition of the term "transition hardwood" and its relation to other New England forest types.

EXPLANATION OF FIGURE 8, SHOWING DIVISIONS, GRANTEES, DATES, AND PAGE REFERENCES TO THE PROPRIETORS' RECORD (PR)

Div.	*Grantee*	*Date*	*PR*
1. House Lot 49	William Spaulding	1733	165
2. 2d	William Chandler	1738	185
3. House Lot 62	Joseph Chamberlain	1733	
4. 1st and 2d	School Land	1753	286
5. 2d	Joseph Chamberlain	1738	186
6. 2d	Nathaniel Stevens	1738	196
7. 4th	Benj. Gates	1753	202
8. 2d	Ministerial Land	1738	197
9. 2d	Philip Brookins	1738	188
10. 3rd	Isaac Ward	1740	274
11. 4th	Samuel Willard	1753	301
12. 4th	Jonathan Prescott	1752	320
13. 3rd	Jonathan Prescott	1740	278
14. 4th, Lot 22	Grantee unknown	1753	297
15. 2d	Jonathan Prescott (Mill Land)	1738	200
16. 3rd	Jonathan Prescott	1740	279
17. 4th, Lot 23	Grantee unknown	1753	297
18. 4th, Lot 24	Grantee unknown	1753	298
19. 4th, Lot 25	Grantee unknown	1753	298

EXPLANATION OF FIGURE 9. THE STIPPLED AREAS INDICATE WOODLAND

1. Lewis McNear	Pasture or cultivation
2. Marshall Hodskins	Pasture or cultivation
3. Lewis Whitney	Pasture
4. Rufus Stowell	Pasture
5. Daniel Sargent	Pasture and woodland (Woodland located from map of 1830 and present stands.)
6. Joseph Brown	"Sheep pasture"
7. Almond and Avira Williams	Farm (Woodlands located from deeds before and after 1850, and from map of 1830. This farm was made up of several properties, separated by dotted lines on the map: 7-A, woodland; 7-B, pasture; 7-C, pasture; 7-D, pasture and woodland.)
8. Samuel Stevens	Farm (The wooded southern extension was formerly a separate parcel, long described as woodland.)
9. Joseph Dudley	Woodland

10. Ansel C. Stowell	Farm (Wood lot located by map of 1830 and existing old stands.)
11. Warren Newton	Farm (11-A is described as pasture.)
12. Seth Holden, Chas. Lee, and Daniel Bacon	Use unknown (Shown clear on 1830 map, but present old stands indicate some woods. This district is known to be incomplete on the map of 1830. See text.)
13. Alfred J. Carruth	Woodland
14. Stephen Fay	Pasture
15. Nathan Hancock	Use unknown

The west-facing slope, on the other hand, has a mixed forest, mainly of hardwoods, among which black birch, red and sugar maples, red oak and shag-bark hickory are, in the order named, the most prominent species. There are a few white pines, hemlocks, white birches, ironwoods and yellow birches. The stand was not badly affected by the hurricane. Judging by dead trees and stumps, the chestnut was formerly one of the more prominent trees. The abundance of such trees as the hickory, with relatively low percentages of yellow birch, white birch and hemlock, and the absence of beech, immediately relate this forest to the central hardwoods. The hickory is especially notable, since it is very poorly represented in Petersham, except on a few such warm hillsides of westerly or southerly exposure as this. It is to be found on the very top of the hill just east of the stand above described, where it has an excellent, forest-grown form among the old trees there. A few high southwesterly exposures in Compartment VIII show an even greater affinity with the central hardwood type, though many trees were blown down by the hurricane. There the hickories are more abundant and mixed with white oaks. In the southern part of Compartment VIII, on a rocky ridge, is an old-field white pine area in which a large percentage of the hardwood advance growth is hickory. The successional significance of this will be noted below.

On the map of 1830 the denser part of this wood was just west of the old road, while that on the hill to the northeastward had its trees more widely spaced, similar to the tract described above. Deeds describing the thicker western part, written in 1809, 1817 and 1870, all note it as woodland, so we may be confident that the trees were never entirely removed. The section between the roads was described as woodland in 1819, but after 1830 no data are available. It seems probable that if it survived to this date, through the period of most active clearing, it is unlikely to have been seriously molested subsequently. Evidence that such is the case is

to be found in the woods themselves, for they closely resemble the other slope forests thus far described and are rather clearly defined from surrounding old field pine stands. The easternmost point of this area, near the river, has a history somewhat similar to that just described, though it had a different series of owners. It was noted as open wood on the map of 1830 and was described as woodland in 1818. At some time after 1843, part of it was merged with other parcels in a large farm belonging to the Williams family and was retained by them until about 1883. Another section of it, nearest the river, became a part of the Dudley farm in 1819. Most of the Dudley farm lay east of the river. During this long period following 1819, it is probable that the area was severely cut over and pastured, though the general appearance of some of the woods which stood there prior to the hurricane suggests that they have never been entirely removed.

The third area of old woods in the Slab City tract is in the southern part, as noted above. It occupies the lower part of the ravine through which the present Barre Road passes on its way out of the valley and extends most of the way from the road to the river (see map, Fig. 9, lot 13). It has long been regarded as "old growth," and there has been no cutting since it was acquired by the University. Like other stands in the valley of the river, it suffered greatly from the hurricane of 1938. Its principal tree species are hemlock, beech and sugar maple, but it has a generous admixture of yellow birch, black birch, white pine, red oak and white ash. The stand, before the hurricane, was of old trees, uneven-aged and of good form, with tall straight trunks relatively free from branches. For some reason this tract is not noted on the map of 1830. However, it was clearly described as woodland in deeds written in 1811, 1813, 1815 and 1834. When acquired by Harvard College in 1908, it was also described as a wood lot. There is little question, therefore, of its continuity as timber land from pre-colonial times. It is perhaps the nearest approach to the hemlock-northern hardwood type which the Forest possesses.

The Pre-colonial Forest

Sources of information about the content and local distribution of the pre-colonial forests of New England have been notoriously inadequate. Recent papers by Bromley ('35) and Raup ('37) have discussed the problem at some length and pointed out the major difficulties. The most important sources are old stands of trees and the writings of colonial historians or travelers. As for the first, it is necessary to establish beyond question the age of the trees and to prove that the stands in which they are growing have never been molested enough to change the species com-

position. With regard to the historians and travelers, it is first necessary to find one who thought the forests sufficiently worthy of note to describe them, along with the usual mass of facts on ecclesiastical and secular chronology. To be of use the descriptions have to be specific as to the kinds of trees and their local distribution over the land surface; so that not only the veracity of the historian, but also his qualifications for writing the descriptions must be critically examined. Last, but not least, is the necessity for proving that the forests described were actually a part of the primeval woodlands found by the colonists when they came to the region in question.

Bromley concluded that there were no entirely primeval woodlands left in Massachusetts, Rhode Island and Connecticut, although a few cut off in recent years were adequately described. It is clear from the present study that occasional modified stands dot the uplands of north central Massachusetts, but the accuracy with which they represent the original types of forest is still open to question until we have drawn a clearer picture, from other sources, of these original forests.

The botanical significance of Whitney's *History of the County of Worcester* has already been noted (Raup, '37), but since the results of the present investigation seem to make it of even greater importance as a clue to early forest conditions, some notes on the book and its author are included here.

Peter Whitney was a native of the town of Petersham, born in 1744. He was the son of Aaron Whitney, who was the town's first minister, and to whom large grants of land were made in the early divisions. Peter was educated for the ministry at Harvard College and held a charge at Northboro, Massachusetts, from 1767 to the time of his death in 1816. His history of Worcester County was published in Worcester in 1793, when he was about 49 years old, and after he had been at Northboro about 25 years. It is presumed that he gained his knowledge of the county in what must have been extensive travels during these 25 years, but he must also have drawn upon recollections of his boyhood in Petersham. His interest in natural science is shown by a note communicated to the American Academy of Arts and Sciences (Mem. 1: 386) on the subject of a curious hybrid apple tree in his native town. Somewhere in his training he must have acquired a remarkable knowledge of the native trees of the region, for in the account of each town (the "History" is written by towns) there is a brief and concise description of the existing timber, with notes on its earlier condition if such were available. He also had a keen sense of the topographic arrangement of the forests and did not fail to make use of it in his descriptions.

