A History of the Forests of Cape Cod

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3/4/66

This paper was written in 1938-1939. Since that time several changes have taken place on Cape Cod which have had important effects on its forests. I would call attention to five matters in particular.

1. Interestingly enough, Social Security and Unemployment insurance have largely replaced the fighting of (set) forest fires as an off-season source of income.
2. The development by Charles Cherry of the State Department of Forestry of the so-called land battleship, or heavily reinforced tanker fire truck, which is able to strike off through the woods to the head of fires, has revolutionized fire fighting technique. Back-firing and the box of matches are rarely heard of now.
3. Cooperation between town fire departments has replaced the former trick of heading off the fire so that it will burn in the next town and local fighters return home. It is now realized that ALL fires are of local importance, even while they are in the next town.
4. The growth of the Cape, with its new developments, has cut our forest areas into very small pieces. Equipment can now reach most fires quickly on paved roads. Often there are even fire plugs nearby.
5. Aeroplane spraying has practically eliminated the gypsy moth, which formerly had raised havoc with the oaks in particular. This spraying has either eliminated or reduced several other pests, including the pine looper.

The writer is indebted to A. C. Cline, now Director of Harvard Forest, for his role in the initiation of this study, and for his encouragement, criticism and material contribution in providing stenographic assistance. The writer is also indebted to most of the librarians of the towns of Cape Cod, and to Miss Helen E. Shattuck, librarian of the University of Vermont and her assistants, for many courtesies; also to the memory and interest of George P. Morse, Wareham, Massachusetts, and to a score of friends and acquaintances on Cape Cod for information and assistance.

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PART I

Purpose of the Study

If one is to understand fully the extent of any natural process, he must first know something of its beginnings. The process of the forest deterioration on Cape Cod* has covered so great a period of time that it is now surrounded by a haze of conjecture and opinion. The present study has had as its purpose a clearing of the historical background, in order to determine not only the extent of the vegetational changes which have occurred as a result of the influence of man, but the nature of the phenomena which have brought about these changes. It is the hope of the writer that this information not only will stimulate and facilitate a coordinated program of biological research within the area under discussion, but that it may help to destroy that apathy toward destruction of a resource which breeds upon a lack of understanding both of the motivation behind social action and of the effect of the loss of such a resource upon the entire social structure.

Method

No one of the early journalists of Cape Cod has left us with a really satisfactory description of the forests of this area as they existed prior to settlement by the Pilgrims. Moreover, there may be found in the writings of later diarists and historians only brief and often indirect mention of

* "Cape Cod", as used in the present paper, refers not only to Barnstable County, Mass., but to that portion of south-

of the land, its resources, and their utilization. From the beginning of the eighteenth century until the middle of the nineteenth, Cape Cod - and in particular, Barnstable County - might almost have been described as a huge home port for ships; a place where men of the sea kept their families. Most of the industries that operated upon the land were auxiliary to the activities of men who drew upon the resources of the sea, or of the lands beyond the sea. The sea dominated the thoughts of these people, and of their later historians. Finally, many of the older records of Cape Cod have been lost through fire.

Because of the nature of the circumstances, the method used by the writer has of necessity been somewhat analogous to that of the anthropologist who, finding a few bones, reconstructs out of clay a prehistoric creature. The line of reasoning behind major reconstructions of this sort will be found in the text.

The almost insular nature of Barnstable County has enabled the writer to draw much information relative to the forest indirectly from other activities of its people. The same method could not be used so successfully for the Plymouth area of Cape Cod, because of the greater influence of adjoining lands, and because its boundaries are of an arbitrary rather than a political nature. Treatment of the latter area must, therefore, be somewhat less complete than that of Barnstable County

eastern Plymouth County, Mass., which is included in the original (1894) Plymouth quadrangle of the U.S. Geological Survey series. The common geological and historical backgrounds of these areas make them an ecological unit.

Physiography of the Area

A casual observer on Cape Cod easily becomes "sand conscious". Because of this fact, there has been a popular tendency to oversimplify both the geological and the vegetative history of the area. A brief review of the more important physiographic features of Cape Cod seems therefore to be desirable.*

Cape Cod rests upon a series of sand, gravel and clay beds dating back to Tertiary time and laid down in the usual manner upon the bed of the ocean. Shaler (1897) has concluded that these Tertiary deposits rise to considerable height above sea level from Buzzards Bay eastward through the towns of Bourne, Sandwich, Falmouth and Mashpee.

Over the finer depositions of Tertiary and early quaternary time, a great mass of glacial debris was later deposited. These deposits were many, and the materials dropped varied greatly in texture. In general, however, the clay content diminished in the more recent depositions in favor of sand, gravel and a scattering of boulders.

Erosion since glacial time has proceeded in very uneven fashion over the surface of Cape Cod, so that the materials exposed today represent a very broad cross-section with respect both to texture and to time of deposition. Latimer, Maxon and Smith (1924) called attention to the presence of heavier soil materials in their statement, "In nearly all areas (of Barnstable County) the surface soils are slightly heavier in textures than

*For further information on the geography and geology of Cape Cod, see Shaler (1897) and Woodworth and Gloesworth (1930).

the subsoils..... the only exception to this is found in the southern part of Barnstable County, where a heavy layer of stratified sediments comes near enough to the surface to form the subsoil". Brick works have operated over a great period of time in Sandwich, deriving their materials from the clay layer that outcrops along the north base of the Barnstable Moraine, mentioned below.

Several features mark the present surface area of Cape Cod. Five miles southeast of the town of Plymouth, Manomet Hill, rising to a height of 350 feet, forms the north end of a long ridge that extends in broken fashion directly south to Cape Cod Canal, then continues uninterruptedly to the village of Woods Hole, and out to sea in a curved line to form the Elizabeth Islands. Shaler calls this ridge the Plymouth Moraine.

At Bourne, another such ridge, known as the Barnstable Moraine, breaks off at a right angle and follows the curved line of the north shore eastward to the sea at Orleans.

In the Plymouth area, extending across the north end of Myles Standish State Forest, is still a third and unnamed height of land.

All of these high points are notable for the coarseness of their surface materials, great boulders being of frequent occurrence (see Figure 7).

A second feature of the surface of Cape Cod is the presence of a great number of lakes, ponds and dry depressions, many of which have the appearance of huge, irregular pot holes. Most of these surface depressions occur in a hit or miss fashion across the landscape, but a great number of

them are members of a series of chains, each of which, upon close study, is seen to follow the course of an ancient valley. The levels of the ponds vary relatively little, though they drop gradually as the sea is approached. Depressions whose bases are more than 100 feet above sea level in the Plymouth area, and 60 feet in Barnstable County, are usually dry, thus indicating the absence of heavy soil materials above these elevations.

This absence of heavy soil materials results also in a scarcity surface drainage on lands whose elevation is about 60 to 100 feet. This in a country of approximately 45 inches of rainfall!

Most of the Provincetown fist, and large areas in Barnstable County along the rims of Cape Cod Bay and Nantucket Sound are composed of materials deposited by ocean currents and winds during recent post-glacial time. This material is a very uniform, coarse, and sterile sand.

Part II

The "Original" Forests on Cape Cod

While none of the diaries and records of early explorers and settlers has contained an entirely satisfactory description of the early forests of Cape Cod, these writings do contain invaluable clues which permit a considerable amount of interpretation. When these records have been consolidated and carefully interpreted, one is left with a reasonably accurate picture of these forests at the time of the Pilgrim landing.

Provincetown Harbor was known to men of the sea long before the Pilgrims came to its shore. Early explorers of the North Atlantic Coast, who sought respite from the violent storms of the area, or who were caught in the cul-de-sac which is Cape Cod Bay, were unable to avoid close acquaintance with it. Early descriptions and references to "Cape Cod" refer in particular to the wind-swept fist of land surrounding Provincetown Harbor, a land in the process of creation out of the depositions of off-shore currents and the action of winds.

We can understand, therefore, Captain John Smith's (1616) dismissal of "Cape Cod" as "only a headland of high hills of sand overgrown with shrubby pines, hurts and such trash, but an excellent harbor for all weathers". Champlain was even briefer. He wrote, ... "which we named Cape Blanc because they were sands and dunes which appeared thus".

But how can we explain the following description, contained in the early Pilgrim diary known as "Mourt's Relation" (Bradford and Winslow)? At the time of the landing of the Pilgrims at Provincetown, these authors

wrote, "The ground or earth, sandhills, much like the downs of Holland, but much better; the crust of the earth, a spits (spade) depth, excellent black earth; all wooded with oaks, pines, sassafras, juniper (Chamaecyparis) birch, holly, vines, some ash, walnut (Hicoria). The wood for the most part open and without underwood; fit either to go, or ride in."

The qualification "for the most part" was carefully considered, since a bit later in their journal the authors tell of struggles with "boughes and bushes" which "tore our very armour to pieces".

When this group landed at Plymouth, these same journalists described the vegetation of that spot in almost identical language. They changed their list of trees only to the extent of adding beech.

Another reference to the early vegetation of the outer Cape area is found in Archer's (1602) account of Gosnold's settlement at Cuttyhunk. Gosnold made a temporary landing in the neighborhood of Nauset Harbor, in the town of Eastham. Archer wrote: "The Captain went ashore and found the ground to be full of pease, strawberries, whortleberries ---- the firewood there by us taken was cypress (Chamaecyparis), birch, witch hazel, and beech--"

A close scrutiny of these and other early records forces one to conclude that all of these records are accurate in a limited, rather than in a general sense. The record of the wanderings of the early Pilgrim exploring party (Mourt's Relation) indicates clearly a wide variety of vegetative cover.

Henry David Thoreau (1[illegible]), an outstanding student of plant life, after careful observation of conditions in the town of Truro and Provincetown, in 1850, had the following comment to make with respect to the description

of the original forest which is quoted from Mourt's Relation, above: "Notwithstanding the great changes which have taken place in these respects, I cannot but think that we must make some allowances for the greeness of the Pilgrims in these matters which caused them to see green. We do not believe that the trees were large or that the soil was deep here. They naturally exaggerated the fairness and attractiveness of the land for they were glad to get to any land at all after that anxious voyage. Everything appeared to them of the color of the roses and had the scent of juniper and sassafras..."

"W hen the Pilgrim got to Plymouth, their reporter says again, "The land for the crust of the earth is a spit's depth" -- that would seem to be their recipe for an earth's crust --'excellent black moult and fat in some places.' However, according to Bradford himself, whom some consider the author of part of Mourt's Relation, they who came over in the Fortune the next year were somewhat daunted when they came into the harbor of Cape Cod and there saw nothing but a naked and barren place. They soon found out their mistake with respect to the goodness of the Plymouth soil".

A key to the solution of the contradiction which is implied by these statements has been furnished by Thomas Morton (1637). Morton was a trader, an opportunist who accepted the world as he found it, who ranged widely and was able to mix freely with the Indians because he accepted without prejudice their manner and customs, and because he used as barter the articles in greatest demand by the Indians, namely: guns, bullets, and, where necessary, liquor.

Morton has given us a series of word pictures of these Indians and their customs that are a priceless contribution to the early literature of south-eastern Massachusetts. In the following statement, he makes the greatest single contribution of any early writer to the clarification of the "original" forest conditions on Cape Cod: "The Savages are accustomed to set fire of the country in all places where they come; and to burn it twice a yeare, vixe, at the Spring, and at the fall of the leafe. The reason that moves them to do so, is because it would be otherwise so overgrown with underweedes that it would be all a copice wood, and the people could not be able in any wise to passe thru the country out of a beaten path..... The burning of the grasse destroys the underwoods, and so scorcheth the elder trees that it shrinks them, and hinders their growth very much: So that hee that will look to find large trees, and good tymber, must not depend upon the help of a wooden prospect to find them on the upland ground, but must seek for them. in the lower grounds where the grounds are wett when the country is fired.... For when the fire is once kindled, it dilates and spreads itself against as with the winds; burning continually night and day, until a shower of rain falls to quench it. And this custom of firing the country is the means to make it passsble, and by that means the trees grow here and there in our parks."

Dwight (1821) has explained that "The grounds, which were covered with oak, chestnut, etc., or with pitch pines, were selected for this purpose because they alone were, in ordinary years sufficiently dry". The purpose of this burning was not merely to make the country more passable, but doubtlessly to produce an ever new and tender growth of hardwood sprouts,

and to prevent the shading out of grass, in order to maintain the food supply of deer, as several writers, including Dwight, have pointed out. Forest destruction was not necessary for this purpose. The burning operation was carried out by the Indians in early spring and late fall, and, in so far as possible, against the wind, in order to prevent such a catastrophe.

These contributions, therefore, leave little room for controversy, in so far as the general picture is concerned. Other references made later in the present paper will tend to corroborate the descriptions which follow immediately.

On the elevations above 100 feet (note Morton's reference to a 'wooden prospect') there was revealed to the Pilgrim group an expanse of open park-like forest, the floor of which was fairly well carpeted with coarse grasses. Much of this forest was almost pure pitch pine (Pinus rigida, Mill.), although between one hundred and two hundred feet elevation were numerous stands of nearly pure oak*. Frequent burning prevented the development of shrubby vegetation. On the floor of the pitch pine stands, in particular, these shrubs** awaited only a neglect of annual burning to become a real detriment to travel (Morton, 1637).

As the early explorer dropped down to approximately 100 feet elevation above sea level, red oak (Quercus rubra L.) and beech (Fagus americana Sweet) appeared in the stand, and white and chestnut oaks, and red maple became more numerous. White pine also became an important factor in the stand. Pitch pine was still present in stands of this character. Trees of all species were taller and of better form than those found on the higher elevations. These stands were subject to frequent burning, but fires were

less intense than in stands on higher sites, because heavier foliage and somewhat finer soils resulted in a cooler, moister forest floor. Less grass but more small shrubs and vines, were present in the understory. It is possible that grape (Vitis spp.), the abundance of which is frequently mentioned by early explorers, began to appear at this elevation. Also green briar (Smilax spp.)

At a level of approximately seventy-five feet, hundreds of ponds and lakes may be found throughout Cape Cod. Springs and small streams also make their appearance. The effect of heavier soils and a shallower water table upon the forest cover was very noticeable to the early explorer.

*Major tree species: Quercus coccinea, Muench., velutina, Lam., Q. alba. L., Q. Prinus., L.

Minor tree species: Red maple (Acer rubrum, L. , gray birch (Betula populifolia, Marsh.), white pine (Pinus strobus, L.)

