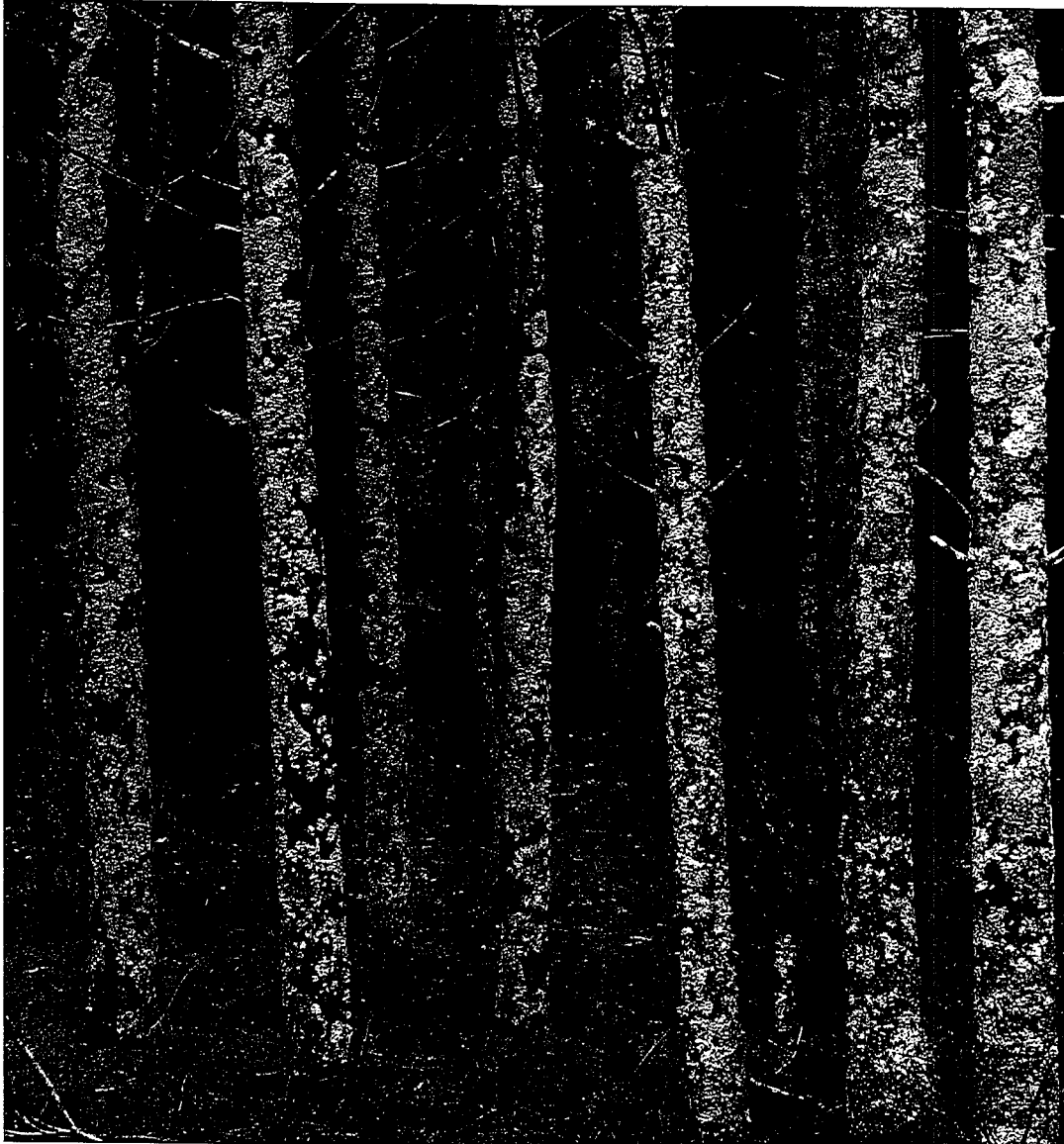


The Forest Primeval

Recent studies of the history of the New England forest indicate that the only constant over the past 1,000 years has been change.