Two checks upon his accuracy are available. His description and lo-

cation of the pitch pine plains scattered over the county agree with their present known distribution. In fact, the map of pine plains given by Bromley ('35, p. 77) could have been made, so far as Worcester County is concerned, from Whitney's notes. The other check is his description of the upland hemlock-northern hardwood forest of Winchendon and parts of neighboring towns in contrast to the oak-chestnut-walnut[1] forests of most of the other parts of the county. In Worcester County today this distribution still holds as described by him. To these things it should be added that a careful perusal of all of Whitney's notes on the various towns fails to reveal any errors such as the naming of tree species not known to grow in this part of New England. We must conclude that his field knowledge of the species was accurate and of no mean proportions.

Thus Peter Whitney's account of the forests in 1793 satisfies very well the "internal" requirements that have been set forth above as necessary for a trustworthy contemporary account. There remains the proof that the forests he was describing were actually pre-colonial in origin. It is noted elsewhere that the town of Petersham had its beginnings in land speculation on the part of the original grantees, and that this first speculative period lasted for 30 or 40 years after the first divisions. Peter Whitney was born in the earlier years of the period and spent his boyhood and young manhood while the division of town lands was still under way.

It is a significant fact that very little descriptive material is found in the deeds until after 1800. An inference that may be drawn from this is that there were very few distinctions in land use to be made prior to that time—that most of the land was still uncleared and unused. There are two lines of evidence to support such a view. One is the lack of a motive for extensive clearing. It has been shown elsewhere in this paper, as well as in other studies of early New England agriculture (Bidwell, '16), that the average upland farm was a self-contained unit, with no appreciable external market for produce prior to about 1800, when the industrial towns began their rapid development. In the Petersham of Whitney's time there could have been no outlet for large quantities of live stock, grains or garden produce. A second line of evidence lends incontrovertible support to the first. In the Massachusetts report on the Valuation of Towns, made in 1771, there is a list of polls and estates, real and personal, of proprietors and inhabitants of Petersham. In it the farm land is classified by acreage in four categories: pasture, tillage, upland mowing and meadow. The following is a table selected from this list, in which all the owners had large holdings of land now in Harvard Forest tracts.

[1] In the early writings "walnut" was a general term for both hickories and walnuts.

	Pasture	*Tillage*	*Upland Mowing*	*Meadow*
John Chandler	17	4	25	20
David McClellan	4	4	8	..
James Jackson	10	6	15	..
Daniel Felton	20	5	16	..
Edward Powers	9	2	9	
Ebenezer Bragg	8	4	6	
Jonathan Sanderson	2	2	4	3
Elisha Ward	9	3	9	0
Seth Hapgood	7	3	8	3
David Curtis	6	5	10	..
Amos Bicknell	6	3	6	0
Shearjashub Spooner	10	4	12	0
Henry Chase	6	3	6	4

There were in the whole list 127 land holders of which the above are typical. The small acreages of cleared land are at once striking and significant, especially when it is remembered that the actual holdings of the individuals would average 100 acres or more. The totals are equally impressive. From data presented in tables on pp. 25-26 it is evident that in the 1780's only 3,000-4,000 acres of the town had been cleared for tillage, mowing or pasture, leaving some 24,000 acres in forest. The conclusion is inescapable, therefore, that Peter Whitney's forest, at least in Petersham, was pre-colonial and primeval in the true sense of the word. The following is his description of the woodlands of Petersham (pp. 220-221):

"On the high lands the growth of wood is oak, more chestnut, and a great deal of walnut of later years. In the swamps and lowlands, there is birch, beech, maple, ash, elm, and hemlock."

Considered in the light of modern classification of forests in New England, he has described here two major types and has noted the material for two others. First is the "high land" forest of oak, chestnut and "walnut." This is the central or "sprout" hardwood type of Connecticut, Rhode Island and eastern Massachusetts. Whether red or white oak was predominant we do not yet know. On the lowlands he notes a forest of birch, beech, maple, ash and hemlock. This combination of species clearly involves the northern hardwood type which, mixed with hemlock, reaches its best development in New Hampshire, Maine, Vermont and parts of Massachusetts. Within his second group of trees we can also see a hardwood swamp type and a lowland or ravine hemlock type. It is a notable fact that white pine is not mentioned, although it surely occurred within the town. It must be concluded that it was so far in the minority as to be negligible as a timber-producing species.

The only other writer whose observations on forests approach those of Whitney was Timothy Dwight. Dwight was President of Yale College and between 1795 and 1821 made a series of summer excursions through New England and New York State. At best his notes on the existing forests of the time were scarcely comparable to those of Whitney. His knowledge of the species was sketchy in the extreme, and over most of his routes he made no comments whatever on the kinds and conditions of forests. Furthermore he lacked the keen sense of topographic differences in vegetation which makes Whitney's notes so valuable. The nearest he ever came to a description of forests in the part of Massachusetts with which we are concerned was in 1795, when he passed through Brookfield, Spencer, Leicester, Worcester and Northboro. When he got to Worcester he remarked that "the forest growth of this and all the preceding townships, is oak, chestnut, hickory, etc.; with interspersions of white and yellow pine." (Dwight, 1: 366). Whitney's account of the uplands in these towns is substantially the same, but he also described lowland woods of ash, birch and maple. In Leicester he states specifically, however, that neither pitch nor yellow pine was abundant. (See Whitney, pp. 32, 81-2, 108, 214, 279) In 1797 Dwight passed even nearer to Petersham, traveling through Lancaster, Sterling, Princeton, Rutland, Oakham and New Braintree. But in none of these did he make any notes on the character of the forest.

The relative unimportance of the white pine on most of the uplands of Worcester County noted by Whitney is corroborated in the writings of Timothy Dwight. As quoted by Bromley ('35, p. 66), he states that the pine "South of the District of Maine, if it were all collected into one spot, would scarcely cover the County of Hampshire."

There remains the problem of correlating the relic stands of old woods described in this paper with the general pattern of the pre-colonial forest outlined by Whitney. It is at once obvious that the lower slope forests of the Tom Swamp Tract and the ravine and valley slope timber in the Slab City Tract are very closely related to the lowland northern hardwood-hemlock type of Whitney. They seem to have come down to us with little alteration, in spite of repeated cutting and culling, not to mention possible past hurricanes. The hardwood swamp type is represented in parts of the Tom Swamp Tract and in the central and southeastern part of the Prospect Hill Tract. Lowland or rocky swamp stands of hemlock are to be found in all these tracts.

The oak-chestnut-"walnut" type is not so easily found in the modern remnants, however, since the "high lands" were cleared earliest and most completely. Two localities are available. One of these is on the gravel knoll in the easterly part of Compartment II of the Prospect Hill Tract.

As noted above, it is covered with a hardwood forest principally of oaks, among which white oak is prominent. This indicates a distinct affinity with the central hardwood type. The other site is on the westerly slopes of the hills in northern parts of Compartments VII and VIII of the Slab City Tract, where a similar central hardwood type is found.

Successions in the Petersham Forests

Upland forest successions in Petersham may be summarized in two categories. The first, which has been discussed at some length in the preceding pages, occurred in tracts that were never cleared for pasture or cultivation. The similarity between the present timber on these tracts, both in composition and local distribution, and that of the pre-colonial upland forest as outlined for Petersham in general, indicates that no serious changes have occurred since the first settlement. Perhaps the most important was the recent elimination of the chestnut by disease. Repeated cutting and occasional burning no doubt set up minor variations, and the smaller size of the trees changed the general aspect, but the composition of the forest must have remained fairly constant.

At this point it is necessary to describe a peculiarity of nearly all hardwood stands. If they are clear cut, culled or burned, they sprout luxuriantly, forming coppice growths around the old stumps. This process may be carried through a series of such changes without a very great change in the species composition of the forest. The result is that the hardwood type is surprisingly persistent, provided it is not actually grubbed out of the ground. The thrifty New England farmers, however, grubbed the trees out so as to make clean pastures. Many hardwoods are heavy seeded, like the oaks and beeches. Others, such as the maples and the ash, have winged seeds which are only moderately free in their movements. Only a few, like the birches, have very light seeds. The results of these inherent characteristics of the species themselves are of first importance in the present study. The more heavily seeded trees require a considerable period of time and modified growing conditions before they can successfully invade old fields. The white pine stage in the succession noted below furnished these requirements.

