

Wildlands and Woodlands



Farmlands and Communities

Broadening the Vision for New England



ABOUT WILDLANDS AND WOODLANDS

The *Wildlands and Woodlands* (W&W) vision, described in two Harvard Forest publications,^{1,2} calls for collaboration among conservationists and willing landowners to permanently protect by 2060 at least 70 percent of the New England landscape as forests, along with another 7 percent that is currently in agriculture—intact and in use for both nature and people. It envisions a balanced approach to conservation and preservation: most land would be actively and sustainably managed for wood, food, and other values while continuing to deliver clean water and air, wildlife habitat, recreation, and support for human lives in a changing environment. About a tenth of the forest (7 percent of New England), along with associated wetlands, streams, ponds, and other habitats, would comprise large wildland reserves shaped by natural processes.

In 2014, a report by the New England Forestry Foundation—*New England Forests: The Path to Sustainability*—demonstrated that the *Wildlands and Woodlands* vision could support a doubling of the region's sustainable production of wood products, largely by bringing more forest lands in southern and central New England into active management while simultaneously establishing large wildland reserves. That same year, *A New England Food Vision* complemented W&W by calling for increasing local farm production and expanding farmed acreage on conserved farmland. Within this regional framework, up to half of the region's food could be supplied if 15 percent of New England were in agriculture. Both reports envisioned that these increases would be accompanied by more sustainable patterns of consumption and increased conservation of resources.

This 2017 report combines the complementary uses of the forest and agricultural landscape with the thoughtful and efficient development of rural villages and towns, suburbs, and cities into an integrated vision of wildlands, managed woodlands, farmlands, and communities of all types and sizes supporting people and nature across New England.

THE WILDLANDS AND WOODLANDS INITIATIVE

The W&W Initiative supports and complements the ongoing success of thousands of individuals and families and hundreds of organizations, public agencies, and municipalities advancing land protection and sustainable stewardship across the region. Initiated in Massachusetts by scientists at the Harvard Forest—Harvard University's 4,000-acre ecological classroom and laboratory—the W&W Initiative broadened to include all of New England through collaboration with conservationists, academics, and many other partners from throughout the region, and with critical engagement from Highstead and the New England Forestry Foundation.

Harvard Forest and Highstead have initiated and continue to advance many programs in support of the Wildlands and Woodlands Initiative. These include research on the history, future, and consequences of land protection and landscape changes in New England through the Harvard Forest Long Term Ecological Research program and the New England Futures project; communication of these findings and their translation into public policy through the Science Policy Exchange; engagement of college faculty, students, alumni, and administrations through Academics for Land Protection in New England (ALPINE); support for the growing success of regional conservation partnerships through the Regional Conservation Partnership Network; convening of a series of conservation finance roundtables and the consensus-building New England Forest Policy Group to increase funding for New England land protection; and education to broaden the base of ongoing support for land protection and sustainable development among policy and decision makers, landowners, K–12 students, college and university communities, and professionals (foresters, real estate professionals, family advisors, local leaders, and others).

DEFINITIONS

Land protection. The permanent protection of a property from future development through a conservation easement or fee ownership by a public entity or conservation organization that is dedicated to land conservation. Protected lands may be actively managed (e.g., for wood or agricultural products) or not. We choose to employ the term “protected” rather than “conserved” to avoid ambiguity.

Conservation easement. A legal instrument that extinguishes specific rights from a property, such as development, subdivision, or mining, through sale or donation by the landowner to a qualified nonprofit or governmental organization that will hold the rights in perpetuity. Easements represent an important tool to conserve land for many values, including farming, forestry, or wilderness. Easements also convey a significant ongoing monitoring responsibility with associated costs to the holder.

Woodlands. Forested lands that are or may be actively managed for wood resources, plant and wildlife habitat, recreation, aesthetics, or other objectives.

Wildlands. Tracts in which no active management occurs, except for limited trail maintenance. Natural processes shape the landscape over time under the prevailing climate.

Wildlands and Woodlands Farmlands and Communities

Broadening the Vision for New England



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EXECUTIVE SUMMARY



To reach the W&W vision's 2060 target and preserve the natural infrastructure that sustains society and nature in New England, we must triple the pace of land protection.

Background. In 2010, scientists reported that after more than 150 years of forest regrowth following the regional decline in agriculture, the great period of New England reforestation had ended. They showed that forestland was being lost to development in every New England state and that the land was changing in irreversible ways. In response to this region-wide loss of forests and the benefits they provide, the authors forged an ambitious vision for the landscape that sought to capitalize on the great capacity for land conservation and stewardship across the six states. The *Wildlands and Woodlands* vision calls for retaining and permanently protecting at least 70 percent of the landscape (30 million acres) in forestland and another 7 percent (2.8 million acres) in farmland by 2060 (Figure 1). Most of the forests would be managed as woodlands for wood products and other benefits, while at least 10 percent (3 million acres) would be designated as wildland reserves. Such a landscape with interconnected natural and cultural infrastructure would support and enrich the lives of New Englanders and provide the capacity for nature and society to adapt to future environmental change.

Purpose of this Report. This new report offers an update on progress toward the *Wildlands and Woodlands* vision and outlines actions that willing landowners, community leaders, conservation groups, public officials, businesses, and others can take to help reach these ambitious goals over the next half century. It also broadens the *Wildlands and Woodlands* vision to fully embrace farmland and the built environment, from rural communities to suburban towns and urban centers, as well as to honor the regional differences in conservation needs and challenges between northern and southern New England. Further, it presents new information on the major challenges and opportunities for achieving the *Wildlands and Woodlands* vision. Finally, it shows how actions to protect and care for

the land can forge a bright future for New England, provide a regional example for the nation, and help mitigate global environmental change.

Broadening the Vision. The broadened *Wildlands and Woodlands* vision recognizes the interdependent role that forests, farms, rural communities, suburbs, and cities play in shaping the New England landscape. In this vision, protected forests dominate the region, even within thickly settled areas, but vary in striking ways to create distinctive landscapes, provide a rich array of habitats, and support a range of human experiences and many valuable resources. Well-managed farmlands diversify the region's landscape, add scenic beauty, plant and wildlife habitat, and biodiversity, and provide healthy local products. Robust rural economies enable the individuals and families that produce our local wood and food to share in the region's prosperity. In more densely populated areas, shade trees, urban gardens, and forested parks and greenways yield community and health benefits and help moderate the effects of climate change. This broadened vision embraces the idea that well-managed forests and farmlands, expansive wildlands, smart growth, and rural economic development are compatible, achievable, and mutually reinforcing.

Benefits from the Land. Today, forest and farmland make up approximately 88 percent of the New England land base, while development covers 3.8 million acres or 9.5 percent of the region. New England forests and farms provide vast benefits to rural and urban communities at local to global scales. The health of the region's environment, economy, and citizens remain inextricably linked to the health of our forests. Local food and wood products for construction, heating, and other uses are important to the economies and livelihoods of many communities. The region's forests remove over 760,000 tons of air pollution each

year, which is worth an estimated \$550 million in health benefits; provide clean drinking water to millions of households; and help support New England's \$10 billion annual tourism industry. The forests also provide global benefits by offsetting more than 20 percent of the region's carbon dioxide emissions that would otherwise contribute to climate change. By protecting and sustainably using these forest and farm landscapes, we can maintain and enhance these many benefits from the land.

Today, New England is one-third of the way toward the *Wildlands and Woodlands* forestland goal but faces many threats, including increasing rates of forest and farmland destruction. To reach the W&W vision's 2060 target and preserve the natural infrastructure that sustains society and nature in New England, we must triple the pace of conservation to protect the remaining 23 million acres.

Growing Threats. The New England landscape faces the increasing loss of forest and farmland to residential and commercial development; ongoing parcelization and fragmentation of land; declines in state and federal land-protection funding; deterioration of iconic tree species—chestnut, beech, hemlock, ash, and elm—from introduced pests and pathogens; unsustainable forest and farm management in some areas; and, the challenge of maintaining public support for land protection and traditional uses of land (e.g., forest harvesting and animal grazing) amidst competing socioeconomic demands.

Development eliminated 24,000 acres of forest each year from 1990 to 2010. At this rate, another 1.2 million acres of farms and forestland will be lost to development in the next 50 years. This transformation of land will alter the inherent character of the New England landscape, diminish its beauty, and undermine its capacity to



yield clean water, mitigate flooding, produce food and wood products, support wildlife, and provide other services needed and valued by New Englanders.

► **State and federal funding for land protection is declining in all six New England states.**

Together, annual state and federal funding declined nearly 50 percent from its peak of \$119 million in 2008 to \$62 million in 2014. Local and state funding varies widely across New England, leading some states to rely largely on unstable federal sources. During this same period, the pace of conservation slowed from more than 150,000 acres per year in the early 2000s to about 50,000 acres per year since 2010.

► **New England's capacity to mitigate and adapt to climate change is diminished by forest loss and poor management.**

While national and global action is essential to halt and reverse the course of climate change, local action can make significant contributions to slowing its pace and helping the region absorb its impacts. At current rates, by 2060 harvesting and development will have reduced gains in forest carbon storage by 19 percent compared to forest growth in the absence of any land use change. Keeping forests intact and managing them well is one of New England's greatest options in combating global change.

► **Land use is likely to exert an even greater impact than climate change on forests and most ecosystem services over the next century.**

Development immediately and irreversibly eliminates forest ecosystems and farmland, whereas climate change gradually alters forest composition and function. As a result, development and harvesting decisions are expected to be the largest driver of changes in forest conditions and associated benefits to society over the next century.

Wildlands & Woodlands Vision for New England in 2060

30 million acres conserved forest
 90% Woodlands / 10% Wildlands
 3-6 million acres conserved farmland
 5 million acres efficiently developed

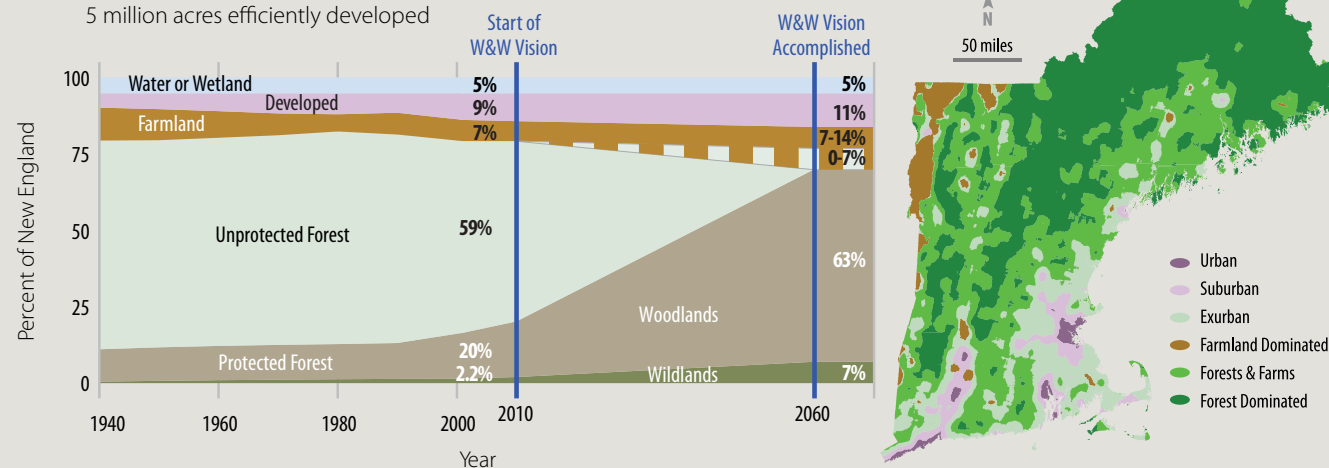


Figure 1. In a Wildlands and Woodlands future, New England will remain a diverse landscape with local conditions, community priorities, and landowner choices determining the relative amounts of forest, farms, and developed lands in each location.

Gaining Ground. Despite these challenges, the last quarter century represents the most active period of land protection in New England's history. This progress grew from an appreciation for the economic and infrastructure benefits of forests, community support for the value of local food and wood products, the growth of conservation partnerships, the far-sightedness of communities and states to fund land protection, and the ability of New England conservationists to compete nationally for funding. Building on this progress will help achieve the *Wildlands and Woodlands* vision.

► **New England remains in a new era of land protection.** Despite the recent downturn, the rate of land protection over the past 25 years was four times higher than in previous decades, with an average of two transactions per day protecting a total of 180,000 acres each year. Half of the region's 9.8 million acres of conservation land was protected during this brief period.

► **New collaborations are a growing force in land protection.** Since 2000, regional conservation partnerships (RCPs) have grown in number from 4 to 43 and have already protected more than 300,000 acres of land. The enduring value of New England's more than 500 town forests is being augmented with 30 new Community Forests, in a movement that is expanding. Leaders from New England's largest, oldest, and most successful forestry and conservation organizations have joined forces to form the New England Forest Policy Group (NEFPG). And in just two years, students, faculty, administrations, and alumni from more than 45 colleges and universities have joined Academics for Land Protection in New England (ALPINE), which seeks to advance land protection locally and regionally.

- ▶ **Innovative conservation finance strategies continue to emerge.** Public agencies have invested nearly \$1 billion in land protection across New England in the past decade. Many individuals and organizations are making a strong case for increased public and private funding to achieve diverse objectives. As a result, municipal, state, and federal investments in the region's natural infrastructure have been steadily augmented by private philanthropy, landowner donations, and innovative private financing.

Recommendations for the Next Ten Years. The need to combat global change, secure the benefits to society of nature's infrastructure, and make our communities more resilient presents a significant opportunity for transforming how New Englanders protect and use the region's land. The people, communities, and institutions of New England bring to this challenge an unparalleled capacity for collaboration and land protection. The following actions can accelerate progress toward the broadened *Wildlands and Woodlands* goals and help support a healthy and prosperous future for local communities, the New England region, and the globe.

- ▶ **Accelerate land protection.** Establish bold state and regional targets for protecting forests, farms, and wildlands that are consistent with *Wildlands and Woodlands* goals. Make significant financial investment in collaborative conservation partnerships that help implement state-level targets. Engage urban, suburban, and rural communities in joint regional land-protection activities. Increase institutional capacity to advance public policy and conservation finance strategies for land protection.
- ▶ **Manage more land, ecologically and sustainably.** Apply sound stewardship to increase production of food and wood products while retaining ecosystem services. Evaluate forest and farm management by the quality of products, resulting ecological conditions, and well-being of local communities. By encouraging local resource production, communities connect with the land

and people that sustain them, improve human health, and reduce environmental impacts of production in distant lands. Expansive wildlands should be preserved as a critical part of the "working landscape" that yields multiple benefits to society while maintaining intact ecosystems and the diversity of plants and animals.

- ▶ **Grow smart in cities, suburbs, and towns.** Implement effective land-use protections and development incentives appropriate for urban, suburban, and rural areas to increase efficiency, develop green infrastructure, build resilience to climate change, and provide more effective local and regional public transportation. Encourage efficient land use by building compactly and redeveloping built landscapes such as former industrial mills on recovering rivers and commercial brownfields. Support healthy communities by increasing tree and forest cover and promoting close interactions with nature and food production.
- ▶ **Support strong rural economies.** Support rural communities as they work to adapt their natural resource economies to new realities and needs. Create economic opportunities for their residents while sustaining the beauty, ecology, and productive capacity of surrounding land and protecting human health and environmental benefits of intact rural landscapes.
- ▶ **Increase funding for land protection.** Increase investments and tax incentives to accelerate land protection and defend existing protected lands in order to secure known benefits of forests and farms to society. Towns, states, private investors, and foundations should share, replicate, and improve successful funding mechanisms currently employed within and outside New England. Achieving the W&W vision's goal may require an additional \$23 billion in public funding; this could be reached by committing less than 2 percent of the funding needed for U.S. infrastructure to accommodate global change.

- ▶ **Reduce consumption and conserve resources.** New England and the globe have real limits in space, resources, and capacity to support humans; nonetheless, regional and national trends are towards increased house size, resource consumption, and waste production. Reducing consumption and using land as efficiently as possible lessen impacts on our natural systems and increase our options for meeting future environmental challenges.

A CALL TO ACTION

New England is a distinctive landscape of mountains, forests, rivers, and coastlines, iconic farms, and a blend of small villages, large towns, suburbs, and cities. The region's history has given rise to its unique character as well as its position as one of the most forested and populated regions of the United States. Science affirms what many New Englanders have long known: by keeping the landscape forested we can secure the best and lowest-cost "natural infrastructure" to address future challenges. As the nation struggles to address mounting global environmental challenges, local and regional actions hold renewed significance. By realizing the broadened *Wildlands and Woodlands* vision, New Englanders can create a national model for responsible environmental stewardship in a landscape dominated by private land ownership. Investing in land protection and supporting the capacity of people to steward their land responsibly offers a path to ecological and economic well-being that can benefit every individual in the region by ensuring that New England forests and farms provide vital benefits for centuries to come.

BENEFITS, THREATS, AND SUCCESS IN THE NEW ENGLAND LANDSCAPE

New England's remarkable 150-year history of forest regrowth has yielded a globally important landscape that is a testament to the resilience of the land and the conservation ethic of its people (Figure 2). The clearing of forests for agriculture that commenced in the 1600s peaked after 1850 (Figure 3). Then the flow of inexpensive feed grain and other foods from the Midwest allowed New England farmers to concentrate their production on less land, triggering a tremendous expansion of forest area across abandoned fields (Figure 4). The return of forests alongside a continuously increasing population has positioned New England as the nation's most heavily forested region and, in its southern reaches, one of the most densely settled.

Today, with a second wave of forest destruction under way in all six New England states, the region's forests are at another turning point.⁴ Suburban sprawl is chipping away at both forest and farmland, reversing the region's environmental success story and jeopardizing the many benefits these lands provide to people and nature. At the same time, land ownership patterns are changing dramatically, and the landscape is being parcelized into smaller and smaller tracts.

These recent changes to the land are compromising the vital natural resources delivered by forests and farms that have supported local economies for centuries, and are undermining the beauty of New England's landscape, which frames its distinct communities. New Englanders have long depended on the region's expansive forests, cared for by millions of private landowners, to provide low-cost benefits such as clean water and flood protection; healthy air; local wood and food; habitat; recreation and tourism; and vast stores of carbon to help mitigate climate change (Figure 5). While this natural infrastructure is more critical than ever to support our communities, it remains underappreciated and undervalued. Protecting landscapes and the benefits they provide is essential to ensuring an environmentally and economically sound future for New England.