**Most important elements: Heaths (Vaccinium spp., Gaylussacia spp., Arctostaphylos Uva-ursi, L.); laurel (Kalmia angustifolia, L.); juneberry (Amelanchier spp.); and scrub oak (Quercus ilicifolia, Wang. and Q. marilandica, Muench.)

Forests below this elevation* were protected from fire not only by a moister forest floor, but by physiographic features such as lakes, ponds, swamps, streams and deeply indented arms of the ocean. Here was found the mesophytic association mentioned by Bradford and Winslow, and by Arche (1602) (note figures 8 and 9). A mixture of white pine, pitch pine, hemlock (Tsuga canadensis (L). Carr.), beech, yellow birch (Betula lutea, Michx.), ash (Fraxinus spp.), hickory (Hicoria, spp.) red maple, white and red oak, sour gum (Nyssa sylvatica Marsh.), and holly (Ilex opaca, Ait.) made up the dominant tree association, except on sites with a definitely south exposure. The latter sites were occupied by those species within the above group that were capable of withstanding somewhat drier and warmer conditions, namely: white, black and scarlet oak, white and pitch pine, and possibly beech.

The great bogs of Cape Cod were occupied by a luxuriant growth of coast white cedar (Chamaecyparis thyoides (L.) BSP) in the early seventeenth century. Areas close to tide-water, whose character was more in the nature of a swamp, were occupied by a thick growth of shrubs. (Bradford and Winslow) and (Thoreau, 1886).

A variation in the above distribution of vegetation was created by the agricultural practices of the red men who had dwelt in this area from time immemorial. Since corn and certain other crops were cultivated by these people, clearings were necessary. Many of these clearings were very large in size. One, whose area is described at fifty acres, was found by an

*On the newer lands, such as the Provincetown fist, Sandy Neck and Monomoy Point, the watertable rose close to ocean level, with the result that xerophilous vegetation was found at a correspondingly low level. A similar situation existed on the Nauset Plains, north of Eastham Village, where a variation in geological history (Shaler 1897) had resulted in the presence of a lower level of sand and gravel materials.

exploring party in the present town of Truro. Another, whose length was five miles, was found by John Goodman and Peter Bourne when they became lost in the woods behind Plymouth village (Bradford and Winslow).

In general, these clearings were located close to the ocean, or to streams since proximity to the water table and to a supply of fish (largely alewives) or crabs for fertilizer was necessary. The work of clearing this land was slow and laborious, due to the primitive nature of the tools used by the aborigines. Trees were usually felled by fire, after they had been killed by girdling. Soils were cultivated until their fertility waned, after which they were permitted to lie fallow, or even to become reforested. Current observations indicate that the most common "old-field" tree species was pitch-pine.

After considering a variety of factors, the most important of which are geology, geography, climate and aboriginal practices, the writer has attempted to summarize forest conditions as they existed in 1620. This summary may be found in Table I, below:

TABLE I

Summary of Land Classes on Cape Cod at Time of Landing of the Pilgrims

Land Class	Barnstable County	Plymouth Area	Total Acres
	% of Land Surface	% of Land Surface	
1. Open Corn Lands	1.5	3.0	8,700
2. Pine Forest - Abandoned corn lands	2.0	9.0	10,000
3, Forest area affected by burning	61.0	74.0	222,800
4. Mesophytic forest association	32.0	16.0	94,000
5. Coast white cedar	1.0	3.5	6,000
6. Swamp and sand waste	1.5	.5	4,200
Total	100.0	100.0	
Total Land Area - in acres	243,700	100,000	343,700

No one is more keenly aware of the deficiencies in the data behind the construction of this table than is the writer. Until more data on early forest conditions are discovered, the writer does not feel justified in attempti a closer break down of cover types for this period.

According to this table, there was present on Cape Cod at the time of the Pilgrim landing, approximately 330,000 acres of timber of saw-log size; that is, timber ranging in diameter from about ten to fifty inches. Approximately 94,000 acres of this cover was of the type known in New England as transition forest, answering closely to the descriptions found in the early Pilgrim journals. About 6,000 acres of land were occupied by pure stands of coast white cedar, while approximately 230,000 acres of land were occupie by stands of timber that varied from pure pitch pine or mixed oak, on the higher elevations, to mixtures of trees that approached the transition type, on the intermediate elevations. A relatively small area (less than 19,000 acres) is estimated by the author to have fallen within the three categories: waste land; agricultural land, and forests whose trees averaged less than ten inches in diameter.

Cape Cod Forests of Today.

In the years 1917 and 1927, data were assembled by the staff of the Massachusetts' State Forester (1917 and MMS) on the forests of Plymouth and Barnstable Counties, respectively. The data were summarized by town-ships into a series of tables, but unfortunately forest classifications were not plotted upon maps. These data present in a fairly satisfactory manner, however, a general picture of forest conditions and other types of land use

on Cape Cod at these dates.

In presenting these data, the writer has been forced to take some liberties in order to make the classification for the Plymouth area and Barnstable County as comparable as possible. Certain values have been expressed in percent of area rather than in acres, in order to facilitate comparisons and contrasts. A summary of these data is contained in Table II, following*. Detailed data for the various townships of Barnstable County may be found in Appendix"A "**.

Although it is obviously impossible to assemble data for the two periods, 1620 and 1920, on an identical basis, Tables I and II do provide a fairly satisfactory means of ascertaining the changes which have been brought about as the result of 300 years of the stewardship of white men.

Consideration of the problems created by these changes will be found in later sections of this study.

*Due to the fact that the Plymouth Quadrangle includes not only the Township of Plymouth, but also portions of three other townships of Plymouth County, the data for the Township of Plymouth, expressed in percentage of the total land area, is used as representative of the entire portion of the quadrangle which lies within Plymouth County.

**There are discrepancies in certain estimates of area between the data contained in these reports and those contained in the U.S. Census for a nearly identical period. Because the reports of the Mass. State Forester contain detailed information with respect to forest conditions that are not found in U.S. Census reports, figures from these reports must be used in Table II and Appendix "A". [illegible] U.S. Census reports reveal changes in [illegible] 1920, data with respect to [illegible] this study will be taken exclusively [illegible]. This unavoidable discrepancy does not greatly affect the picture of current forest conditions, however.

A. Plymouth Area - 1917

Diameter Breast-High - Inches	White Pine	White Pine and Oak	Oak	Pitch Pine & Scrub	Agricultural Land	Residential	Idle	Total %	Acreage
	Percent of total area, exclusive of fresh water surface and tidewater marsh								
Less than 2	-	3.3	6.3*	43.9	9.7	2.8	.3	12.8	13,000
2 - 7	.5	4.0	9.0	12.6				53.5	53,500
8 - 10	.1	.6	2.2	2.2				26.1	26,000
10 or more	.3	.7	.4	1.1				5.1	5,000
Total	.9	8,6	17.9	59.8	9.7	2.8	.3	2.5	2,500
								100.0	[illegible],000

*Includes pure scrub oak, and sprout areas of tree species recently out, burned or killed by insects.

B. Barnstable County - 1927

Diameter Breast High - Inches	Scrub Oak	Pitch Pine & Oak *	Oak	Pitch Pine**	Agricultural Land	Cedar	Residential	Idle	Shifting Sand	Total %	Acreage
					14.2		13.2	9.6	.6	37.8	92,000
Less than 2	12.0	9.0	14.2	17.7		-				52.9	129,000
2 - 7	-	2.4	2.2	4.6		.1-				9.3-	22,600
8 - 10	-	-	-	.1-		.1-				.1-	60
/Total	12.0	11.4	16.4	22.4	14.2	.1	13.2	9.6	.6	100.0	242,660

*Includes pitch pine and scrub oak; and pitch pine and arborescent oak.

**Old field type.

According to Table II, there existed on Cape Cod in 1920 an insignificant acreage of forest containing timber of saw-log size. Most of the timber of saw-log size was not of saw-log quality. The oak was gnarled and badly damaged by gypsy moth and by disease. It was almost entirely of sprout origin. The pitch pine was rarely straight enough to permit utilization of more than short logs. The quality of the white pine was low. Much of this also had been damaged by attacks of the gypsy moth. Red ring r was a common defect in white pine.

There did remain, in the 1920's, a large additional area of land which has been classified as forest; 236,160 acres, to be exact. Of this area, mor than 182,000 acres were covered with growth that was less than two inches in diameter. Of the woody species occupying these 182,000 acres of land, pitch pine and scrub oak were most important. Except for the areas of old field pitch pine in Barnstable County, most of this pitch pine consisted of struggling, fire-scarred sprouts (see Figure 1) that gave little promise of anything more than a mere cover for the land. Very little of the old field pitch pine, in fact, showed markedly greater promise, since it was growing on soils whose small store of fertility had been destroyed by primitive agricultural practices.

Pitch pine not of old field origin is invariably mixed with scrub oak on Cape Cod, while beneath the latter is usually found a ground cover of heaths, sheep laurel, bearberry and other small xerophilous shrubs.

Table II also reveals the presence of approximately 49,000 acres of forest on which the trees ranged in diameter from two to seven inches.

Figure 2 shows an average quality stand of old field pitch pine in this diameter range. Figures 3 and 4 show stands of pure pitch pine not of old field origin, in this diameter range; while Figure 6 shows a stand of mixed oak, the autumnal appearance of which is an illusion, since it has just been stripped of its foliage by the gypsy moth. In the white pine-oak mixtures, all trees have been attacked by the gypsy moth.

Table II shows an additional 5200 acres of forest land upon which the timber averages eight to ten inches in diameter. Most of this is either pitch pine or oak. A small amount of white pine remains in the Plymouth area. White pine occurred in Barnstable County in amounts too small to record. Figure 5 shows a stand of pitch pine in this size range, although conditions of undergrowth have been disturbed.

The picture of forest devastation on Cape Cod today is not a cheerful one to contemplate. Has this destruction of a natural resource been absolutely necessary? Is the current trend toward further destruction, or is progress now being made toward forest restoration? If the forces which have brought about this destruction still [illegible], can we determine, by a study of their operation, how they may be overcome? Do forest conditions on Cape Cod justify any great restorative effort today? If a restorative effort is found to be justified, what values are uppermost today in the determination of forest policy?

These are some of the questions which well up in the mind of the forester when such a dismal picture as the above is presented. It is as an effort to answer some or all of these questions that the history which follows has been written.

PART III

Influence of the White Man - Seventeenth Century

Land Cultivation - The ferment out of which the Pilgrim fathers stepped was a by-product of great social and industrial changes taking place in England at the turn of the Seventeenth Century. The flood of modern knowledge had begun and, even as today, purposeful individuals were able to profit by the confusion of society which resulted. The Pilgrims were village folk, one segment of a large population whose economic underpinning was being rudely struck away by the fencing into sheep runs of the lands that had been expropriated from the old baronage and the Catholic Church by a new landowning nobility, to meet the demands of a revolutionized, wool textile industry. (Abbott 1818) (Goldsmith. The Deserted Village). They differed greatly from many other groups that came to America about this time in that they had no illusions of easy wealth. They were of a class accustomed to labor, and asked only for soil and freedom to think as they wished.

The interest of the Pilgrim group in the land is strikingly revealed in the first ecstatic descriptions of the soil of Cape Cod by the authors of Mourt's Relation. So little prepared, in fact, was the group to draw upon the resources of the sea that there were not even fishhooks among their first belongings. Until the beginning of the eighteenth century, the principal energies of the Old Colony were devoted to agriculture.

The colony increased rapidly in population after the first difficult winter. In 1627, the tillable land was divided among the family groups present, 20 acr being assigned to each family, all remaining land being held in community

The influx of settlers which followed the changes of 1627 was very rapid, taxing the capacity of the land available for cultivation. For the Pilgrims very quickly discovered a harsh fact, namely that when the shore lands, the Eel River Valley, and the land adjacent to Manomet Point (the Carver sandy loam of modern nomenclature) had been occupied, there was very little other land suitable for cultivation in the immediate vicinity of Plymouth Village.

The trend of settlement from this time on is shown by the recognition, about 1638, of the townships of Marshfield, Duxbury, Scituate, Taunton, Seacunke (Rehobeth), Yarmouth, Barnstable, Sandwich and Nausett (Eastham). By 1641, there were complaints about the "straitness and barreness of ye place", which caused many to remove, and much talk of this by others. Attempts at cultivation of the sand country back of Plymouth had largely failed. The acreage in actual cultivation today in the Plymouth area is probably an all-time maximum, or very nearly that, due to the recent development of the cranberry industry.

Land cultivation attained a greater importance during the 17th century in Barnstable County than in the Plymouth area. Unfortunately for agriculture, the judgment of the bank which left Plymouth in 1646 "for better parts" was poor. This group settled on the thin soils of Nausett (Eastham) plains and shortly thereafter began to encounter difficulties with that soil.

There is, of course, no accurate means of estimating the area under cultivation in [illegible] County [illegible] the [illegible] census taking of the 17th century. One method of arriving at the area under cultivation during the 17th century is to divide the population by five to arrive at the number of families (since early records show this to be the average family size) and

then multiply by twenty, the acreage usually assigned to a family (Higgins 1918) A shorter method is to multiply the population by four. The writer has, therefore, prepared a table of population for the towns of Barnstable County, the early figures of which are, with a few exceptions, purely estimates, based upon such indirect information as is available in the various towns. This table is contained in Appendix "B".

The value of the above procedure lies in the fact that it puts a reasonable limit upon speculation with regard to the extent of cultivation in the early days. When the resulting figure is compared to the total acreage in the area, one is able to visualize more clearly the relation of cultivation to the original forests of Cape Cod. Thus, in 1684, Eastham, with a known population of 650, was cultivating approximately 2800 out of a total of 45,000 acres, or 6% of its actual land surface. Barnstable County as a whole, on this basis, was cultivating about 21,000 out of a total of about 243,000 acres or nearly 9% of its land surface. A slight additional acreage was, of course, cultivated by the Indian population.

The small store of fertility in the Eastham soils was rapidly depleted through cropping, leaching and surface erosion. The only fertilizer added to the soil was fish and eel[illegible] (Pratt 1844). Wind hastened depletion on the exposed sites.

Very little material is available on the problems of cultivation in the western towns of Barnstable County for the period previous to 1800. From the observations of Kendall (1809) and Dwight (1822) shortly after the turn of the 19th century, however, we infer that the same problems of soil deterioration were encountered, though on a diminished scale, due to the presence of Gloucester soils and of the clay layers along the northern base of the Cape Cod

moraine and in the southern part of the county, "often near enough to the surface to form the subsoil". (Latimer 1924).

