IV. Present Conditions and Future Prospects

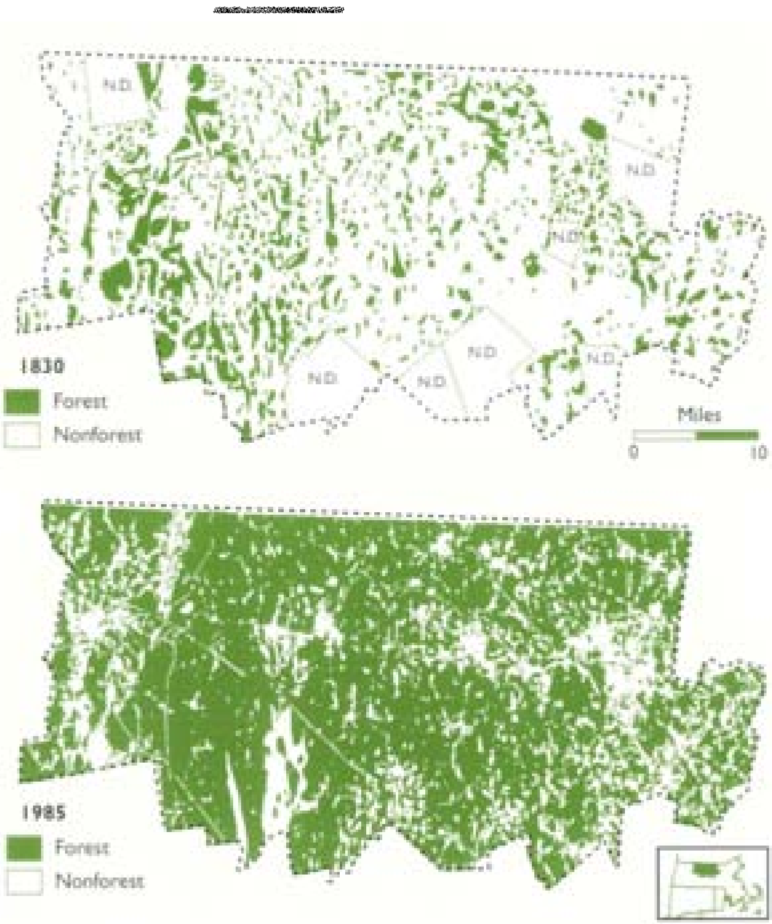
How do the forests we see today differ from the forests the colonists found? The process of deforestation and reforestation has produced landscape patterns that vary with the distribution of natural and cultural features within local areas. Today, open agricultural land is primarily found only in broad river valleys and on the crests of broad ridges. Urban concentrations developed first along the coast and major rivers and later along the railroads, which tended to follow the rivers. More recently, suburban development has occurred along major highways, especially near junctions. Forests now predominate outside these zones, and in protected reserves and some of the wetlands within them, and are under the greatest pressure at the edges of these zones.


PETER DEL TREDICI

Old stone walls surrounded by forest bear witness to abandoned farmland

The changes have strongly favored a new landscape of even-aged forests, with sharp boundaries between types. Agricultural clearing and abandonment, heavy cutting for fuelwood, intensive harvesting of old-field pine and other species early in this century, the hurricane of 1938 with its subsequent salvage harvesting—all these phenomena have combined to create the even-aged forests we find throughout Massachusetts. Land-use regulations and land ownership boundaries create visible differences in vegetation that tend to be perpetuated through time and through changes in ownership. Trends in the size of fields and farms and in regional timber harvesting practices have imposed a repetitive patchwork of forest types that has replaced the natural vegetation patterns. These even-aged forests and imposed patterns increase the possibility that disturbances will in the future cause far more damage than might be expected in a more diverse forest. Moreover, the relative scarcity of very young forests inhibits the growth of species that require this type of habitat.

Although they tend to be even-aged, over the past one hundred-plus years, the forests in Petersham have continually increased in area and size, a trend that has been repeated in forests throughout the state. How has the composition of our forests been affected? The most dramatic change has been the increase in white pine following agricultural clearing and subsequent abandonment. Prior to European settlement white pine was confined mainly to sandy outwash soils that had undergone natural disturbance or to sites heavily burned by Indians; or it appeared as scattered, emergent individuals



Forest cover (shown in green) for north-central Massachusetts in 1830, at the approximate peak of agricultural clearance, and in 1980. Major physiographic regions include the Connecticut River valley, the rough Pelham Hills to its east, and the undulating central upland regions farther east ND indicates no data [34]

in old stands of mixed species. Following agricultural abandonment, especially of pastures, white pine proliferated throughout most of the state on sites it would never have occupied without prior clearing and grazing. Despite intensive harvesting and the 1938 hurricane, white pine remains much more dominant and widely distributed today than it was before European settlement.