New England Forests: A Globally Important Resource



Figure 2. *New England is one of the most heavily forested parts of the United States. Forested areas provide critical benefits to its population and an essential corridor for plant and animal movement between the southern Appalachians and the boreal forests of Canada in a time of climate change.³*



New England Forest Cover and Human Population

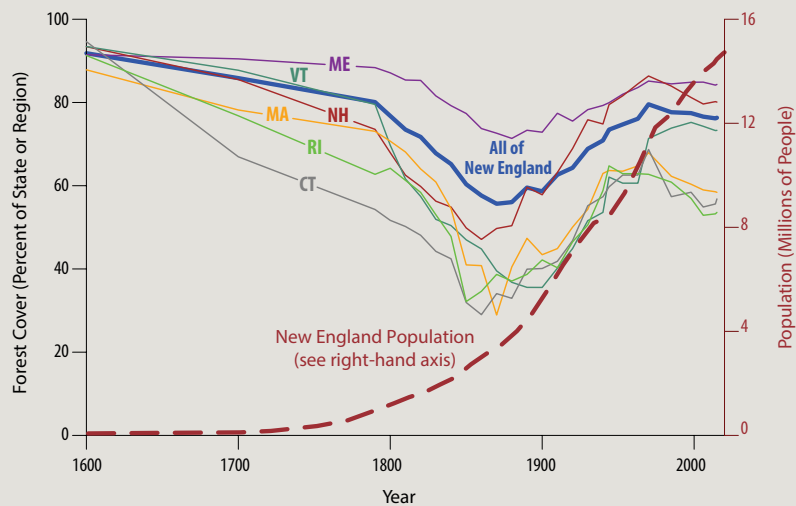


Figure 3. The second wave of forest loss now under way in New England jeopardizes the region’s environmental success story, which has been characterized by the return of forests following the decline in agriculture in the East.⁵

New England Farmland Over Time

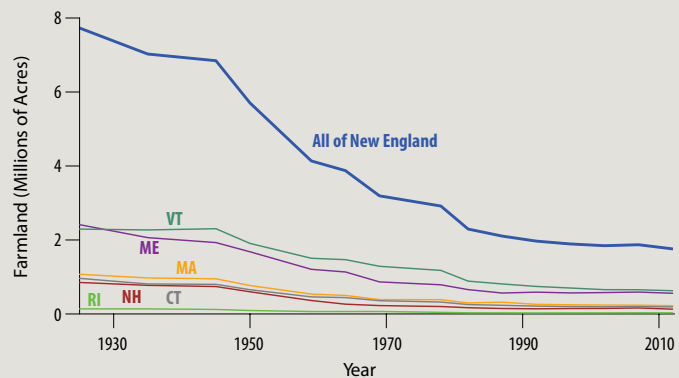


Figure 4. Farm area has declined across New England from a peak in the mid to late 19th century, and has largely regrown as forest. More recently, farmland has been replaced by housing and commercial development.⁶

New England Today: A Peopled and Forested Landscape

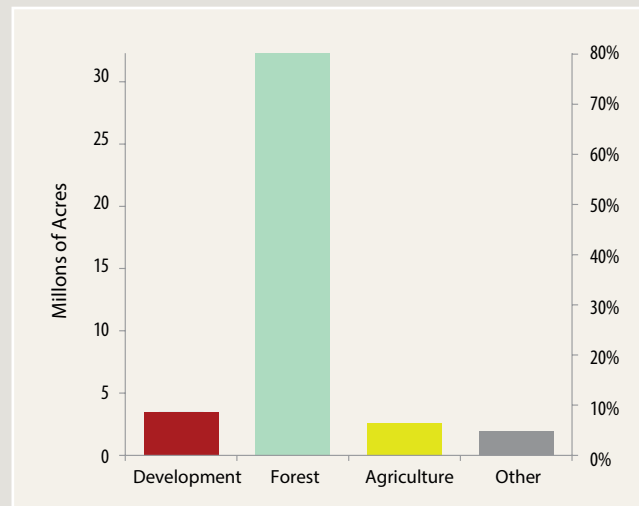
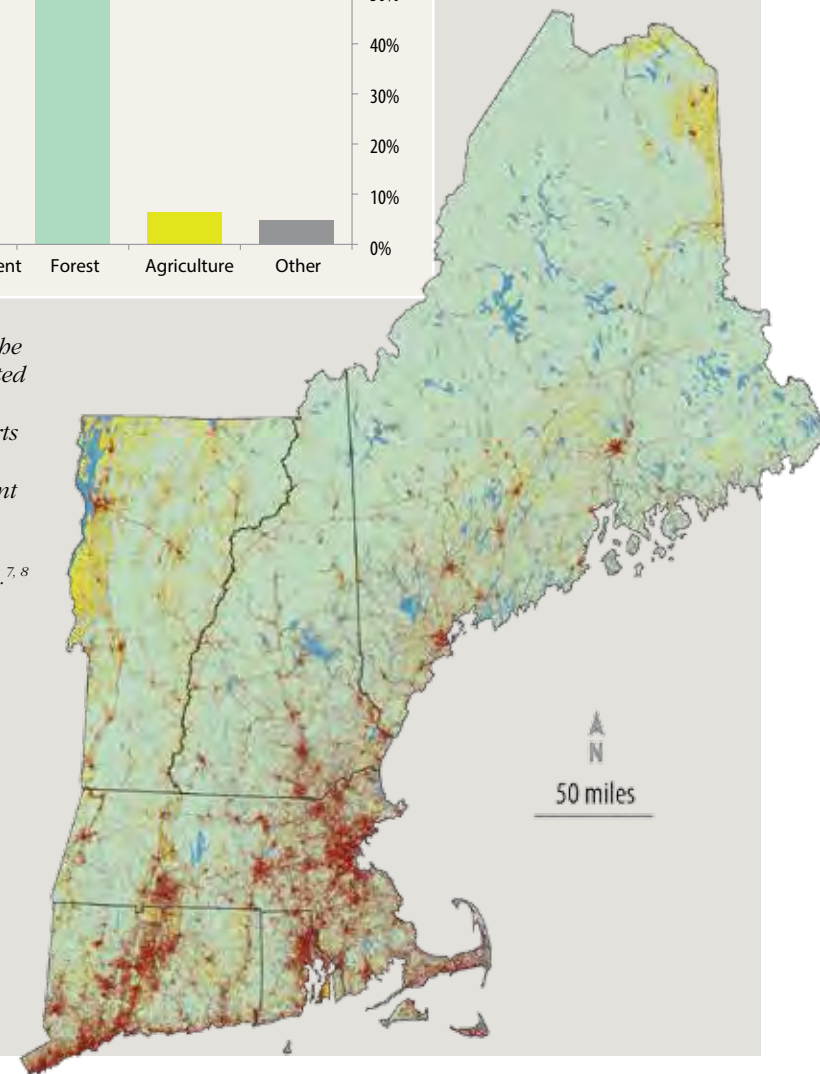


Figure 5. As one of the most densely populated regions in the U.S., New England supports expansive forests across over 80 percent of its land base and farmland on an additional 7 percent.^{7, 8}



Benefits from the Land

Well-managed woodlands and farmlands, together with intact wildland reserves, provide myriad local, regional, and global benefits to the human and wildlife inhabitants of New England.

Local Benefits

LOCAL FOOD

As consumption of locally grown food surges, the demand for agriculture and accessible farmland is on the rise across New England. From city centers to rural areas, support for gardens and farms is rooted in the desire for healthy lifestyles and communities that are connected to the land and that value the local sources of products and the people who produce them. The emerging pattern of food production is diverse, including a greater variety of crops, more grass-fed animals, and more emphasis on ecologically integrated operations. *A New England Food Vision*⁹ documents the capacity to produce within the region a larger proportion of the food consumed in the region. Specifically, these food and farm experts calculated that New England could increase the production of its food to as much as 50 percent through a doubling of productive farm area, focusing primarily on vegetables, fruits, and grass-based livestock.



Protecting Land for Clean Drinking Water: Massachusetts and Maine

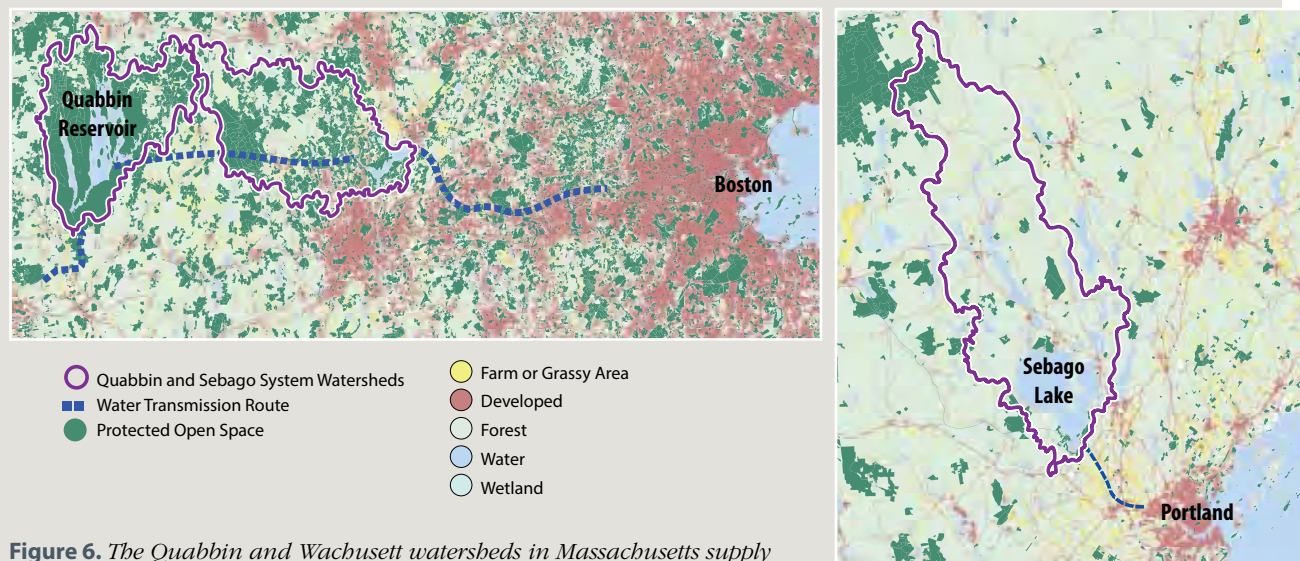


Figure 6. The Quabbin and Wachusett watersheds in Massachusetts supply clean drinking water at low cost to nearly 40 percent of the Commonwealth's residents while the Sebago Lake watershed serves Portland and Maine's most populous region. Both areas are the focus of active forestland protection to secure the natural infrastructure that yields this essential resource, without the need to build costly water treatment facilities.¹²

LOCAL WOOD

New England has an enormous capacity to grow trees and provide wood for value-added products such as furniture, pulp for papermaking, chips and pellets for biomass energy, fuelwood, dimensional lumber, and engineered wood products such as laminated timber and composite pallets. Throughout the region's history, foresters, loggers, and manufacturers have adjusted to changing forest conditions and global markets to provide an evolving flow of wood products from its forests. Sustainably managed woodlands could provide a much larger fraction of the region's timber and energy needs if coupled with reduced resource consumption, effective conservation, and expanded markets that keep the long view and site-specific silvicultural needs of the forest in mind.^{10, 11} The more of its food and wood demands New England can meet locally, the less potential environmental pressure and

impact it will outsource to parts of the world that often have few safeguards for worker and environmental protection (see Box 1).

RECREATION AND ENJOYMENT

Regionally connected woodlands and farmlands provide the natural infrastructure needed for nature-based recreation, tourism, and enjoyment of local beauty for human health and well-being. New England residents and visitors alike depend on the access to the region's forests that has been provided for centuries by private landowners and public agencies. In recent years, a burgeoning farm tourism economy has drawn additional visitors to New England to visit local farms and sugar bushes. The region's extensive trail network throughout both rural and densely populated areas facilitates widespread access to and public enjoyment of the New England landscape.

The Illusion of Preservation: An Environmental Argument for the Increased Use of Local Resources Coupled with a Reduction in Consumption

The Illusion of Preservation: A Global Environmental Argument for the Local Production of Natural Resources, published in 2002, advances a simple assertion: the global environment would be measurably improved if people from relatively wealthy and resource-rich areas like much of New England obtained more of their natural resources (e.g., wood and food) from their own backyard.¹³

“The Illusion of Preservation” recognizes that many residents in such areas hold the well-intentioned impression that by opposing the local harvesting of trees, they are protecting the environment. But it counters that **(1)** in large parts of New England, excluding the industrial forestlands in the north, forest growth greatly exceeds harvesting rates and so the region could produce a much greater share of its wood needs; **(2)** New England landscapes have supported and proved resilient to harvesting for centuries; **(3)** New England residents who care deeply about the land and the products they consume will likely apply much stricter regulations to forestry than those in many other regions; **(4)** harvesting elsewhere can damage more pristine and fragile landscapes and is associated with larger climate change and biodiversity impacts and with energy costs for transportation; and **(5)** by actively engaging in greater local production, New Englanders might increase their support for the conservation of land and resources and consume less. “The Illusion of Preservation” and subsequent reports

calculated that New England could produce half its wood needs, compared to about 25 percent today, by increasing local production and significantly reducing consumption through increased recycling and reduced demand.

Looking at these assertions today, we recognize that local production—of wood, food, and other resources—has many additional advantages. Farmers and woodland owners are the direct beneficiaries of this local commerce, and the community benefits from the local resources and economic activity. Local and regional recreation and tourism also benefit from the enduring protection of productive forest and farm landscapes and the biodiversity that they support. Recent modeling of different future scenarios of development, harvesting, and land protection in Massachusetts highlights the great benefits of a scenario akin to that advocated by “The Illusion of Preservation.”^{14, 15} In the modeled results, increased land protection, concentrated new development, and a doubling of selective forest harvesting to improve the quality and eventual harvesting of valuable timber trees such as white pine, sugar maple, and oak over a 50-year period led to a doubling of wood production and an increase in the value and proportion of large and old trees, along with gains in habitat diversity. The ability of the landscape to store carbon diminished by only 4 percent in comparison with a continuation of current activities.

Since “The Illusion of Preservation” was written, the local food movement and the use of regional wood to meet local heating and building demands have grown. As we consider the future of the New England landscape through the lens of a *Wildlands and Woodlands* vision, it is worth considering both the local benefits and the global implications of our conservation, production, and consumption decisions.

Regional Benefits

LAND FOR DRINKING WATER AND FLOOD PROTECTION

Forestland protection provides a cost-effective means of supplying clean water to local residents and major population centers without costly filtration plants. Similarly, forests and other natural landscapes help to store and slow runoff from storms, thereby reducing the frequency and magnitude of floods.

The Quabbin and Wachusett watersheds in Massachusetts and the Sebago Lake watershed in Maine offer two examples of the value of natural infrastructure for drinking water that demonstrate the linkages between cities and surrounding lands,

and the critical need for land protection (Figure 6). The Quabbin and Wachusett watersheds supply about 200 million gallons of clean water daily to nearly 40 percent of the population of Massachusetts living in Boston and 40 other towns in the greater metropolitan area. These watershed lands also support the most active forest harvesting program in the Commonwealth, provide habitat to a flourishing array of plants and wildlife, and offer recreation including hiking, fishing, and deer hunting. An active land-protection effort by public agencies, conservation organizations, and landowners has conserved more than 80 percent of the Quabbin watershed for these multiple uses.

The Sebago Lake watershed is the major source of drinking water for the Greater Portland region, providing 22 million gallons of clean water daily to 11 communities accounting for 15 percent of Maine residents. Here, despite lower development pressure, the watershed faces increasing land-use threats as only 10 percent of the watershed is protected from development. With its land trust partners, the Portland Water District already invests in land protection in the watershed, and an emerging partnership in the Sebago region is beginning to amplify those investments to ensure that Sebago forever provides clean drinking water.

FORESTS FOR CLEAN AIR

Other human health benefits are becoming increasingly quantifiable. For example, the forests of New England provide tremendous capacity for improving air quality by removing pollutants through filtering by the canopy and gas exchange by the leaves and bark of trees. Forests in New England remove approximately 760,000 tons of pollutants that cause smog and ground-level ozone (Figure 7). The associated improvements in air quality bring such health benefits as reduced cases of respiratory illness, asthma, and hospitalizations from air pollution related illness. In New England, these benefits are valued at \$550 million per year.¹⁶

Global Benefits

CARBON STORAGE TO MITIGATE CLIMATE CHANGE

Annually, New England's forests take up a vast amount of carbon dioxide from the atmosphere, providing the critical service of mitigating climate change (Figure 8). Across the region this storage offsets approximately 20 percent of the total carbon dioxide that is released across New England through fossil fuel combustion. Most of the forests of New England are maturing (currently 75 to 125 years old) and vigorously growing. However, the size of trees and actual amount of carbon stored in each forest varies considerably with the forest type, land-use history, and recent pattern of harvesting. Across large parts of northern Maine, due to a long and ongoing history of intensive harvesting, small young trees and low levels of carbon are prevalent, and carbon stocks are actually declining. Elsewhere, tree sizes and carbon storage are increasing annually as forests are harvested less than they grow each year. By retaining existing forests and managing them regionally for older, mature conditions, New England's role in climate mitigation will increase.