Pasturing of Livestock - In his "Conclusions for the Plantation in New England", written about 1629, Winthrop gave as reasons for the practicability of emigration by the Puritans:

"The possibility of Breeding of Kine wch grows to a greater bulke of body in that country than with us, in this Kingdome, secondly, of Goates wch may easily be transported with small charge. 3dly swine wch breed in great numbers by reason of the abundance of Acornes, groundnutts."

These statements were founded upon reports from the Plymouth settlement, upon which were focused the eyes of all English Puritanism, particularly after the dissolution of the Parliament of 1629.

The pasturing of live stock rapidly became a major factor in the destruction of the forests of Cape Cod. Woods pasture management may be said to have begun with the burning practices of the original Indian inhabitants. Livestock used was the native deer. The white man, however, put the livestock industry on a business basis. His only contributions to pasture management technique, unfortunately, were the axe and a much more intensive use of fire.

Beginning modestly in Plymouth with one bull and three heifers, brought over in 1624, this industry expanded with great rapidity. In 1627, there were one cow and two goats to six persons, also a total of 146 swine. By 1638, cattle brought high prices and cattle breeding was considered to be very profitable. Sandwich was settled by cattlemen from Plymouth shortly after 1624, and was organized as a township in 1637. Cape Cod was furnishing live stock to the settlers who were filling the country to the north and west.

One of the earliest sources of friction between New Englanders and the home country was wool. As early as the 17th century, England had become a manufacturing nation whose economy demanded cheap raw materials and a command of the market for manufactured goods. The Pilgrims had been financed by a group of business men who looked for profit in the above form. The policy of the mother country in supressing colonial manufacture can therefore be understood.

English textiles were high in price and money was scarce in the new colonie With characteristic independence, the colonists insisted on manufacturing their own woolen goods. Plymouth had a fulling mill as early as 1655. In 1656, efforts were made by local governments throughout southern New England to force the home manufacture of textiles. Officials assessed each family for one or more spinners. Each one assessed must, for 30 weeks each year, spin a pound per week of lining cotton or woolen. The penalty was 12d for every pound short. (Weeden 1890). This represented the wool production of about 6 to 8 sheep for each person assessed, since wool, being cheaper than cotton, was most commonly used in the rural districts. In many towns, ordinances were passed for the clearing of commons to make room for sheep. This seems to have been carried out in larger sections of the present towns of Truro, Wellfleet, and Eastham, where the cool, [illegible] produced a very high grade of wool. [illegible] gave a final impetus to this movement.

[illegible] of Foreign Plantations had estimated that there were 100,000 sheep in New England in 1660. (Weeden 1890). From 7 - 10,000 of these sheep were

in Barnstable County. In the Plymouth area, sheep were pastured heavily around the numerous ponds south of the village. Herdsmen were appointed at the town meetings.

A fulling mill is known to have existed in Barnstable in 1687. Other mills may have operated on Cape Cod, although definite records on the subject are not available.

The effect of this pasturing of the forests of the Cape must have been profound. Cattle prefer hardwood sprouts, browsing coniferous seedlings only when feed or water is scarce. Favored species are ash, oak and maple. Sheep and goats will browse heavily on the reproduction of all broadleaf trees and conifers. It does not take many years of intensive mixed grazing to destroy the young growth in a forest. As fast as the large trees on such a grazed area are utilized for lumber and other wood products, the land is reduced to a waste of weak sprouts. If continued on an intensive scale, mixed grazing will eliminate tree growth altogether. On very light soils such as are commonly found on Cape Cod, only grasses, weeds and shrubs of low palatability finally remain where such treatment is continued.

Although no figures are available, it is known that there were fewer sheep in the western townships of Barnstable County than those in the east. In these western townships, cattle occupied the most important place among livestock. Due to the more selective tastes of cattle, and to the poor distribution of water in the western Barnstable County, which caused a concentration of grazing in the vicinity of water holes, it was deemed advisable by owners to burn over the cattle range systematically, in order to improve feeding conditions.

At local town meetings, each year, large numbers of men were appointed to burn over the woodlands before the middle of April. Attempt was made to burn against the prevailing wind.

Utilization of Wood - We have emphasized the relatively minor effect upon the forests of land cultivation during the 17th century and have shown that agriculture made more serious demands upon the forest in the form of pasturage.

Men of the soil also needed houses, fuel and fences. Trade in wood products had interesting possibilities.

The average house contains from 15 to 20 thousand board feet, or the equivalent, of wood products. Barnstable County houses ran somewhat smaller than in the Plymouth area. Otis (1888) states that log cabins were not built in Barnstable County beyond the crude temporary structures of the first settlers. His statement to the effect that the timber was unfit for log cabins needs some modification, since excellent cedar was available in many sections of Cape Cod.

Most of the houses of 17th century Barnstable County were built from local planks, which were either hand sawn or hewn from split logs. Only the wealthy could afford frame houses, and wealth was not common until the whaling, fishin and sea trading industries developed in the following century.

In 1639, a sawmill was established in northern Plymouth County, at Scituate, Massachusetts (Otis 1888). This town quickly developed into an important lumber center. From Scituate came practically all of the finished lumber used throughout the Cape Cod area during the latter half of the 17th century.

It is difficult even to approximate the amount of local timber used for building structures on Cape Cod during this period. In Plymouth, the amount

must have been almost negligible. The thousand or so farm units in Barnstable County in the 17th century used perhaps 30,000,000 board feet of material. When it is considered that much of this material came from the clearing of fields, it will be seen that the demand for building materials was a factor of relatively small importance from the standpoint of forest devastation.

Goodman Hallett (Otis 1888) of Barnstable, considered forty cords of wood to be a good year's fuel supply for his 17th century house. Throughout the year Goodwife Hallett maintained a fire, either in the great fireplace inside of the house or in the outside fireplace at which she did her summer cooking and baking. On the basis of an average volume of 30 cords to the acre, a consumpti of 40 cords per family, and the population table in Appendix "B", it is estimate that approximately 58,000 acres of the original forests of Barnstable County were cut over for fuelwood during the 17th century. In view of the heavy grazing and woods burning practice in vogue at the time, much of the cut-over area must have reprodiced very poorly, if at all.

In the Plymouth area, fuelwood was also a very important factor, but a more difficult one to measure because of the less insular nature of this area. Data on population in this area have been less easy to secure or to estimate. As nearly as can be estimated, less than one-half as large an acreage was affected in the Plymouth area by domestic fuelwood operations as in Barnstable County.

Early continental travellers in America bemoaned the extravagant use of wood fuel and fence posts by the colonists, and predicted early depletion of the forests. Zigzag rail fences protected the cultivated fields of Cape Cod from

the cattle, sheep, hogs and goats that roamed the forest, except in the proximity of the moraines, where stone walls were gradually built up. Many of those rail fences were made of split cedar and were a large factor in the depletion of the coastal white cedar in the swamp areas.

Clapboards which were shipped to England in December 1621 on the "Fortune" were split by hand. Hand-split shingles were also shipped from Plymouth under the pressure of indebtedness. As early as 1635, the Pilgrims were carrying on a profitable business in Europe with lumber manufactured at their outpost on the coast of Maine. Pipe staves and lumber continued to be one of the biggest items of trade with England, Spain and the Indies during the 17th century. It is doubtful that much of the lumber used in this trade came from Cape Cod, but oak pipe staves were sawn in the small mills that operated in the area.

An occurrence which must be considered in discussing the early forests of the Cape Cod area was the hurricane of September, 1635. This storm, to quote Bradford (History of the Plymouth Plantation), "blew down many hundred thousands of trees, turning up the stronger by the roots, breaking the higher pines of the middle, and the tall young oaks and walnut (hickory) trees of good biggness were wound like a withe. The signs and marks of it will remain 100 years in these parts where it is forest".

To one familiar with the qualities of the trees occurring in this forest, it is evident that the "higher pines" which were broken off were largely white pine. The trees turned up by the roots were probably beech, maple, oak, pitch pine and hemlock, as well as some white pine.

The destruction of the Spanish Armada in 1588 brought to a climax the commercial and colonial supremacy of Spain and Portugal. England and The Netherlands were in the ascendancy. Europe had turned its eyes across the seas, and there grew a demand for ships.

British naval officials quickly discovered the superiority of American white pine for ship masts, bowsprits and yard arms. And so likewise did buyers from the Indies, The Netherlands and Ireland, and from Spain and Portugal, which latter two nations were struggling desperately to recover from the catastrophe of 1588. Not only were the best prices to be had in markets outside of England, but payment in these markets was made in gold, whenever the seller so demanded, rather than in goods, as was the shortsighted policy of English buyers. The great scarcity of good currency in the colonies and the abundance of gold in the former markets created a natural economic relation in which this trade was of greatest advantage both to the colonist and to the Dutch and Latin peoples. The tremendous drain upon those forests which were located near the coast can be easily understood.

The reaction in England to this trade quickly made its appearance in the form of the King's Broad Arrow. This mark upon all accessible white pine over two feed in diameter was but one measure of many designed by England to cripple not only Spain and Portugal but her neighboring rival, The Netherlanc Interest in such a policy was completely absent in New England.

In those sectio[illegible] for [illegible]parated from the water, such [illegible] New Hampshire and the Connecticut Valley, [illegible] points of outlet, [illegible] [illegible]irly well. Along the southeastern New England coast, however, ships stole into out-of-the-way harbors and loaded

pine masts, yard arms and bowsprits for forbidden ports. On Cape Cod, men did not grieve because of the lack of sufficient waterpower to handle large logs, when white pine masts 33-35" in diameter brought £96-£115, and larger ones were worth up to £1600, even in England. (Weeden 1890). Under the stimulus of such prices, most of the original white pine of Cape Cod, that had not been damaged by the storm of 1635, was shipped across the seas. Local officials were unable to stop the theft of pine from the town commons, so bold did these prices make the traders in masts; a fact which seems to indicate that many of these officials may have been involved in the trade.

Weeden (1890) has pointed out the fact that the demand for heavy oak ship timbers was such as to make board sawing along the coast unnecessary. The trunks of the oaks were shipped unsawn.

The expanding fleets of Europe needed not only ship masts and good oak, but also resin for naval stores. The tapping of pitch pine became yet another source of friction with England. As was the case with ship masts, the mother country desired to monopolize the supply of resin.

Turpentine brought 8d-6d per barrel delivered at the vessel, in 1678 (Weeden 1890). One man could get a barrell of tar a week when working alone - more than when working with a gang. Freeman (1836) mentions the fact that one Cape Cod town received £[illegible] per year in [illegible] from each person tapping for turpentine on the commons. In 170[illegible], [illegible]66 barrels of tar and pitch were shipped from America, a large portion of which came from New England (Weeden 1890). Much was also used at home. The crude tapping methods in practice, in conjunction with the systematic firing of the woods which was

practiced at this time, was no doubt one more serious factor in the destruction of the original stand of Cape Cod pitch pine.

By 1650, the men of Cape Cod were beginning also to tap the resources of the sea on a commercial scale. Off shore whaling became a factor in local economy. Blubber from beached whales was tried over fires along the shore, and once more the forests contributed their bit to the process. By 1687, 200 tons of oil went to England from Plymouth Colony. There is no means of telling how much was shipped in clandestine fashion to the forbidden markets of the world, but the amount was no doubt large, for the colonists suffered no qualms of conscience in evading the edicts of the Crown. By far the greater amount of the 17th century whale oil was consumed at home, however. The demand of this industry for fuelwood increased constantly up to the end of the century.

In 1624, an expert saltmaker was sent to the Plymouth Colony. While he was not a personal success, his arrival marked the beginning of an industry that was destined to become one more important factor in the destruction of the forests of Barnstable County.

Much of the salt for the early fisheries and for consumption in the homes of New England came from the West Indies. The colonists liked neither its quality nor the thought of paying for a product an unlimited supply of which lay at their front door. Not until the fishing industry began to assume a place of importance in local economy, however, did the production of salt from sea water receive serious attention. By 1670, land was being granted as an inducement to prospective salt makers; largely, no doubt, for the fuel supply contained thereon.

Until 1778, all salt was manufactured by the process of boiling sea water in open pans. The method was inefficient, and extremely wasteful of wood. One cord of wood produced from 10 to 12 bushels of salt. There are no figures on the annual production of salt in the 17th century, but it is safe to surmise that by the turn of the century, it ran into many thousands of bushels. It was not until the 75 years preceding the Revolution, however, that the boiling of salt became a major industry and therefore a major drain upon Cape Cod forests.

Forest Conditions at the End of the Century

The progress of forest destruction in the eastern townships of Cape Cod during the 17th century is indicated by the measures passed by the people of Eastham during this period. In the town records we find the following ordinances and memoranda:

1676. Sergeant Jonathan Bangs and Samuel Knowles chosen to act in town's behalf to seize knots or tar and to prosecute persons of other towns who gather knots or "run" them for tar.

1680. No Indian to cut any wood or pine knots, or to run pine knots on any of the town's commons. Indians shall [illegible] on the commons. Five persons appointed to execute the order.

1680. "Stephen Atwood, Sen. hath grant of an acre of land on Nauset Hills provided he do not plant same to Indian corn."

1683. No sheep, ram or rams shall run at large upon town commons from July 1 to end of October, upon forfeiture of one half of said ram to the informer.

1690. No wood to be cut upon commons by anyone for transportation out of town. Fine of 10 shillings per cord for breach of ordinance.

1694. Cutting and transportation out of township of wood or timber from any source prohibited.

1695. Much trouble being experienced about wood transported out of town. No person whatsoever shall cut any wood or timber on any of the commons or individual lands within Eastham. 20 shillings fine. "Great damage hath been done."

1715. The Town of Truro (a part of Eastham until 1709), having found it impracticable otherwise to prevent great waste of wood on the commons, ordered that the commons be divided. Other towns followed suit about this time.

Shortly after 1700, the Reverend Samuel Osborn, of Eastham, began teaching local inhabitants the use of peat for fuel. Sixty-five years had been sufficient for the people of Eastham to complete the destruction of their forests. From that period to the present, the most important local source of fuel wood in [illegible], [illegible] outer [illegible] areas, has been driftwood picked up along the shores.

