

Essay: From Forest to Farm and Back Again

The rich history of Petersham, Massachusetts makes an excellent case study for understanding what happened to the New England forest ecosystem after European colonists arrived. Although specific dates for the change from forest to farm and back again may vary from region to region, a similar pattern of clearing forests, farm abandonment, and returning second-growth forests occurred in most regions of the United States.



Figure 1: Wilderness Home

Photo courtesy of Lycoming County Historical Society

From Forest...

The forest ecosystem in central Massachusetts in the 1600s was a subtle patchwork of two types of mature forest communities. In the warmer, lower elevations, the most common trees were oaks and hickories where chipmunks, flying squirrels, turkey, blue jay, and deer grew fat on a diet of acorns, pignuts, walnuts and mocker nuts nosed from under the brittle autumn leaf fall. On the higher, cooler highlands of central Massachusetts, beech, sugar maple, and hemlock made up the hardwood canopy. Red-backed

The Nipmuc People

Originally located in central Massachusetts, northern Rhode Island and northeastern Connecticut, the Nipmuc may have numbered more than 15,000 people before first contact with Europeans. After epidemics due to the diseases brought into their villages by Europeans and casualties and migrations to other tribes due to King Philip's war, this number was reduced by some estimates to perhaps 3,000 people by the late 17th century.

About 2,000 Nipmuc were confined to "praying Indian" villages supervised by Puritan missionaries in remote New England locations, and more than 1,000 Nipmuc sought refuge from the ravages of the 17th and 18th centuries wars with New York State and Canadian natives.

The Nipmuc are most closely related to the Pequot, Mohegan, Narragansett, Wampanoag and Pennacook tribes in language, custom and tradition.

The Nipmuc are currently recognized by the Commonwealth of Massachusetts with about 1,400 members. There are currently 2 reservations - Hassanamisco in Grafton, Massachusetts, and the privately owned Chaubunagungamaug, in Webster, Massachusetts.

Source: <http://www.newiqwam.com/hnipmuc.html>

voles, snowshoe hare, red squirrels and porcupine joined the deer gathering seeds under the leathery autumn leaf fall. Ribbons of white pine and chestnut trees flowed through both forest types.

The Native Americans living in the forests were a group of Algonquin-speaking people referred to as the Nipmuc. The Nipmuc cleared small patches of land in the village they called Nichewaung for Indian corn, squash, beans, and tobacco. They also burned the forests regularly to clear large swaths of the forest to improve habitat for game animals. They harvested all the materials to build their homes, transportation, and house wares from the trees in the forests with stone tools and fire. Narrow saplings were used for wigwam and long house poles. Large yellow birch trees were hollowed out to make canoes--the Nipmuc's primary vehicle of transport. Inner bark of white oak was turned into lashing, rope and thread. Hickory bark was used to tan hides. Sugar maple sap was boiled into syrup.

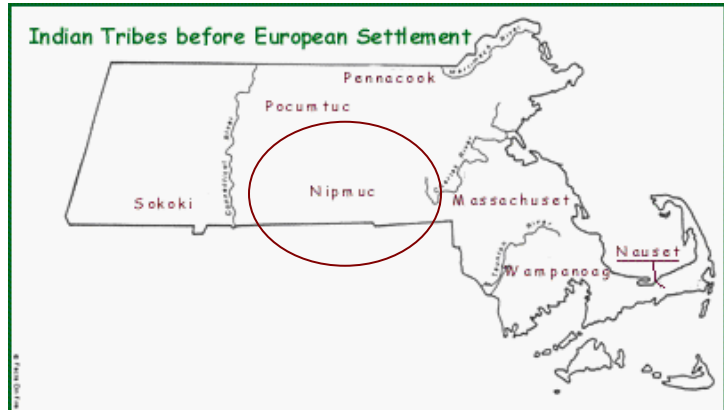


Figure 2: Indian Tribes before European Settlement
Courtesy of Facts on File, 1994.

...To Farm...

In 1733, the colonial settlers of Petersham traveled by boat up the Connecticut River, rather than from Boston on foot. Like the native people, the colonial settlers cleared the land for agriculture and used wood as material for homes, transport, and house wares but with the significant difference of forged iron tools and oxen.