The second type of upland forest succession occurred in fields that had been entirely cleared of timber and used for pasture or cultivation. Starting with small homestead openings in the timber, the process of clearing went on steadily until about the middle of the last century. The first stage in the development of the modern old-field forests began with the abandonment of these pastures and crop lands. As population in Petersham began to decline about 1850, increasing acreages were abandoned

and allowed to revert to forest. Apparently there were enough scattered pines along fences, in pastures or in farm wood lots to furnish large quantities of seed. Because the pine seed was light and easily transported by the wind, and because the abandoned fields provided a good bed, both tilled land and pastures seeded to white pine which grew up in nearly pure stands during the second half of the nineteenth century (Fisher, '33, p. 219). Due in part also to the periodicity of seed years these stands were usually of even age, high density and fair quality timber, and constituted an enormous source of forest wealth for Petersham and other towns throughout this region. Small woodworking plants had located in Petersham by 1865 and after using some of the remaining old growth they began to exploit the more mature stands of this "old field" white pine. Cutting of the second growth was not done on a large scale until about 1890 and continued for 20 years; large amounts were removed annually for the wooden-box industry.

The second stage in recent forest history began in many of these older fields with advance growth of such valuable hardwood trees as white ash, red oak and sugar maple, which had started to come in under the pine. When the lots were clear cut, however, numbers of fast-growing hardwoods such as gray birch, pin cherry, poplar and red maple came in and partially suppressed the stock of more valuable seedlings.

For the purpose of this report it is significant to note that the white pine wood lots were only a transition and could not maintain their composition, even if uncut, against the new association of hardwoods coming underneath. Such wood lots were a direct result of farm abandonment and were often unsuited to the sites they occupied.

In some ways this second stage, hardwoods following old field pine, was also accidental in composition and distribution, for certain hardwoods happened to be on hand to furnish seed after the pine was cleared. It was possible to find, reported one investigation, distinct groups of hardwoods as large as one-half acre in which one or more species predominated. This was due to fence trees and those few scattered in the pine stands which had survived from the earlier farm-pasture stage (Griffith, Hartwell and Shaw, '30, p. 11). It is thought by some that, excluding the forest weeds which are rare in old growth, this second stage is but a step in the process of reversion to the original mixed composition of the early forests (McKinnon, Hyde and Cline, '35, p. 13). If, however, the concept of the original forest as outlined in this paper is valid, then it must be admitted that the present composition of much of the upland hardwood following old field pine is approaching that of the primeval type.

There is some evidence also that the new hardwood stands are related

to topography, soil and exposure in much the same way their ancestors were. A particularly striking example of this has been mentioned above, in connection with a description of relic woods in Compartment VIII of the Slab City Tract. Here an old field pine stand occupied a rocky hogback of southern exposure. The advance growth of hardwoods contains a high percentage of hickory, showing a succession from white pine to a central hardwood complex rather than to one of transition or northern hardwoods. This type of succession is bound to be rather limited, geographically, in New England. It has been noted previously in central Massachusetts by McKinnon, Hyde and Cline ('35). Recent studies of old-field forests in southern New England (Raup, '40; Lutz, '25) suggest that old field succession in the central hardwood region involves an initial stage of red cedar and gray birch, in contrast to that of white pine in the transition hardwood region. Such a succession as that noted above, therefore, can be expected only in areas of overlap between the two types.

Swamp and bog forests have probably remained more or less unmodified in species composition unless they were affected by artificial drainage and made into more mesophytic habitats. Evidence of succession on very light soils that were cut over or cleared is fairly precise. Studies in the Adams-Fay Lot, at the north end of the Tom Swamp Tract (see pp. 42-43) indicate that hardwoods have never played an important part either in the successions or in the natural forest. Marshall concluded that conifers had succeeded conifers in this area, in varied mixtures of hemlock and white pine, depending upon the degree of clear-cutting.

Summary and Conclusions

It has been shown that certain tracts of woodland in Petersham, within the Harvard Forest, have remained in the form of woodland from the pre-colonial forests, and that they represent northern hardwood-hemlock and central hardwood types. The former occupy ravines, lowlands and northerly slopes, while the latter grow on dry knolls and warm, south-facing hillsides.

On the basis of early descriptions of the timber, notably those of Peter Whitney, and early records of land tenure and use, it has been shown that the pre-colonial forests in Petersham were similar in composition and general topographic arrangement to the old forest types still remaining.

It will be noted that these relic stands of timber have not been described here in detail as to percentage composition or minor constituents. To attempt a correlation between these details and such hypothetical ones as could be construed for the pre-colonial forest would be futile with our present knowledge. The records at the Forest contain considerable

information about these stands: their composition, understory, ground cover, and treatment during the past 30 years. Much further investigation is necessary before the details can be related logically to the past or the future; and such an investigation is beyond the scope of the present project.

Several useful suggestions appear as corollaries of these results. First, relic wood lots may be used with a reasonable degree of accuracy to determine present-day timber-growing potentials in terms of natural or primeval forest conditions. Second, these wood lots may be used as a scale against which to plot the probable results of future development in old field forests. Third, the results of the whole investigation strongly suggest that the basic arrangement of natural forest types, in comparison with the existing ones, is relatively simple, and that the bewildering complexity of the present mosaic of types is very largely due to the differential consequences of land use and abandonment. It is suggested that if a dimension for time is added to the present-day type maps of the Harvard Forest tracts, all of them will be greatly simplified, and most of the present stands of timber will appear in their true perspective as developmental stages moving toward the simpler natural arrangement.

This natural arrangement will be determined first by the forest trees made available through the position of the Petersham region in the geographic configuration of forest types in New England. This involves a mixture of deciduous and evergreen coniferous species, the first of which are more important. The most prominent hardwoods are beech, yellow birch, sugar maple, red, white and black oaks, hickory, white ash, red maple and black birch. The first three are commonly called the northern hardwoods, while white and black oaks and hickory predominate among the so-called central hardwoods. The coniferous species are principally white pine, hemlock and red spruce.

The local distribution of these trees is probably determined by the distribution of topography and soils and by the effects of the former upon local climates. Ravines, lowlands and cool northerly slopes may be expected to support forests dominated by beech, sugar maple, yellow birch, red maple, red oak, white ash and hemlock. The ash and red oak should be most prominent in the drier and warmer parts of these situations. Dry knolls and warm south-facing hillsides should support a timber of white, black and red oaks, and hickory, with some white ash and hard maple. In general, westerly slopes should favor the southern groups, while easterly slopes carry a more northern type. White pine should be occasional and scattered, probably most common on the drier and warmer sites. Very dry, sandy soils should produce chiefly pine and hemlock, if slope and water supply permit the latter. Swamps, if of the bog type, will

produce red and black spruce, and if they have better drainage, a hardwood swamp forest made up principally of red maple and yellow birch.

This concept of the natural forests is consistent with contemporary description of the pre-colonial timber in Petersham and with the distribution of types within the relic wood lots which may be seen today in the Harvard Forest. It will be noted by those who have studied the forests at Petersham, and have followed the work carried on there, that many aspects of the concept are not new. Largely through the extraordinary insight of the late Professor Fisher they have gradually taken form during the past thirty years, based almost entirely upon observation and deduction in the existing timber. It is hoped that the results of the present study will add some confirmation to these ideas and help to establish the concept as an adequate working hypothesis for future silvicultural research and management.

APPENDIX

Index of Land Divisions

The following columns provide a guide to the several land divisions of the proprietors in Petersham and relate the separate grants to the basic proprietary rights and original house lots. As noted in the chapter on "History of Land Divisions," many of the early proprietors were absentee owners and were not on hand to make their own "pitches." In the following table the absence of a number in the second or third division columns is probably an indication that the owner was a resident proprietor; only for absentee owners were these divisions numbered and drawn by lot.