On woodlots, repeated cutting for fuelwood and burning for agriculture in the nineteenth century favored an increase in invasive, shade-intolerant pioneer species—gray and paper birch, aspen, pin and black cherry—as well as species that sprout prolifically—chestnut, oak, red maple, hickory, and birch. Chestnut is probably the species that responded most favorably to these nineteenth-century disturbances because it sprouts prolifically from dormant basal buds and is capable of phenomenal rates of growth both in height and diameter when reproducing vegetatively.[32,33]

As our forests have reappeared following the period of extensive cutting at the turn of the century, the loss of chestnut in the teens, the 1938 hurricane, and the more recent initiation of fire-suppression policies, long-lived, shade-tolerant species have gradually increased in number—hemlock, sugar maple, and, to a lesser extent, the highly disturbance-intolerant beech. However, early survey records and pollen analyses suggest that these species, especially beech, remain well below their presettlement distributions. On the other hand, oak, which requires at least moderate disturbance for successful regeneration, may be more common than before settlement.

Significant new harvesting has followed on the recent maturation of considerable areas of Massachusetts forest. At the same time, the environmental awareness that began to develop in the 1960s has led to new regulations on forest-cutting practices;[35] these in turn have raised the extent and quality of professional forest management across the state. The growing understanding that forests do not function in isolation has highlighted the need for regionally mapped information for use in designing management practices within the context of a region or ecosystem. Fortunately, the requirement to file a cutting plan for all harvests greater than 25,000 board feet has made it possible to map current harvesting patterns in much finer detail than was possible in the past.

The Pisgah old-growth tract in Westminster, New Hampshire This forest of 300-year-old white pine, hemlock, and hardwoods was purchased by the Harvard Forest in 1922 in order to protect it from logging and to provide a study area for investigating natural forest processes In the hurricane of September 22, 1938, it was completely blown down, and the area has formed an important long-term study in forest dynamics and recovery from disturbance

Growing environmental interest has also led to the discovery of remnant patches of old-growth forest, once assumed to have been entirely eliminated by the extensive clearing and harvesting of the nineteenth and early twentieth centuries. Although exact definitions of "old-growth" vary considerably, these remnants typically include dominant trees well over two hundred years old and show minimal evidence of human disturbance. At present between 500 and 1,000 acres of old-growth forest are recognized in Massachusetts,[36] and the number continues to rise as more areas are investigated by scientists with a better understanding of what they are looking for, which is not necessarily huge old trees.

Many of these remnants are small patches of barely ten acres—which, according to one current working definition, is the minimum size necessary to prevent significant edge impacts—but some remnants are considerably larger. Most are located on steep, rocky slopes, often on headwater streams, where they were inaccessible for harvesting from either the stream valley or the broad ridges and were somewhat protected from natural disturbances as well.

Not even these sites offer protection from recent human disturbances, which are subtle but pervasive. These include atmospheric pollution and rising carbon dioxide (CO_2) levels, both of which may be implicated in the global warming predicted by many scientists. While neither of these forces has yet had serious, measurable impacts on our forests, both have the potential to significantly alter them in the future.

Because the effects of pollutants are extremely complex, the eventual impact of long-term exposure is still largely unknown.

Map of currently known old-growth stands in Massachusetts.

The amount of nitrogen (NO_X)—an important component of atmospheric pollution—increases as one moves farther west and to higher elevations in Massachusetts.[37] As the major limiting nutrient for plant growth in our soils, nitrogen works initially as a fertilizer, but at higher concentrations it may lead to nutrient loss through leaching.[38] Ozone found at low atmospheric elevations is another pollutant with potentially serious forest impacts.

Elevated CO_2 levels affect the quality of organic matter in the soil through their influence on plant growth, competitive interactions, and leaf chemistry, and have the potential to change global climate. We do not yet understand how forest communities and ecosystem processes might ultimately be changed by elevated CO_2 levels, nor do we know the local effects of global warming. Massachusetts' forests do have some impact on the global CO_2 level: because they are still relatively young and growing, our forests take up and store significant amounts of CO_2, slightly offsetting the increases from fossil-fuel burning and deforestation. CO_2 levels and pollution are both international issues that will require unprecedented levels of cooperation if they are to be controlled.

Our forests have changed constantly throughout geologic and historical time, but human-induced changes over the past three hundred years have been much more frequent, varied, and far-reaching. These changes have been superimposed upon natural disturbances, and where the two processes have acted in concert, as in the 1938 hurricane, the impact has been substantial.

The forests across the state today are quite different from those the colonists and Indians saw—indeed, they are quite different from those of sixty years ago. They will continue to change, but recent trends in carbon storage and increasing volume of wood will undoubtedly continue. Changing ownership patterns will increasingly affect forest development. Over the past fifty years both the term of ownership and the average size of forest properties have continued to shrink as our population has become less and

The tower of the Harvard Forest's Environmental Measurement Station measures exchanges of gases, energy, and moisture between the atmosphere and the forest. These measurements document the surprisingly high rate of carbon uptake by temperate forests that are recovering from earlier land use. It also documents seasonal changes in forest activity due to meteorological changes and ozone stress.

less agrarian and more and more mobile, and—as suburbs encroach on rural areas—as more and more people have built their homes in wooded areas. These trends will influence our forests and their management into the next century. At the same time, demands for forest conservation and preservation will no doubt increase—especially on public lands—as the value of our forests for recreation, amenity, and watershed-protection increases even more rapidly than their value for development or other economic uses. Humans—directly, indirectly, and in conjunction with natural processes—will continue to be the dominant force acting on our forests.