Forests Improve Regional Air Quality

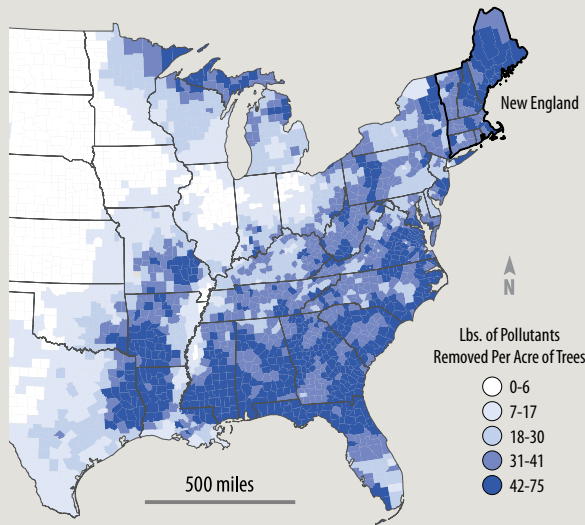


Figure 7. Forests improve air quality immensely by removing ozone, nitrogen oxides, sulfur dioxide, and fine particulate from the atmosphere. In aggregate, New England's forests remove approximately 760,000 tons of pollutants annually.¹⁷

Forests Store Carbon

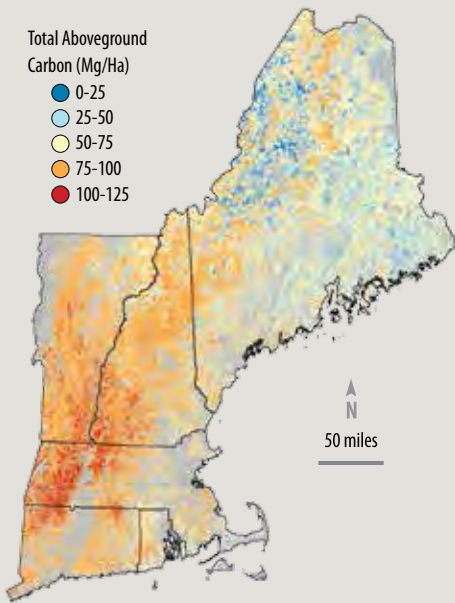


Figure 8. New England's forests provide a vast storehouse of carbon that helps mitigate global climate change. Variation in the amounts of carbon, wood, and the size of trees across the region is largely due to the history of timber harvesting. Data are not represented for gray areas that are predominantly agricultural or densely populated.¹⁸



The Growing Threat of Forest and Farmland Loss

Recent studies confirm that development continues to erode forest and farm cover in all six New England states. From 1990 to 2010, New England lost an average of 24,000 acres per year of forestland, with much of this driven by suburban sprawl in eastern Massachusetts, adjoining New Hampshire, and southern Connecticut, and by coastal development in Massachusetts and Maine (Figure 9). Even in rural areas where development pressure is low, the parcelization and perforation of large forest blocks has striking visual impacts and disrupts natural processes and effective management of the land. Though slowed by the recession in 2008, forest loss is rising as the economy rebounds.

If forest destruction continues at the current rate over the next 50 years, New England will lose an additional 1.2 million acres of forest. Across large areas, forest harvesting will also alter the structure of large forest areas. In combination, over the next century these land-use trends will exert an even greater impact on forests and the ecosystem services that they provide than climate change.¹⁹ Even under extreme projections of climate warming, changes in forest composition and growth will be subtle due to the longevity of trees, whereas development immediately and irreversibly eliminates forest ecosystems and farmlands. Computer-based ecosystem models project that these rates and patterns of forest loss and timber harvesting will decrease forest carbon storage by 19 percent by 2060 compared to scenarios with no land-use impacts. Forest loss and harvesting will also alter the capacity of the land to filter drinking water, regulate floodwaters, and provide wildlife habitat significantly more than climate change alone.^{20, 21, 22}

Although less than 1,000 acres of farmland were converted to other uses annually from 1990 to 2010, these losses are proportional to forest losses and erode local farming activity and potential. Farmland destruction also weakens the business economy that furnishes farmers with supplies and machinery, as well as the distribution system for getting their products

to market. Given future food needs and the growing interest in local farming, there is a pressing need to protect remaining farmland in order to support farm enterprises.

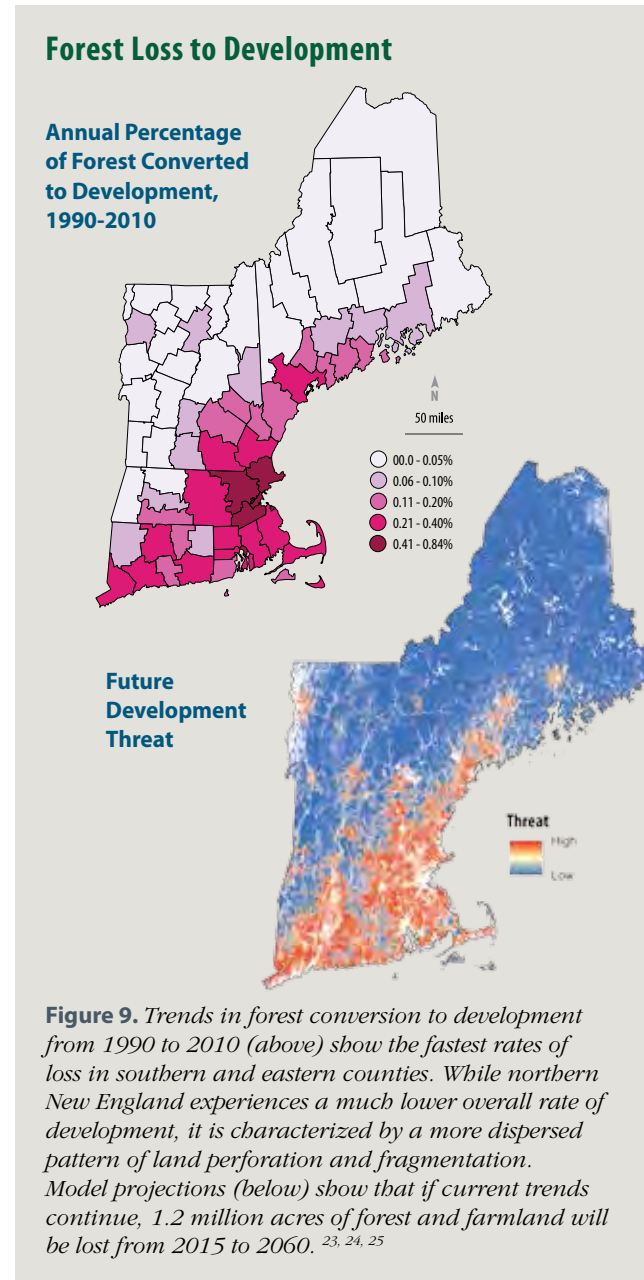
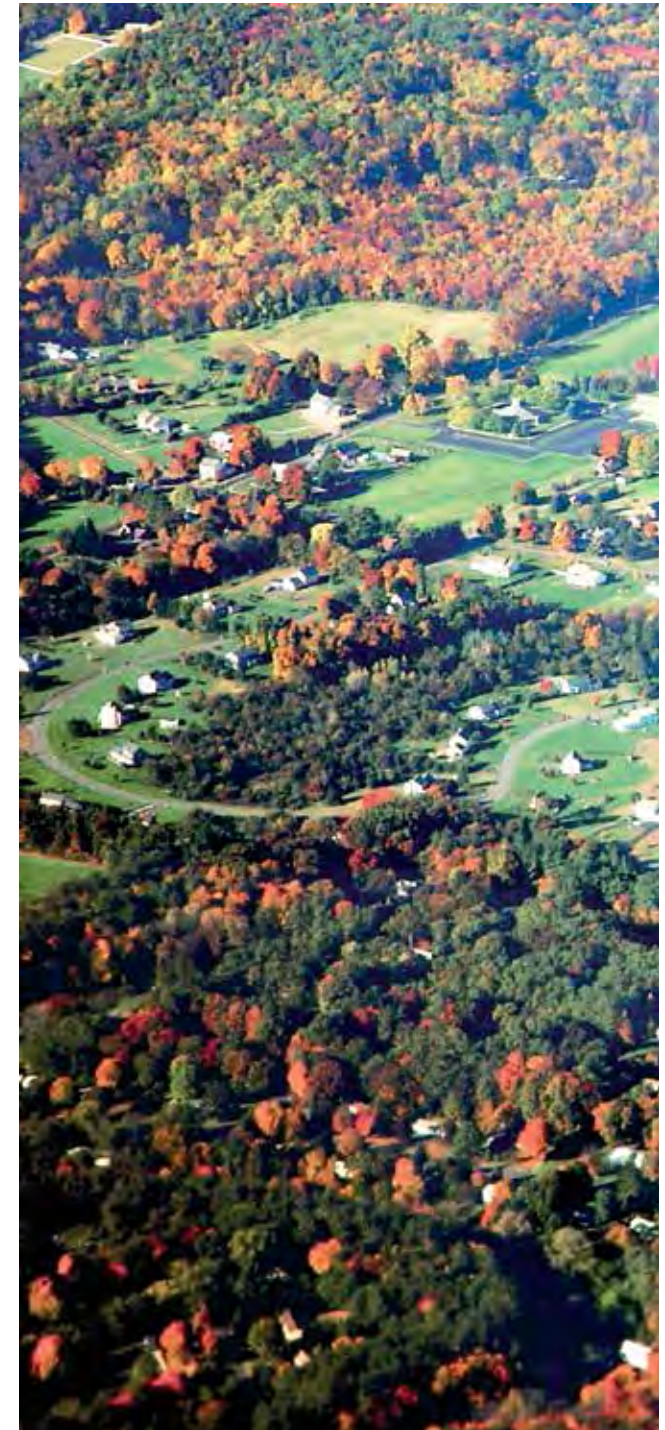


Figure 9. Trends in forest conversion to development from 1990 to 2010 (above) show the fastest rates of loss in southern and eastern counties. While northern New England experiences a much lower overall rate of development, it is characterized by a more dispersed pattern of land perforation and fragmentation. Model projections (below) show that if current trends continue, 1.2 million acres of forest and farmland will be lost from 2015 to 2060.^{23, 24, 25}



The Gains in Land Protection in New England

Protecting land from development in perpetuity—through easements and acquisitions—is the best tool to combat forest and farm loss and to keep these lands in active use. Land protection serves as an insurance policy: investing in it ensures that the valuable social, environmental, and economic benefits New Englanders reap from forests and farms will be there in the future as regional reliance on natural infrastructure grows. Land at low risk is easier and more cost-effective to protect. As threats to forest and farmland development increase, so does the cost to protect them along with the risk that they will not be intact and able to provide equivalent services in the future.

A growing appreciation of the benefits from and threats to the land, coupled with new policy tools and a remarkable capacity for conservation action by thousands of organizations in New England, gave rise to a recent period of expanded land protection. Across the region, 26 percent of forestland and 12 percent of farmland in New England is currently protected from development. Since 1990, the rate of land protection has greatly outpaced that of every previous period, with an average of 180,000 acres of land protected from development per year. Half of the 9.8 million acres of New England’s conserved land has been permanently protected in the last quarter century.

During this period of increased land protection, the diversity of participants and approaches to land

protection has expanded greatly. Privately owned land now represents 40 percent of all the protected land in New England, a significant shift from the historical dominance by state and federal government ownerships (Figure 10). The role of private owners and use of permanent conservation easements as a cost-effective tool for land protection continues to grow in importance. In the last decade, easements accounted for more than 70 percent of newly protected lands.

Conservation easements on about two dozen very large tracts of former industrial forestland in northern New England make up roughly half of the land protected since 1990, or about 4.5 million acres. Estimates from the best available data show that more than 17,000 smaller land-protection projects (about two

Land Ownership and Protection Patterns Vary Across New England

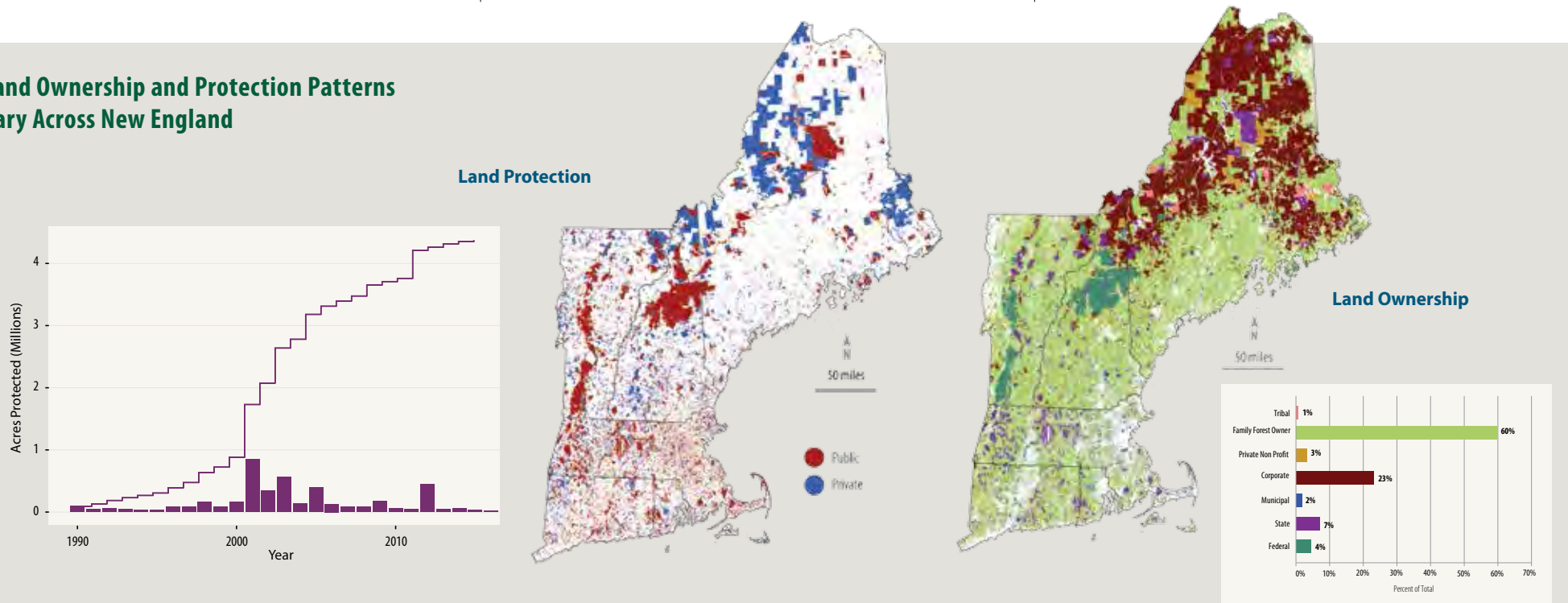


Figure 10. (a) The protection of a series of large parcels in northern New England helped to drive a rapid increase in land protection of new acres in the past two decades. (b) The distribution of protected lands forms a distinct pattern, with thousands of small parcels dominating in the south and larger properties standing out in the north. (c) Across much of the region, forests are owned by individuals, families, and nonprofit organizations, along with a range of municipalities and state agencies. In Vermont, New Hampshire, and parts of Maine, federal agencies also play a role. In the far north, the landscape is dominated by large parcels owned predominantly by investors and corporations. ^{26, 27, 28, 29}



per day) were completed in communities across New England during this time period, underscoring the region-wide embrace of land protection.³⁰ The permanent protection of farmland, woodland, streams, wetlands, lakes, and other habitats extends from the region's remotest corners into essentially every community, including the largest cities (see examples in Figure 11).

It is important to recognize that land protection and development are not simply opposing forces. Land protection does not create new land; it simply keeps existing forest and farmland intact. In contrast, development actively destroys forests and farmland. Thus, land protection is an essential long-term solution to securing the region's natural infrastructure. But in order to reduce losses to development as we strive to reach the *Wildlands and Woodlands* goals, we need to make substantial changes in the ways we plan and develop the region's built infrastructure and the growth of our rural, suburban, and especially urban areas. This imperative to consider the connected fate of rural, suburban, and urban communities and their interdependence with the surrounding landscape forms the basis for broadening the *Wildlands and Woodlands* vision.

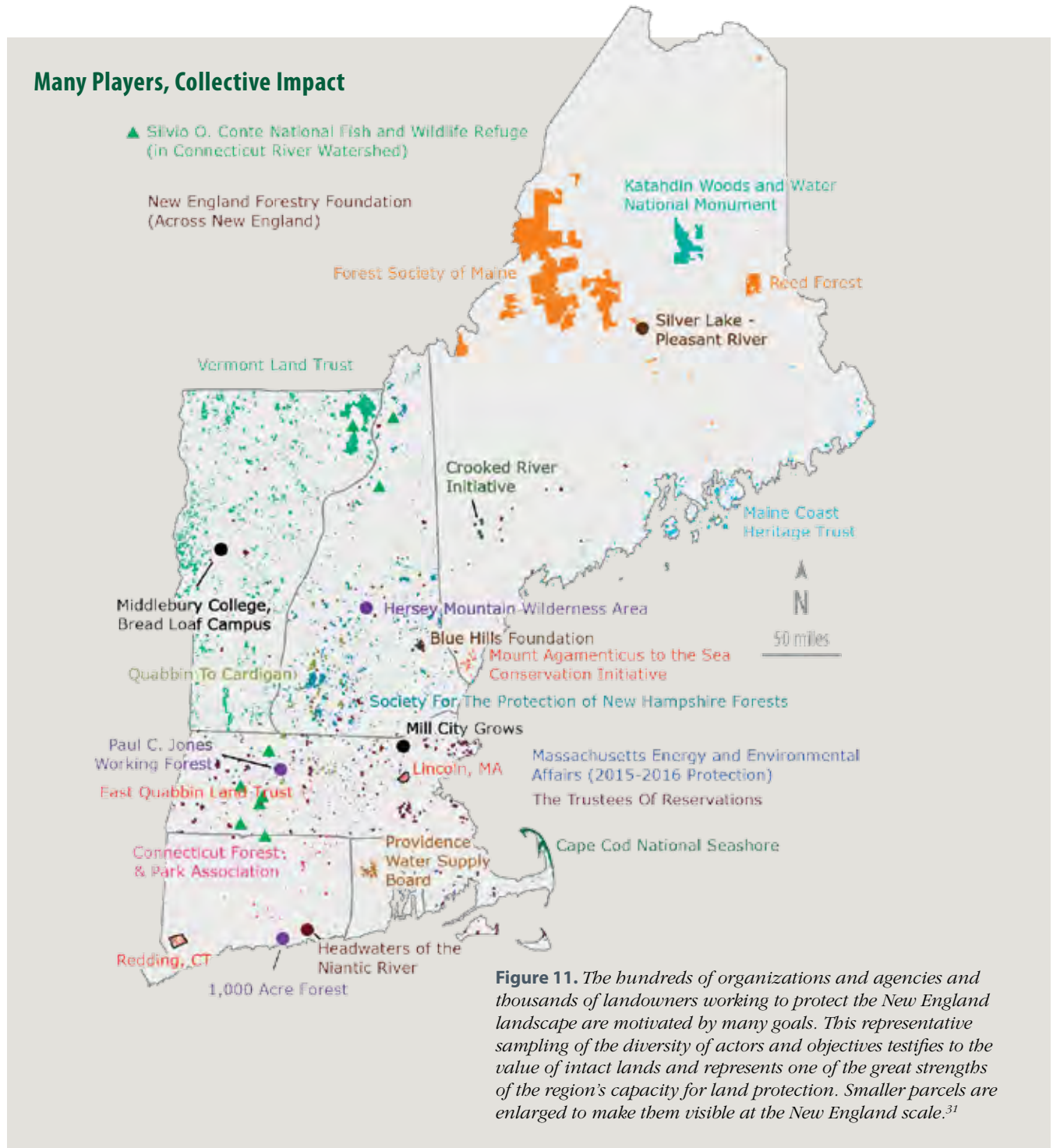


Figure 11. The hundreds of organizations and agencies and thousands of landowners working to protect the New England landscape are motivated by many goals. This representative sampling of the diversity of actors and objectives testifies to the value of intact lands and represents one of the great strengths of the region's capacity for land protection. Smaller parcels are enlarged to make them visible at the New England scale.³¹



A landscape of intermingled forests, farms, and communities, shaped by nature and people and shifting through time, has defined New England for centuries. Sustaining and enhancing this landscape mosaic to support communities across the region remains the focus of the *Wildlands and Woodlands* vision. The 2010 *Wildlands and Woodlands* report focused on the permanent protection from development of forests across 70 percent of the region in a mixture of actively managed woodlands and large wildlands where nature alone shapes the land. The broadened *Wildlands and Woodlands* vision recognizes the interconnectedness of forests, farms, waters, and communities and embraces the entire natural and cultural variation of the region. This report envisions a diverse landscape with well-managed forests and farmlands, intact wildlands, and thriving communities, with rural villages linked to suburban and urban centers through conserved lands, and recognizes that smart growth and rural economic development are compatible, achievable, and mutually reinforcing.