Original Proprietor	*(1733) House Lot No.*	*(1738) Second Division Lot No.*	*(1740) Third Division Lot No.*	*(1753) Fourth Division Lot No.*
Samuel Fletcher	1	40	3	50
Samuel Sawyer	2		26	6
Henry Willard	3	36	17	2
Peter Atherton	4		10	52
Abner Brown	5		25	69
Samuel Rugg	6	16	13	22
Samuel Willard	7			62
Joshua Webster	8	38		33
Jacob Perley	9	13	30	63
Jethro Eames	10	12	31	68
Jeremiah Perley	11	8		59
Benjamin Walker	12		5	18
Samuel Tarbell	13		18	29
James Houghton	14	4		45
Minister's Lot	15			54
Jacob Cory	16	1	40	65
John Bennett	17	18		15
Ephraim Houghton	18	20		31
Ephraim Farnsworth	19		34	72
John Goss	20	35		27
Jonathan Perling	21			4
Richard Hall	22			21
John Hazzen	23	5	19	28
Samuel Learned	24	32	12	41
Joseph Reed	25	6	15	14
Henry Colburn	26	10		3
Fairbank Moore	27	22	2	48
John Varnum	28	41	29	71
Benoni Boyington	29	29	27	66
Jonathan Atherton	30			12
Jacob Eames	31	24	32	11
John Wilder	32	30		10

Original Proprietor	*(1733) House Lot No.*	*(1738) Second Division Lot No.*	*(1740) Third Division Lot No.*	*(1753) Fourth Division Lot No.*
John Baker	33	21	41	20
Abial Foster	34	39	.	55
Ezra Sawyer	35	2	..	17
Robert Ford	36	37	16	43
Edward Houghton	37	..	11	74
Samuel Hilton	38	..	42	38
David Whitcomb	39	11	36	8
Benjamin Gates	40	14	47	34
Daniel Houghton	41	19	..	56
Samuel Brown	42	27	.	35
Jonathan Ferrin	43	.	43	51
Moses Hazzen	44		24	39
Benjamin Barker	45		39	5
Reuben Farnsworth	46	.	14	46
Moses Chandler	47	34	37	9
Henry Houghton	48	.	.	44
William Spaulding	49	9	.	49
John White	50	28	.	37
Joseph Whitcomb	51	3	1	26
Samuel Shattuck	52	.	23	53
Joshua Hutchins	53	31	8	61
John Leviston	54	23	45	42
William Hutchins	55	.	6	73
Timothy Hall	56	.	9	58
Thomas Farmer	57	15	..	16
Aaron Rice	58	..	35	70
John Sawyer	59	..	7	19
Jonas Houghton	60	33	44	67
Samuel Stickney	61	25	.	30
John Dunton	62	..	20	1
Samuel Mossman	63	26	28	57
Jonathan Willson	64	.	22	13
Caleb Dalton	65	.	.	7
Joseph Willson	66	..	.	47
Stephen Merrill	67	7	..	25
Stephen Houghton	68		21	24
Oliver Pollard	69	17	..	23
Samuel Trull	70	..	46	40
Phenihas Foster	71	..	38	64
Jonathan Adams	72	..	33	60
Ministry lot	..	..	..	32
School lot	..	..	..	34

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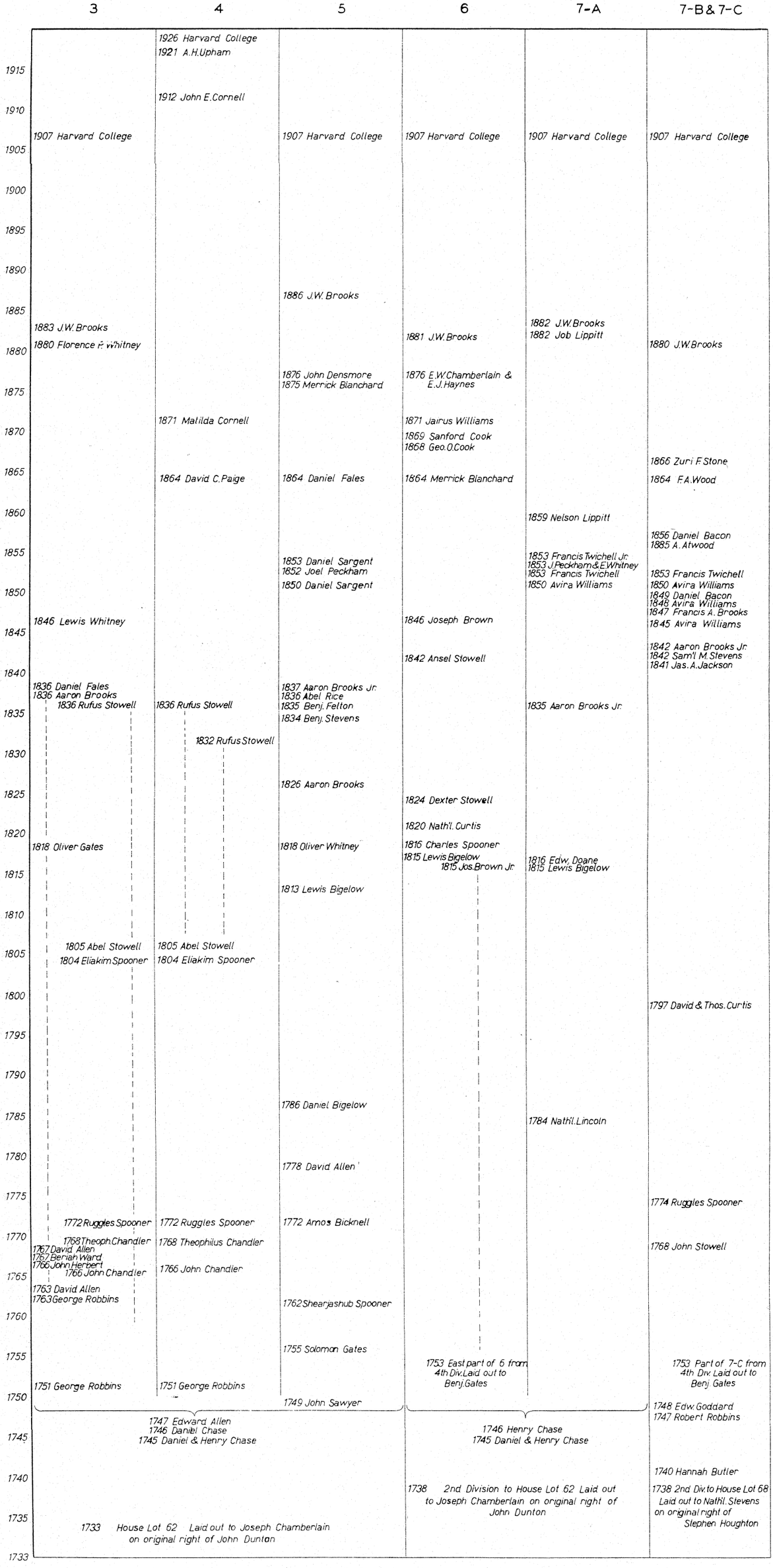

FIG. 3

Chart showing the titles to six parcels in the northern part of the Slab City Tract. The parcels are numbered to correspond with the numbers in Figure 9. Note the two periods of speculation: 1733 to about 1775, and 1830 to 1885.