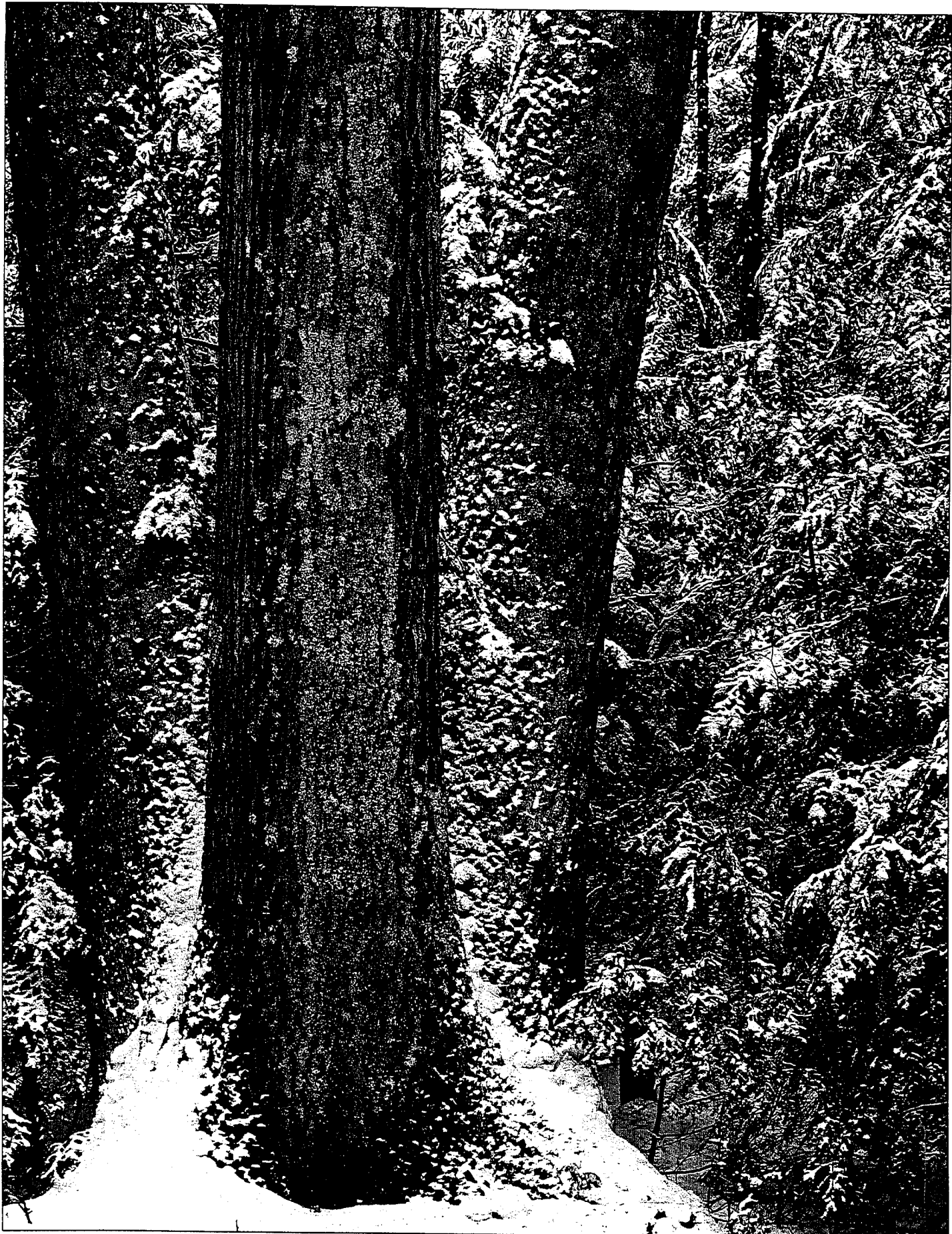
by David R. Foster



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Lichen-covered white pines, Cape Cod, Massachusetts

If you have ever hiked a woodland path in the Berkshires or gazed across the sandplains of the Cape and Islands and wondered what the local landscape was like before the Europeans landed, if nothing else, you were in good company. Beginning with literary figures like James Fenimore Cooper and scholars like Yale president Timothy Dwight, who documented the early nineteenth-century variation in New England's landscape, there seems to have been a preoccupation with the region's primeval nature. Henry Thoreau framed the issue succinctly in 1864. "No one has yet described for me the difference between the wild forest which once occupied our oldest townships, and the tame one which I find there today," he wrote. "It is a difference that would be worth attending to."