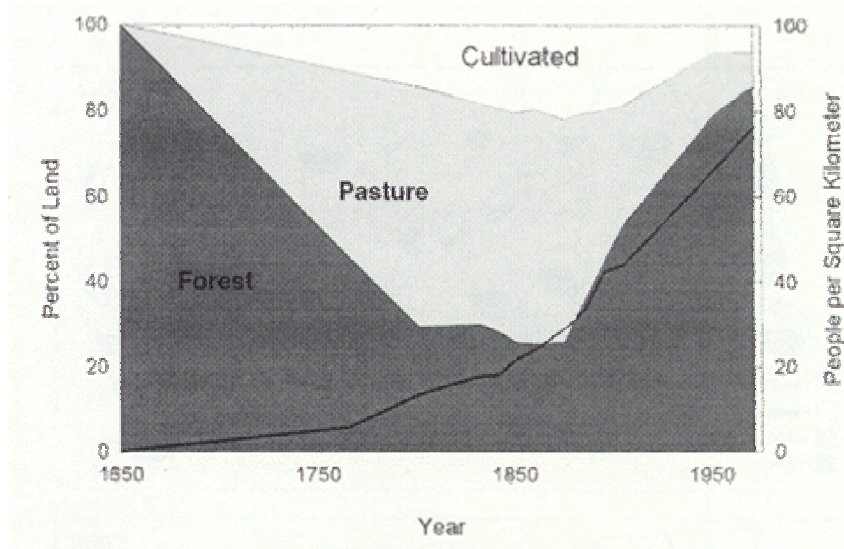


Figure 3: Changes in land use in Massachusetts from 1650-1950.

Dark gray = Forest
Light gray = Pasture
White = Plowed
Black Line = People per Square Kilometer, read x-axis on right.

Source: Foster, David, Glenn Motzkin, and Benjamin Slater. "Land-Use History as Long-Term Broad-Scale Disturbance: Regional Forest Dynamics in Central New England." *Ecosystems* 1 (1998), p. 103.

Forests were cleared for homesteads, livestock pasture, and row crops. Tree trunks became log houses. Saw timber became barns. Worm fences were built to keep livestock corralled. (See figure 4.) Wood heated colonial homes, cooked food, and fueled forges. Horse-drawn wagons or ox-carts were the primary transportation. In 1771, an inventory of land use in Petersham reported 845 acres of livestock pasture, 443 acres of crop tillage, 958 acres of mowing, and 256 acres of meadow. This total of 2,502 cleared acres represented about 12% of the town.

Following the American Revolution, New England entrepreneurs found that they could increase their personal wealth by creating surplus grain and livestock to sell at markets. Farm to market roads improved. More land was put into pasture and rows for crops. As the town grew, water-powered mills were built to grind grain from the farms and saw the lumber for the barns. As income was generated, banks developed and people were able to obtain loans to fund woolen mills, tanneries, and brickyards that consumed more wood for buildings and fuel. By 1830, 77% of the land in Petersham had been cleared and residents of the town of Petersham were prosperously selling meat, grains and produce to the growing cities of Boston and Providence.



Figure 4: Worm Fence
A quick way to fence livestock was the worm fence. In order to avoid digging postholes, timbers were stacked atop each other in a zigzag pattern. These were poorly made, required a huge quantity of wood, were subject to rot, and had to be replaced every 6 to 8 years. *Forest History Society* photo.

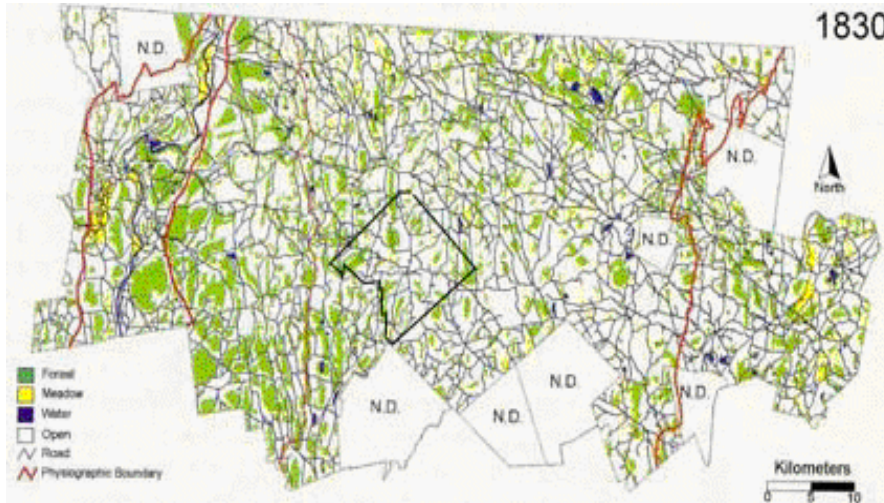


Figure 5: Forest cover in central Mass in 1830.
Green=forest
Yellow=meadow
Purple=rivers, streams
White=open land

Source: Foster, David, Glenn Motzkin, and Benjamin Slater. "Land-Use History as Long-Term Broad-Scale Disturbance: Regional Forest Dynamics in Central New England." *Ecosystems* 1 (1998), p. 105.