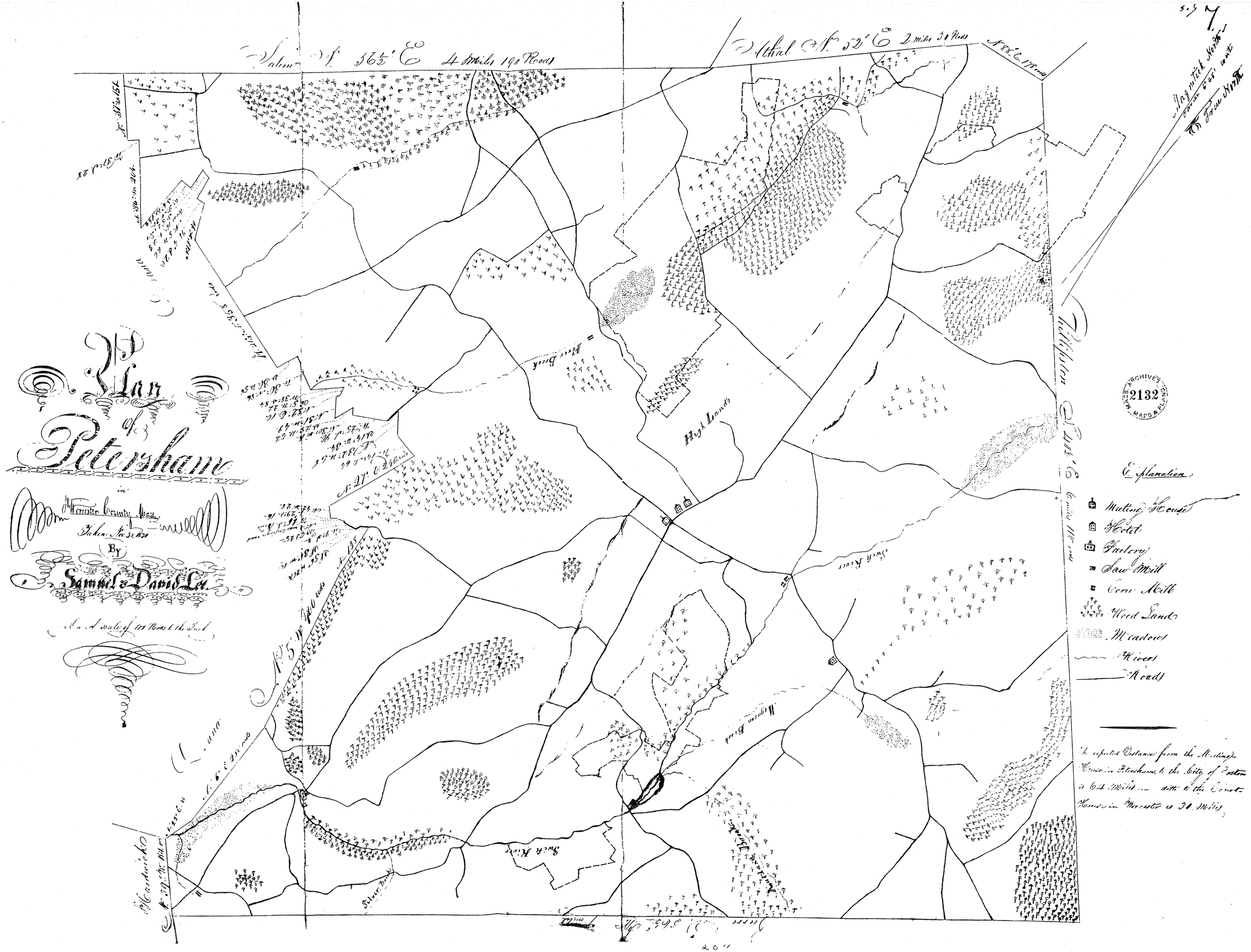

FIG. 2

Map of the Town of Petersham made in 1830 (Archives, State House, Boston). The approximate boundaries of the three larger Harvard Forest Tracts have been sketched in.

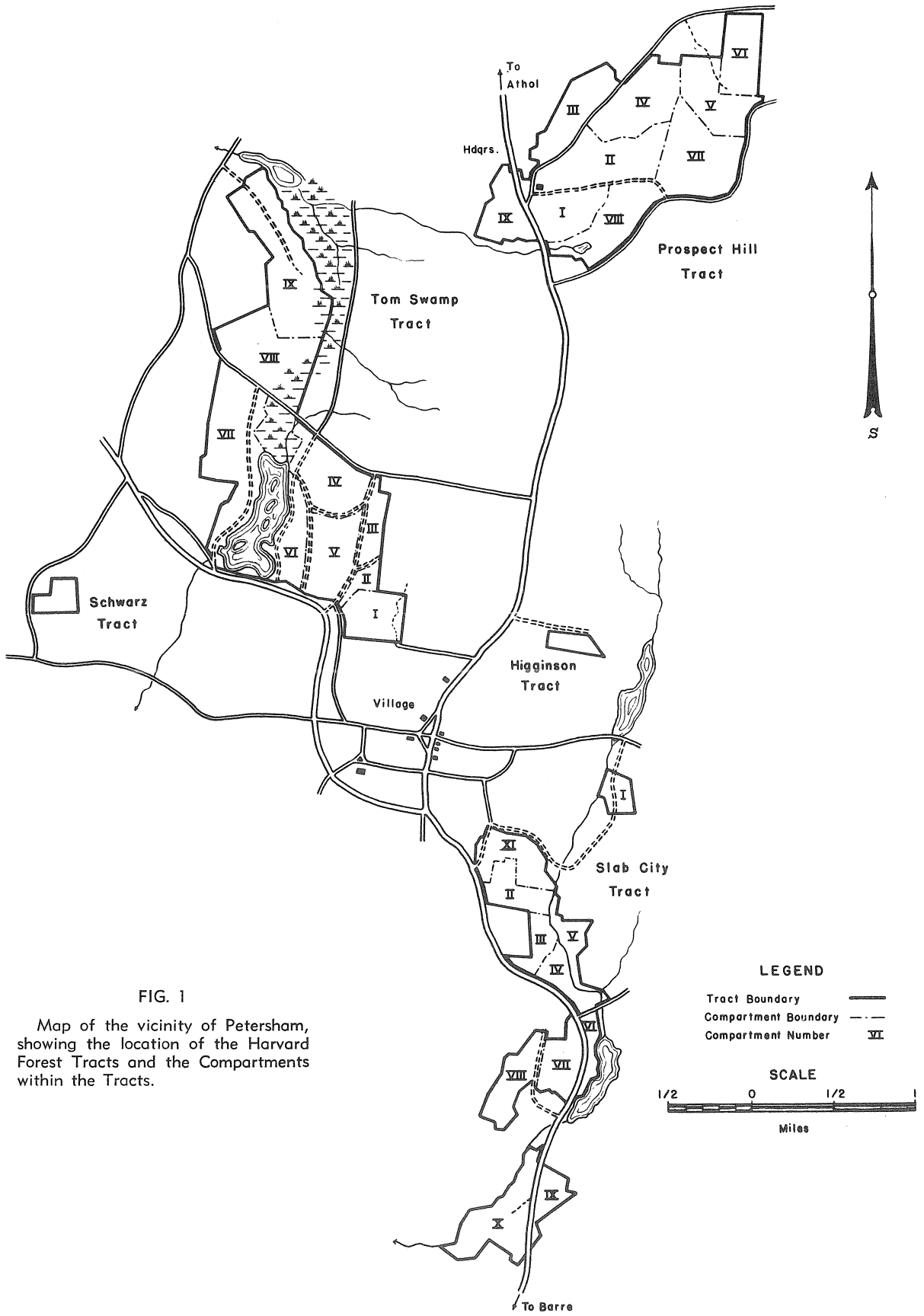

FIG. 1

Map of the vicinity of Petersham, showing the location of the Harvard Forest Tracts and the Compartments within the Tracts.