Red oaks and hemlocks after snow, Royalston, Massachusetts

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Nostalgia and a fascination with wilderness frequently motivated this quest. But there are important practical considerations as well. Ecologists have long recognized that landscape history affords remarkable insights into the range of responses of plants and animals to natural and human disturbance, and the ecological processes that control landscape patterns through time. In similar fashion, conservationists have looked to the past as they have sought to restore species or identify processes that are critical to the functioning of natural areas.

Four hundred years ago, New England was forested with a wide range of tree species that varied regionally with climate and soil conditions. Although temperature and the length of the growing season declined generally, to the north the variation in elevation in valleys and mountains and the moderating influence of the ocean produced a complex geographic pattern in vegetation. There were patches of treeless tundra on the very highest mountains while more northern and higher elevations were dominated by red spruce and balsam fir intermixed primarily with paper birch. Broad areas of Maine, Vermont, New Hampshire, western Massachusetts, and northwestern Connecticut were covered with northern hardwoods—hemlock forest, dominated by long-lived shade-tolerant species such as sugar maple, beech, and yellow birch. Paper birch was locally common along with white pine, pin cherry, white ash, and black cherry, especially on disturbed sites, and, to the south and at lower elevations, the oaks increased, first red, then black, and then, farther south, white.

This variation in species and forest types was controlled by climate. In central Massachusetts, from the Connecticut Valley up across the Central Uplands and down onto the Eastern Lowlands toward Boston—a region involving only 200 meters in elevational variation and less than 1.5 degrees Celsius variation in annual temperature—the dominant vegetation changed from oak to northern hardwoods—hemlock-white pine-oak and back to oak. These forests of oak and hickory increased to the south across much of Connecticut, Rhode Island, and eastern Massachusetts.

One intriguing question emerges concerning this pre-European landscape—how much did vegetation patterns vary through time and across local landscapes?

Remarkably, it turns out that there was substantial change in broad-scale forest cover in the centuries before European settlement. Five hundred to a thousand years ago, the dominant species, including beech and hemlock, began to decline, and red spruce, and in some cases oak or birch, increased from Massachusetts to Maine. The scale and timing of this change suggest that it may have resulted from the so-called Little Ice Age, a cool period of variable growing seasons (see page 5). Because this period extended through the mid-nineteenth century, some of the vegetation changes that we attribute to colonial settlement were probably initi-

ated by the global climate.

The Little Ice Age, though distinctive and important, was not a unique period. Pollen records indicate that vegetation and climate change have been continuous, though variable, over past millennia. For example, new records from the Quabbin Reservation depict a major shift from oak to chestnut and an increase in fire associated with drier conditions approximately 1,500 years ago. This long-term record completely dispels the myth of one original “primeval” forest and instead suggests that the scene encountered in 1620 was part of an endlessly unfolding picture.

Geographically, other factors, especially soils, modified forest patterns. Extensive coastal areas across southeastern New England, Cape Cod, and the Islands are formed of sandy outwash plains laid down by the glaciers. There, and on more localized sandplains in the Connecticut and other valleys, oaks, pitch pine, white pine, and ericaceous plants such as huckleberry dominated. Meanwhile, the finer soils of the old glacial lake beds and extensive floodplains supported specialized trees and herbaceous vegetation. Bedrock geology was also important, as shown by the greater abundance of species such as sugar maple in the rich soils of the Berkshires, Green Mountains, and traprock ridges.

Natural disturbance also shaped the landscape. Early surveyors encountered windthrown forests, some of which were extensive and presumably generated by hurricanes or downbursts. Especially notable was the great hurricane of 1635, described by Governor William Bradford. “It began in the morning a little before day, and grew not by degrees but came with violence in the beginning, to the great amazement of many.... It blew down many hundred thousands of trees, turning up the stronger by the roots and breaking the higher pine trees off in the middle. And the tall young oaks and the walnut trees of good bigness were wound like a withe, very strange and fearful to behold.”

Using similarly detailed eyewitness and newspaper accounts, meteorological descriptions, and a simple model of tropical-storm meteorology, historical ecologists at the Harvard Forest have been able to reconstruct the wind and damage patterns for all New England hurricanes since 1620. The results depict a strong gradient in hurricane frequency and intensity from southeastern New England to northern Vermont and Maine. Extreme storms, including hurricanes in 1635, 1788, 1815, and 1938, occurred every eighty-five years to the southeast, to every one hundred fifty years across western Connecticut to southeastern New Hampshire, and never much farther to the north. Equally important was the incidence of weaker storms, which are important to forest and wildlife dynamics because they create small forest openings. These occurred every five to ten years to the southeast, ten to twenty-five years in central New England, and seventy-five to two hundred years to the north.