Unaware of how the westward expansion would impact the Petersham economy, residents continued to clear more and more land for farming, producing food for the booming cities of Boston, Providence and New York. But by 1850, Bostonians and New Yorkers found that boxcars of wheat, corn, and livestock from Chicago were cheaper than wagonloads from Petersham. Farmers went broke and were forced to abandon their land. By 1870, at least half of the open land was no longer being farmed. Weeds and white pine seedlings sprouted rapidly in the broken ground as forest succession began to reclaim the landscape.

...And Back Again

By the late 1800's, with the countryside so abandoned and unsightly, newspapers ran headlines announcing a "Timber Famine". The U.S. government responded by establishing the United States Forest Service. Colleges and universities responded by opening schools of forestry. Harvard University was one of the first.

In 1907, two graduates of Harvard offered the University a large tract of land in Petersham for their new School of Forestry. The Research Forest became a year-round headquarters for professional foresters studying silviculture and forest management. Harvard has continued to manage the 3000 acres of forestland ever since. Today mixed hardwood forests cover nearly 85% of the landscape in Petersham.

Since its establishment, the Harvard Forest has served as a base for research and education in forest biology. Today, this research and education continues as the faculty, staff and students seek to understand historical and modern changes in the forests of central New England resulting from human and natural disturbance.

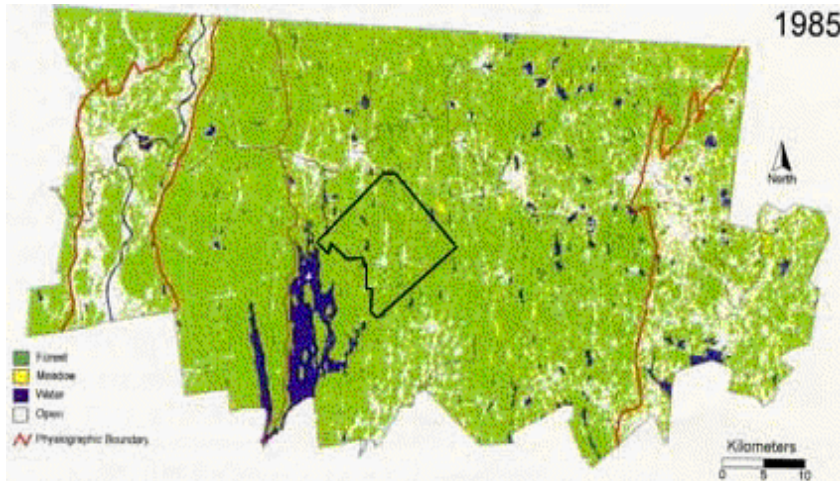


Figure 6: Forest cover in central Massachusetts in 1985 after 80 years of forest succession. Green=forest
Yellow=meadow
Purple=rivers, streams
White=open land

Source: Foster, David, Glenn Motzkin, and Benjamin Slater. "Land-Use History as Long-Term Broad-Scale Disturbance: Regional Forest Dynamics in Central New England." *Ecosystems* 1 (1998), p. 105.

Research conducted by academic foresters reveals that the vegetation in Harvard Forest today is different than the forest the colonists found in 1733. The forest the colonists found was a two-tone forest quilt, with northern hardwood on the cooler highlands and oak hickory on the warmer lowlands. Chestnut ran through both forests, as did patches of white pine. Today the canopy is more like one large piece of mottled cloth, a jumble of hardwoods with no relation to highlands or lowlands. Research is currently underway to determine why.