Woodlands Support Resilient Communities

Twenty-seven million acres of well-managed forests are an essential part of the *Wildlands and Woodlands* vision, with 90 percent of the forests (63 percent of the entire New England landscape) actively managed for ecological objectives, wood products, and many other goals. W&W defines “woodlands” as forests of diverse age, species, and structure that are permanently protected from conversion to development and that are managed sustainably and ecologically to provide a wide array of economic and environmental benefits.³²

In the long term, protecting large blocks of well-managed forestland is crucial to retaining the greatest numbers and diversity of forest plants and animals and ensuring the maintenance of other ecosystem services. Creative development and support of local

forest-based economies will be critical to achieving this goal. Tourism and nature-based recreation are rapidly growing and will certainly be one major solution. The development of new product markets for wood will likely be another. Signs of progress exist, such as the introduction of payments for ecosystem services including carbon sequestration and efforts to develop markets for sustainably harvested low-grade wood that allow remaining trees of higher quality to grow larger.

Declining markets for low-grade forest products that support economically viable forest management have been a long-standing and increasing concern for timberland owners. At the same time, it is critical that markets for these products be coupled with improved approaches to harvesting, such as Low Impact Forestry,³³ that ensure that the ecological quality of the resulting forests and economic value of the resulting products continue to improve.³⁴ The global and national competition for manufactured wood products is fierce. New England manufacturers must be competitive in order for the region’s forest products and family forest ownerships to be economically and ecologically viable. Wildlands and Woodlands partners are committed to finding new approaches for bolstering wood products markets, local manufacturing, and other economically viable means of supporting local populations from our vast forest resource.



A Place for Wildlands in New England

Northern New England supports the largest remaining blocks of unbroken private forest in the eastern U.S. Across this vast landscape, and south into the more densely settled parts of the region, lies the opportunity to establish true wildlands—large continuous tracts where diverse ecosystems of land and water are allowed to function and develop under the influence of natural processes and the prevailing environment. Today, few New England forests are formally protected as true wildlands, in which all active management is precluded and nature prevails. Remarkably, the area of wildlands in New England is exceedingly difficult to determine. No entity tracks wilderness with any precision, and the management guidelines for areas designated as “reserves,” “wild,” or “wilderness” vary widely and often accommodate a wide range of human activity. Many “reserves” allow for active management, including harvesting, mowing, and prescribed fire in order to maintain habitat, for the “restoration” of desired conditions, or in the aftermath of natural disturbances.

Yet wildlands are an essential complement to the expansive woodlands that dominate the region, and so the *Wildlands and Woodlands* vision calls for increasing their protection to cover at least 7 percent of the landscape, or 10 percent of all protected forests. Wildland was the long-standing condition of much of the New England landscape before European settlement and should be allowed to re-emerge as an important part of the landscape.

In vast wildlands, natural patterns of variation and ecosystem functions prevail at a landscape scale and support the diversity of plants and animals that thrive on an array of habitats that only develop over centuries of growth, natural disturbance, and recovery. Among other benefits, wildlands bring great value to science, offering invaluable insights as control areas for comparison with actively managed areas. Expansive wildlands are also essential for human well-being. As clearly articulated by such visionaries as Henry Thoreau, John Muir, Bob Marshall, and Aldo Leopold, the founding of the wilderness movement

and organizations such as the Wilderness Society was motivated by the human need to experience wild nature, with its silence, solitude, rhythms, and lack of imposed order. Modern research supports the therapeutic influence of wilderness on human perception and behavior, and also highlights the economic benefits of wildland protection to adjacent communities.

The ecological and human arguments for expansive wildlands are even greater today. So, too, are the opportunities to establish them. As New England’s vast forest landscape is protected for diverse future uses, large tracts should be set aside to be wild.

Farmland Promotes a Thriving Regional Food System

Recent decades have witnessed the beginnings of a transformation in New England agriculture with increased interest in local and organic production, community-supported agriculture, grass-based meat and milk operations, urban gardens and markets, expansive protection of farmland through conservation easements, and even the expansion of farm acreage in some areas. New Englanders have an opportunity to seize on this momentum and expand food production across New England. If conducted in sustainable ways that work with nature, this effort would reduce the global impact of the region’s food and wood supply by localizing fruit and vegetable production, shifting livestock increasingly towards a pasture base, and bringing sound forest and agricultural management practices (e.g., maple syrup production) to more family forests.

It would also reconnect more people with the nourishment of their daily lives, and expand the array of natural and cultural landscapes that support native plants, insects, and wildlife. Strong local food and wood movements help support the viability of rural economies and the sustainable production of regional goods and services. Here, we call for retaining existing agricultural land and increasing the application of sustainable farming methods and leave open the possibility of substantial expansion in farmland.



Community Development Shapes the Land

In addition to land protection, New England must turn its attention to remaking the built environment and supporting the green renewal of New England's cities, suburbs, towns, and villages. The imperative that towns, states, and the country face to reinvest in built infrastructure today, both to upgrade outmoded and failing systems and to prepare for climate change, provides an opportunity to rethink our built landscape and transportation and to invest more substantially in natural infrastructure solutions to our challenges (see Box 2).

Concentrating human development reduces the pressure on other lands. But great opportunities exist to be much more strategic in the development of these lived spaces: building more compactly and efficiently to improve the quality of urban and suburban life while reducing energy and resource use; increasing the resilience of communities; revitalizing the hundreds of small mill towns that lie along recovering waterways; and relinking population centers with efficient transportation on abandoned or under-used rail systems.

These green population centers need to incorporate nature and connect to the surrounding landscapes that sustain them. In urban areas, adding more trees addresses multiple problems: they cool apartments, houses, and streets and reduce energy costs, clean the air, reduce flooding, clean stormwater, facilitate species movement, and enhance biodiversity. Farms and gardens interwoven with the urban environment can help meet local food needs and make organic produce more affordable for those who are food insecure, while connecting city dwellers with the land and enhancing neighborhood aesthetics. Connecting urban greenspace with suburban open land—especially along rivers and streams—increases ecological connectivity and benefits the people in both areas. Expanding green infrastructure downtown can help sustain expansive farmlands and forests up-country, with benefits to both rural and urban dwellers. Creating attractive, livable, affordable, and efficient cities and suburban towns goes hand-in-hand with protecting wildlands, woodlands, and farmlands. Healthy cities and countrysides are mutually supporting.

Box 2.

Incorporating New England's Built Environment in the Work of Land Protection

In the next half century, viable New England communities will be founded on green building, the redevelopment of underutilized or abandoned spaces, renewable energy, efficient transportation, open land, and clean water—and on the protection of the natural infrastructure that makes human life possible and enjoyable.

Green building can encompass mixed residential, commercial, and industrial use at different scales. As the economy rebounds, accelerated construction of environmentally friendly, multi-unit, and low-cost housing on small lots can help meet the demand for housing and other building needs. Green construction of new and refurbished buildings can minimize inputs and waste, maximize efficiency, and be built primarily with regional wood products, reducing New England's carbon footprint.

Renewable energy that is appropriately sited can shrink fossil fuel use and the associated needs for oil and gas extraction, pipeline construction, and the disruption of intact natural landscape. Car parks, walkways, streets, and roofs can be covered with tree shade, green cover, and solar arrays that reduce local temperatures and stormwater flows while providing energy without clearing forests or using prime agricultural soils.

Efficient transportation systems can reconnect mixed-use built areas and the surrounding countryside. Highways can be perforated for wildlife crossings. Safe, appealing walkways and bikeways are needed in population centers, and future transit-oriented development can be designed around public-transport hubs.

Productive open spaces can include urban farms, forests, and natural areas. New England cities and suburbs can support increasing cover of trees and woods and supply thousands of acres of market gardens. Neighborhood farmers can grow food alongside back-lot vegetation corridors that help increase the density of connected greenspaces.

Safe, clean water supplies are key to the economic sustainability of cities and towns, whether dense urban hubs or small rural villages. Intact forests are well documented as the best sources of clean and abundant water, and modern water supplies serving dense populations are usually located at a distance from the populated areas that use them. New approaches to stormwater management that reduce impervious surfaces and redirect and reduce runoff flows can help keep these waters clean and in check during storm events.





Putting It All Together: Wildlands, Woodlands, Farmlands, and Communities

The broadened W&W goals for a landscape with extensive woodlands, wildlands, and farmlands with vibrant cities, suburbs, and villages are compatible and mutually reinforcing. However, given the diverse social and economic challenges in southern and northern New England (see Box 3), it is imperative to acknowledge how the application of the *Wildlands and Woodlands* vision differs from region to region, and to offer strategies for working toward the shared goal of retaining intact and healthy landscapes that support both people and nature (see Box 4). In urban, suburban, and suburbanizing landscapes, the work of land protection must be joined with smart growth, affordable housing, improved public transit to help combat sprawl, and new programs to increase green landscapes and local food production to grow the constituency for conserving and using the land.

In rural northern lands, the work of conservation must also expand to include increasing public investment in rural economic development that links community well-being and conservation outcomes (e.g., local producers and community forests); linking markets for low-grade wood with incentives for long-term management that improves forest conditions and protects air, water, and soil quality; expanding

research and development for innovative and sustainable wood products (e.g., engineered structural building materials and composite wood pallets); and expanding private investment in land protection, including long-term costs for the monitoring and defense of protected lands, for ecologically significant wildland reserves, and for lands that provide important natural infrastructure for mitigating and adapting to environmental change.

Challenges exist concerning resource production as well. *A New England Food Vision* noted that although the expansion of farmland and agricultural production could improve health, food justice, and environmental sustainability, these benefits would not be automatic. In particular, the report highlighted environmental questions and the difficulty of making locally produced food accessible to all. Converting a few million acres of forest to pasture could be accomplished while maintaining the *Wildlands and Woodlands* target of 70 percent forest cover, yet it would also have to meet the high standards of water quality, carbon sequestration, and wildlife habitat that the forest provides.

For woodlands, robust markets may ensure that landowners can manage their woods and that products will be produced, but to what end on the land? Increasing the share of wood produced regionally will only lead to positive change when the resulting landscape functions well ecologically and supports local communities. For that to occur, economic support for the forestry sector should be accompanied by a long-range public-private strategic plan for the future of the land. For the forestry sector to succeed, there needs to be durable land protection to ensure a stable base of forests, ownerships large enough to sustain long-term management, and the local population and economy to facilitate it.

Although the *Wildland and Woodlands* strategies for tending the diverse needs of the region are ambitious, a bold vision for New England's future may help attract the level of innovation and public and private investment that is needed for them to succeed. Collectively, the expanded *Wildlands and Woodlands* vision supports people, the landscape, the region's economy, and the global environment.



Fitting a Regional Vision to Different Cultures and Economies within New England

The broadened *Wildlands and Woodlands* vision acknowledges the differences between northern and southern New England, along with the importance of supporting rural economies through a period of transition where people living in the landscape face increasing difficulty making a living from the land.

Across New England, differing challenges require different strategies for achieving the *Wildlands and Woodlands* vision. In populated and urbanizing areas of southern New England, the growth of economic opportunities and population, coupled with the demand for housing in the vicinity of jobs, drives the conversion of open space to buildings and roads and puts affordable housing out of the reach of many. This leads to increased sprawl in outlying communities, especially those with access to highways and rail. Visible development pressure across these areas motivates public support for land protection and acceptance of zoning and land-use planning to help guide development. Evidence of this support includes public funding for land protection, the passage of Community Preservation Act ballot initiatives by Massachusetts voters, and the adoption of Natural Resource Protection Zoning.

At the same time, many of these suburbanizing communities face a cultural challenge—limited experience with traditional land uses such as forestry, farming, and hunting—that can hinder efforts to produce more local wood and food. With fewer people working on the land, a growing number of suburban dwellers are unfamiliar with its benefits and harbor aesthetic, environmental, and safety concerns. This growing disconnect between people and active land use and wildlife management fosters the “illusion of preservation” (see Box 1) and



creates social barriers to achieving a more sustainable future that is tied to the land and its great capacity to produce many resources. Together, development that converts forest and farms, the high cost of land, and the cultural disconnect from land management pose the greatest challenges to achieving the *Wildlands and Woodlands* vision throughout southern and central New England.

Rural areas of northern New England (and some rural areas to the south) face a contrasting set of challenges. In forest-dependent communities, major changes in land ownership, decades of intensive harvesting, declining timber stocks in the far north, and the loss of local jobs and manufacturing to global competition have contributed to declining economic opportunity for residents. In Maine, 12 of the 18 primary mills closed and 10,600, or 39 percent, of wood products jobs were lost between 2001 and 2016.^{35, 36} Since 1980, the land area harvested has doubled to a rate of 530,000 acres per year, while a shift to partial harvesting has kept the harvested volume about the same^{37, 38} and revenues have declined. As part of this economic and landscape transition, by 2007 industrial ownership—which linked ownership of land to mills and local jobs while managing the land very intensively—had declined to 16 percent, and financial investors—with smaller local workforce needs and few incentives for long-term forestry—owned 42 percent of forestland in Maine.³⁹ Although development is less of a concern in this region than in southern New England, the division of parcels for dispersed camps and second homes remains a threat. Meanwhile, the lack of economic opportunity when combined with intensive forestry practices remains a great challenge.

With the decline of the forest products industry and the local economies dependent upon it, rural communities have experienced ongoing job losses, depopulation, and aging of the population.

Uncertainty looms over whether some towns and municipalities in remote areas will continue to exist. Many of these shifts have resulted from the degree to which local economies and community well-being have been coupled with the ownership and fate of the land. In this context, public funding that pays absentee owners to protect land may be seen as ignoring local economic needs, with the result that land-use controls are rolled back or regulatory entities replaced in hopes of attracting new investment (such as the shift from regulatory control by the Land Use Regulatory Commission to the Land Use Planning Commission in Maine in 2012). Similarly, calls for more wilderness and less intensive forestry to encourage more diverse and maturing forests may be misconstrued as undermining future economic gain.

In the face of these differing challenges, historical and cultural connections to the land hold strong in many rural communities and the landscape remains predominantly forested, albeit often by young forests. While debate persists concerning the impact of decades of intensive forest management practices and the true benefits of conservation easements in intensively managed landscapes with low threat of development, the opportunity remains to achieve the *Wildlands and Woodlands* goals of keeping the land forested, promoting sustainable forestry practices, supporting local economies over the long term, and establishing large wildland reserves on lands that can provide valuable ecological qualities over time.



Box 4.

Biodiversity in a Landscape of Conserved Woodlands, Wildlands, and Farmland

Conserving a matrix of diverse landscapes is essential to preserving New England's rich biodiversity. Undisturbed woodlands are essential for vulnerable species that thrive in extensive, older forests with large trees (e.g., American marten, wood thrush, cerulean warbler), and riparian areas with few roads (e.g., wood turtle) and will benefit from additional contiguous forest. Here the retention of large wooded landscapes will be critical, especially when they embed expansive

wildlands. Sustainably harvested woodlands provide habitat for rare plants that are highly threatened by competition with taller, woodier species. A large diversity of insect species are associated with shrubby, semi-open vegetation that requires regular disturbance by grazing, harvesting,

or fire. Maintaining agricultural lands benefits the open-land bird and mammal species that specialize in grassland (e.g., grasshopper sparrow, eastern meadowlark, northern bobwhite) or shrubland habitat (e.g., brown thrasher, towhee, New England cottontail)—species that have declined significantly in New England over the last 50 years, as former agricultural lands have become forest. The New England landscape is naturally heavily wooded, and if these cultural and successional habitats and the species that depend on them are to persist, the landscape needs to support the type of active land use, especially farming, that produced and maintained them over the past four centuries.



The opportunity exists to harness the energy and ingenuity in the region to retain at least 70 percent of New England as forest and at least another 7 percent as farmland, enhance the local economies of northern communities, establish large wild landscapes, protect and expand woodlands and agricultural lands, and manage sustainably and ecologically the mosaic of land to meet local and regional needs. Recent trends in conservation and development make it clear that these ambitious goals remain daunting but achievable. The broad uptick in land protection over the last quarter century confirms that the land-protection capacity in New England is among the most successful in the world. Nevertheless, at the current pace, that goal will not be realized until about 2140, by which time another 3 million acres of forests and farms may have been consumed by development. The pace for protection must triple to protect the remaining 23 million acres of forest and agriculture to hit the W&W vision's 2060 target (trends for northern New England are shown in Figure 12; W&W goals as a proportion of available land are shown in Figure 13).

Challenges to Achieving the Vision

The single greatest challenge to reaching this goal is funding for the purchase of land and especially of easements on private lands to ensure that they remain undeveloped in perpetuity. Even at a conservative \$1,000 per acre in total cost, an intact future New England landscape will require an investment of approximately \$23 billion over the next five decades. In contrast, the recent economic downturn of the mid-2000s spawned major cuts in state and federal conservation funding, with a commensurate decline in land protection. Combined federal and state funding for conservation fell by half, from nearly \$120 million in 2008 to about \$60 million in 2014. Per-capita spending has varied widely among states. For example, from 2004 to 2014, the combined federal and state per-capita spending in Maine and Vermont has been two and half times that of Massachusetts and Connecticut (Figure 14).