The recovery of Massachusetts' forests is testimony to the resilience of our landscape in the face of centuries of natural disturbance and unthinking human activity. However, it is critical that decisions regarding conservation, forestry, wildlife management—in fact, *all* environmental decision-making—begin with knowledge and an appreciation of the history and dynamic nature of our landscape. Without these, any plan will almost certainly produce surprises, if not failure. The forests have reclaimed abandoned farmland and now cover nearly two-thirds of Massachusetts. As our population expands onto this land, the new suburban forest owners, largely unaware of the history of our forests and only slightly more informed about changes now occurring, must become more knowledgeable about the dynamic nature of their backyard forests. We are blessed with a landscape and a climate that are ideally suited for growing trees and forests, but without an understanding of the past we may unwittingly lose many of the values these forests can provide.

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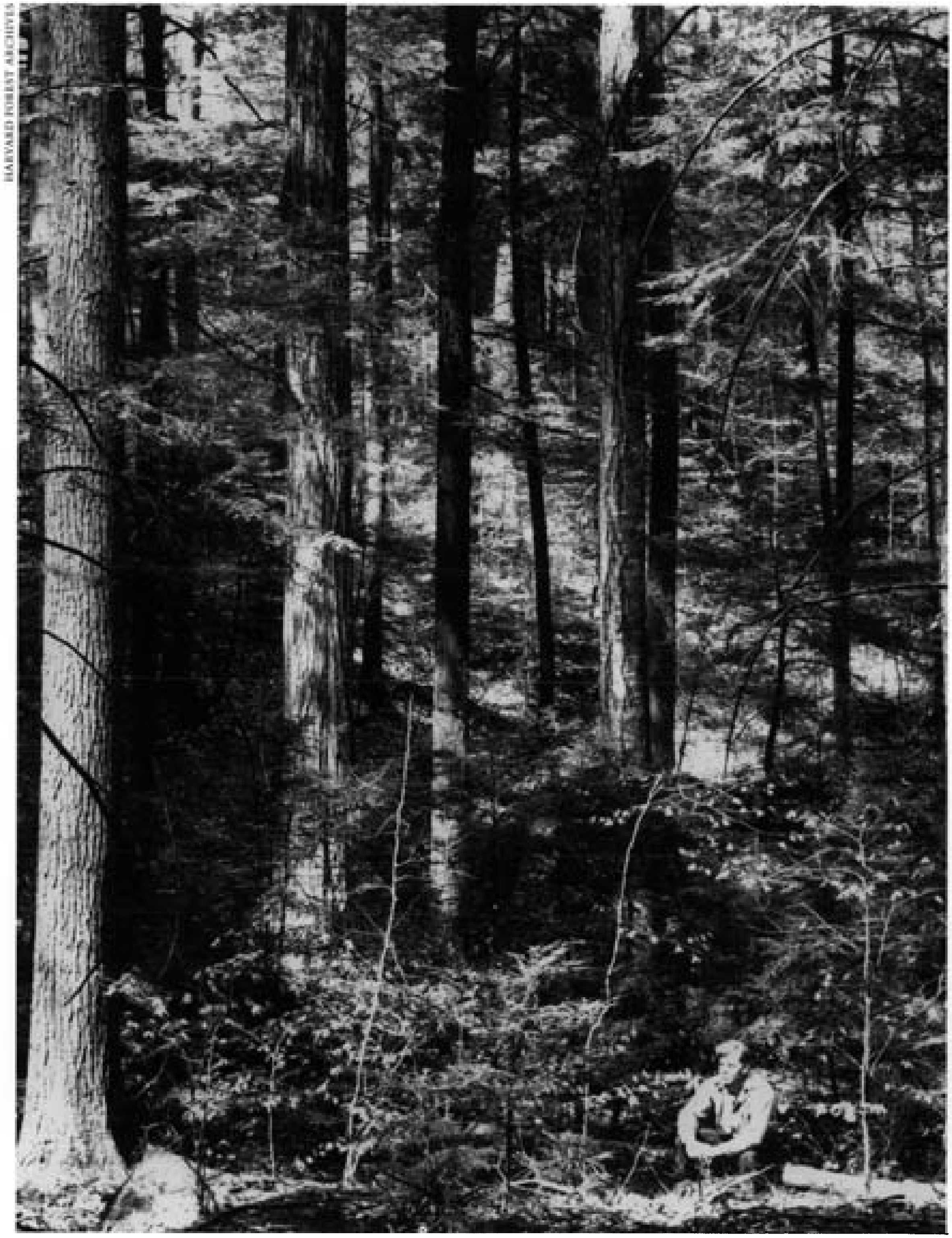

Old-growth forest in New England before the hurricane of 1938