Conclusion

The use and management of the upland forest ecosystem--first called Nichewaug Hill, then Prospect Hill, and now Harvard Forest--is a classic case study of American forestry. Embedded in this 400-year history is the evolving story of people using their forests. The Native Americans managed the landscape to supply game, boats, housing materials, and small-scale farming. The early colonists subsisted on the land, clearing for agriculture and harvesting for fuel, tools, and housing. The industrious Petersham farmers capitalized on neighboring markets to generate capital and improve their standard of living. Once the land was protected by Harvard Forest, professional foresters researched and demonstrated the practice of silviculture. Today, the Harvard foresters are measuring and recording the successional changes to derive insight into second growth ecological vitality. When left to mature for 100-150 years, the central Massachusetts forest was able to come back, but different from its original condition. The hills and swamps of Petersham bear witness to an ongoing and intimate relationship between people and their forests.

Worksheet 1: Keywords

Read the essay entitled "From Farm to Forest and Back Again." Copy a sentence that uses the word below. Then propose your own definition of the concept.

Algonquin

1. Sentence:
2. Definition:

Land Use

1. Sentence:
2. Definition:

Forest Succession

1. Sentence:
2. Definition:

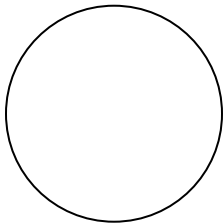
Silviculture

1. Sentence:
2. Definition:

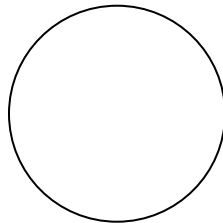
Worksheet 2: Essay Analysis

Read the essay to answer the questions below.

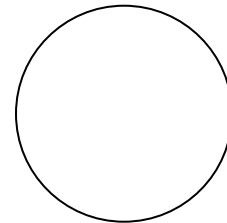
1. Using the graph in Figure 3 of the essay, create 3 pie charts of land in Petersham, contrasting the amount of cleared land (cultivated land and pasture) to forest for the years 1700, 1740 and 1850. (Make the forest black and the cleared land white.)



1700



1740



1850

According to the black line and right axis of Figure 3:

2. How many people lived on one square kilometer in 1700? How were they using the landscape?
3. How many people lived on one square kilometer in 1740? How were they using the landscape?
4. How many people lived on one square mile in 1850? How were they using the land?

Worksheet 3: Historical Record Analysis

Read the history of Petersham, published in the *Worcester County: America's First Frontier in 1793* to answer the questions below.

1. What eyewitness evidence does this history give about past Native American use of the landscape?
2. What eyewitness evidence does this history give about the use of timber for shelter in 1793?
3. What eyewitness evidence does this history give about the types of trees that were planted by the settlers?
4. What drink were farmers able to provide to the town's people?
5. What eyewitness evidence does this history give about the scale and type of crops grown in 1793?
6. What eyewitness evidence does this history give about the industries in Petersham in 1793?

Examine the Dioramas

7. Describe the structure of the landscape in each scene.
 - A. 1700:
 - B. 1740:
 - C. 1850:

Worcester County: America's First Frontier

This document was written in 1793. Enjoy the old style sentence structure and wording.

Petersham

This was an original grant made by the General Court, in the close of the year 1732, or beginning of 1733, to John Bennett, Jeremiah Perley, and others, as a compensation for services performed by them in the Indian wars, under a Capt. John White of Lancaster. The first meeting of the grantees was held on the 10th of May, 1733. Some time after the grant was made, to quiet the Indians who claimed the soil, the proprietors made them a satisfactory consideration therefore. It is rather more than six miles square. It had been a seat for Indians, and was called many years by its Indian name, which was Nichewaug; and in the south part of the town lies Nichewaug Hill, so called by the natives, whereon, as in some other parts of the town, they had formerly planted fields of Indian corn, of which there remained evident traces when the first English settlers began there.

While in its infancy, and struggling for life, so early as 1744, a French war broke out, and the Indians, being always in the interest of the French, they became hostile, and began to commit depredations in various parts of the land, which occasioned the few inhabitants great fear, terror and danger, obliging them to build forts in different parts of the town, round certain houses, into each of which a number of families moved for safety and defense, and soldiers were stationed there as a guard to the inhabitants, and to reconnoiter the country. The people used to labor on their lands, in small parties, changing works with one another, having their guns by them, and these also they were, for a long time, obliged to carry with them whenever they went to the house of God for religious worship, and also to place sentinels at the doors. But although they were often alarmed, yet no white person was ever known to be killed in the place. When peace was settled between England and France, and danger and fear from the Indians ceased, the settlement of the plantation went on very rapidly, and the people were become so numerous and able, as that the place was incorporated with all town privileges April 20th, 1754, and received the name of Petersham.