In addition, despite widespread public support for conservation, state funding—the largest share of public support for land protection in New England—is perennially vulnerable to state politics and budget pressures. For example, New Hampshire's leading program, the Land and Community Heritage Investment Program, has often been diverted to other purposes and received no revenue in 2012 or 2013. Funds from Connecticut's Community Investment Act have been diverted to the state's general fund. In 2015, over \$11 million of voter-approved bond funds for the Land for Maine's Future program were withheld by the governor. Such vulnerability comes at a time when the average age of landowners is increasing, leading to a growing likelihood of land sale and development over the next 20 years. Support for private land protection will be especially critical to rechart this path.

This recent history makes the prospects of raising \$23 billion over the next five decades daunting. Yet, for comparison, such an investment would be equivalent to one-tenth of what the New England states will spend collectively to manage state highways over the same period. In addition, New England communities, states, and businesses will need to make major investments to combat and accommodate rising temperatures and sea levels and the increased frequency of flooding and severe storms. A significant portion of that should go to maintaining natural infrastructure of forests, wetlands, and intact coastal landscapes as a cost-effective alternative to the construction of expensive built infrastructure.

Fortunately, new imperatives, resources, tools, landowner interest, public and private capital, and participation by larger audiences can increase the current funding allocation and therefore the pace of protection. In addition, many emerging collaborative approaches to land protection are leveraging and making that funding more effective while addressing a major need in land protection: providing local connections to landowners and communities on a regional scale across New England.



W&W Goals and Land Protection in Northern New England since 1950

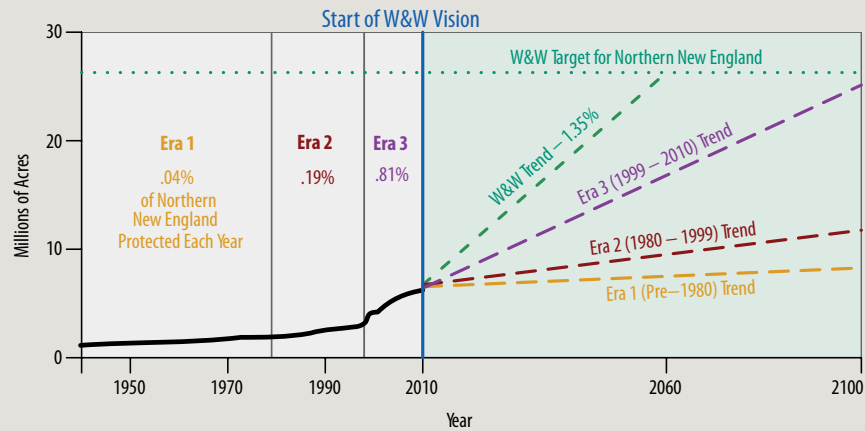


Figure 12. Wildlands and Woodlands goals are achievable and will require a tripling of the current pace of protection to reach the goal by 2060. There is precedent for such an increase. In the three northern states (Vermont, New Hampshire, Maine), three eras of land protection reveal a rate increasing four- to five-fold between each era.⁴⁰

Protected Forest and Farmland in New England: Towards a Wildlands and Woodlands Future

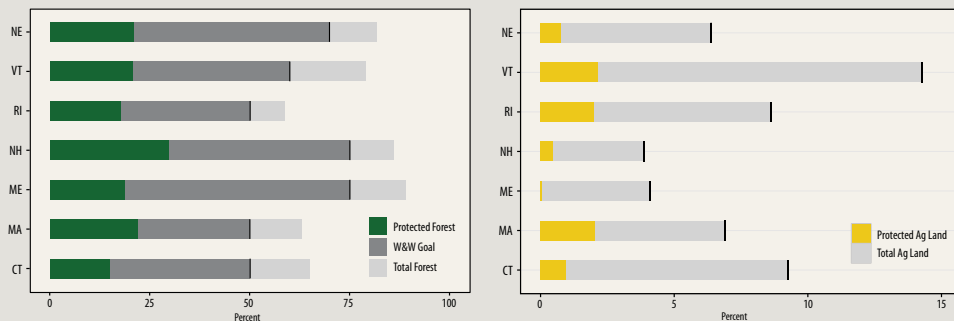


Figure 13. (a) Forest protection in New England ranges from a low of 14 percent in Connecticut to a high of 30 percent in New Hampshire. The gray bars indicate the total amount of forest as a percentage of total land area in each state; the black vertical lines indicate the approximate extent of forest protection required to reach Wildlands and Woodlands goals. (b) Agricultural land ranges from about 4 to 14 percent in the various New England states. Many groups have argued for its complete protection.⁴¹

Federal and State Conservation Funding in New England, 2004-2014

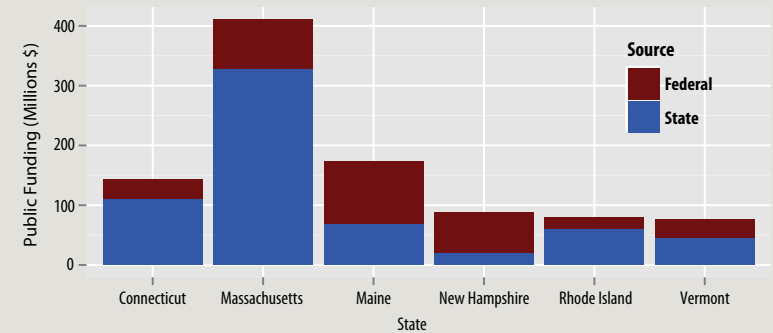
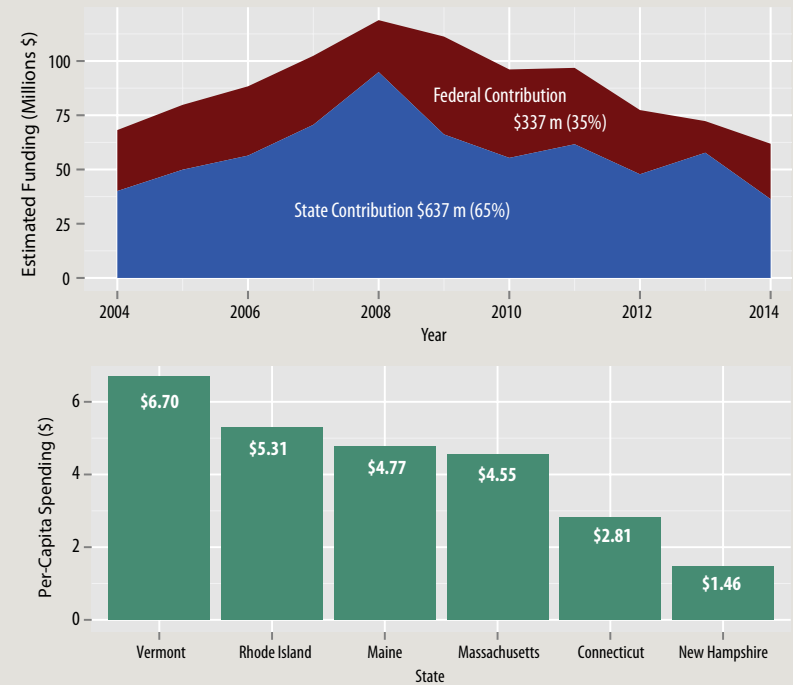


Figure 14. (a) Between 2004 and 2014, federal and state agencies contributed \$973 million of the total funding that protected 1.4 million acres in New England. Together, federal and state funding has declined by half since the 2008 financial crisis, with state funding being particularly vulnerable to political maneuvers that left voter-supported funding underfunded. (b) On an average annual per-capita basis, state funding programs varied considerably between states, with a 4.6-fold difference between Vermont and New Hampshire. (c) The proportion of federal and state funding varied considerably. Massachusetts contributed 80% of its conservation funding; New Hampshire, 24%.⁴²

Opportunities for Progress

The Growth of Collaborative Land Protection

New England has developed one of the world's greatest capacities for land protection through the actions of and partnerships among individuals, families, nonprofit organizations, private businesses, and public agencies working at scales from local to national. The recent surge of collaborative activities, including regional conservation partnerships, efforts within and among academic institutions, regional forest policy alliances, and the establishment of Community Forests, have expanded this capacity, engaged broader audiences, and tapped new sources of funding—and brought the W&W vision within reach.

REGIONAL CONSERVATION PARTNERSHIPS

The 2005 *Wildlands and Woodlands*⁴³ vision recognized that engaging individual landowners and communities is a key to New England conservation. That report proposed the formation of regional conservation partnerships (RCPs; or woodland councils)—collaborations among existing land trusts and municipal, state, and federal agencies—to promote local engagement on a regional scale. The proposal to form RCPs was based on the success of existing collaborations, including the North Quabbin Regional Landscape Partnership in central Massachusetts and the Chittenden County Uplands Conservation Project in Vermont. The effort to champion RCPs and to create an RCP network to support these initiatives has been advanced by Highstead and has proven remarkably successful.

Ten years later, 43 RCPs exist in areas that represent over 60 percent of New England and portions of eastern New York (Figure 15). Twelve RCPs have together conserved approximately 300,000 acres, and many others have been gearing up to follow suit. Twenty-five of the RCPs have built added capacity with support from state, federal, and network-related grants (e.g., Jessie B. Cox Trust RCP Innovation Grant Program). Several are also pioneering the use of



the USDA's Natural Resources Conservation Service (NRCS) Regional Conservation Partnerships Program (RCP) and have raised over \$21 million in three years. The growing role for RCPs in advancing large-landscape conservation includes developing strategic regional conservation maps, recruiting landowners and municipal volunteers as peer leaders, aggregating multi-owner land-protection projects, collaborating on grants and capital campaigns, and protecting connected landscapes across town, county, state, and even national lines.⁴⁴

With the continuous support of the RCP Network and engagement with the Wildlands and Woodlands Initiative and other regional partners, RCPs are increasing the pace and advancing the practice of large-landscape conservation in these ways:

Expanding geography. New RCPs in northern and metropolitan New England, and in other states, will yield new lessons, tools, and approaches to collaborative land protection.

Experimenting with and sharing new strategies. For two decades, RCPs have been developing new and better methods for large-landscape conservation. Through regular peer exchange and active collaboration, each RCP works to further its success as well as that of the entire network of RCPs.

Increasing funding for land protection through local constituencies. RCPs establish mutually beneficial relationships with academic institutions, municipal commissions, watershed managers and water districts, housing and historic preservation groups, outdoor enthusiasts and sporting groups, land-use planning and economic development agencies, and the business community.

Building land trust capacity to protect, steward, and monitor land. RCPs and the RCP Network work with state-based land trust councils and the Land Trust Alliance to support their land trust members' growth and development.

Improving assessment of the impact of land-protection projects on regional objectives. Working with Academics for Land Protection in New England (ALPINE—see page 26), RCPs can better measure the quantity and quality of the land conserved and other activities.

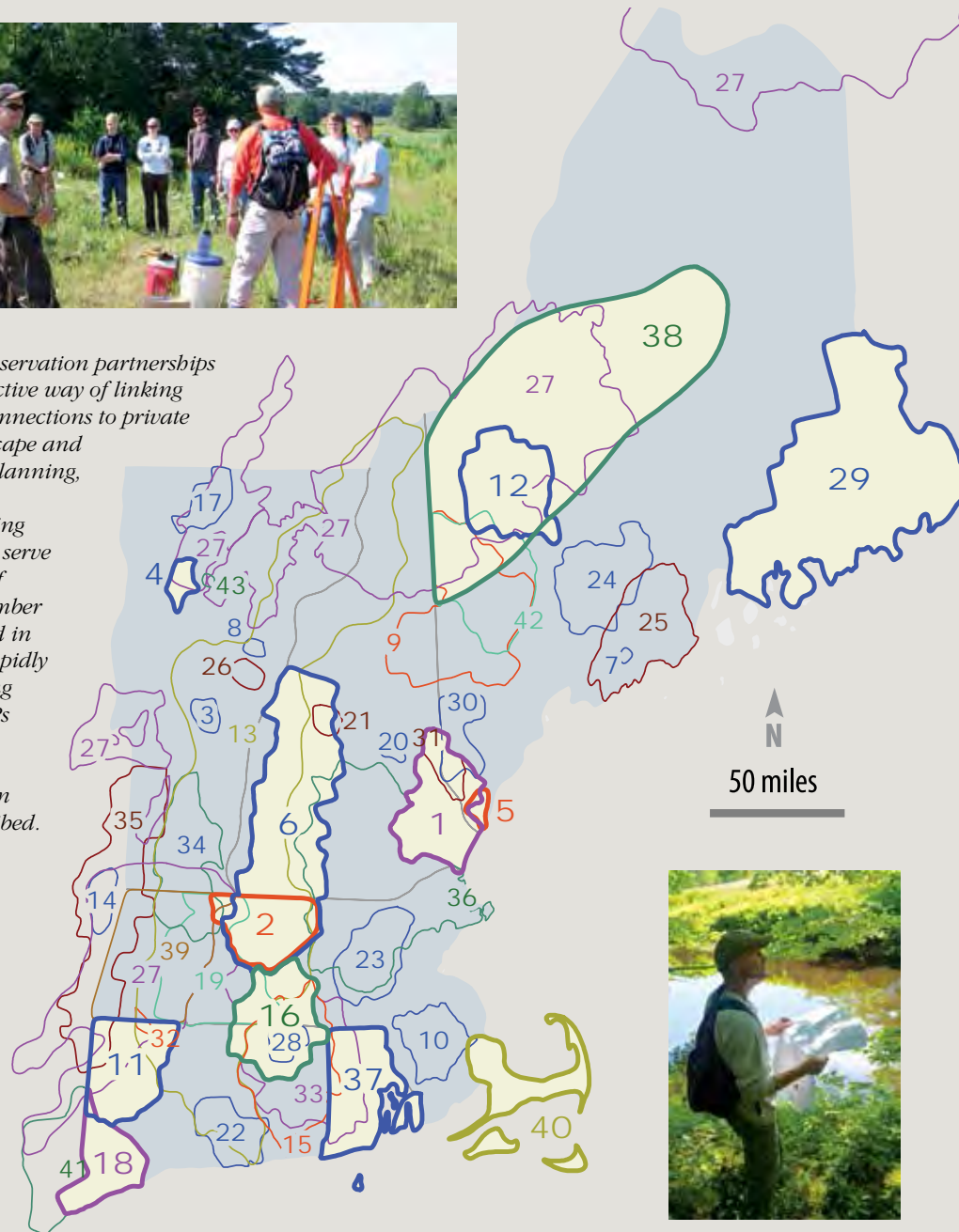
Collaborating across networks. RCPs work together and with ALPINE, state and federal agencies, foundations, and other conservation groups and networks on New England-wide and sub-regional scale activities including climate-informed habitat network mapping, communication, stewardship, environmental justice, fundraising, and land-protection initiatives.



Regional Conservation Partnerships (RCPs) in New England



Figure 15. Regional conservation partnerships (RCPs) provide one effective way of linking local knowledge and connections to private landowners with landscape and regional conservation planning, science, and funding. Forty-three RCPs involving 350 organizations now serve more than 60 percent of New England.⁴⁵ The number of RCPs conserving land in the region has grown rapidly in recent years, doubling since 2009. Several RCPs are marked in bold on the map at right, with their recent conservation highlights further described.



1. Great Bay Resource Protection Partnership (GBRPP; founded 1994)

Since 2014, the GBRPP has provided 22 grants to land trusts and municipalities working to conserve 3,679 acres of priority lands in 15 communities, leveraging over \$490,000 in other funds. GBRPP assists landowners in managing large blocks of conserved lands collaboratively—two so far totaling over 3,200 acres. Since 1994, it has conserved 6,105 acres directly and helped to facilitate the collaborative protection of a total of 80,000 acres by its member groups.

2. North Quabbin Regional Landscape Partnership (NQRLP; founded 1997)

The partnership built cohesion by completing the 22-mile regional Tully Trail and then with the leadership of the Mount Grace Land Conservation Trust protected 104 parcels totaling 9,000 acres in the Tully region using \$8 million in state funding. Many multi-parcel and partner efforts followed, using Forest Legacy, state, and foundation funds; these include the Quabbin Corridor (20 parcels, 2,100 acres), Metacomet–Monadnock Forest (15 parcels, 1,875 acres), and (with many partners) the Quabbin to Wachusett project (23 landowners, over 4,000 acres).

3. Chateaugay No Town Conservation Project

4. Chittenden County Uplands Conservation Project (CCUCP; founded 1997)

Using federal, state, and local funding and with the assistance of students and faculty from the University of Vermont and Middlebury College, the CCUCP has conserved over 8,000 acres of intact working forests and watersheds.

5. Mount Agamenticus to the Sea Conservation Initiative (MtA2C; founded 2002)

In the last 15 years, MtA2C has completed over 80 land-protection projects, expanding a core of watershed lands to connect nearly 14,000 acres of ecologically significant wildlife habitat and other natural areas. The collaborative received an EPA Environmental Excellence award in 2006. MtA2C has been recognized as being first to conserve a working waterfront dock, for working directly with municipalities to advance complementary land-use policies, and for successfully raising over \$20 million through a joint fundraising campaign.

6. Quabbin to Cardigan Partnership (Q2C; founded 2002)

Q2C partners spent three years developing a strategic conservation vision to identify core forest habitats across a third of their region. Since then they have succeeded in protecting more than 105,000 acres through donated and purchased easements, supported by the Forest Legacy program, the Natural Resource Conservation Service, and private donor funding.

7. River-Link

8. Orange County Headwaters Project

9. Upland Headwaters Alliance

10. Resilient Taunton Watershed Network

11. Litchfield Hills Greenprint Collaborative (LHGC; founded 2005)

Coordinated by the Housatonic Valley Association, LHGC partners created a strategic conservation plan to protect large blocks of forests, prime farmland, and drinking water supplies. By building the capacity of land trusts and leveraging nearly \$11 million in public and private support, LHGC has protected 3,300 acres in 20 projects in 17 communities.

12. High Peaks Initiative (HPI; founded 2005)

HPI completed an ecological study of the 85,000-acre region and then worked with landowners to conserve the recreational values of wilderness, solitude, and undisturbed beauty associated with the Appalachian Trail. Approximately 18,000 acres were protected through a series of Forest Legacy projects through 2013. Current projects include development of a gazetteer and protection of an additional 13,500 acres in Maine's High Peaks region.