Forest destruction on Cape Cod during the 17th century ~~century~~ diminished progressively from the easterly towns to those of the west. Accordingly, the turn of the century found considerable bodies of the original forest still remaining in the present towns of Brewster, Barnstable, Sandwich, Mashpee, Falmouth, Bourne and Plymouth. In particular, Falmouth and Plymouth seemed to have escaped best the heavy cutting

which marked this period. Forest renewal must have been nearly at a standstill over the eastern part of the Cape. It is this situation, in conjunction with the increasing effects of drought, and the attacks of insects and disease brought about by deterioration in site conditions, that hurried the destruction of the forests of Cape Cod during the centuries that followed.

PART IV

Influence of the White Man - Eighteenth Century

Land Cultivation - For better or for worse, the Pilgrims, an agricultural people, settled in a country whose soil was incapable of supporting 17th century, frontier, agricultural practice without a catastrophic upsetting of the slender balance which nature had been able to maintain. Some loss in position of agriculture in 18th century Cape Cod economy is therefore to be expected. The area under cultivation diminished throughout the century.

Cultivated crops were gradually limited to accord with the demands of local consumers. Corn and the cereals were all ground locally. Where water power was lacking, wind was utilized, bringing a picturesque memory of the Holland sojourn to the Cape.

Pasturing of Live Stock - While land cultivation did not increase during the 18th century, agriculture continued its demands upon the forests of the Cape in the form of pasturage. The breeding of cattle for sale to settlers in western and northern New England was taken over by farmers established closer to the frontiers. Some beef was shipped to urban markets on the hoof from the western towns of the Cape, but milk and beef production for local consumption became the principal objective in cattle breeding very early in the century.

There is little mention of goats in the 18th century Cape Cod literature. Hogs, like cattle, were apparently raised only for the local larder. Salt pork, being the least perishable meat of the period, was a standard item in the diet of the fisherman.

The townships of western Cape Cod continued, far into the 18th century, to appoint men to burn over local woodlands. In 1754, for example, 42 men of Sandwich were delegated at town meeting to burn over the woodlands of the town before April 16th.

The struggle for independence from English woolens continued unabatedly until 1713, when the Treaty of Utrecht was signed. Following signature of this treaty came a great influx of English capital into the colonies, largely in the form of staple commodities. Among these commodities were great amounts of linens and woolens that gradually weaned the more prosperous of the colonists away from homespun goods.

It is difficult to determine the effect of this change of taste upon the total volume of spinning in the colonies, due to the rapid increase in population, a goodly portion of which was not in a position to purchase foreign goods. In view, also, of the constant demand of the English mills for raw wool, it is doubtful if this influx of manufactured woolens had any great effect upon the sheep industry itself.

Whatever shrinking in the sheep industry may have occurred after the Treaty of Utrecht was halted around the middle of the century, when the struggle of the colonies with England became intensified. At this time, most towns developed spinning schools to insure higher grades of woolen goods. Factories for manufacture of goods comparable in quality to those supplied by England were encouraged. Manufactures increased rapidly up to and during the Revolution, in defiance of the edicts of the mother country. The Daughters of Liberty, in 1776, "had sessions all day long for spinning, in Providence."

The President and first graduating class of Rhode Island College were entirely clothed in fabrics of American manufacture at Commencement, in 1769. (Weeden 1890).

In one of the smaller towns of New England, 30,000 yards of woolen cloth were manufactured in 1767. Records show the manufacture of as much as 500 - 700 yards of cloth by certain families each year. (Weeden 1890).

This demand for native woolens abated temporarily after the close of the Revolution, when English woolens again flooded the American markets for a time. Independence from the mother country, however, brought a great release in the energies of the peoples of the new nation. Yankee ingenuity and inventiveness came into full blossom, and with it great improvements in the manufacture of textile machinery. The total effect of this improvement in manufacture was to maintain the profits of the sheep industry, which, in turn, exacted a corresponding toll upon the forests of Cape Cod and of southern New England in general.

Utilization of Wood - The destruction of the British Navy in the great storm of 1703, increased the demand upon New England forests for ship timbers, bowsprits, and masts. The forests near the coast were combed by dealers in these items. Moreover, ship building was becoming a home industry. By 1720, Massachusetts was launching 140-160 vessels annually, averaging 40 tons each. Her merchants and fishermen owned 190 vessels averaging over 40 tons. English capital, following the Treaty of Utrecht, pursued a profitable round of trade between America, the Indies and Britain. A cargo of English goods was exchanged in New England for a new ship and a cargo of lumber or fish. The latter cargo was sent to the Indies and exchanged

for a cargo of more precious goods, which were, in turn, brought back to England, where ship and cargo were sold (Weeden) 1890).

The flood of British goods produced an unfavorable balance in trade between America and the mother country which was estimated, a few years after the above treaty, at £200,000 annually (Weeden 1890). The greater part of this unfavorable balance fell upon New England. The total effect was to stimulate illegal cash trade with the West Indies and the continental nations. The slave trade was particularly encouraged. Fish and lumber from New England were exchanged in the Indies for sugar and molasses. The molasses was distilled into rum in New England, which was exchanged in Africa for slaves. The slaves were in turn sold in the Indies and in the Southern Colonies. These activities exerted a constant pressure for liquidation of the forests, particularly those forests lying near the coast, from which timbers and pipe staves could easily be smuggled aboard a ship.

When the towns of Cape Cod finally gave up the futile task of guarding the town commons, during the first fifteen years of the century, many of these lands that still contained merchatable timber were picked up by investors from the larger centers. Speculation in former common lands was greatly stimulated when Parliament freed colonial export of wood and lumber in 1721. Export trade in wood products became next in importance to that in fish and vessels (Weeden 1890). The demand for heavy timbers, from Portugal, Spain and the other nations of Europe, continued to be so great as to preclude the necessity for sawing. Entire trunks of trees were

sent across the water in specially built vessels.

By the middle of the 18th century, it is doubtful if any large timber remained from the original forests of Cape Cod. Yet the demands upon the forests of the Cape were destined always to intensify, until finally these forests had been entirely consumed in the heat of the struggle for possession of a continent.

The development of turpentining in the Carolinas brought an end to that industry on Cape Cod before the middle of the 18th century.

During this century, there developed one of the most devastating of forest industries, namely, the production of potash. The financial inflation which became more and more acute up to the middle of the century greatly encouraged the production of potash. One laborer could cut, clear and burn the wood from four acres of forest in a year. The yield of two tons per acre was worth from £ 40 to £ 60 per ton (Weeden 1890). Unfortunately, the only references to the industry on Cape Cod are vague, and give no inkling of the quantities produced.

As inflation in the New England colonies deepened, toward the middle of the 18th century, English merchants were no longer able to exchange goods for ships at a profit. In 1738, there were but 41 vessels in the stocks of New England, according to official reports. By 1741, the figure had dropped to 15 (Weeden 1890). [illegible] of the greater tonnage [illegible] early vessels, however.

Heavy duties exacted by the Crown did much to create new shipbuilding centers. Remote ports became centers of an illegal traffic in ships, the

volume of which could not be estimated. In 1750, the first professional shipbuilder appeared on Cape Cod in the person of Thomas Agrey. His establishment was located at Barnstable. The industry spread rapidly along the Cape Cod shore. If any great volume of ship timbers still remained on the Cape at this time, they were, no doubt, quickly spotted by these builders. Most of the material for the new ships, however, was brought in from Maine (Pratt 1844), and other points north and east. This could indicate but one thing, namely, the lack of any great amount of proper materials on Cape Cod.

The volume of construction in the illegal shipyards was tremendous. As the foreign trade in ships diminished, shipbuilders found their best markets among the fishermen, whalers and slavers of the New England coast. Kalm (1751) gives a figure of 665 vessels in the Massachusetts cod fisheries between 1766 and 1775. Estimates of the number of vessels in the Cape Cod whaling fleet at the opening of the Revolution ran as high as 1,000. The writer has seen no estimate of size of the slave fleet.

The destruction of the New England fishing and whaling fleet during the struggle for independence had the effect only of stimulating post-Revolutionar construction in these newly established shipbuilding centers. The end of the century saw the approaching climax of the great whaling era of south-eastern Massachusetts. The profits of Salem's China trade did not escape the notice of wealthy Cape Cod fishermen. Before the turn of the new century, the keels of a trade that was to reach a glorious peak in the middle years of the following century, were being laid in the shipyards of C

Not only were ships in demand, but barrels. One 240-ton whaler of 1791 sailed out of Nantucket for the Pacific with a cargo including "440 barrels with iron hoops, and about 1400 barrels with wooden hoops..." (Weeden 1890) This was a comparatively small ship.

Cordwood used in trying blubber was the common ballast of outgoing whalers. The wood consumed by the whaling fleet must have reached an important total.

Bank fishing began in 1730, bringing with it a demand for larger ships and much more salt; for all fish were salted. It is unfortunate that there were no observers of the calibre of Dwight or Kendall on Cape Cod in the years before the Revolution, to give us reliable figures on the volume of salt produced by the boiling process.

Although there are vague references to the tremendous havoc wrought upon Cape Cod forests (Brigham 1920) through use of cordwood in boiling salt, the West Indian product was still able, at the beginning of the American Revolution, to compete with local salt to such an extent that Congress was forced to subsudize salt producers to stimulate domestic production. Under this stimulus, a native of Cape Cod, one Captain John Sears, in 1779 developed the method of solar evaporation. The basis of his method was the exposure of large surfaces of shallow water to the sun's rays. This called for the construction of a great number of shallow trough units measuring 100 feet by 10 feet. Major Nathaniel Freeman brought in the aid of a windmill to pump the sea water, and Reuben Sears of Harwich, in 1793, invented the rolling roof. Stimulated by the profits of an industry

that had lifted itself beyond the need for subsidy, Cape Cod producers worked out refinements in methods of manufacture during the early years of the next century that eventually spread to the west and ultimately put them out of the salt business.

In the interim, however, an industry of major proportions flourished. Production of salt at the turn of the 19th century reached a figure of 40,000 bushels. The new equipment mentioned above had not yet fully replaced the old, so much of this salt was still being boiled out. (Freeman 1838). Approximately 3,000 bushels of Glauber's salts, secured as a by-product of the process, at the proportion of 1 to 15, were produced annually. Glauber's salts could be produced only through boiling of the brine which remained after ordinary salt had been removed. Approximately one cord of wood was required by the removal of 10 bushels of Glauber's salts. (Estimate by author).

White pine boards, pland and dimension stock use in the construction of salt sheds came by water from Maine (Dwight 1822). The piling was local oak and pitch pine.

During the 18th century, the iron industry became an important consume: of wood in the form of charcoal. Iron was first discovered in the bogs of southeastern Massachusetts in the 17th century. A small mill appeared at Taunton, in 1690. The first article produced was the square nail. The production of iron goods became another source of friction between the colonies and the mother country. [illegible] producers were not at [illegible] ipment to England of pig iron. As

late as 1735, only 9 cwt. of raw iron was exported. In 1740, 14 tons were exported, but high exchange as the result of inflation reduced the figure to 2 tons in 1745.

Most of the hollow ware used throughout the colonies during the 18th century came from southeastern Massachusetts. During the Revolution, the mills of the Plymouth area were operating at capacity in the production of cannon balls and arms used by the colonial forces.

The iron industry of this section reached its full stride after the close of the Revolution. Statistics on the industry are of a scattered nature. Mr. George P. Morse, of Wareham, Massachusetts, mentions the presence of 6 or 8 iron mills in the township of Plymouth, and 7 in the Wareham area during the century under consideration. One of the largest, Federal Furnace, opened in Carver, in 1793. Individual plants had very checkered histories.

We see here a great split between the economy of Plymouth and that of the Barnstable area, where shipbuilding, fishing, whaling and the clipper trade were the leading activities of the same period. The rise of the iron industry in the Plymouth area was made possible by the presence of a large amount of wood that could be converted into charcoal. Charcoal was the only fuel used by these mills.

Some idea of the vast quantities of wood consumed may be gained through figures found in Griffin's "History of Carver". In 1[illegible], the employees of the Charlotte Furnace of South Carver made 24,000 bushels of charcoal during the off season of mill operation or enough for six weeks

run of that mill. With an annual run of about six months, the mill would seem to have required about 100,000 bushels of charcoal or the product of about 2,200 cords of wood. Assuming that the average stand per acre at this time was 20 cords, this represented the clear cutting of about 110 acres for the operation of one mill for one year. Since an average of about ten mills drew upon the forests of this area during the latter years of the century, the drain upon the Plymouth forests was very great.

Oak was somewhat preferred to pitch pine for charcoal, yet the latter was acceptable.

The demands of the fuelwood industry upon the forests of the Plymouth area must have been equal, if not greater, than that of the iron industry. The forests of eastern Barnstable County had been so depleted by the time of the Revolution that peat was a common fuel as far west as Brewster and Harwich. It becomes difficult, in fact, to estimate the acreage affected by fuelwood operations for local consumption in Barnstable County during the 18th century because of the lack of definite information on peat utilization. Toward the end of the century, second and third growth timber was being cut over all of the western townships of Cape Cod. On the basis of population figures, a full use of wood for fuel, and a reduction in stand to 20 cords per acre, the harvesting of some 375,000 acres of fuelwood would have been required in Barnstable County alone through the century. This would appear to be a rather high figure.

[illegible], however, considered in conjunction with other demands upon the forest, and with heavy grazing, go far toward an explanation of the present condition of Barnstable County forests. By the end of the century, very little fuelwood remained in Barnstable County outside of the townships of Sandwich, Falmouth, Bourne and Mashpee.

Forest Fires

As destruction of the Cape Cod forests progressed, the presence of slash baked oven-dry by the sun, and the spread of huckleberries, blueberries, scrub oak, and sheep laurel, created a condition whereby forest fires on a modern scale were inevitable. It was no longer an easy matter for the men who burned over the woods each spring to keep fires down on the ground and under control. Fires became holocausts for the first time. In 1762, a great fire is recorded in Sandwich, in which many sheep were destroyed. In 1772, another fire was reported in this area, attended by great destruction of sheep and a heavy depreciation of property. Since there was no agency primarily interested in the control of forest fires, or in records of the same, there is no knowing the full extent of damage caused by fire. Profit in wool so influenced the thoughts of the people of Cape Cod that fires occurring before or after the grazing season were considered by a large portion of the population as blessings rather than ill fortunes.