Willett Newlands

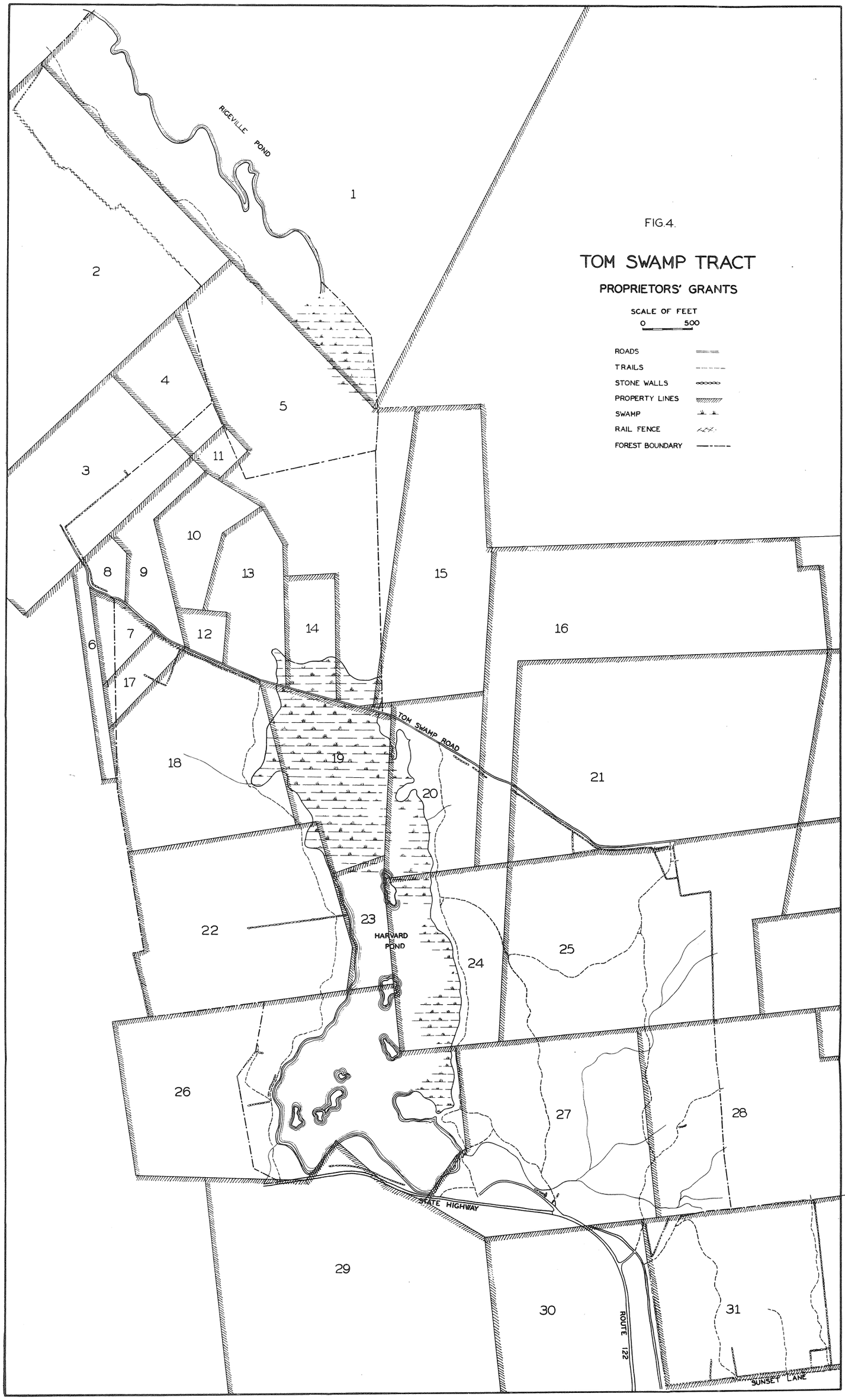
FIG.4.
TOM SWAMP TRACT
PROPRIETORS' GRANTS
SCALE OF FEET
0 500
ROADS
TRAILS
STONE WALLS
PROPERTY LINES
SWAMP
RAIL FENCE
FOREST BOUNDARY
RIGEVILLE POND
TOM SWAMP ROAD
HARVARD POND
STATE HIGHWAY
ROUTE 122
SUNSET LANE
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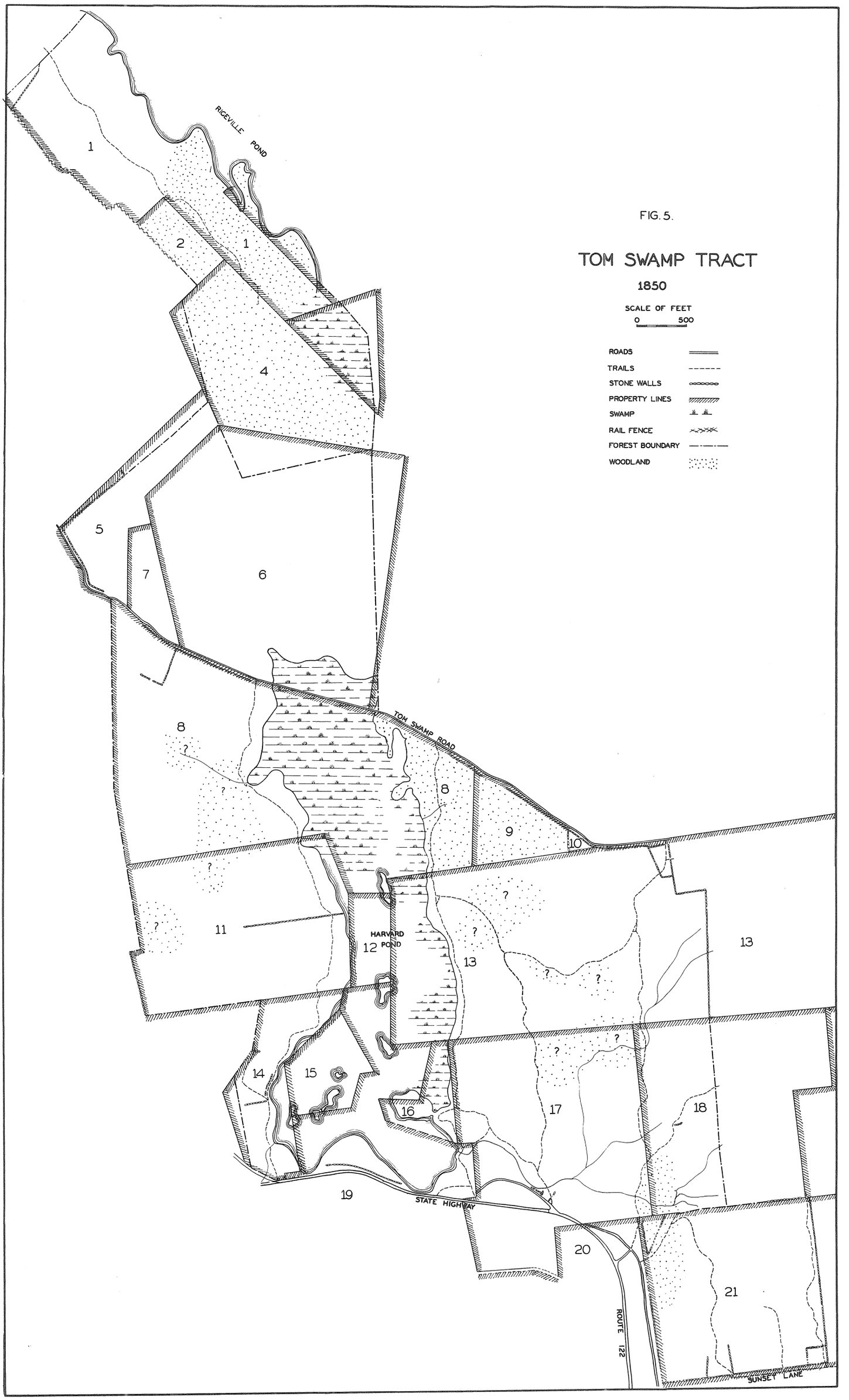
FIG. 5.
TOM SWAMP TRACT
1850
SCALE OF FEET
0 500
ROADS
TRAILS
STONE WALLS
PROPERTY LINES
SWAMP
RAIL FENCE
FOREST BOUNDARY