13. Friends of the Silvio O. Conte National Fish and Wildlife Refuge

14. Rensselaer Plateau Working Forest Initiative

15. Thames River Basin Partnership

16. Mass-Conn Sustainable Forest Partnership (Mass-Conn; founded 2007)

Mass-Conn partners established a new Massachusetts Forest Legacy Area, received \$3.9 million in Connecticut Forest Legacy funding to conserve 1,500 acres of contiguous forest, and recruited another RCP and regional

and national conservation organizations to obtain \$500,000 in grant funding to support landowner outreach in priority focus areas.

17. Cold Hollow to Canada Forest Link Project

18. Fairfield County Regional Conservation Partnership (FCRCP; founded 2008)

FCRCP grew from 5 to 23 towns and 27 partner groups before completing a strategic action plan and regional conservation policy map. They partnered with New York groups on a \$210,000 USFS grant to engage landowners between the Hudson and Housatonic rivers and formed a second RCP while endorsing focused land-protection projects.

19. Forever Farmland Initiative

20. Belknap Range Conservation Coalition

21. Newfound Land Conservation Partnership

22. Lower Connecticut River and Coastal Region Land Trust Exchange

23. West Suburban Conservation Council

24. Kennebec Woodland Partnership

25. 12 Rivers Conservation Initiative

26. Taylor Valley Conservation Project

27. Staying Connected Initiative

28. Quiet Corner Initiative

29. Downeast Conservation Network (DCN; founded 2011)

DCN's network of educators, scientists, citizen science organizers, land trusts, and organizations collaborated on research including a regional economic study and received funding to revise its strategic plan, vision, and goals; engage municipalities; and establish a land-protection due diligence fund. It has also developed a climate-informed strategic plan to protect large priority areas in its nearly 3-million-acre landscape.

30. Forest Works!

31. Salmon Falls Watershed Collaborative

32. Sandy Brook Conservation Corridor

33. Southern New England Heritage Forest Partnership

34. MA-VT Woodlands Partnership

35. Berkshire-Taconic Regional Conservation Partnership

36. Merrimack Conservation Partnership

37. Rhode Island Woodland Partnership (RIWP; founded 2013)

RIWP is a collaboration among public agencies, small businesses, and nonprofit organizations that seeks to maintain the health of Rhode Island's forestland and advance climate-change mitigation and adaptation. Its climate-informed strategic action plan promotes public policy, education, and stewardship to sustain forests and forest cover.

38. Maine Mountain Collaborative (MMC; founded 2015)

After developing a strategic conservation and action plan, MMC sought acquisition funds for partner groups and two existing RCPs: Maine West and High Peaks Initiative. Currently, it is developing a model green timber investment management organization (TIMO) and implementing a \$4.6 million Healthy Forest Reserve Program funded by NRCS.

39. Berkshire Wildlife Linkage Partnerships

40. Massachusetts Coastal Pine Barrens Partnership (PBP; founded 2015)

The diverse PBP partnership includes local, state, and federal agencies, planning commissions, universities, and statewide, regional, and local conservation organizations committed to sustaining its region through land protection, restoration, and management. PBP is pursuing a strategic conservation plan, landowner outreach and engagement, and state and federal funding.

41. Hudson to Housatonic Regional Conservation Partnership

42. Maine West

43. Shutesville Hill Wildlife Corridor Project

ALPINE: BROADENING THE CONSTITUENCY FOR CONSERVATION

With their academic roots, the authors of *Wildlands and Woodlands* recognize that an untapped source of energy, skill, and commitment for land protection lies in the four pillars of every college and university in New England: students, faculty and staff, administration, and alumni. In 2013, a dozen representatives of New England institutions convened the first meeting of ALPINE: Academics for Land Protection in New England. After four meetings, the number of institutions participating is 45 and growing (Figure 16). These include all of the main campuses of the six state universities, many small private colleges, community colleges, rural institutions with great land holdings, and urban institutions in densely populated areas.

ALPINE aims to share success stories and lessons learned in order to increase the protection of institutional lands and those of surrounding communities, engage more of each institution's alumni in land-protection activities, and expand the regions targeted by conservation organizations and agencies. Initial activities guided by the ALPINE steering committee include developing case studies of institutional land-protection activities; mapping the land base of New England academic institutions; forging a strong collaboration with the RCP Network on landscape-scale initiatives, including the Appalachian Trail corridor, the Connecticut River Watershed, and the Long Island Sound Watershed; sharing curricula on the theory and practice of land protection; and offering resources for undergraduates, including a hub for internships in land protection supported by a summer institute for successful interns.

To recognize and motivate academic interest and action in land protection, ALPINE began awarding the Charles H. W. Foster Award for exemplary leadership in land protection by a New England academic institution. In 2016, Middlebury College received the inaugural award in a ceremony held at the Harvard Kennedy School in recognition of the permanent protection of the school's 2,100-acre Bread Loaf landscape in the heart of Vermont's Green Mountains. In a region with 250-plus colleges and universities, ALPINE will continue to grow and welcomes all institutions to join in its work within the expanded *Wildlands and Woodlands* vision.



ALPINE (Academics for Land Protection in New England):
Tapping the Region's Colleges and Universities to Advance Conservation

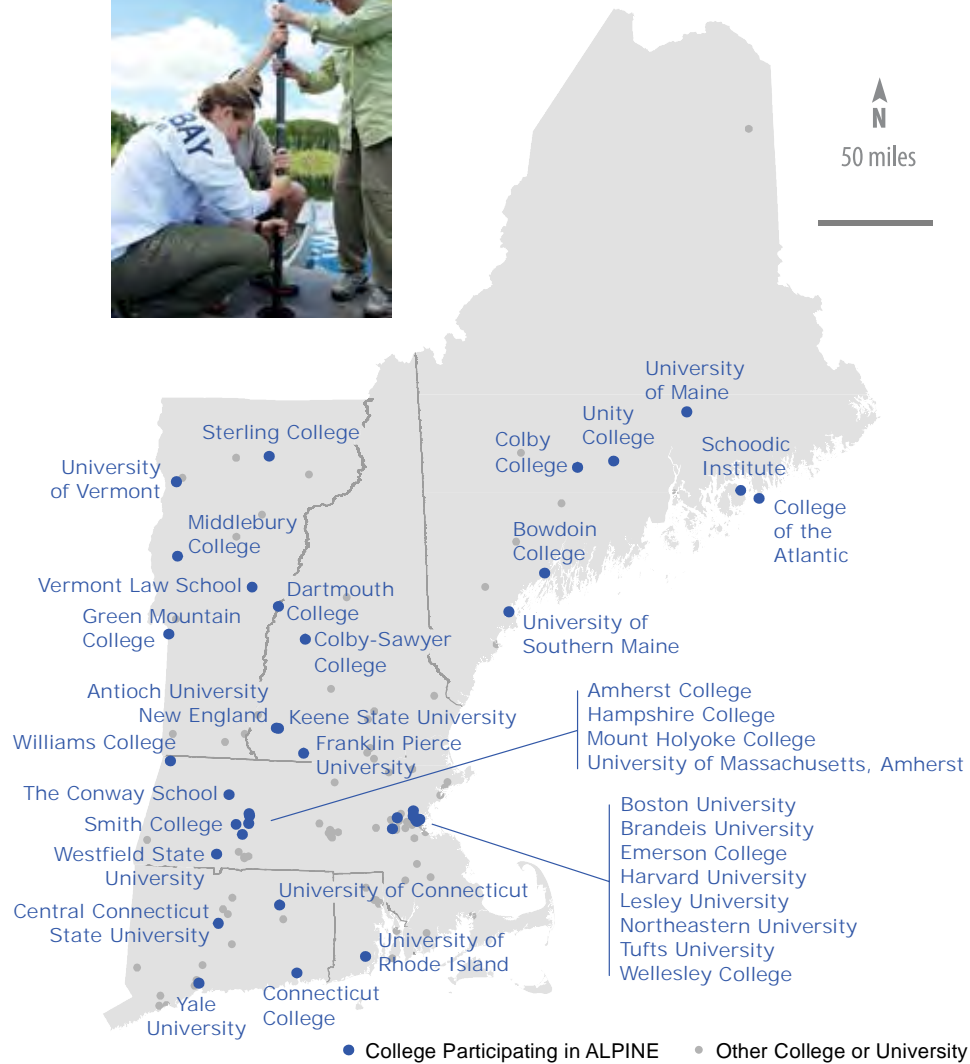


Figure 16. The authors of *Wildlands and Woodlands* established ALPINE in 2013. The consortium is actively growing, with students, faculty, staff, and administrators from more than 45 institutions working together to advance land protection in the region. School locations provided by Hedberg Maps, Inc.

COMMUNITY FORESTS

The *Wildlands and Woodlands* vision challenges residents and policy makers to move beyond simply protecting “special” landmarks, habitats, and species to conserving the region’s natural infrastructure to ensure public health and welfare, support economic activity and community vitality, and sustain biodiversity and ecological health. The Community Forest movement, rooted in the tradition of the New England “town forest,” has gained new relevance in this quest to sustain communities across the region and has a trajectory that could make it an important factor in regional land protection (Figure 17).

Town ownership of forests dates back to original charters in the 1600s. In subsequent centuries, state legislation and town activism led to municipal forestland acquisition to restore and protect timber and water supplies. Today New England supports over 500 town forests, including thriving examples. Danville, New Hampshire’s 300-acre forest was established in 1761 to provide timber for the construction of a parsonage. Weston, Massachusetts, actively manages almost 2,000 acres of town forest and conservation land that support agriculture, trail-based recreation, firewood and timber production, and education. Nonetheless, many town forests sit virtually unknown, unmanaged, unprotected from development, and underappreciated for the many additional benefits they might bring to their communities.

The Community Forest movement, a new effort supported regionally by the Northern Forest Center, the Trust for Public Land, and the Open Space Institute, with federal funding from the USFS Community Forests Grant Program, provides financial assistance to establish Community Forests that provide continuing community benefits. Key features of a Community Forest include ownership by a municipality, tribe, or nonprofit; community participation in decision-making and management; direct community benefit; and permanent land protection.

Examples of Community Forests include the following:

- ▶ **Farm Cove Community Forest** and **West Grand Lake Community Forest** in Maine encompass 57,000 of a 1-million-acre landscape of protected lands that provide local economic support through timber and non-timber forest products, recreational enterprises, and community development.
- ▶ The 7,000-acre **13-Mile Woods Community Forest** in Errol, New Hampshire, was financed through timber sales and the New Markets Tax Credit, which has been principally used in urban areas to finance affordable housing projects.
- ▶ The 380-acre **Barre Town Forest** in northern Vermont forms a key parcel in a regional network of mountain biking trails and was financed in part with community and economic development funds.
- ▶ The **Nulheganaki Tribal Forest** in Barton, Vermont, serves as the seat of governance for the tribe, provides income from a maple sugaring operation, and educates members about agricultural, medicinal, and crafts practices. This tract is the first land owned by the Nulhegan Abenaki in over 200 years.

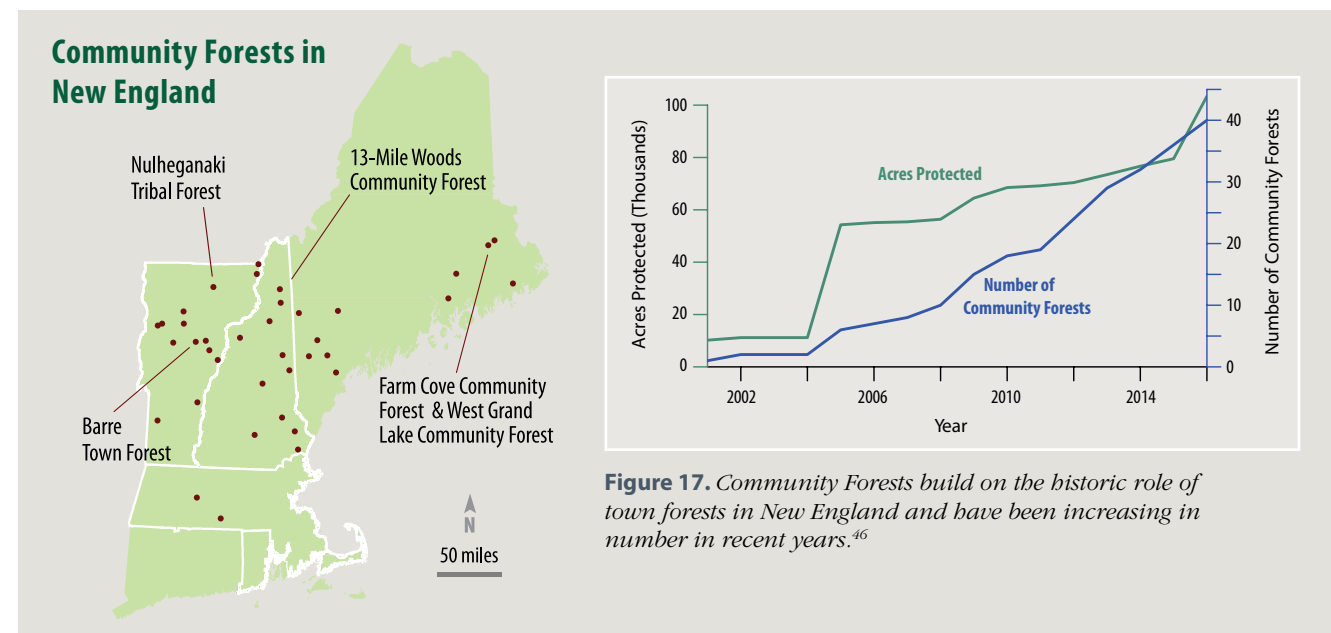


Figure 17. Community Forests build on the historic role of town forests in New England and have been increasing in number in recent years.⁴⁶



REGIONAL COORDINATION FOR NEW ENGLAND FOREST POLICY

Public funding plays a critical role in sustaining New England's forests and forest-based communities, yet the region has lacked a coordinated voice to advance federal policy priorities that target the unique needs and interests of our landscape. To address this need, leaders from New England's largest, oldest, and most successful forestry and forest conservation organizations joined forces in 2011 to form the New England Forest Policy Group (NEFPG). The NEFPG produced policy agendas for forest conservation and management in 2012 and 2013 that sought additional federal funding. Both agendas achieved unprecedented region-wide consensus and support from more than

80 organizations, culminating in letters of testimony for Senate and House appropriations subcommittees.

In 2016, the NEFPG engaged additional state policy groups and surveyed conservation and forest policy leaders to identify priorities for advancing state and federal policies and funding programs for forest conservation. The priorities that emerged from this outreach process include **(1)** communicating why forest conservation, sustainable forestry, and local forest products are vital to New England; **(2)** identifying policies that are successful elsewhere to inform potential new directions for New England; **(3)** evaluating how to best utilize, leverage, and expand federal funding for forests; **(4)** promoting bipartisan collaboration to ensure that New England



receives its share of federal resources in a post-earmark era; and (5) engaging partners from many different sectors to broaden the voice for New England forests. The NEFPG has developed a work plan to implement these new and expanded priorities and to prepare for the reauthorization of the federal farm bill in 2018. Going forward, the opportunity exists to expand and build on the work of the NEFPG by engaging leaders in state government to form a region-wide conservation policy council to coordinate legislative activities and promote information sharing among state agencies.

Innovations in Conservation Finance

Funding is typically the primary factor limiting the rate of land protection. Fortunately, conservation finance tools have evolved since the expansion of the land trust movement in the 1980s. Then, as now, public grants, philanthropic contributions, and donations of land have supported the purchase of many conservation lands. At the same time, a desire



by landowners to conserve their land while retaining it and accessing some of its monetary value has increased the sale and donations of conservation easements on private forests and farms.

The development of easements as an accepted land-conservation strategy has fueled a growth in land protection. Building on this opportunity, conservation groups have advanced innovations in conservation-oriented investments, tax incentives, debt restructuring, federal agency funding, and state bond programs to accomplish unprecedented conservation on a very large scale. Conservationists are also exploring new funding streams through partnerships with community and economic development programs that rely on the myriad benefits of conserved lands. While public programs remain at the core, public-private partnerships and innovative finance mechanisms are beginning to emerge.



PUBLIC FUNDING: A CORNERSTONE OF LAND-PROTECTION SUCCESS

The report *Public Funding for Land Protection in New England* shows that public funding continues to be a major engine of regional land protection and will be critical to increasing its pace.⁴⁷ From 2004 to 2014, federal and state programs contributed approximately \$973 million of the cost of protecting 1.4 million acres. In addition to direct public funding, successful financing programs, such as tax deductions and in some cases tax credits, have motivated private landowners to protect their land.

Federal Sources

In all the years analyzed, 55 to 80 percent of federal funds for New England land protection originated from programs under the Land and Water Conservation Fund (LWCF), which relies primarily on royalties paid by oil and gas producers. The Forest Legacy Program, a USDA program funded by LWCF, supports states and private landowners in placing conservation easements on mostly woodlands and some wildlands. Forest Legacy has been the leading funder of land protection in New England and has benefited every state. Maine alone received over

\$50 million from 2004 to 2014. Unfortunately, each year Congress diverts approximately two-thirds of LWCF funding to other purposes.

Another key federal source for New England land protection is the North American Wetlands Conservation Act, which provides matching grants to protect wetland ecosystems for flood mitigation, water purification, and habitat. New England has also benefited from the fledgling Community Forest Program of the U.S. Forest Service, to protect economically and locally important forests from Maine to Massachusetts.

Recent innovative federal programs have encouraged public-private partnerships in large landscape conservation. For example, the Regional Conservation Partnership Program (RCPP) of the USDA's Natural Resources Conservation Service (NRCS) is funded nationally at \$1.2 billion over five years and will leverage an additional \$1.2 billion from private partners for forest conservation easements. Largely due to the collaborative capacity of New England's regional conservation partnerships, New England has received five national awards under this program totaling nearly \$32 million, including the \$10 million Long Island Sound Watershed Partnership and the \$4.6 million Maine Mountain Collaborative (in 2015 and 2016, respectively). This new funding allows New England landowners access to the Healthy Forest Reserve Program, another NRCS program that helps landowners enhance and protect plant and animal biodiversity while promoting sound forestry. The continued development of new federal funding programs that are suited to the needs of private forest and farmland owners in New England can help reverse the declining trends in conservation funding in the region.