By the end of the century, such a complete destruction of vegetation had occurred in eastern Barnstable County that shifting sand was a common sight from Yarmouth east. Local ordinances (Kendall 1809) had become necessary, calling for the planting of beach [illegible] by [illegible] on windblown soils.

Conditions at the Turn of the Century

The post-Revolutionary period in United States history was marked by a steady invasion of Europeans, largely English, who crossed the ocean to point a finger of scorn at crudities in the manners and living conditions of the citizens of this young republic. This finger pointing, incidentally, was

usually publishable at a comfortable profit in England or on the Continent.

Fortunately for the present study, a certain Edward Augustus Kendall, Esq. (1809) chose to travel on Cape Cod. Kendall harbored a genuine curiosity for people and for things, and was able to give a very clear picture of all that he saw, in spite of occasional lapses to the level of the criticism so common at this time. He visited Cape Cod in 1807.

Aroused, no doubt, by the aspersions of foreign observers, Timothy Dwight, president of Yale College, devoted much of his time to travel through out eastern America around the turn of the century. His object was that of presenting a true picture of this much-maligned young nation, giving proper recognition to the good things found and holding such matters and conditions up as object lessons to those sections whose culture was at a lower level. Dwight visited the Barnstable area in September 1800, and the Plymouth and Carver areas about 1814.

The picture which these two gentlemen, with such widely different viewpoints, presented of the Cape Cod landscape agrees even in details. It is unfortunate that neither of these travellers got out of the stage coach and walk through the more remote sections of the Cape.

Dwight (1822) travelling from Plymouth to Carver, described Plymouth woods as a "vast yellow pine (Pinus rigida) plain....An entire sameness of prospect everywhere wearied the eye; and approached in many places toward complete desolation". He noted that an iron furnace in Carver was supplied by ore from lakes, one of which yielded 600 tons in a single year. He noted that in the two counties of Plymouth and Bristol were "20 iron furnaces and

as many forges, a number of slitting and plating mills, and a great number of people employed in the manufacture of nails, and other articles of which iron is the material."

Kendall (1890) noted of the Plymouth area that "the herbage is scanty, and the timber, which consists in black pine (Pinus rigida) and oak, is of a stunted growth." Kendall travelled south from Plymouth toward Bourne.

Dwight observed that "the road from Sandwich to Barnstable was hilly and in a great degree bare, bleak and desolate; the inhabitants having universally cut down their forests and groves and taken no measures to renew them." The forest growth in both Sandwich and Barnstable was chiefly pitch pine and oak.

"Between Barnstable and Yarmouth", Kendall noted, "the road enters a wood and the sand disappears..... The trees are small and in places so young a growth as to afford no shade.

"Crowds of caterpillars vainly toiled in the ruts.... to ascent their sides..... Hosts of caterpillars march [illegible] New England.*

"From..... the church in Yarmouth..... [illegible] scenery of Cape Cod, a soil of white sand, generally covered with a sward and with forest while in a state of [illegible] every wind, which [illegible]

*Mr. R. C. Brown, entomologist with the [illegible] and Plant Quarantine, hazards the guess that the forest [illegible] Kendall was the forest tent caterpillar (Malacosoma [illegible]), a native forest pest that defoliates hundreds of thousands of acres in periodic outbreaks.

allows the winds to enter, they speedily tear up whole areas. The plain, around the church, in this part of Yarmouth, exhibits the effects of this violence, for, with the exception of some portions, hourly diminishing in extent, it is one sea of sand." (Kendall 1809).

Dwight found the road from Yarmouth to Orleans "hilly and unpleasant.. the soil principally lean.... the verdure faded prematurely; the forests, which in Dennis extend along the road in one place three miles, are low and unthrifty.... the surface destitute of beauty."

Dwight (1822) observed that little wood grew in Harwich, that imported wood and peat were the fuels used. In Falmouth, Kendall noted that "thickly wooded hills and steep declivities distinguish a great part of the road between Falmouth and Buttermilk, but arrived at the bay the country is more level and open.... composed of rocks and sands."

From Orleans, Dwight found no forest until he reached a point one mile south of the Wellfleet line. From this point to Wellfleet village was a stand "lower and leaner than any we had seen before." A dune area in Eastham covered 1,000 acres.

The hills of Truro were dry, sandy and barren, the soil where not blowing was "covered with short grass, now russet and melancholy."

The Provincetown flora was intermediate between the dune stage and partial stabilization. Sand blew about the houses of the village.

PART V

Influence of the White Man - Nineteenth Century

Land Cultivation: The increase in population of Cape Cod was very rapid from 1800 to the Civil War, after which date began a rapid exodus of young folk to the West, and to the booming textile and shoe towns of central and southern New England. In Barnstable County, the population of 18,900 in 1800 had been doubled by 1860. It is inevitable, therefore, that there should once more be some increase in area cultivated. Both Kendall and Dwight noted a thriving industry in onions in the neighborhood of Barnstable, "thousands of bushels" being exported. Thoreau (1886) found that 1,000 bushels of corn had in the past been sent annually to market "above local use" in Eastham, but estimates that this was no longer possible in 1850.

Dwight (1822) found farmers around the ponds of Plymouth and Carver raising "small crops of rye and maize.... Carver..... is a lean-looking collection of thinly scattered plantations.... and the whole aspect of the country is discouraging. Everything appears as if it had been long at a stand; and as if it could scarcely again become progressive."

Thoreau (1886), touring the Cape on three occasions through the middle years of the 19th century, remarked that "the thin layer of soil from Barnstable thins out and disappears at Truro". Orleans was like a great sandbar. "Generally the plowed fields look white and yellow, like a mixture of salt and Indian meal.... a historian of Chatham says of a part of that town: 'There is a doubtful appearance of soil beginning to be formed. It is styled doubtful because it would not be observed by every eye and perhaps not acknowledged by many'".

Thoreau referred to a sand waste in Eastham of 1700 acres that had once been cultivated for wheat. Not a particle of organic material remained. Sand hills 50 feet high formed in 25 years. Small swamps and valleys were filled. Apparently the sand area mentioned by Dwight had increased in size.

The cranberry industry, which had its first success in Dennis in 1816, developed rapidly in Barnstable County until nearly all cedar swamps that had not been exploited for peat were cleared and cultivated by the end of the century. The clearing of cedar swamps by the cranberry men is largely a twentieth century development in the Plymouth area.

As has been stated, the area of cultivated land in the Plymouth section increased very little after the seventeenth century, until the advent of the cranberry industry at the end of the nineteenth century.

Pasturing of Livestock

The rise of the woolen textile industry in New England coincided with the importation of Merino sheep from the royal herds of Spain. Profiting by the chaos of the Napoleonic Wars, a Vermonter in the diplomatic service of the United States (Wilson 1936) was able to purchase a large herd of Merinos for breeding purposes. The Merino adapted itself readily to the climate of New England and to the demands of the woolen industry. Vermonters performed miracles in breeding. The farmers of Cape Cod quickly purchased stock, with rejuvenating effect upon their herds and pocketbooks. Thoreau, in 1850, remarked that Truro "a few years before was remarkable among Cape towns for the number of sheep raised". By 1850, however, Vermon breeding stock had helped build up a great sheep

industry in western United States and in Australia. Thoreau found only two herds in Truro in 1850. This corresponds with the decline of the wool industry in Vermont. Except for a temporary boom during the Civil War, the industry had, by 1850, entered a sharp and permanent decline.

The Plymouth area also experienced a boom in wool production during the first half of the nineteenth century. Mr. George P. Morse of Wareham relates that up to 1850, all sheep owners from Rochester, Carver and Wareham drove their sheep into the area between Agawam River and Sampson Brook. At least 10,000 sheep were pastured there. The plains around Charge and Fearing Ponds were especially good feeding grounds. The low areas around College and the ponds immediately south also contained such grass. Full-time hersmen kept an eye on the sheep.

Cattle from Mattapoisett and Rochester also seem to have been herded by "men of Plymouth". (Leonard 1907).

In Barnstable County, the peak of agricultural expansion was reached in 1860, when 30.6 percent of the county was classified as farmland. The figure for Massachusetts as a whole was 65.2 percent. Of the total area involved - some 78,000 acres - only 34,336 acres were improved. The remainder was brushy pasture and woods. Pasturage rights were, in addition, leased from owners of purely woodland areas.

The amount of farm land in Barnstable County did not drop greatly from 1860 to 1900. The census figures for the respective years are 30.6 percent and 29.6 percent of the land area. The proportion of brushy pasture and farm woodland was much greater in 1900, however. Pastures in 1900 were seeding rapidly to pitch pine.

Utilization of Wood

Although a considerable volume of sawed materials was produced during the nineteenth century, lumber production on Cape Cod was definitely a minor activity. Except for the existence of a small cooperage industry in Barnstable County, all known mill operations were in the Plymouth area.

Mr. George P. Morse, town surveyor of Wareham, Massachusetts, who has long been interested in local forest history, has stated that a considerable amount of white pine remained within five miles of the Buzzard's Bay shore until 1800. He mentions the presence during the nineteen century of eight or ten long sawmills, each with a cut of ten to fifty thousand board feet per year. Pitch pine as well as white pine was sawed. All lumber was used locally. These were up and down mills, with pitch pine flutter wheels. One such mill was located at the foot of East Head reservoir. The exact period of its operation is not known.

A product of much greater importance in the Plymouth area during the nineteenth century, according to Mr. Morse, was slack cooperage, for which pitch pine was preferred. Most of the stock went into nail kegs, the demand for which was heavy, throughout the century. Pitch pine bolts four feet, seven inches in length, were utilized in making staves for nail kegs. Six mills operated in W[illegible] from [illegible] 0, each with four machines which turned out 10,000 eighteen-inch staves daily per machine. The operation of these plants was seasonal. The total volume of timber utilized by the mills in the Plymouth area reached rather surprising proportions. The writer ventures an estimate of 6,000,000 board feet per year taken from the Plymouth area during good times, on the basis of Mr. Morse's

A barrel shop operated in Harwich for many years but the writer has very little information on the volume of barrel production in the Barnstable area in this or any other period.

The mackerel fishery progressed rapidly after its inception in the early part of the nineteenth century, receiving great impetus with the development of the purse seine in 1853. The production of mackerel ferkins from white pine occupied at least two Wareham mills for an unknown period during this century. It is impossible to estimate the volume of wood utilized. Neither is it known whether or not other mills in the area manufactured this product.

An unknown quantity of barrels for shellfish were also manufactured. Oak was preferred for these. Virginia oak has now replaced the local product in this manufacture.

Shipbuilding was a minor industry along the Plymouth shore. Pitch pine was commonly used for ribs and knees. (Leonard 1907). Shipbuilding in Barnstable County was a major industry, however. Practically all materials used were brought to the shipyards by water, the most important source being Maine. Although mention is made in several recent popular books on Cape Cod of the use of Barnstable County wood for the construction of ships during the century under discussion, the writer agrees with Brigham (1920) that the volume of this wood was insignificant.

Freeman (1[illegible]) reported a salt production for Barnstable County of 40,000 bushels in 1802. Dwight (1[illegible]) listed areas of salt vats totaling 1,213,130 square feet for the same year. Kendall (180[illegible]) reported the

production of salt five years later as 100,000 bushels. He listed areas of vats at this time totaling 30,827,730 square feet. While there seems to be some discrepancy here, construction was, no doubt, ahead of salt production at the latter date. A tremendous expansion of the salt industry was occurring. Dennis, Brewster, Barnstable, Chatham and Yarmouth were the greatest centers of production, with Provincetown, Eastham, Orleans, Truro, Wellfleet and Harwich trailing some distance behind. No production was listed by Dwight or Kendall for Falmouth, Sandwich or Bourne, though it is known that a considerable volume of salt was produced in Falmouth and Bourne during the first half of the nineteenth century. A tremendous expansion of the industry occurred under stimulation of the Restricted Commerce Act of 1809, which compelled abolishment of commerce with England and France, and placed a duty of 12 to 20 cents per bushel upon salt. This duty remained until after the War of 1812. (Church 1909).

Expansion of the salt industry continued until approximately 1940, when competition with the salt mines of the interior became very keen. In the Congressional Records of 1830, the current production of Barnstable County salt works was reported to be 393,537 bushels. Data on the industry contained in these same records tell more clearly than could any words the story behind the sudden and complete disintegration of the salt industry on Cape Cod, after 1840.

	Investment	Men Employed	Production Bushels	Price per Bushel
Barnstable Co., Mass.	$1,379,971	520	393,537	.39
Onandaga Co., N.Y.	$ 402,200	180	1,291,820	.40 - .50

The production in 1827 of 595,322 bushels (Barber 1841) represented the peak, and could have been attained only under the influence of speculation in the years immediately preceeding. The sheer weight of this unsound volume lent speed to the final collapse.

Such was the incalculable effect of a canal built across a strange wilderness to the west.

One factor which made salt production extremely expensive in Barnstable County was the cost of wood used in the salt sheds, all of which, with the exception of the piles, came from Maine. At the peak of production, about 125,000,000 board feet of white pine was in use. Approximately 30,000,000 board feet of pitch pine and oak were in use as piling. Yarmouth, which attained a peak production of 365,000 bushels of salt, was forced to import most of the piling, as were all of the towns to the east. A considerable amount of the imported piling came, no doubt, from Plymouth, where a wood shipping center of some size developed at Harlow's Landing, just south of Salt Pond in Ellisville, during this century.

The production of Glauber's salts ran into many thousands of bushels, but at times did not maintain its position with respect to ordinary salt, due to an oversupply on the market. Production estimates are difficult to make, due to this unevenness in production. For some ten or fifteen years, however, the demand for fuel wood for the boiling of these salts must have

been close to 1500 cords per year.

Containers were not used for salt as it was shipped in the bulk. A large amount of the brine left after the salt had been removed was sold at $1.00 per barrel, but it is doubtful if Cape Cod was able at this time to produce all of the tight, oak cooperage stock needed for these barrels.

By 1848, the iron industry had moved as far east as Dennis, in Barnstable County, where there were seven forges. One furnace operated at Sandwich for many years. Forges at Yarmouth employed 32 persons in 1845. Dennis and Yarmouth forges were no doubt occupied with gear for the shipbuilding industry. A considerable amount of charcoal was used at these forges, and this, together with the charcoal used at Sandwich, constituted a minor industry in this country. (Crowell 1932).