WOODLAND
RICEVILLE POND
TOM SWAMP ROAD
HARVARD POND
STATE HIGHWAY
ROUTE 122
SUNSET LANE
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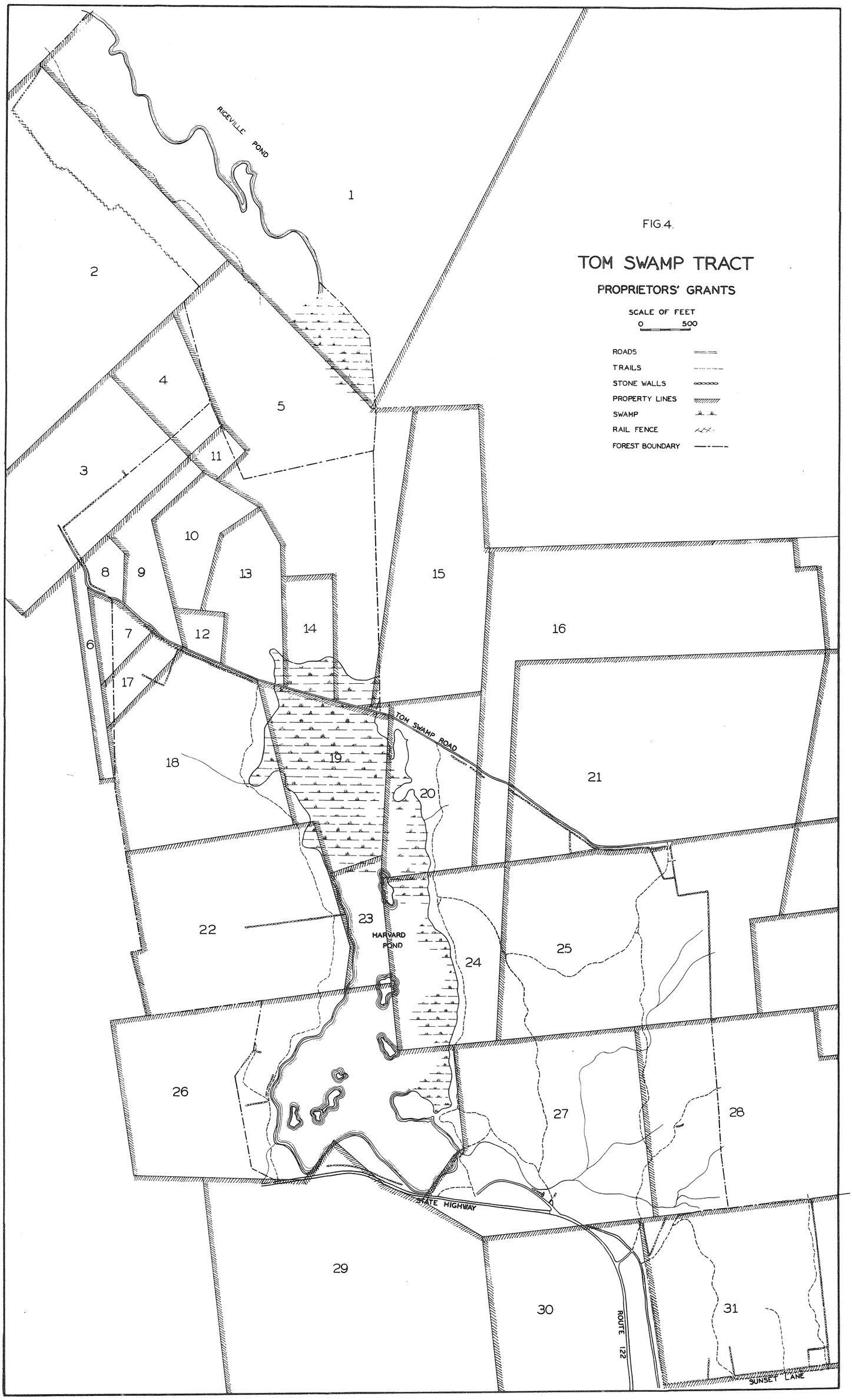
FIG. 4.
TOM SWAMP TRACT
PROPRIETORS' GRANTS
SCALE OF FEET
0 500
ROADS
TRAILS
STONE WALLS
PROPERTY LINES
SWAMP
RAIL FENCE
FOREST BOUNDARY
RIGEVILLE POND
TOM SWAMP ROAD
HARVARD POND
STATE HIGHWAY
ROUTE 122
SUNSET LANE
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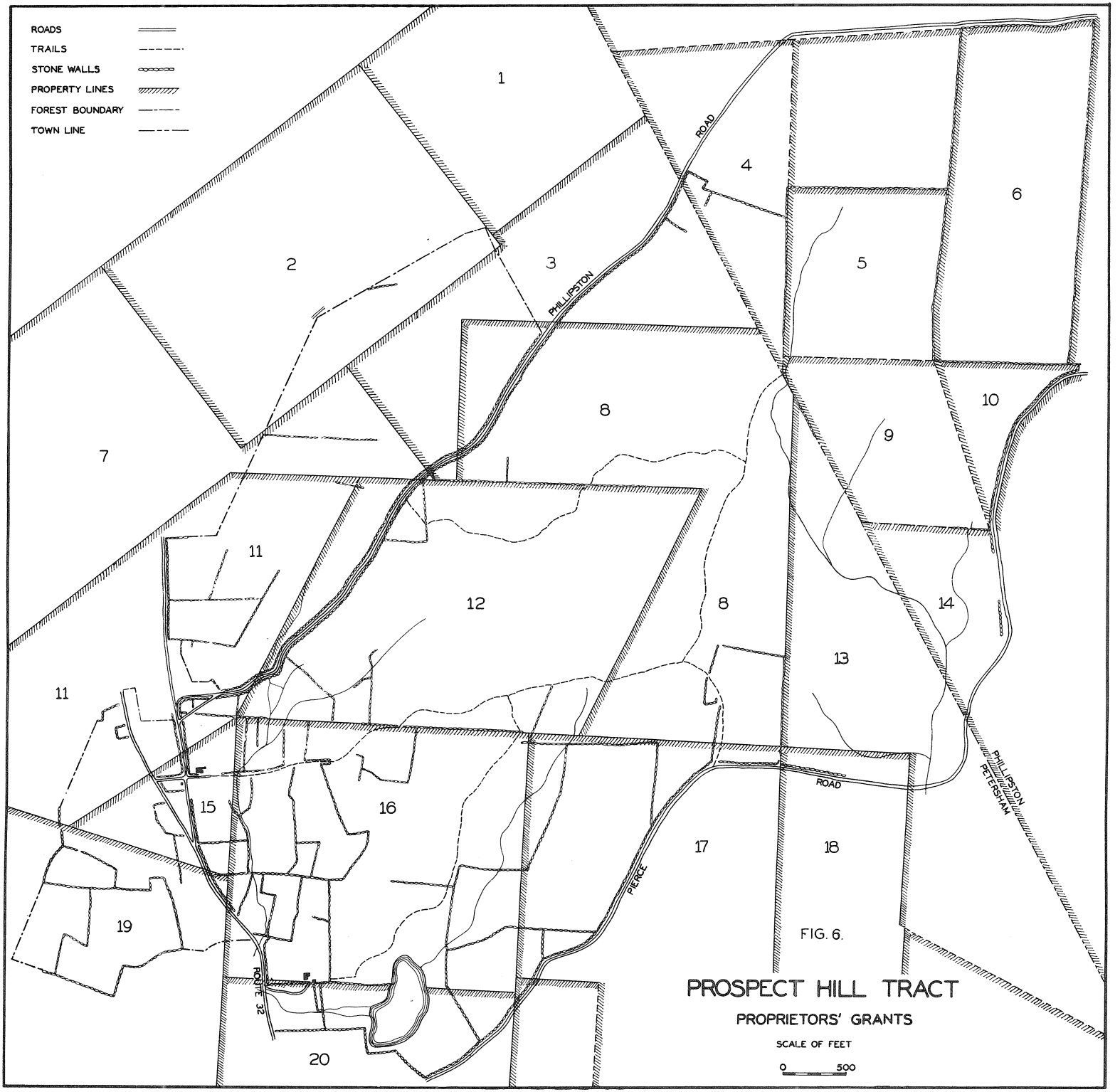