State Sources

State land-protection programs in Massachusetts, Maine, Rhode Island, and Connecticut rely primarily on voter- or legislative-approved bonds for funding, whereas appropriations, deed fees, and real estate transfer taxes are tapped principally in Massachusetts, Vermont, and New Hampshire. Expanding these and other successful state-based approaches to all six states could help to increase public funding in the region.

For example, the Commonwealth Conservation Land Tax Credit in Massachusetts provides landowners with a credit of up to 50 percent of the value of donated land or conservation easements. While the program has a \$75,000 cap and is only currently funded at \$2 million per year, it is the only refundable conservation tax credit in the U.S., which makes it attractive to landowners across the economic spectrum. The program has a two-year waiting list, which has stimulated calls for a funding increase. Over its six-year history, the program has leveraged state funding nearly fivefold in other public and private sources. Vermont, which spends the most per capita of any New England state on land protection annually—about \$7 per capita—has a multi-pronged approach drawing from appropriations, bonds, and a real estate transfer tax.

Local Sources

Many individual towns use their local tax dollars to fund land-protection priorities, often leveraging state, federal, or private money. These efforts conserve locally important forests, farmland, and waters. As such, they retain town character and quality of life, strengthen tourism and local farm and wood production, and secure critical natural infrastructure such as water sources, stream buffers and wetlands, and timber. The mechanism and size of these local funding sources vary widely by town and state. Massachusetts has two noteworthy examples that could be replicated elsewhere: the Community Preservation Act and community land banks.

More than half of the towns in Massachusetts have voluntarily adopted the innovative Community Preservation Act (CPA), a surcharge on local property taxes that ranges from 1 to 3 percent and is supplemented by state funds to support open space and land protection, historic preservation, and affordable housing (Figure 18). More than 70 percent of the towns that have voted on CPA have utilized this form of local taxation. Through 2017, over \$1.75 billion has been raised for more than 9,000 projects, which include the protection of 26,000 acres of farmland and open space and 4,400 historic preservation projects, and the creation or support of 10,000 housing units and 1,700 outdoor recreation projects.



One State's Funding Innovation: The Community Preservation Act (CPA)

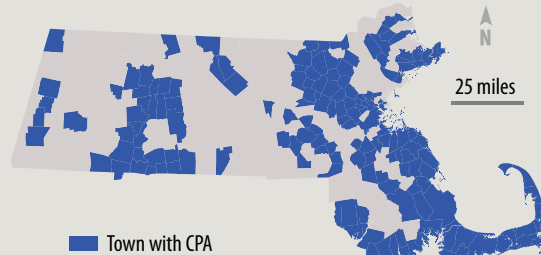


Figure 18. As of 2017, approximately half the towns in Massachusetts had voted to adopt the CPA to help fund land protection.⁴⁸

Another example of local funding in Massachusetts comes from Cape Cod, and the islands of Martha's Vineyard and Nantucket, where sandy aquifers and coastal ponds are vulnerable to contamination, and development pressure is severe. Through state legislation in the 1980s, these areas established land banks that institute a 2 to 3 percent fee on real estate transactions to support land acquisition, conservation easements, and public access. Despite exorbitant land values that make acquisition expensive, this approach and long-standing private efforts have achieved leading land-protection rates (Nantucket consists of more than 50 percent protected land, Martha's Vineyard over 40 percent, and Cape Cod more than 25 percent). While this approach may challenge many communities economically and politically, the results demonstrate that permanent land protection is possible even where land is expensive and at risk.

Similar examples come from adjoining states. For example, in 1998 the State of New York created enabling legislation that allows towns to self-impose an increase in real estate transfer taxes to fund open space. Five towns in eastern Long Island each approved a 2 percent real estate transfer tax to fund the Peconic Bay Community Preservation Fund, which

is used to acquire land for open space, farmland, and historic preservation, as well as for recreational purposes. Between 1999 and 2015, the fund raised over \$1 billion to protect over 10,000 acres of land on the East End of Long Island.

Local land-protection funds are also generated in many New England towns through municipal bonds, town meeting votes, appropriations, or tax surcharges. Since 1996, a total of 362 local and 15 state ballot measures have succeeded in New England, generating \$1.14 billion and \$260 million, respectively, for a total of nearly \$1.4 billion for conservation.⁴⁹ Voters have supported these local and state measures with 65 percent and 67 percent average approval ratings, respectively. These figures do not include additional municipal funding in Vermont and New Hampshire, where towns typically pass funding measures at town meetings, rather than by ballot.

PRIVATE FUNDING: CRITICAL SUPPORT FOR LAND PROTECTION

Although the total amount of funding is unknown, private sources provide substantial and critical support for land protection. Private funding sources include cash donations to land trusts, foundation grants, access to low-cost debt, and bargain sales—the sale of land or easements at less than market value—that provide landowners with tax benefits. Indirect support from public programs that leverage private funding is also critical. For example, anglers and hunters have long paid fees associated with the purchase of licenses and “land stamps” that are invested in land protection. The “Pennies per Hundred Program” in Rhode Island has generated over \$14 million from water users to conserve over 2,500 acres of water-supply lands.

In addition to philanthropic contributions, conservationists are exploring new funding methods such as partnering with community and economic development programs and developing new financial instruments to attract private investment (see Box 5). Leveraging private capital holds great promise for accelerating the pace of land protection in New England.

Impact investors represent an emerging source of private funding. This group of high-net-worth individuals, endowments, and institutional investors seeks to stimulate the long-term social and environmental benefits of forest and farm protection while achieving modest rates of financial return. For some of these investors, financial returns are secondary to mission-driven outcomes. For others, larger returns come by combining multiple revenues, such as timber sales, conservation easements, and carbon offset sales. Many of these alternative revenue streams are facilitated by public finance or regulations that create value for ecosystem services, such as carbon offset markets or water quality trading programs.

Private investment represents a tremendous pool of capital that has the potential to dwarf current public allocations, yet paradoxically it relies on public funding programs to generate part of its return. For example, some large timberland investments generate revenue by selling conservation easements purchased through the public Forest Legacy Program. One major challenge to increasing private investments in conservation is creating markets in which the environmental benefits the investments provide can be bought and sold. Accessing some of the massive pool of private capital will require investors and conservationists to develop innovative solutions together.



Stimulating Public and Private Investment in Land Conservation

Highstead, Harvard Forest, and many other organizations in the region are collaborating to develop new conservation finance strategies and promote the adoption of proven tools in other towns and states. These new strategies include emerging ideas on natural infrastructure investments, payments for ecosystem services, working forest investments, and new public funding programs. For example:

- ▶ **Highly successful state-level funding programs**, such as the Massachusetts Community Preservation Act, should be enhanced with higher appropriations and adopted by other states. Programs from outside the region should also be investigated. For example, the Minnesota Legacy Amendment enacted a 0.375 percent sales tax increase to generate \$317 million per year; thus far it has protected 269,000 acres and supported arts and cultural resources. A similar program if enacted in New England with a modest 0.125 percent sales tax increase would generate \$240 million per year, at an average annual household cost of \$47.⁵⁰
- ▶ **Tax incentives for landowners** to donate easements and land have been highly successful. The Internal Revenue Service first bestowed a tax deduction on landowners who gifted conservation easements in 1980, and in 1981 the Uniform Conservation Easement Act provided enabling legislation for states to adopt easements. The number of land trusts tripled over the next three decades, and today, 4.2 million acres of New England are permanently protected through conservation easements. Developing a refundable tax credit program, such as the Massachusetts Land Conservation Tax Credit, in other New England states would encourage landowners for whom a simple tax deduction is not an adequately compelling incentive to protect their land. Tax credits can be especially appealing for rural landowners whose land value and income may be lower, and whose tax deductions may have less value overall.
- ▶ **Impact investors and foundations** could collaborate on a regional revolving loan fund with an extended payback period (e.g., 10 to 15 years) that could finance regionally important projects. Fundraising for completed projects is challenging for land trusts, so such a fund should be paired with focused grant programs that value the leverage of a large revolving fund to support state-specific conservation objectives. For example, clean water state revolving loan funds exist in every state and are capitalized by federal and state funding. These could serve as a model of low-interest debt that finances priority water infrastructure projects.
- ▶ **New state and federal policies** may spur major new infrastructure investments to help address the backlog of civil works projects in the U.S. Some of the infrastructure investments should be dedicated to the protection of natural infrastructure for flood protection, clean water supply, and coastal adaptation for resilience. With coming infrastructure development, opportunities may also exist to create environmental damage assessment and mitigation funds, which could be used to protect and restore habitat, wetlands, and forests.





RECOMMENDATIONS FOR THE NEXT 10 YEARS

1. Accelerate Land Protection

- ▶ Establish state-specific targets for land protection of woodlands, wildlands, and farmlands to move the region towards the *Wildlands and Woodlands* goals.
- ▶ Expand collaborative landscape-scale conservation to implement state-level targets by increasing resources to regional conservation partnerships, community forests, and other partners, and by engaging ALPINE institutions in these efforts.
- ▶ Educate advisors of private landowners (e.g., foresters, real estate professionals, lawyers, financial planners) concerning land-protection options to assist their clients in achieving their long-term objectives.
- ▶ Promote local, state, and federal policies advancing land-protection and smart growth policies including USDA designation of New England as a critical conservation area.
- ▶ Engage urban, exurban, and rural communities in joint regional land-protection and policy activities.
- ▶ Diversify RCP state- and New England-wide conservation partners by including hunters; anglers; backcountry guides; off-road riders; public health, affordable housing, and city park advocates; garden clubs; and environmental and social justice groups.

2. Manage More Land, Ecologically and Sustainably

- ▶ Increase the regional production of food, wood, and other resources, while retaining ecosystem services and expansive wildlands.
- ▶ Develop markets and policies to support local sustainable food and wood economies.
- ▶ Increase the connections between people and their regional farm and forest production and producers.
- ▶ Strengthen the value of conservation easements by providing incentives for exemplary forest and farm management with robust ecological goals on those lands.

- ▶ Invest in the ecosystem services and natural infrastructure provided by private lands.
- ▶ Encourage land trusts to engage landowners who manage for wood products or wildland reserves as peer leaders to share their passion and experience.

3. Grow Smart in Cities, Suburbs, and Towns

- ▶ Engage with the urban and land planning communities to apply smart growth policies and incentives alongside land protection to forge integrated urban, suburban, and rural landscapes that support people, nature, and food production.
- ▶ Develop policies to advance green infrastructure and build resilience to climate change, rein in low-density development, and address housing affordability.
- ▶ Advance effective local and regional public transportation.
- ▶ Work with RCPs in coastal watersheds to strengthen resilience to climate change on communities, regions, and watersheds.
- ▶ Eliminate deleterious regulations and incentives, such as minimum lot size requirements that promote low-density sprawl and subsidies on solar and wind projects that destroy farms and forests.
- ▶ Increase public investment in underserved rural and urban communities to support businesses that capitalize on local farms, forests, water, and recreational resources.

4. Support Strong Rural Economies

- ▶ Support rural communities in coupling new investments and ways of using natural and agricultural resources with land protection, while increasing local health and economic benefits of intact rural landscapes (e.g., community forests).
- ▶ Link markets for low-grade wood with incentives for long-term forestry that improves forest conditions and protects air, water, and soil quality.





- ▶ Expand research and development for innovative and sustainable wood products (e.g., engineered structural building materials, composite wood pallets).
- ▶ Expand private investment in land protection, including stewardship costs, for wildland reserves and lands providing natural infrastructure for mitigating and adapting to environmental change.

5. Increase Funding for Land Protection

- ▶ Strengthen public investments in land-protection benefits through additional public tax incentives for donations of conservation easements, incremental gasoline taxes, real estate transfer taxes, and a carbon tax that reinvests proceeds in sequestering carbon through forest protection.
- ▶ Ensure the stability of existing state funding programs and adopt successful state and local programs from elsewhere.
- ▶ Form an expanded forest conservation policy council with state representatives to advocate for federal funding and promote adoption of proven state-based policy measures across the region.
- ▶ Establish local, state, and federal policies to recognize ecosystem services—the direct benefits to human and community well-being from nature’s infrastructure, such as clean water and flood mitigation—and catalyze public funding and private markets to secure them permanently.
- ▶ Develop finance tools that attract private investments in sustainable natural resource management and land protection, such as expanded carbon offset markets, water quality trading markets, and payments for exemplary forest stewardship.

- ▶ Strategically direct a portion of the anticipated massive federal investment in infrastructure to protect natural infrastructure.
- ▶ Promote the expansion of federal programs such as the Land and Water Conservation Fund and the USDA’s Regional Conservation Partnership Program, which deliver major support to New England land-protection projects.
- ▶ Create and fund regional revolving, small grant, and transaction cost funds to leverage other larger private, state, and federal investments in land-protection projects.

6. Reduce Consumption and Conserve Resources

- ▶ Support increased efficiency in transportation, appliances, and lighting and renewable energy that is environmentally sensitive.
- ▶ Encourage pricing that incorporates the full cost of recycling of consumer goods.
- ▶ Advance regulations that encourage compact development and smaller residences and discourage large single-family homes.
- ▶ Advance programs that involve more wood use in construction of all types.
- ▶ Encourage the redevelopment of built landscapes such as industrial mills on recovering rivers and streams, and commercial brownfields.

Collaboration: What We All Can Do

Our Pledge: As a partnership of academics, nonprofit leaders, landowners, and community members, we pledge to bring our shared knowledge and resources together to continue developing, communicating, and advancing the *Wildlands and Woodlands* vision. This includes conducting regional science to explore the past and future dynamics of the New England landscape and their environmental and societal consequences, and conveying the results of these activities to stakeholders and policy makers; publishing books and reports on the state of the land and connections to human actions; supporting and sharing the success of private individuals and

organizations and public agencies in advancing land protection; enhancing collaborative region-wide activities including the Regional Conservation Partnership Network, ALPINE, and the New England Forest Policy Group; and convening groups to promote local, state, regional, and federal funding for land protection.

What You Can Do

Landowners. Consider permanently protecting your land and the benefits it provides to you, future owners, and society. Work with knowledgeable advisors, land trusts, and planning boards to understand the role of your land in the larger landscape. Share your successful land-protection experience, speak to how actions by individual landowners contribute to achieving the W&W vision, and share your views on the need for conservation funding with local, state, and federal officials.

Conservation organizations. Consider starting or joining a regional conservation partnership. Pursue legislation and funding measures that support land protection (e.g., Environmental Priorities Coalition in Maine or Maine Conservation Voters). Engage school programs in local conservation efforts to build a sense of community around local land resources, and to educate the land stewards of the future.

Local governments and commissions. Permanently protect town-owned lands, such as town forests, and utilize them for education, recreation, wildland reserves, and natural resource production. Update your local land-use plans and develop effective land-use tools such as open space zoning, natural resource protection zoning, and transfer of development rights to support land-protection efforts. Create incentives for developers to voluntarily incorporate protected space into their planning. Promote the protection and use of local forest and farmland held by private landowners. Participate in your local regional conservation partnership and coordinate with surrounding towns, private organizations, and public agencies in conservation planning and land management.

State government. Establish ambitious state targets for conservation funding and land-protection acreage, including specific programs and measurable goals for achieving targets. Create effective policies and programs to enhance the protection of forests and farms to secure community character and natural infrastructure, and increase local production of goods. Leverage the resources of private institutions and individuals in land protection.

Federal government. Secure and expand existing programs that conserve forests, wetlands, and farmlands. Create opportunities for cross-sector strategic planning and support for training in collaborative planning and communications. Promote the redesign of our built environment to reduce resource use, mitigate future impacts, provide access to local foods and conservation areas, and generate healthier lifestyles.

Foundations and individual donors. Form funding networks with philanthropic groups that coordinate grants to achieve greater impact through challenge grants, transaction cost funds, and additional capacity-building programs. Consider expanding funding programs that link land protection with the communities and populations directly benefiting from the land.

Private investors. Explore new ways of protecting land with local land trusts or regional conservation partnerships to yield tangible conservation benefits and financial returns. Develop partnerships with public agencies (local to federal) for targeted investments to conserve critical ecological services. Join with like-minded investors to maximize collective impact.

Academic community. Engage students, staff, faculty, administrations, and alumni in advancing land protection by creating links between academic communities, land trusts, and regional conservation partnerships to train students through internships and to support conservation and management decisions through knowledge-to-action partnerships. Use protected lands and conservation case studies to support the teaching, research, and societal mission of academic institutions. Support the permanent legal

protection of the substantial forest and farmland holdings of academic institutions.

Landowner advisors (foresters, financial advisors, real estate professionals, lawyers, landscapers, etc.). Advise landowners regarding land protection and sound stewardship. Provide or seek training in leading land-conservation tools and land-management approaches. Identify and become active with local or regional conservation efforts and community planning. Host conservation speakers at your professional association meetings.

Developers. Work with local land trusts and planning groups to plan development that does not directly conflict with conservation priorities. Consider ways to adapt development plans to use land as efficiently as possible through clustering or other means. Seek examples of profitable revitalization of existing buildings and brownfields and determine if this can be part of your development portfolio. Identify corporate benefits of collaborating with municipalities and conservation interests, through marketing, community building, and supporting long-term community well-being. Understand how protected lands can support long-term economic growth, including increased property values.

Businesses. Help build a sense of community by collaborating with local conservation groups that engage community members with hands-on conservation or habitat restoration projects. Work within your company or business associations to provide grants to organizations that support protection of forest and farmlands for local food and wood production. Include land conservation in your corporate sustainability planning.

Sporting and recreational enthusiasts. Get to know the land you use and its conservation status. Help identify land that needs protection. Host forums to highlight the link between land protection and high-value hunting and fishing grounds. Participate in regional planning efforts that protect access to working forests and wildlands for multiple uses. Find conservation alliances that bolster your interests in protecting fish and wildlife habitat.