The demand for charcoal in the iron industry of the Plymouth area increased steadily until the advent of the cupola furnace, about 1830, which used Pennsylvania coal for fuel. The production of iron during the first thirty years of the nineteenth century was far greater than at any time during the previous century. The history of the iron industry was attended by many ups and downs in the history of individual plants, which make an estimate of charcoal consumption impossible. The drain upon the forests of the area must have been particularly serious during those first thirty years.

Bloomeries and forges continued to use charcoal after 1830. The iron industry lost ground rapidly after 1850, however, as the result of competion arising out of the discovery of rich ore deposits in the lands to the west.

Nail manufacture continued to resist the trend until about 1875, when it, too, began slowly to lose position.

In the years after the American Revolution, a great demand for fuelwood developed in the rapidly growing industrial centers of New England. As the forests near these centers were depleted, wood was shipped in from ever greater distances. Unfortunately for their forests, the people of Cape Cod profited greatly as the result of these new markets. Dwight (1822), in a diary written in 1800, remarked that 30 vessels were employed in the transportation of fuelwood from Sandwich to Boston.

Early in the century - namely, January 1837 - a very illuminating article appeared in the "Yarmouth Register". The writer deplored the high price and scarcity of wood and recommended forestry measures, including the withdrawal of cattle from the forests. He also urged the use of stoves rather than fireplaces. Mention is made of the increasing use of peat for fuel, and there is a description of the highly subdivided ownership of peat bogs in the eastern townships. "Every ten rods is considered equal to an acre of woodland." Peat sold for 12 1/2 cents per barrel. A dollar's worth of peat was said to maintain a fire as long as two dollars' worth of wood. The writer bemoaned the existence of an "aristocracy of wood sellers."

With the collapse during the middle years of the century of the whaling, salt, wool, shipbuilding, glass and iron industries, and of the China trade, and the gradual concentration of the fishing industry in Boston and Gloucester, following developments in refrigeration and in

methods of fishing, the laboring classes of Cape Cod were forced either to find employment in new or expanding local industries, or to migrate to other sections of the nation, or to reduce their standard of living. The pressure of unemployment prevented any cessation in the exploitation of Cape Cod forests. The cutting of fuelwood is said to have been the most important source of income of the people of Falmouth, from 1850 to 1890. Older residents of this town remember when Megansett, or North Falmouth, was an important wood shipping center. One individual recalled having seen "miles of wood piled up" at this point, when he was a boy. This was approximately 1875. The last boatload of wood left Falmouth about 1900. A large part of the wood cut in Falmouth throughout this period was oak.

The deeply sunken roads that form such an intricate pattern through the eastern half of Plymouth woods give some indication of the large volume of wood that was taken out through Plymouth and Ellisville during the nineteenth century. Mr. George P. Morse has estimated that, in 1850, about 150 men from the towns of Carver, Rochester and Wareham were engaged in Plymouth woods cutting the fuelwood and wood for charcoal which came out through Wareham and Carver. These men worked four months each year in the woods, and averaged between one and two cords per man per day. This would indicate a total cut of approximately 20,000 cords of wood which was utilized either as fuelwood or as charcoal each year. The favorite wood was oak, according to Mr. Morse, large blocks of which were present in the territory west of Halfway Pond.

A very important factor in the later history of the forests of western Barnstable County was the construction of the famous Sandwich Glass Works in 1825. It is said (Crowell 1932) that a representative of the company spent two years acquiring woodlands before the mill was constructed. Pitch pine was the most desirable fuel because of the intense heat developed by it. In 1845, the industry had expanded until it boasted of a payroll of 316 persons. From 1825 until the passing of the industry in 1888, the drain upon the forests of western Barnstable County by the glass furnaces was a very severe one.

Pennsylvania coal does not seem to have offered much competition to wood as a fuel on Cape Cod, until the last quarter of the century. In Barnstable County homes, as far west as Yarmouth, peat was used as fuel until 1870.

The appearance of stoves in the first half of the century gradually cut the local consumption of wood from 40 cords to about 15 cords per family per year, an immense saving, but unfortunately one which came too late to greatly affect the forests of the Cape.

Forest Fires

It was not until the nineteenth century that uncontrolled forest fires became clearly [illegible]. As the [illegible] of exploitation intensified, those areas in Plymouth and in western Barnstable County that had managed to retain a semblance of forest form, presented conditions more and more hazardous from the standpoint of forest fires.. The presence of slash was a constant hazard from the origin of the colony, but that factor of which we must never

lose sight was the change in vegetative cover which was the inevitable result of the treatment to which these forests had been subjected.

Centuries of light burning by the original Indian population had left a large area of forest as somewhat park-like in appearance, with a ground cover largely of grass. When the white man combined a cutting of the overstory with heavy grazing and much more intensive burning, however, shrubs began gradually to assume a place of dominance in the vegetation of the drier areas.

In the eastern townships of Barnstable County, where sheep grazing was extremely intensive, only the unpalatable species of grass, herbaceous weeds and shrubs could maintain their position. In the western townships of this county, and in the Plymouth area, where sheep grazing was not carried on so intensively or so constantly, and where large areas without a water supply excluded more than casual grazing, cutting and burning was just the type of culture most conducive to the spread of the shrub species. The elimination of the overstory gave sunlight and vigor to the shrub species. The dessicating effect of wind and sun handicapped the grass and tree species, but had little effect upon the shrub species. The increased root competition of the latter made more and more difficult the reestablishment of the tree species. The increasing severity of forest fires further handicapped pitch pine and the arborescent oaks and reduced their sprouting vigor, but tended to give the shrub species new vigor in much the same way as would a pruning. Insects and diseases began to attack the [illegible] trees. Scrub oak, laurel, the heaths and green briar spread across the landscape. Fires became helocaust

The impenetrability of the hinterland, particularly in western Barnstable County, was far greater at the beginning of the 19th century than in the days of Thomas Morton. Access to very large areas was confined more and more to town roads, many of the woods roads having become overgrown as the timber to which they formerly provided access disappeared. The tangle of roots on the ground made the construction of fire lines extremely slow in contrast to the fast traveling head developed by fires. In the absence of proper public sentiment and organization, any serious attempt on the part of an interested few would have been an enterprise extremely hazardous to huma life. It is not surprising, therefore, that fire fighting was extremely crude as to method and was attempted only when the fate of homes and lives was at stake. So unpopular and hazardous was the task that it became a local custom in Barnstable County for men of one town merely to back fire in such a manner as to head a fire into, or to confine a fire to, a neighboring township, whereupon the fire fighters returned home. In any event, matches and torches became the standard equipment of fire fighters. The question has been posed by the late Mr. Lincoln Crowell, fire warden of Barnstable County, as to which has done more damage in the past - the original fires or back fires.

Unfortunately, little record was kept of forest fires during the 19th century. Forest fires became so common that only those fires that were particularly destructive of property and lives are recorded. Even these records must be dug out patiently from current newspaper files.

In a local newspaper (Yarmouth Register 1837), for example, we read of the great fire of 1837 in the Plymouth area in which much wood in piles was lost. Mr. George P. Morse has described to the writer a great fire in the early 70's "which killed most of the white pine in Plymouth Woods." The great fire of May 18 and 19, 1896, is described at length in local newspapers (Wareham Courier 1911). This fire started near Kinney's [illegible]

mill at South Wareham railroad station, and covered a strip roughly from Charge and College Ponds on the west to the Agawam River on the east. It ran north to the Symington estate near Halfway Pond and to Long Pond Village. H. O. Cook, State Forester of Massachusetts, states (1938) that the acreage covered by this fire was estimated to be 30,000 acres.

The pessimism of generations who had never seen timber of any great value on Cape Cod, and who had come to believe that the soils of the area were not capable of supporting a "real forest", no doubt contributed to the lack of interest shown during the late19th century toward fire control.

With the coming of the railroad to Sandwich in 1848, a new and unrealized resource thrust itself upon the consciousness of the people of Cape Cod. Coastal scenery and a quaint historical background were in demand by tired and bored city folk. The railroad crept to Yarmouth in 1865, and to Provincetown in 1873. Hotels and summer homes mushroomed along the ocean shore. Cape Cod folk soon learned to play down the depressing scenery of the interior.

Neither the railroads nor the summer visitors contributed to the improvement of that scenery, however. A market for oak and pitch pine ties developed. Sparks from the locomotives started additional fires. Special excursions organized by the railroads brought large numbers of enthusiastic but irresponsible week-enders to the Cape, creating a situation more and more discouraging to the pioneers of fire control. Those persons who wished to build summer homes were forced to avoid the beautiful but dangerous sites along the lakes of the interior.

PART VI

Influence of the White Man - Twentieth Century

Land Cultivation in a Period of Social Change

The agriculture of the 20th century has been of a somewhat different nature than was that of previous periods. The last milk train was discontinued about 1920. A few sheep remained in Truro at the turn of the century, but these had become an unimportant factor in local economy. Villagers gave up their horses and cows, with the result that pitch pine began to creep toward the lines of houses.

The acreage of farms in Barnstable County had shrunk to 9.0 percent of the land area by 1930, representing a total of 21,871 acres, of which about 8,000 acres were available for crops and pasture. The abandonment, between 1860 and 1930, of some 58,000 acres, located for the most part in the eastern, central and southern portions of the country, largely explains the presence of an extensive area of old field pitch pine in these sections. About 10,000 of the 21,871 acres of farm lands of 1930 were also actually forested, largely with pitch pine. We see, therefore, a building up of the forest area in these sections of the Cape where the forests were first and most thoroughly wiped out.

The greatest agricultural change in the Plymouth section during the 20th century has been the expansion of the cranberry industry to bogs of that area. This has been attended by an influx of cranberry workers, most of whom cultivate small garden patches.

The year 1920 introduced a new cycle in the agricultural history of

Cape Cod. During the census period 1930 to 1935 there occurred an increase of 132% in the number of farm units in Barnstable County (see Appendix "C").

The area of farm land increased 92%. The value of all farms increased only 33%, however.

The expansion of agriculture during this period has been purely a depression phenomenon; a fleeing of distressed families to the land. Most of the lands recently occupied had previously gone through the cycle of cultivation and abandonment, due to inherently low, or to depleted soil fertility. The type of agriculture attempted on these lands is largely of a subsistance character. Nearly all cash crops are truck and small fruits. Most of the new owners are dependent upon a supplementary income from outside sources for the satisfaction even of the barest essentials of family life.

Data on the agricultural trend during this period, in the Plymouth area, are not available. It is believed that similar developments, on a modified scale, have taken place in this area, however.

It is pertinent to note the accelerated increase in the colored segment of the population during the 20th century. One and three-tenths percent of the total population of Barnstable County were colored, in 1860. In 1900, the figure was 2.2%, while in 1930 it had risen to 5.1%. It is believed that another sharp increase has taken place in Barnstable County since 1930, as indicated in the data on farm owners contained in Appendix "D". Although it is impossible to separate data for that section of the Plymouth area, under discussion, it is believed that the population increase for this group has been even more striking there, particularly in the rural sections.

Excluded by circumstance from a proportionate share in the earnings of the summer industry on Cape Cod, most members of this colored group are dependent upon the soil for a living. Because of their low standard of living, they have been able almost to monopolize the labor on cranberry bogs. Because of their industry and skill as gardeners, they have been able to grow very good crops of vegetables and small fruits on very inferior soils. In spite of intensive cultivation and a low standard of living, however, the simple mathematics of population (See Appendix "B") has created a critical problem.

The recent influx of unemployed white workers from the mill towns of Rhode Island and southeastern Massachusetts, reflected in Appendix "C", has further complicated the labor situation. A study of Appendix "C" indicates the fact that the economic status of the new white farm owners was lower in 1935 than was that of colored farm operators in 1930, and approximately the same as that of colored operators who have settled in the area since 1930. The significance of rural poverty to foresters will be discussed in the section on "Forest Fires", below.

Wood Utilization and Forestry Activities

The story of wood utilization on Cape Cod during the present century is brief and minor. Fuelwood remains the most important wood product. Although coal and fuel oil have replaced wood as a fuel in many Cape Cod homes, these fuels are beyond the means of an important segment of the Cape Cod population. A local supply of wood remains a vital factor in their personal economy.

A small market has existed for railroad ties, but the disappearance of local timber of tie size has now dried up activities in this direction.

An attempt made at Sandwich, in 1921, to conduct a pulping operation in pitch pine was abortive.

Late in the 19th century it became apparent to many citizens that certain problems could not be solved short of public ownership and control. Through the initiative of the Trustees of Public Reservations, a private organization working in the interest of conservation in Massachusetts, the Province Lands behind Provincetown became public property. A program of dune stabilization and reforestation has been carried out since that time. It has since become apparent to those concerned that the production of wood on these new soils is a minor element in this enterprise.

In 1917, the Legislature of Massachusetts voted to establish Myles Standish Forest, in Plymouth and Carver townships. On this forest some 2500 acres of coniferous plantings have been made. A variety of tree species have been used. A wide degree of success was experienced. A variety of cultural measures have been carried out within native stands of timber. The records of these forestry operations lack detail and continuity, so that it is not possible at this time to comment on them.

Recent activities upon Myles Standish Forest have been concerned largely with the development of facilities for forest recreation.

Another state forest of several thousand acres extent was established within the townships of Sandwich and Bourne, in 1923. This was first known as the Shawme Forest, later the Shawme-Crowell Forest. The area has recently been incorporated into the artillery range of the Massachusetts

National Guard. During the 17 years of its existence as a state forest, a considerable amount of this area was planted to coniferous trees, most of which were produced in a nursery located within the forest boundaries. Many parcels of state-owned land located throughout Barnstable County were likewise planted by the veteran forester, Lincoln Crowell, who had charge of state forest activities in this area. Records of these and other state forestry activities in this area are in the files of the state forester.

Largely through the activity of the Trustees of Public Reservations, a fourth important forest area was turned over to the State of Massachusetts in 1934, namely, the Roland Nickerson Forest Park, located in the township of Brewster. Most of the activities on this forest since its establishment have been concerned with the development of facilities for forest recreation.

Other Industry

For two-and-a-half centuries, the economy of Cape Cod was built around certain very tangible resources and traditional activities, notably: the soil (producing cultivated crops, forage for livestock, and wood); the sea (producing fish, whales, salt, and an avenue for trade); minerals (for the production of glassware and iron); and construction (ships and railroad cars).

There remains today of this group only agriculture: which is still a very important source of income due primarily to the presence of bogs suitable for cranberry production; and fishing, which has shrunk to a shadow of its former importance.