FIG. 6.

PROSPECT HILL TRACT

PROPRIETORS' GRANTS

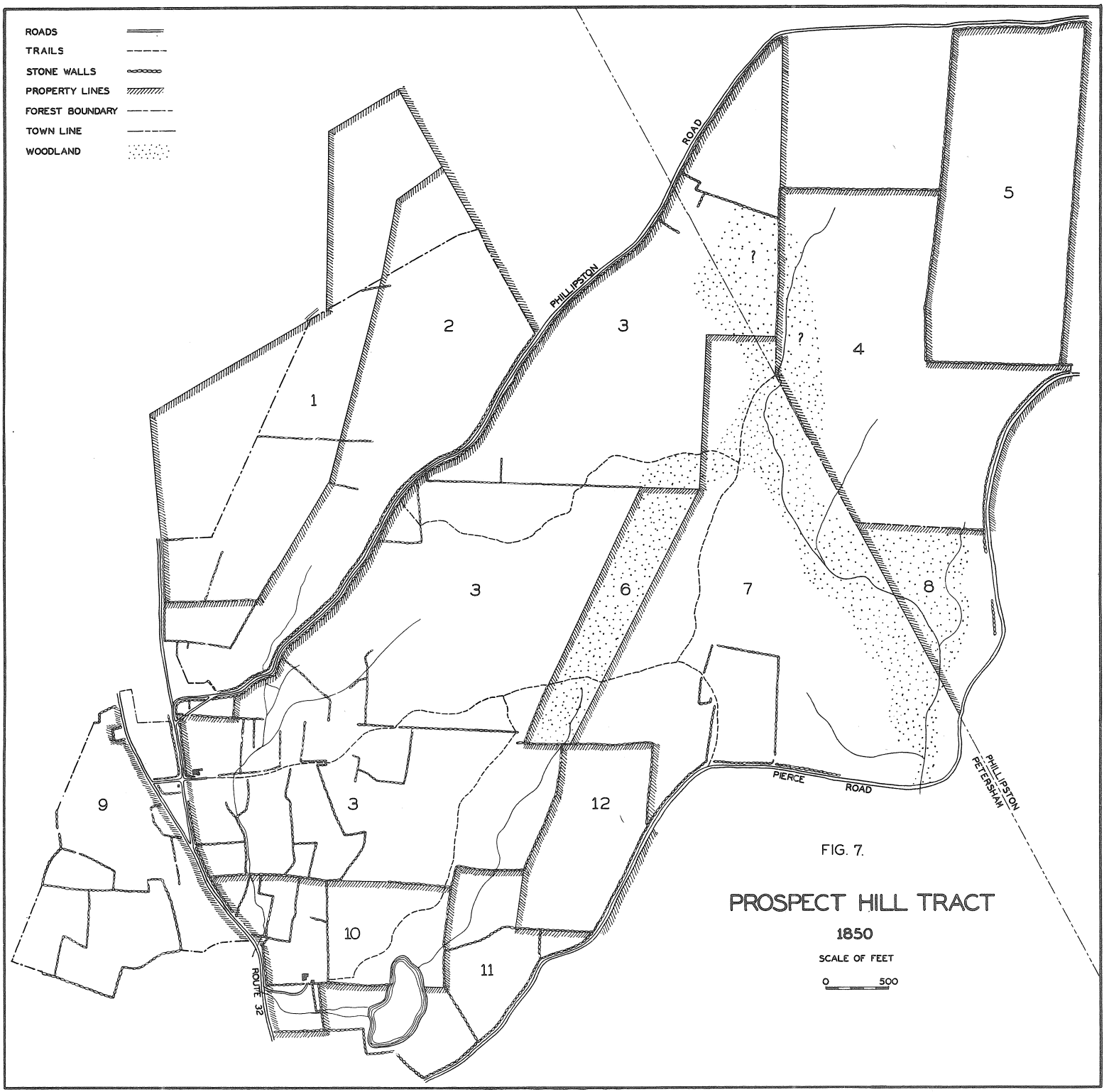

FIG. 7.

PROSPECT HILL TRACT

1850

SCALE OF FEET

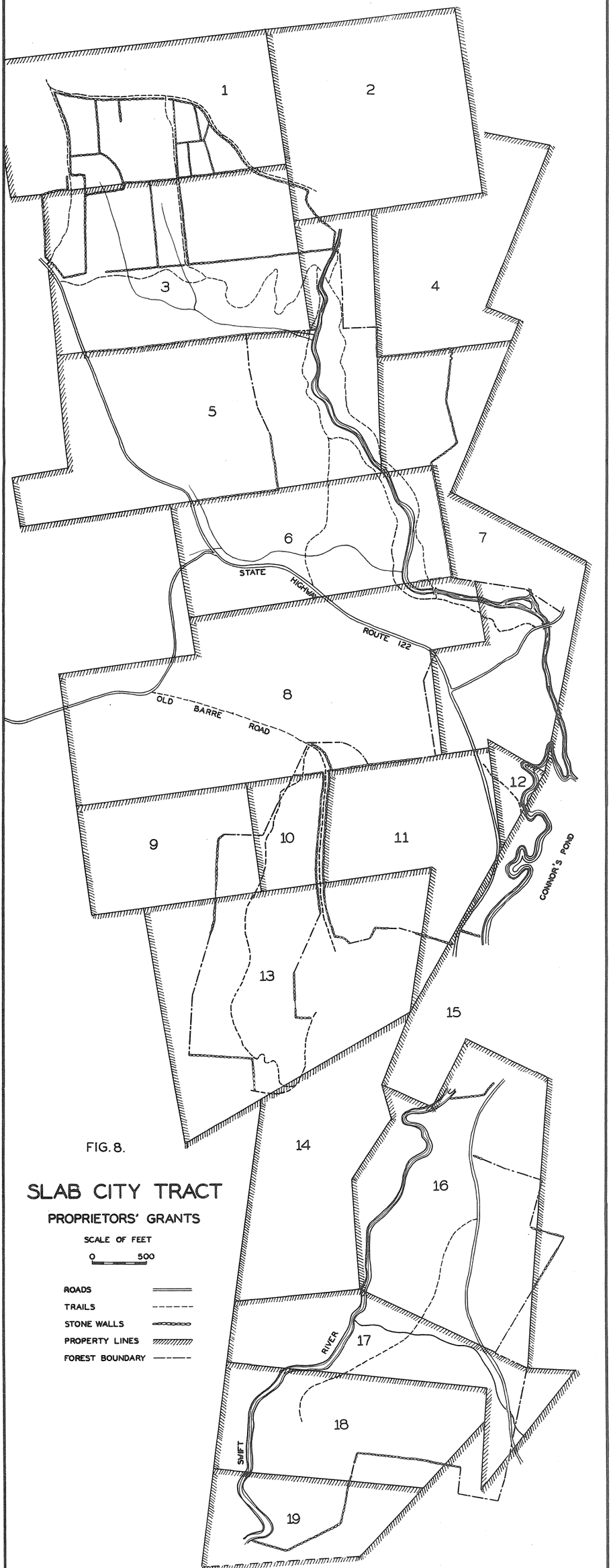

FIG. 8.

SLAB CITY TRACT

PROPRIETORS' GRANTS

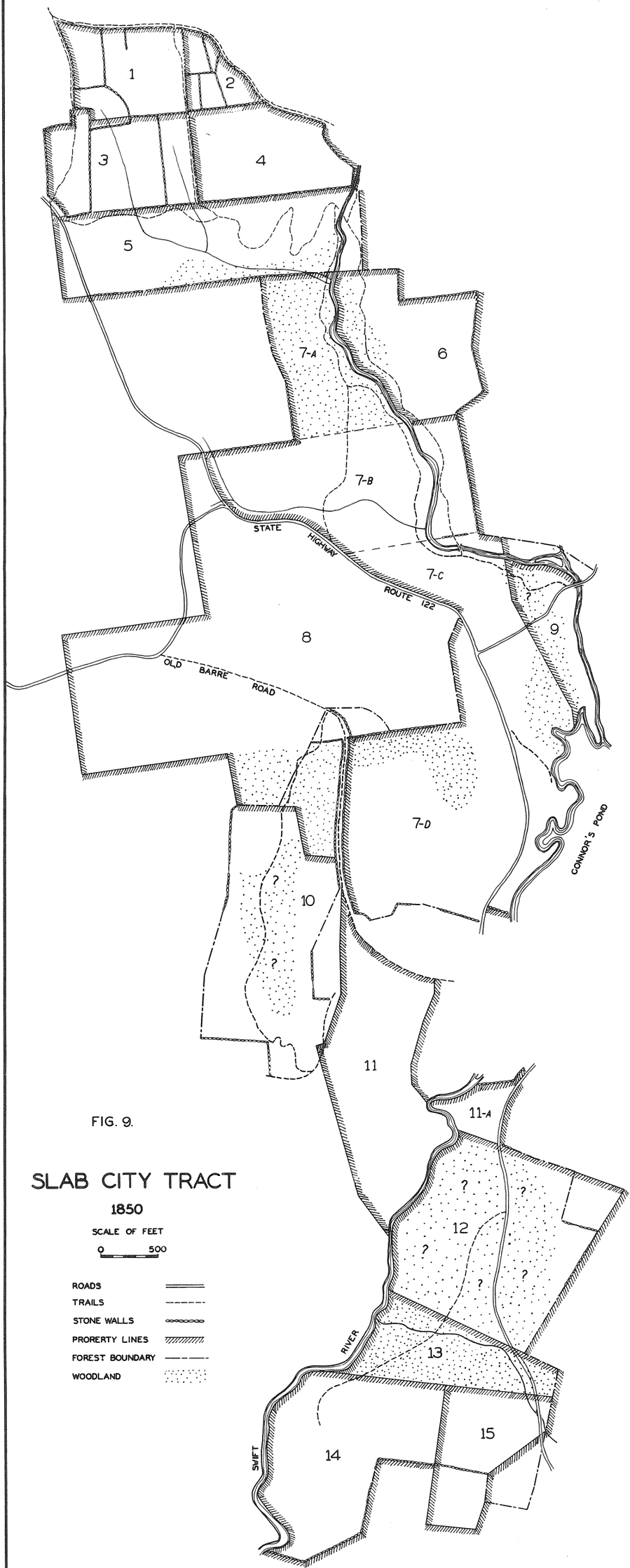

FIG. 9.

SLAB CITY TRACT

1850