IN SUMMARY

Through decades of land protection by thousands of individuals and organizations, large expanses of the distinctive New England landscape have been permanently conserved for current and future generations. But today, the forest and farm base that supports human livelihood, wildlife, and critical nature-based benefits for society is being chipped away slowly by development and parcelization. Retaining an intact landscape is the single most important step that we can take to ensure the continuous flow of benefits from nature to society in the face of mounting environmental threats. Fortunately, local communities, public agencies, and the private sector are banding together to develop new partnerships and approaches for conserving forests, farms, and green space in cities, towns, and the countryside. These protected spaces can provide greater environmental stability and stronger economic return to landowners for the wood, air, water, and wildlife benefits their lands provide. The broadened *Wildlands and Woodlands* vision imagines a community-based regional revitalization, that meets the needs of people by caring for the land and harvesting wisely its food and fiber, growing the conservation economy, and embracing the voluntary and permanent protection of the land as a continuation of the cultural and environmental heritage that has defined this region for more than 200 years. Such a vision calls on us to link the future of open and built space in a way that recognizes their interdependence and supports the betterment of each. This may take years to decades to occur, but history shows that the concentrated effort of many individuals can transform an entire region in ways that shape the land and benefit communities for centuries to come.



CITED REFERENCES

- Foster, D. R., D. B. Kittredge, B. M. Donahue, G. Motzkin, D. A. Orwig, A. M. Ellison, B. R. Hall, E. A. Colburn, and A. W. D'Amato. 2005. *Wildlands and Woodlands: A vision for the forests of Massachusetts*. Harvard Forest Paper No. 27. <http://www.wildlandsandwoodlands.org>.
- Foster, D. R., B. M. Donahue, D. B. Kittredge, K. F. Lambert, M. L. Hunter, B. R. Hall, L. C. Irland, R. J. Lillieholm, D. A. Orwig, A. W. D'Amato, E. A. Colburn, J. R. Thompson, J. N. Levitt, A. M. Ellison, W. S. Keeton, J. D. Aber, C. V. Cogbill, C. T. Driscoll, T. J. Fahey, C. M. Hart. 2010. *Wildlands and Woodlands: A vision for the New England landscape*. Harvard University Press, Cambridge, MA. <http://www.wildlandsandwoodlands.org>.
- Hansen, M. C., R. S. DeFries, J. R. G. Townshend, M. Carroll, C. Dimiceli, and R. A. Sohlberg. 2003. Global percent tree cover at a spatial resolution of 500 meters: First results of the MODIS vegetation continuous fields algorithm. *Earth Interactions* 7:1–15.
- Foster, D. R., B. M. Donahue, D. B. Kittredge, K. F. Lambert, M. L. Hunter, B. R. Hall, L. C. Irland, R. J. Lillieholm, D. A. Orwig, A. W. D'Amato, E. A. Colburn, J. R. Thompson, J. N. Levitt, A. M. Ellison, W. S. Keeton, J. D. Aber, C. V. Cogbill, C. T. Driscoll, T. J. Fahey, C. M. Hart. 2010. *Wildlands and Woodlands: A vision for the New England landscape*. Harvard University Press, Cambridge, MA. <http://www.wildlandsandwoodlands.org>.
- Modified from Foster and Aber (2004) with additional data from USFS FIA state reports. Foster, D. R. and J. D. Aber. 2004. *Forests in time*. Yale University Press, New Haven, CT.
- Data compiled from U.S. Agricultural Census reports by Brian Donahue and Sarah Sutton at Brandeis University.
- Olofsson, P., C. E. Holden, E. L. Bullock, and C. E. Woodcock. 2016. Time series analysis of satellite data reveals continuous deforestation of New England since the 1980s. *Environmental Research Letters* 11(6):1–8.
- Homer, C. G., J. A. Dewitz, L. Yang, S. Jin, P. Danielson, G. Xian, J. Coulston, N. D. Herold, J. D. Wickham, and K. Megown. 2015. Completion of the 2011 National Land Cover Database for the conterminous United States—representing a decade of land cover change information. *Photogrammetric Engineering and Remote Sensing* 81(5):345–354.
- Donahue, B. M., J. Burke, M. Anderson, A. Beal, T. Kelly, M. Lapping, H. Ramer, R. Libby, and L. Berlin. 2014. *A New England food vision*. Food Solutions New England, University of New Hampshire, Durham, NH. <http://www.foodsolutionsne.org/sites/default/files/New-England-Food-Vision.pdf>.
- Lillieholm, R. J. 2007. Forging a common vision for Maine's North Woods. *Maine Policy Review* 16(2): 12-25. <http://digitalcommons.library.umaine.edu/mpr/vol16/iss2/4>.
- Keeton, W. S. 2007. Role of managed forestlands and models for sustainable forest management: perspectives from North America. *George Wright Forum* 24(3): 38-53.
- 2011 Land cover data is from the NLCD: Homer, C. G. et al. 2015 (see cited ref #8). Watershed boundaries were simplified from the USGS hydrologic unit codes: <https://water.usgs.gov/GIS/huc.html>. Protected open space data is from Harvard Forest and Highstead.
- Berlik, M., D. Kittredge, and D. Foster. 2002. The illusion of preservation: a global environmental argument for the local production of natural resources. *Journal of Biogeography* 29:1557–1568. <http://harvardforest.fas.harvard.edu/publications>.
- Thompson, J. R., K. F. Lambert, D. R. Foster, M. Blumstein, B. Broadbent, A. Almeyda Zambrano. 2013. Changes to the land: four scenarios for the future of the Massachusetts landscape. Harvard Forest Paper. <http://harvardforest.fas.harvard.edu/changes-to-the-land>.
- Thompson, J. R., K. F. Lambert, D. R. Foster, E. N. Broadbent, M. Blumstein, A. M. Almeyda Zambrano, and Y. Fan. 2016. The consequences of four land-use scenarios for forest ecosystems and the services they provide. *Ecosphere* 7(10):e01469.
- Nowak, D. J., Hirabayashi, S., Bodine, A., and Greenfield, E. 2014. Tree and forest effects on air quality and human health in the United States. *Environmental Pollution* 193:119–129.
- Nowak, D. J., S. Hirabayashi, A. Bodine, and E. Greenfield. 2014. Tree and forest effects on air quality and human health in the United States. *Environmental Pollution* 193:119–129.
- Kellndorfer, J., Walker, W., LaPoint, E., Bishop, J., Cormier, T., Fiske, G., Hoppus, M., Kirsch, K., and Westfall, J. 2012. NACP Aboveground Biomass and Carbon Baseline Data (NBCD 2000), U.S.A., 2000. Data set. Available on-line at <http://daac.ornl.gov> from ORNL DAAC, Oak Ridge, Tennessee, U.S.A.
- Thompson, J. R., J. S. Plisinski, P. Olofsson, C. Holden, and M. Duveneck. In Review. Forest loss in New England: A projection of recent trends.
- Thompson, J. R., J. S. Plisinski, P. Olofsson, C. Holden, and M. Duveneck. In Review. Forest loss in New England: A projection of recent trends.
- Thompson, J. R., Foster, D. R., Scheller, R., and D. B. Kittredge. 2011. The influence of land use and climate change on forest biomass and composition in Massachusetts, USA. *Ecological Applications* 21(7):2425–2444.
- Thompson, J. R., K. F. Lambert, D. R. Foster, E. N. Broadbent, M. Blumstein, A. M. Almeyda Zambrano, and Y. Fan. 2016. The consequences of four land-use scenarios for forest ecosystems and the services they provide. *Ecosphere* 7(10):e01469.
- Thompson, J. R., J. S. Plisinski, P. Olofsson, C. Holden, and M. Duveneck. In Review. Forest loss in New England: A projection of recent trends.
- Olofsson, P., C. E. Holden, E. L. Bullock, and C. E. Woodcock. 2016. Time series analysis of satellite data reveals continuous deforestation of New England since the 1980s. *Environmental Research Letters* 11(6):1–8.
- Homer, C. G., J. A. Dewitz, L. Yang, S. Jin, P. Danielson, G. Xian, J. Coulston, N. D. Herold, J. D. Wickham, and K. Megown. 2015. Completion of the 2011 National Land Cover Database for the conterminous United States—representing a decade of land cover change information. *Photogrammetric Engineering and Remote Sensing* 81(5):345–354.
- U.S. Geological Survey (USGS) Gap Analysis Program (GAP). 2016. Protected areas database of the US, PAD-US (CBI Edition). <https://gapanalysis.usgs.gov/PADUS/>.
- The Nature Conservancy (TNC). 2014. Secured lands geodatabase. <https://www.conservationgateway.org>.
- Thompson, J. R., J. S. Plisinski, P. Olofsson, C. Holden, and M. Duveneck. In Review. Forest loss in New England: A projection of recent trends.
- James W. Sewall Co. 2015. Geospatial mapping. <http://www.sewall.com/services/geospatial/mapping.php>.
- Meyer, S. R. and J. R. Thompson. The Growth of Regional Conservation: How land protection in a privately owned landscape shapes the future landscape. In Review.
- Data from the Harvard Forest, Highstead, and individual organizations.
- Foster, D. R., B. M. Donahue, D. B. Kittredge, K. F. Lambert, M. L. Hunter, B. R. Hall, L. C. Irland, R. J. Lillieholm, D. A. Orwig, A. W. D'Amato, E. A. Colburn, J. R. Thompson, J. N. Levitt, A. M. Ellison, W. S. Keeton, J. D. Aber, C. V. Cogbill, C. T. Driscoll, T. J. Fahey, C. M. Hart. 2010. *Wildlands and Woodlands: A vision for the New England landscape*. Harvard University Press, Cambridge, MA. <http://www.wildlandsandwoodlands.org>.

33. Lansky, M. 2003. Low impact forestry: forestry as if the future mattered. Maine Environmental Policy Institute, Hallowell, ME. <http://www.meepi.org/lif/>.
34. Perschel, R. T., R. A. Giffen, and F. Lowenstein. 2014. New England forests: the path to sustainability. New England Forestry Foundation, Littleton, MA. <https://builditwithwood.org/our-publications/>.
35. Maine Forest Products Council. 2016. Maine's Forest Economy. <http://maineforest.org/wp-content/uploads/2016/09/Maines-Forest-Economy-10-12-2016.pdf>.
36. Maine Department of Labor. 2016. Center for Workforce Research and Information. <http://www.maine.gov/labor/cwri/qcew.html>. Accessed Feb. 15, 2017.
37. McWilliams, W. H., B. J. Butler, L. E. Caldwell, D. M. Griffith, M. L. Hoppus, K. M. Lausten, A. J. Lister, T. W. Lister, J. W. Metzler, R. S. Morin, S. A. Sader, L. B. Stewart, J. R. Steinman, J. A. Westfall, D. A. Williams, A. Whitman, and C. W. Woodall. 2005. The forests of Maine: 2003. US Forest Service Research Bulletin. NE-164. Northeastern. Research. Station, Newton Square, PA.
38. Fishell, D. 2016. An "economic crisis" in Maine's paper industry, mapped. Bangor Daily News. March 16, 2016.
39. Noone, M. D., S. Sader, and K. R. Legaard. 2012. Are forest disturbance rates and composition influenced by changing ownerships, conservation easements, and land certification? *Forest Science* 58(2):119–129.
40. Adapted from Meyer, S. R., C. S. Cronan, R. J. Lillieholm, M. L. Johnson, and D. R. Foster. 2014. Land conservation in northern New England: Historic trends and alternative conservation futures. *Biological Conservation* 174: 152–160.
41. Forest cover data from Olofsson et al. 2016 and Homer et al. 2015 (see cited refs #7 and 8). See Thompson et al. In Review (cited ref #19) for methods. Conservation data from USGS 2016 (cited ref #26).
42. Data primarily from Highstead and the Trust for Public Land. Complete references available in M. Buchanan. 2016. Public conservation funding in New England: recent trends in government spending on land protection. Highstead, Redding, CT. <http://www.wildlandsandwoodlands.org/public-funding-report>.
43. Foster, D. R., D. B. Kittredge, B. M. Donahue, G. Motzkin, D. A. Orwig, A. M. Ellison, B. R. Hall, E. A. Colburn, and A. W. D'Amato. 2005. Wildlands and Woodlands: A vision for the forests of Massachusetts. Harvard Forest Paper No. 27. <http://www.wildlandsandwoodlands.org>.
44. Labich, W. 2015. The regional conservation partnership handbook. Highstead Foundation. Redding, CT. <http://wildlandsandwoodlands.org/rcpnetwork>.
45. Data from B. Labich, Highstead, and individual RCPs.
46. Community Forest Collaborative. 2007. Community forests: a community investment strategy. https://northernforest.org/images/resources/community-forests/Community_Forests_Report_1.7MB.pdf.
47. Buchanan, M. 2016. Public conservation funding in New England: recent trends in government spending on land protection. Highstead, Redding, CT. <http://www.wildlandsandwoodlands.org/public-funding-report>.
48. MassGIS. 2016. Community Preservation Act (CPA) Towns. Office of Geographic Information (MassGIS), Commonwealth of Massachusetts, MassIT. <http://www.mass.gov/anf/research-and-tech/it-serv-and-support/application-serv/office-of-geographic-information-massgis/datalayers/cpa.html>.
49. North, B. and S. R. Meyer. 2017. New England conservation pathways: A survey of emerging conservation finance strategies. Highstead Foundation. http://www.wildlandsandwoodlands.org/sites/default/files/Highstead_Pathways_Report.pdf.
50. North, B. and S. R. Meyer. 2017. New England conservation pathways: A survey of emerging conservation finance strategies. Highstead Foundation. http://www.wildlandsandwoodlands.org/sites/default/files/Highstead_Pathways_Report.pdf.
- Gartner, T., J. Mulligan, R. Schmidt, and J. Gunn. Natural infrastructure: investing in forested landscapes for source water protection in the United States. World Resources Institute, Washington, DC. <http://www.wri.org/publication/natural-infrastructure>.
- Labich, W. G., E. M. Hamin, and S. Record. 2013. Regional conservation partnerships in New England. *Journal of Forestry* 111(5):326–334. <http://wildlandsandwoodlands.org/rcpnetwork>.
- Sorenson, E., R. Zaino, J. Hilke, and E. Thompson. 2015. Vermont conservation design: maintaining and enhancing an ecologically functional landscape. Vermont Fish and Wildlife and Vermont Land Trust. http://www.vtfishandwildlife.com/get_involved/partner_in_conservation/vermont_conservation_design.
- Society for the Protection of New Hampshire Forests (SPNHF). 2001. New Hampshire Everlasting: an initiative to conserve our quality of life. Society for the Protection of New Hampshire Forests, Concord, NH. <https://forestsociety.org/new-hampshire-everlasting>.
- Thompson, J. R., C. D. Canham, L. Morreale, D. B. Kittredge, and B. Butler. 2017. Social and biophysical variation in regional timber harvest regimes. *Ecological Applications* 27(3):942–955.

ADDITIONAL REFERENCES

- Anderson, M. G., A. Barnett, M. Clark, J. Prince, A. Olivero Sheldon, and B. Vickery. 2016. Resilient and connected landscapes for terrestrial conservation. The Nature Conservancy, Eastern Conservation Science, Eastern Regional Office. Boston, MA.
- Catanzaro, P., J. Fish, and D. Kittredge. 2013. Massachusetts forestry: best management practices. University of Massachusetts and State of Massachusetts Department of Conservation of Recreation.
- Ducey, M. J., K. M. Johnson, E. P. Belair, and M.H. Mockrin. 2016. Forests in flux: the effects of demographic change on forest cover in New England and New York. *Carsey Research National Issue Brief* 99: 1–10.
- Forman, R. T. T. 2014. *Urban ecology: science of cities*. Cambridge University Press, NY.
- Foster, D. R., D. B. Kittredge, B. M. Donahue, K. F. Lambert, C. M. Hart, J. N. Levitt. 2014. The Wildlands and Woodlands Initiative of the Harvard Forest, Harvard University. In J. N. Levitt, *Conservation catalysts: the academy as nature's agent*, Lincoln Institute of Land Policy, Cambridge, MA. http://harvardforest.fas.harvard.edu/sites/harvardforest.fas.harvard.edu/files/publications/pdfs/Foster_ConservCatalystsCh1_2014.pdf.

SUPPLEMENTARY REFERENCES

In addition to the limited bibliography at the end of the report, the Wildlands and Woodlands webpage, <http://www.wildlandsandwoodlands.org/>, includes a downloadable high-resolution copy of the report and an extensive set of resources that complement and support the arguments and facts presented in it. These include sources, metadata, and downloadable high-quality images of all the graphs and maps; and extensive references to additional resources. The website will be updated to provide further information on many of the findings, activities, and recommendations provided in the report. Additional data and resources may be found on the websites for the Harvard Forest (<http://harvardforest.fas.harvard.edu>) and Highstead (<http://highstead.net>).



The Harvard Forest



Located in the rural hill town of Petersham, Massachusetts, the Harvard Forest has served as Harvard University's rural laboratory and classroom for ecological research and education since 1907. The Forest comprises 4,000 acres of forests, ponds, streams, wetlands, farm fields, and buildings that provide diverse natural and cultural landscapes for study, habitat, diverse products, and enjoyment. The Forest is protected from development and operates under a long-term management plan designating specific areas for active forest management, agriculture, long-term scientific experiments, and wildland reserves. Since its founding, the Forest has been a pioneer in applying the lessons from human and natural history to the interpretation and conservation of landscapes. Staff at the Harvard Forest collaborate with the town of Petersham, conservation organizations, state and federal agencies, and many partners to study and protect landscapes locally, regionally, and globally. The Forest is also home to the Fisher Museum and its world-renowned dioramas that depict the history of landscape changes in New England since colonial settlement.

Highstead Foundation



Situated on a diverse landscape of forests, extensive fields, and waters in the broadly conserved landscape of Redding, Connecticut, Highstead has worked with regional partners since its founding in 1982 to conserve the landscape of New England through science, stewardship, and land protection. The staff and board at Highstead seek to manage the 100-plus-acre property and programs to inspire and educate visitors about the natural world and the need and opportunities for conservation, and to serve as a compelling, tangible example of the *Wildlands and Woodlands* conservation vision. Highstead staff are actively promoting and coordinating regional conservation partnerships, innovative conservation financing, conservation research, conservation internships, and science-informed governmental policies.

New England Forestry Foundation



New England Forestry Foundation (NEFF) was founded in 1944 to encourage more prudent use of New England's forests, which suffered from poor harvesting practices and a lack of good management planning. Today, NEFF is a recognized leader in sustainable forest management, innovative conservation finance, forestry education, and assisting landowners in the long-term protection and management of their properties. NEFF owns and manages over 141 community forests, totaling more than 27,000 acres across New England. It also holds over 150 conservation easements, protecting more than 1,145,000 acres of forestland. NEFF is reviewed by the American Tree Farm System and the Forest Stewardship Council so that its activities meet the economic, social, cultural, and environmental needs of present and future generations.

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Wildlands and Woodlands

Farmlands and Communities

Broadening the Vision for New England