The natural situation of the town is exceedingly beautiful; it is very high, but not hilly and uneven: The body of the town lies upon the highest land in it, which is a very large long flat hill, upon the highest part of which the great road runs from the south to the north, eight rods wide, and set with trees on both sides, and for three or four miles in length affords a most commanding prospect, not only of the whole town, but of all the adjacent towns. The houses are large and well finished, standing on either side of the street, from whence the land falls each way east and west, about a mile and an half to a stream, and then rises again, especially to the east, where it is fully settled. It is in clear view on the main street, and appears like another town.

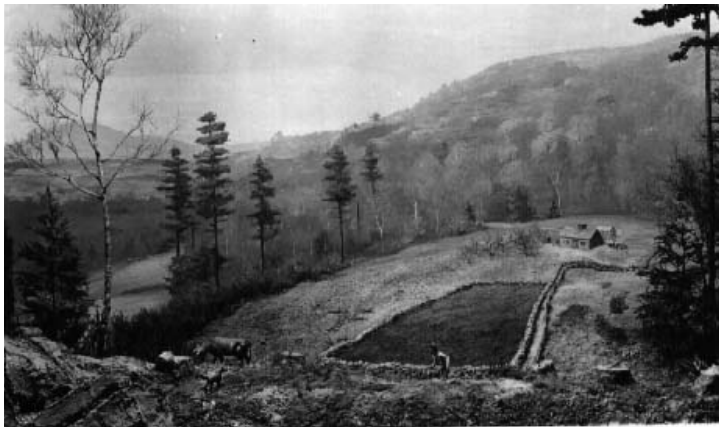
The land in this place is exceedingly favorable to the growth of all kinds of fruit trees, being high and warm; and here are large and excellent orchards, and much cyder is made here, beyond what the inhabitants consume; but they find a ready market for the surplus in the newer settlements.

The soil is rich and fertile, and the lands bear all kinds of grain, but most natural to grass and pasturage, and from the appearance and face of the town, we must judge the inhabitants to be industrious and wealthy, who subsist mainly by the cultivation of the earth. Though the town lies very high, yet the land is not dry, but stony and moist, abounding with springs and brooks of water; there are, however, but two noticeable streams: Swift River, which rises from springs in Gerry, runs to the southwest, through the easterly and southerly part of Petersham, into the northwest part of Hardwick. West Brook, a considerable stream, rises in the northwesterly part of the town, and runs through all the west side of it, and then enters Greenwich, in the county of Hampshire. On each of these there are both corn and saw mills, and clothiers' works; and by the sides of both there are considerable bodies of good meadow land. Here are works for making pot and pearl ash, where much business is profitably carried on, and many persons employed. On the high lands the growth of wood is oak, more chestnut, and a great deal of walnut of later years. In the swamps and low lands, there is birch, beech, maple, ash, elm, and hemlock. This town is situated sixty six miles from Boston, nearly west, and about twenty eight miles from the courthouse in Worcester to the northwest, and is bounded on the north by Athol; on the east, by Gerry and Barre; on the south, by Barre and Hardwick; and on the west, by Greenwich and New Salem, in the county of Hampshire.

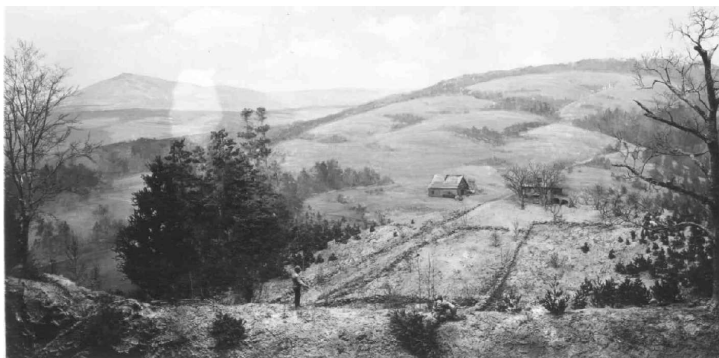
Harvard Forest Museum Dioramas



1700



1740



1850

Worksheet 4: Historical Map Analysis

Map 1: 1765

1. How many people lived in Petersham in 1765?
2. The essay tells us that in 1771 an inventory of the land use in Petersham reported:
 - 845 acres of livestock pasture,
 - 443 acres of crop tillage,
 - 958 acres of upland mowing,
 - 256 acres of meadow.