Presumably, patterns in forest structure would have

resulted from the tendency for the strongest winds in New England hurricanes to come from an easterly and southeasterly direction. On exposed-level or east-facing slopes, intense winds would have initiated patches of younger, dense forest strewn with mounds resulting from the roots of downed trees and decaying wood. In narrow valleys and on leeward westerly slopes, extremely long intervals without such damage would have led predominantly to old-growth conditions. The actual effects of hurricanes on forest composition in these areas were probably minor. In fact, there is no indication of a pre-European hurricane in the pollen record of vegetation change.

In contrast, fires have left a definitive record in the form of charcoal and associated vegetation change in wetland and lake sediments. Fire in New England is generally interpreted as resulting from purposeful burning by Native Americans to improve hunting and village sites. Fire also is the major means by which a relatively small population of fewer than 150,000 individuals, lacking domesticated animals or widespread agricultural practices, could have an extensive impact upon the landscape. Fire and local human activity are also primary means by which young and open vegetation and its associated early successional plant and animal species may have been maintained in a largely forested landscape.

Based on a handful of early quotes from Thomas Morton, William Wood, and others from a very few localities, extreme pictures of Native American activity and the resulting vegetation have been depicted: frequent, or even annual, burning that created open, parklike forests, savannas of grass and interspersed trees, extensive sandplain grasslands, and mosaics of active agriculture and successional vegetation on fallow fields and abandoned villages.

The paleoecological record provides no support for these visions and when coupled with other historical data paints a very different picture of the broad landscape. Sites from the central Massachusetts uplands show evidence of fires and vegetation dynamics, but only at hundred-year intervals or longer. Although infrequent, fire still modified this forested landscape as sprouting and successional species such as birch, chestnut, and oak prevailed for more than 250 years after each fire. In the Berkshires and uplands of northern Vermont, an even lower frequency of fire is recorded, presumably due to wetter conditions and lower Native American populations. Fire and human activity increased in the Connecticut Valley to the south and in coastal areas. Higher fire frequency in these regions is associated with greater oak and pine, but, even on the

driest sandplains in the Connecticut Valley where fire may have been most frequent, forests of pitch pine, white pine, and oak prevailed and, not infrequently, apparently reached old-growth status. On the Cape and coastal islands, Native American populations and fire frequency were high and apparently created a patchwork of oak or pine forests with huckleberry and blueberry understories. However, to date, there is still no conclusive historical evidence of scrub oak barrens, sandplain grasslands, heathlands, or savannas before European settlement. These modern hot spots of biodiversity, rarity, and modern conservation interest are much more likely the product of European land use (as they are, in fact, in Europe) than relicts of an aboriginal landscape.

Given the extensive forest that predominated in most of New England, many features that are now uncommon

in our landscape would have been widespread. Most obvious and abundant would be the structural elements of old and deep woods—massive windthrow mounds and pits from roots, large decaying boles of fallen trees, and dense jumbles of coarse woody debris in brooks, streams, and rivers. All of these would have added to

“the wild, damp and shaggy look” envisioned by Thoreau. Also common was woodland wildlife, some of which—bears, moose, beavers, and fishers—are now returning; however, many other important species are still missing such as the wolf and cougar. Meanwhile, many common successional and open-land species of plants, insects, and birds that surround us today would have been uncommon, clinging to ridge tops, cliffs, and bluffs, or the edges of Native American villages where harsh environments and disturbance kept sites open and dynamic.

What you can say about the landscape in the time before European arrival is that it was always changing; that it was varied and followed its own vagaries rather than the more arbitrary divisions of ownership and land use that drive the modern pattern. The land was occupied and influenced by people and wildlife and natural processes that are mostly lost to us and about which we have much more to learn. But even though the changes in the environment, landscape, and biota are largely irreversible, we can take these lessons from the past, use them to understand the present, and begin to shape the future. As Thoreau reflected in 1860, “If we attended more to the history of our [wood]lots we should manage them more wisely.”

David Foster is director of the Harvard Forest and author of Thoreau's Country: Journey through a Transformed Landscape.

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