Manufactures of textiles and rope, located within the village of Plymouth, have maintained a fairly strong labor market, but the population directly

affected lives either outside or on the far northerly edge of the area under consideration.

During the past fifty years, a strange new industry has developed - that of feeding, lodging, clothing, transporting and entertaining summer visitors. This industry has become the most important factor in the economy of Cape Cod today.

The summer industry was created by a remarkable complexity of geography (proximity to urban centers), tired nerves, sedative village scenery, admiration for a remarkably virile historic past, bracing climate, a shore which permitted the eye to wander without inhibition upon a fresh and primitive landscape, and coastal waters in which unexcelled bathing, boating and fishing could be enjoyed.

The interior of Cape Cod was long looked upon by summer visitors merely as a waste area through which it was necessary to pass in order to reach distant shore points. The growth of the summer industry, therefore, has tended to create a concentration of accommodations and services along the shore, rather than an even expansion throughout Cape Cod.

During the past two decades there has been a minor drift of summer hom construction and camping around the shores of fresh water lakes of the interio [illegible] there is a minority of outsiders (which includes the author) for whom the [illegible] interior [illegible] a subtle attraction, the fact cannot be overlooke that these dry, scrub-covered lands [illegible] too forbidding in [illegible] attract the large numbers whose expenditures provide most of the bread and butter of the people of Cape Cod.

Approximately $25,000,000 is now being spent on Cape Cod each year

by the summer trade. Expressed in terms of population, this represents a theoretical income of approximately $500 for every man, woman and child in the area. Expressed in terms of the land, it is equivalent of an income of $73 from every acre of land on Cape Cod. This is a far higher rate of income than that averaged by agriculture in any state of the Union. It is many times higher than the increment value of our most productive forests.

It is one thing to indicate average income, however, and another thing to consider the actual distribution of this income. A very considerable portion of the profits of the summer trade has been taken by outsiders who have financed hotels, real estate developments, tea houses, general services, and highway construction. College students and roving hotel workers have taken many of th better positions in the summer industry. Large though this income may be, it has not been sufficient to penetrate in any great amount to many of the more ou of-the-way homes of the Cape.

Since 1930, it has become difficult to determine just what will constitute normality of employment in the near future on Cape Cod. With the destruction of her forest capital, and the deterioration of much of her farm soil, Cape Cod has lot some of her economic resiliency in the face of misfortune. Her relief rolls are now long with the names both of white and of colored persons. It has been necessary for the State to take over supervision of the finances of one township in Barnstable County.

Forest Fires

By the beginning of the [illegible] century, large sections of the forests of Cape Cod had become veritable tinder boxes. The [illegible] outlined in earlier sections of this paper was [illegible]

exploitation and the great forest fires of the 19th century. Few forest fires in this area originate either spontaneously or as the result of dry electric storms however. Fires on Cape Cod are the product of human activity.

According to our statisticians, most of the forest fires on Cape Cod at the present time originate from the following causes:

Carelessness of automobiles, picnickers, and hunters.
Incendiarism.
Trash burning around homes and cranberry bogs.

The modern automobile has had an amazing effect upon the habits of men. It has also had an amazing effect upon his environment. Not only does the auto mobile bring hundreds of thousands of persons to Cape Cod from far distant points, but on weekends it brings a great swarm of picnickers from nearby citi These weekend visitors soon discovered the lovely waters that lay hidden amon the little hills of Cape Cod. Those among them who were hunters were amazed at the size of the deer population, and many of them have returned to try their hunting skill during the fall season.

As traffic increases, trunk highways to the area were hard surfaced. Grave side roads, constructed for the benefit of cranberry men, wound in picturesque fashion among the low hills that beckoned to exploring picnickers. A little pon sparkling in the bottom of a green basis - a little campfire or a careless cigarette - sudden flight - a roaring inferno! How often this scene has been enacted on Cape Cod no one will ever know.

Today, observers [illegible] to follow the advance of weekend traffic [illegible] and other large cities, during periods of high fire hazard, by the advancing line of spot fires. When conditions are particularly bad, the haze from forest fires frequently limits observation to a

to a scant mile or two radius from the tower by three or four o'clock on a Saturday afternoon. Towermen are commonly making reports on from three to six or more fires at a time.

Forest incendiarism on Cape Cod may be broken down into three categories or motivations, namely: the desire to produce a crop of blueberries, the desire to create work, and pure maliciousness (a state of mind which may have arisen out of unemployment and malnutrition). Economics is either the sole, or contributing, factor in each of these motivations.

Pressed by genuine want, many members of the low income group have been forced, in traditional Cape Cod fashion, to work out their own destiny. Excluded by circumstance from a more conventional sharing of the income from the summer trade, these people have profited by the knowledge that one well-timed forest fire will create a sea of blueberries almost anywhere in central or western Cape Cod. The market for these berries flows up and down the highways of the area in an endless stream throughout the blueberry season. For what more could a needy but willing laborer ask?

During the present century, many values become twisted. Means often become ends; and so fire fighting has become a seasonal job for a certain element of the local population, with a rate of pay which is higher than that earned on many cranberry bogs. Some of the greatest forest fires of the present century, in this area, have been motivated by the desire of one or more persons to create work.

Maliciousness as a motivation for incendiarism is a factor whose relative weight it is practically impossible to determine. There are few genuine contributions to our knowledge of this matter, though no dearth of opinion.

These opinions usually vary according to the asperity of the contributor.

Many serious fires originate from brush burning around houses and cranberry bogs, due to unexpected changes in wind velocity and direction, to failure to put out the last spark, and to careless issuance of permits. This source of forest fires should be one of the easiest to control.

The establishment of state forests on Cape Cod has been an immense stimulus to local organizations interested in the protection of the forests of this region. Active forest fire protective associations have been organized. That the problem has kept pace with these efforts, however, is illustrated by recent forest fire statistics. During the past ten years, some of the most disastrous fires of the present century have occurred. The most effective experiment to date (Massachusetts Forest and Park Ass'n. 1937) was dropped after three years of encouraging progress, due to lack of administrative and budgetary support.

Forest Parasites

One of the most disconcerting aspects of the modern forest problem on Cape Cod is that of damage from parasites, particularly insects. Kendall's observations in 1807 indicate that insect attacks are not a new phenomenon on Cape Cod. There is no reason for believing, however, that attacks of parasites in the past even approached in severity those of the 20th century.

The loss of complexity of the forest cover is, in itself, justification for such a position. Great expanses of mixed oak, and of pitch pine, are an open invitation to widespread damage by parasites. The reduction in fertility of forest soils, as the result of three centuries of intensive mismanagement, reveals itself in the low vigor of the present cover.

While the records of the past forty years are not complete, it is known that many thousands of acres have been defoliated by attacks of the forest tent caterpillars (1), and that severe damages has incurred by sawflies (2), leaf miners (3), loopers (4), midges (5), twig and tip moths (6), scale insects(and rusts (8). The most destructive parasite that has visited the forests of Cape Cod, however, has been an introduced species, the gypsy moth (9). This insect first became an important factor in 1914. Sugsequent outbreaks occurred in 1918, 1919, 1921, 1925, 1928, 1929, 1932, and every year since the last date (Brown 1938). No other section of New England is attacked so severely or so frequently by this insect, as is Cape Cod (note figure 6). The aimless history of these forest areas has provided a vegetational trend perfectly suited to the needs of this insect. It will probably remain a nuisance to summer people, to owners of real estate, and to operators of cranberry bogs, as long as aimlessness remains the dominant policy in the management of these woodlands.

(1) Malacosoma disstria, Hbn.
(2) Lophyrus lecontei, Fitch; and Diprion simile, Hartig
(3) [illegible]
(4) [illegible]
(5) Diplosis resinicola, Sack.
(6) Evitria comstockiana, Fernald; and Ryacania buoliana
(7) Matsucoccus spp.
(8) Peridermium spp., and Collosporium spp.
(9) Porthetria dispar (1)

PART VII

Summary

At the time of the Pilgrim landing, approximately 97% of the land surface of Cape Cod was covered with forest. On the higher elevations, this forest was park-like in appearance and xerophytic in type. Between the higher and lower elevations there was a gradual transition to a mesophytic association whose principal tree species were white pine, hemlock, pitch pine, red and white oak, white ash, yellow birch, beech, red maple, tupelo, sassafras and holly. Great stands of coast white cedar occupied the bogs.

For 250 years, these forest contributed a constant stream of products that enriched almost every important economic activity of the people of Cape Cod. The ability of these forests to continue growth of such an immense quantity of wood in the face of systematic burning, excessive pasturing, damage to site through clear cutting, and heavy attacks of insects and fungi, is one of the amazing stories of American forest history.

The stream of wood products from the forests of Cape Cod has finally tapered off to a mere trickle, however. Much of the forest area today is occupied by a tangle of scrub growth, and the trees that are present are stunted by fire, the attacks of parasites and the depletion of the soil. At the [illegible] most of those industries to which the area in the past has been [illegible] trends have been closely parallel, and often related.

Within the past few decades, the entertainment of summer vacationists has become an industry of greater proportions than any that has preceded in Cape Cod history.

The summer industry has filled the vacancy left by the decay of 19th century industry in a manner that has been more than satisfactory to a large section of the population of Cape Cod. Because of its seasonal nature, however, this industry cannot provide a complete answer to the economic needs of that large class of local citizens whose only, or principal, asset is its labor.

The summer industry of Cape Cod has been built around a certain environmental complex, one of whose most important elements is the beauty and unspoiled nature of her coastal lands and shore. Because of the hazard of fire, and the low aesthetic value of the forest area of the interior, housing and servicing developments for this industry have been concentrated along the shore to the extent that the very values which have attracted the industry are, in many places, now being threatened. This threat arises not merely from the effect of concentration of summer population and restrictions of private owners upon the enjoyment of the landscape, but from the financial restrictions to newcomers offered by speculative valuation of a diminishing area of desirable land. Thus, indirectly, the forest areas which were at one time such an asset to the people of Cape Cod have become, through mismanagement, an actual liability.

Because of this present hazardous condition, these forests are a further and direct liability in that the cost of fire suppression has become a great burden to the towns of Cape Cod and to the State of Massachusetts.

The lowered productivity of the soil has not led to an abandonment of exploitative processes. These have merely become more desperate and distorted in nature.

Forestry activity on Cape Cod during the present century has lacked the guidance of a consistent, well-defined policy. Local organizations are still occupied almost exclusively with the problem of fire suppression.

The administration of recreational areas which have been developed by the CCC on state lands has been a severe tax upon state forest personnel, and has tended to limit the radius of their activity, even in the matter of fire suppression.

Very little research with respect to local forest problems has been undertaken. Educational activities have been sporadic and inadequate.

Discussion and Conclusion

A soil is a subtle complex of inert and living elements, whose proper balance can be maintained under conditions of exploitation only as the result of conscious and intelligently directed effort.

The destructive exploitation of soil and of its products is most commonly defended as a temporary expedient, which will be corrected by inevitable changes in the alignment of economic forces.

As a matter of fact, the depletion of the soil and forest resources of Cape Cod has made it increasingly difficult for those who depend upon these soils to survive. Many persons have been forced off the land, while others, ironically, have been forced back on to the very same land, necessitating a more intensive cycle of exploitation. Trapped by impoverished soils, many of these people are now forced to resort to such desperate extremities as that of starting forest fires in order that they may be paid to extinguish them, or of accepting public aid which too often has represented a tax upon the unearned income of future society.

When the economic status of persons living upon the land has been reduced to this level, those persons have neither sufficient working capital, the necessary physical and intellectual energy, nor even a secure enough grip upon any part [illegible] building of soil and forest resources. It becomes increasingly difficult [illegible] maintain the level of soil fertility even on those lands on [illegible] they are producing annual crops. It becomes impossible for them to act constructively with respect to a crop for whose earliest possible maturity they must wait

many troublesome and threatening decades. This situation would appear to apply as well to incorporated owners as to individual land owners.

It may be argued that the economic barriers which apply with respect to scarcity operate over larger areas; that the entire national scene must be taken into consideration, since the nation, rather than Cape Cod, is an economi unit; that when a national lumber scarcity has become an accomplished fact, then the application of proper forestry measures will become economically feasible on Cape Cod.

The answer may be found in the literature of the American forestry profession. There has been emphasized, again and again, the increasing rigidity of the barriers to private forestry practice which are set up by the depletion of forest and soil capital, barriers which represent the same or comparable factors as now operate on Cape Cod, namely; the hazards of fire, insects and disease; the problem of working capital; the problems of financial and plant organization created by uneven distribution of age classes; the effect of increasing taxes upon land whose productivity is low; the problem of production costs; the insistence of stockholders that profits are the paramount issue; the competition of [illegible] in other parts of the world.

Of significance in this matter is the lack of evidence to indicate that deterioration of forest and soil capital has proceeded any more rapidly on Cape Cod than in other sections of this nation; or, for that matter, in many of the other lands of this earth. (Bennett 194[illegible]). It is well to remember [illegible] forests of Cape Cod were capable of yielding very respectable volumes [illegible] wood more than 100 years after the arrival of white settlers; that the peak of

agricultural development was not reached until some 225 years had passed; that agriculture still remains an important sources of income on Cape Cod, although much of that income is derived from soils that have been exploited for less than 100 years (i.e., cranberry bogs). The situation with respect to the exploitation of the forest resources of Cape Cod would appear to differ from that in most of the other sections of this land only in the matter of time. It might be said that the exploitive process on Cape Cod has reached a greater maturity than in areas more recently settled.

It may be further argued that the situation on Cape Cod is complicated by the development of the summer industry; that the rebuilding of her forest and soil capital is no longer a relevant issue, since it has been overshadowed by the economic importance of that industry.

The summer industry on Cape Cod represents a form of land use. If the present study has done nothing else, it has indicated the interrelationship and interdependence of all forms of land use. The problem refuses to divide itself into arbitrary spheres of influence and action. The problems of the summer industry are linked with those of forestry and agriculture not merely because this industry is incapable of providing year-around employment to certain peoples of Cape Cod, but because of the increasing difficulty, in the face of forest conditions in the interior, of preserving the subtle balance of values which is the foundation of that industry.

[illegible] been incidental to the satisfaction of various [illegible]. [illegible] of these needs is the only reliable motive around which any program of reconstruction of these resources can be built. The success of such a program requires that the

people of Cape Cod, and her visitors, be convinced of its immediate as well as its future benefits. To date, they have not been so convinced.