If we use the 1765 population density map and the 1771 inventory, we can estimate roughly how many acres of forest must have been cleared to meet the needs of one person in Petersham in about 1768. What is your estimate?

Map 2: 1831

3. How many people lived in Petersham in 1831?
4. If the ratio of people to cleared land were the same in 1831 as it was in 1768, how many acres of forest would have been cleared in 1831?
5. The 1771 inventory said that the total of pasture, tillage, mowing and meadow was 2,502 acres or 12% of the town. What was the total acreage of the town?
6. Based upon your answers to # 4 and #5 above, what percentage of the town would have been cleared in 1831?
7. Does the percentage you tabulated in #6 match the information provided in the essay about the amount of land cleared in Petersham by the year 1831? Make sure to provide evidence to support your answer.

Historical Maps: Population Density



Map 1: Population Density in Central Massachusetts, 1765.



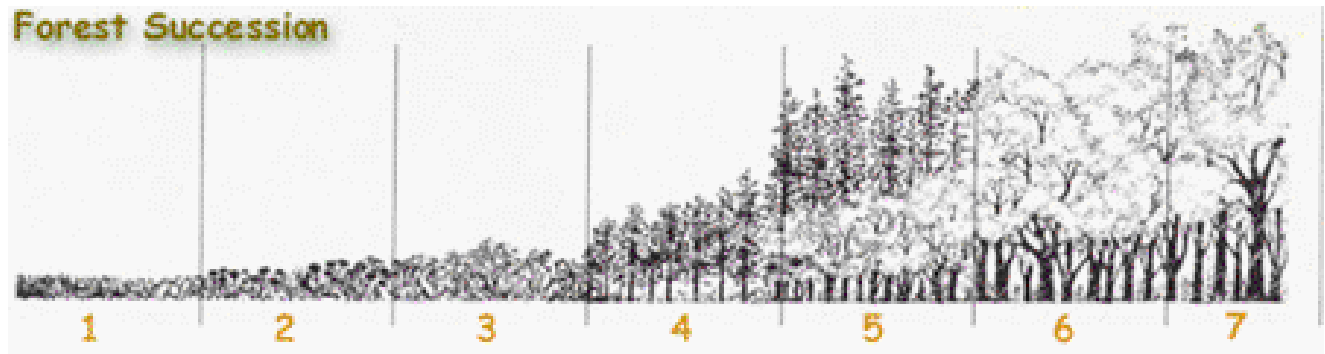
Map 2: Population Density in Central Massachusetts, 1831.

Worksheet 5: Diagram Analysis

Read the Forest Succession handout to answer the following questions.

1. List the species present you find on an abandoned farm in stage 3.
2. One species competes most successfully on abandoned Massachusetts's agricultural sites in the first 80 years. Name that species.
3. What conditions favor the sprouting of trees like beech, maple and oak?
4. Using the forest succession diagram, in what successional stage do you think the Harvard Forest would have been in 1907 when the research forest was created?
5. In what stage would it be now?

Diagram: Forest Succession



Succession of Plant Communities

Vegetation follows established patterns of re-growth and change after disturbance by farming, timber harvesting, or fire. This process of predictable change in the plant species is called **forest succession**. Succession on abandoned fields is rapid. Crabgrass and a mixture of other short-lived herbaceous species dominate old fields in the first stage. In the 2nd stage, larger species such as Queen Anne's lace, asters, and broom sedge raise the height of the vegetation and shade out the crabgrass. Blackberries, sumacs, and other shrubs appear by the third stage. Tree seedlings then begin to rise above the shrub layer, crowding out herbaceous plants in the 4th stage.

On upland fields in central Massachusetts, the earliest invading tree species is white pine. Since the white pine grows faster than the hardwood seedlings, almost pure stands of white pines rise up on abandoned Massachusetts' farmland. White pine dominates the canopy for their life span of 80 to 120 years. White pines drastically change the environment beneath them by decreasing the amount of light reaching the ground and using large quantities of water from the soil. This combination makes it impossible for most white pine seedlings to grow in the shade of mature trees. Thus, shade-tolerant hardwood species begin to grow under them and set the stage for the 5th stage in succession. At the end of that stage, the white pine trees begin to die naturally or become subject to attack by insects or disease. With the pines out of the canopy, the hardwoods grow tall and wide--stage 6. Because most of the hardwood species are able to regenerate in their own shade, the forest continues to mature--stage 7--and maintain itself until the next disturbance.