The reason for this lack of conviction may not be due entirely to short-sightedness, or to a resistance to educational influences. It seems quite probable that present programs with respect to these lands may not be based upon all of the realities of the situation. Thus, interpretation by conservationists of the term "forest land" appears to have been very narrow, in some instances. For example, certain "forest lands" may be more properly suited to non-forestry activities, such as the systematic production of berries of one kind or another.

Formulation of a sound program of land use requires a groundwork of broad, yet intensive, research, including consultation with all groups whose welfare is directly concerned. Promotion of such a program calls for an educational effort which is sufficiently bold and imaginative to cut through a welter of social maladjustments and trivial, but persistent, distractions. Support of this program requires the type of legislative action which can be secured only through the determined request of intelligent and well-informed citizens.

These are the necessities of the situation. To date, these necessities have not received adequate recognition. Until they have received proper recognition, forest and soil destruction will remain a constantly increasing source of irritation in the social and economic life of Cape Cod.

APPENDIX "A"

LAND CLASSIFICATION - BARNSTABLE COUNTY

1927 Survey
Massachusetts State Forester *

Percent of Total Area, exclusive of water surface and salt marsh

Township	Idle Land	Oak	[illegible]	Pitch pine & oak	Pitch pine	Agricultural	Shifting sand	Residential	Cedar	Total Acres
Bourne	3.8	5.1	[illegible]	15.1	5.8	7.7		13.0		26,189
Sandwich	2.7	24.1	[illegible]	7.2	8.3	9.5		5.0		26,652
Falmouth	4.1	33.3	[illegible]	12.5	12.6	12.7	.9	12.1		28,438
Mashpee	8.9	11.8		25.8	47.8	4.0		1.7		15,289
Barnstable	8.3	13.4	[illegible]	21.7	22.0	18.2	.6	13.0		33,503
Yarmouth	11.0	6.4		4.8	58.3	13.3		5.6		14,398
Dennis	11.5	3.3	[illegible]	6.1	33.4	24.9		7.6	.5	12,434
Harwich	1.0	27.3	1.2	20.0	22.1	14.7		10.7		12,405
Brewster	14.1	32.9	2.1	6.7	26.7	17.4		1.1		13,772
Chatham	1.1	11.7	[illegible]	5.2	28.4	28.4		16.3		9,370
Eastham	[illegible].6	7.4	[illegible]	2.2	18.5	27.8		32.7		7,365
Orleans	.7	9.9	-	3.6	31.0	43.5		11.3		8,717
Wellfleet	21.8	6.1	1.[illegible]	2.8	34.0	2.6		31.2		11,752
Truro	[illegible]	2.8	.4	-	14.8	6.4		40.1		12,927
Provincetown	[illegible].2	25.6					13.8	7.4		5,446
Grand Total	[illegible].8	16.4	[illegible]	11.4	22.4	14.2	.6	13.2	.1-	243,670

Forest by diameter classes - percent of total land area

8-10" dbh				.1-	.1-	.1-
2-7"	2.2		2.4	4.6	.1-	9.3-
2" and under	14.2	12.[illegible]	9.0	17.7		52.9
Total	16.4	12.[illegible]	11.4	22.4	.1-	62.2%

* Unpublished manuscript. All figures above are derived from data contained in this manuscript.

Appendix "B"

BARNSTABLE COUNTY, MASSACHUSETTS - POPULATION STATISTICS 1640-1930

Township	Or[illegible]	1640	1650	1675	1690	1735	1764	1776	1800	1830	1850	1870	1880	1890	1900	1930
Sandwich	1637	200	400	[illegible]	900	1200	1449	1912	2024	3367	4470	3604	1446	1453	1437	151[illegible]
Barnstable	[illegible]	from Sandwich											1657	2590	2595	333[illegible]
Yarmouth	1639	from Sandwich										343	303	242	241	38[illegible]
Falmouth	1686	from Sandwich			200	800	1225	1355	1602	2548	2519	2237	3500	3500	4821	653[illegible]
Dennis	1639	200	600	[illegible]	1600	1800	2108	2610	2964	3974	4901	4703	4364	4835	7271	803[illegible]
Brewster	1639	200	200	[illegible]	1200	1200	2000	2000	1727	2251	2595	2433	1632	1269	1794	209[illegible]
Harwich	1694	from Yarmouth							1408	2317	3257	3260	2333	1536	1529	201[illegible]
Chatham	1712	from Yarmouth			500	1002	1000	(2700) 2392	2987	2463	3253	3080	2324	1649	2339	237[illegible]
Eastham	1646	from Yarmouth							(1810) 1102	1416	1525	1259	689	688	769	71[illegible]
Orleans	1797	from Yarmouth				500	677	930	1351	2130	2439	2411	1749	1737	1931	205[illegible]
Wellfleet	1718		200	(1[illegible]4) 600	850	600	1331	1700	659	966	845	668	502	430	543	60[illegible]
Truro	1709	from Eastham				500	700	900	1152	1549	2051	1269	767	554	513	541[illegible]
Provincetown	1714	from Eastham				(1748) 15	205	500	812	1720	3157	3665	4247	4246	3808	407[illegible]
Wellfleet	1718	from Eastham				300	550	800	1207	2044	2411	2135	988	826	823	948
Orleans	1797	from Eastham							1905	1799	1848	1323	1123	1012	1161	1428
TOTALS		[illegible]	1150	1150	5200	7500	12127	15597	19918	28541	35276	32774	27828	26670	32305	36,64[illegible]

Numbers in italics are estimates. Data from 1830 to 1930 from official Washington census. All other data from miscellaneous sources.

Appendix "C"

Analysis of Certain Data on Agriculture - Barnstable Co., Mass. - Based on U.S.Census of 1935

	All Farms			White Operators			Colored Operators		
	1930	1935	Change in Value	1930	1935	Change in Value	1930	1935	Change in Value
[illegible] Population	1933	4712	+137						
[illegible]ber of Farms	494	1126	+132	467	1011	+121%	17	112	+559%
[illegible] Acreage	21,871	42,002	+ 92	21,638	40,628	+ 87%	183	1,374	+651%
[illegible] Income	$5,045,312	$6,719,657	+ 33%	$4,973,142	$6,403,532	+ 29%	$72,370	$316,125	+335%
[illegible] Value Farms	$10,486	$5,985	-42.0%	$10,650	$6,356	-40.5%	$4,250	$2,828	-33.5%
[illegible]rage Value [illegible] 7 [illegible] 1935		$2,004			$2,620			$2,402	
[illegible]nge in Value [illegible] Farms vs [illegible] Farms			-75%			-75.3%			-42%

Appendix "D"

Population Data - Barnstable Co., Mass. - 1930 - U.S. Bureau of Census

Age	All Classes			White Native		Foreign born white		Negro	
	Total	Male	Female	Male	Female	Male	Female	Male	Female
Under 1	500	257	243	320	292		1	24	17
Under 5	2741	1410	1326	1204	1100	3	4	119	111
5-9	2876	1429	1447	1282	1301	13	15	105	124
10-14	2879	1372	1500	1241	1104	13	17	107	93
15-19	2505	1275	1230	1133	1092	44	50	83	70
20-24	2232	1102	1130	1051	930	34	31	57	83
25-29	2121	1151	1070	927	855	151	131	84	39
30-34	2000	1093	907	841	731	151	164	60	37
35-44	4103	2023	2080	1410	1305	430	437	123	72
45-54	3701	1901	1800	1293	1410	397	462	102	75
55-64	3402	1657	1745	1270	1200	313	373	50	26
65-74	2307	1153	1200	[illegible]	[illegible]	[illegible]	[illegible]	12	13
75 & over	1314	530	800	[illegible]	[illegible]	11	13	4	14
Unknown	54	27	27	24	21	1		2	3
Total	42195	21010	21204	18157	18282	1830	2052	904	758

"About 370 children under 5 years of age per 1000 women 15-45 years of age (childbearing age) are required to maintain population stationary at the 1930 expectation of life in the United States of 61 years." (Baker 1930). ~~Expectation of life for Barnstable County, Mass. is somewhat lower therefore.~~ This ratio varies for various social groups living within Barnstable County, Mass.

	Ratio	Surplus (+) or Deficit (-)
Native White	430.	+ 27%
Foreign born white	7.7	- 95%
All white	407.	+ 11%
Colored	785.	+112%
U.S. average rural non-farm	471.	+ 27%
U.S. average rural farm	545.	+ 47%

Appendix "B"

Farm Land According to Use - U.S. Census 1935 - Barnstable Co., Mass.

	1935 Acreage	1934 Acreage	Change in Value
Total Cropland	5,138	10,546	+101. %
Plowable Pasture	1,872	3,100	+ 65.
Woodland Pasture	341	337	- .5
Other Pasture	1,202	921	- 23.4
Woodland not pastured	9,337	21,633	+130.5
Other Land	3,401	4,940	+ 45.
Total Land Available for Crops	7,030	13,646	+ 94.
Total Farm Land	21,071	40,602	+ 92.

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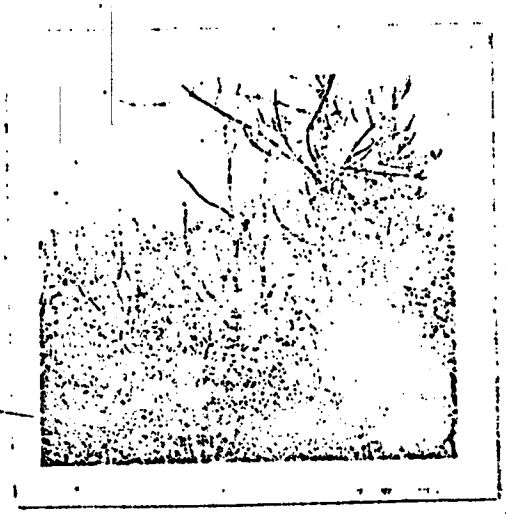


Figure 1.

The ability of pitch pi
to recover from severe fire
injury through sprouting is
one of the most important
reasons for poor form in th
species, since few stands o
Cape Cod have escaped fire
injury. Town of Sandwich,

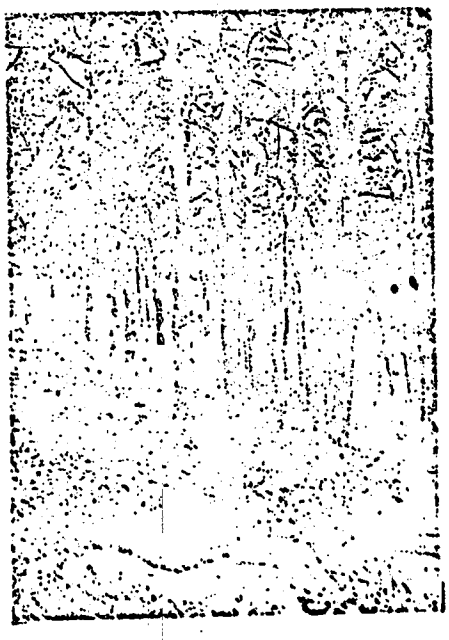


Figure 2.

Old field pitch pine stand,
on a gravelly kame. Note thin
undercover of grass. The only
shrubs present are occasional
bayberry. Roland Nickerson
State Park, Brewster, Mass.

Figure 3.

Stand of pitch pine which has been killed b the looper, Ellopia athasaria, L. Myles Standish State Forest, Town of Plymouth, Mass.

Figure 4.

Stand of pitch pine which has "recovered" from fire injuries simil ar to those shown in Figure 3. Town of Wareham, Mass.

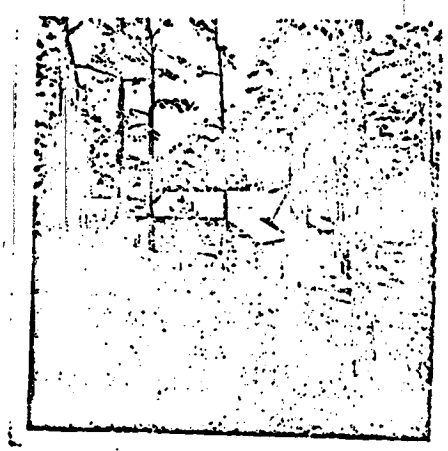


Figure 5.

Public bathhouse on Collo Pond, Myles Standish State Forest, Town of Plymouth, Ma

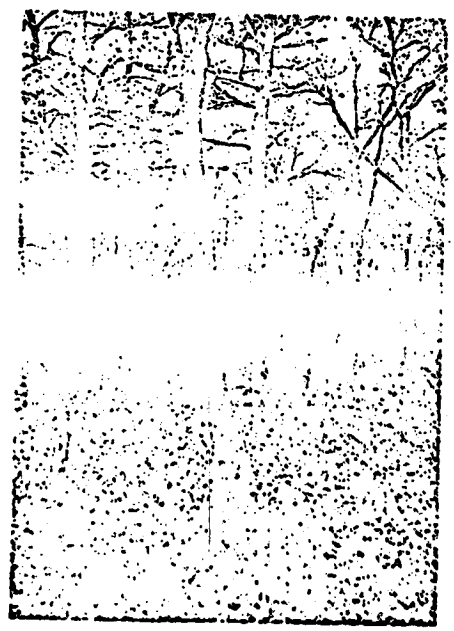
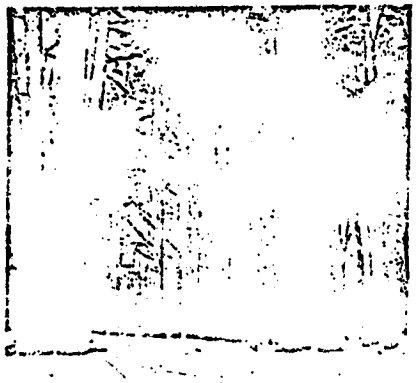


Figure 6.

Scarlet and black oak completely defoliated by gipsy moth, summer of 1939. Picture is blurred by a swarm of moths. Town of Brewster, Mass.

Figure 7.
Scrub oak-heath waste on high lands near Widgeon Pond, Myles Standish Forest, Town of Plymouth, Mass. Planted to conifers about 1930, following severe fire. Note large boulders characteristic of local moraines.



Figures 8 and 9.
A relic of the original mesophytic forest of the lower elevations. Mixed hemlock, beech, yellow birch, red maple, pitch pine and holly. Stand is located on an island in the center of Halfway Pond, Township of Plymouth, Mass. Surrounding country is a frequently burned waste of scrub oak and pitch pine.

white