BEYOND THE "ILLUSION OF PRESERVATION"

Taking Regional Responsibility by Protecting Forests, Reducing Consumption, and Expanding Ecological Forestry in New England

Caitlin Littlefield | Brian Donahue | Paul Catanzaro | David Foster | Anthony D'Amato | Kenneth Laustsen | Brian Hall

AUTHORS

Caitlin Littlefield
Conservation Science Partners

Brian Donahue
Brandeis University

Paul Catanzaro
University of Massachusetts

David Foster
Harvard Forest

Anthony D'Amato
University of Vermont

Kenneth Laustsen
Maine Forest Service Biometrician *(retired)*

Brian Hall
Harvard Forest

RESEARCH CONTRIBUTORS

Thank you to the following people who provided important information and data that supported this publication.

Charles Barnett
Brett Butler
Jesse Caputo
Soren Donisvitch
Kevin Evans
Mike Mauri
Ron Piva
David Publicover
Jeff Tilley
Bill VanDoren
Harry Webb
Michelle Webb
Carolyn Ziegra

REVIEWERS

We are grateful to the following reviewers whose thoughtful feedback strengthened this publication tremendously. The views we express are our own and do not necessarily reflect those of the reviewers.

Richard Carbonetti
Adam Daigneault
Julie Renaud Evans
Ed Faison
Fred Heyes
Lloyd Irland
Ali Kosiba
Bill Labich
Marissa Latshaw
Amanda Mahaffey
Susan Masino
Jake Metzler
Bob Perschel
David Publicover
Jack Savage
Jamie Sayen
Jen Shukan
Mike Snyder
Jonathan Thompson
Liz Thompson

Support for this publication was provided by USDA's Renewable Resources Extension Act.

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Executive Summary

The forests of New England support humans and non-humans alike in countless ways, as they have for thousands of years. It is therefore heartening to see a growing recognition of the importance of forests as the planet warms, as species disappear, and as our connections with nature and with one another fray. We increasingly look to our forests as a "natural climate solution" and as inextricably linked with protecting biodiversity.

At the same time, wood from our forests remains a valuable renewable resource we all rely on and a key component of an emerging bioeconomy that can help mitigate climate change. And so, while pursuing goals to preserve more wild forests—which we, the authors, wholeheartedly support—we must just as steadfastly protect *productive* forests and seek to improve the standard of that production, right here in our own backyard. Despite covering 80% of the region, only a quarter of our forests are formally protected today; the rest lie vulnerable to fragmentation and development.

Even as the region touts a strong conservation ethic, we suffer from a considerable shortfall in production compared to our enormously high rates of consumption and our capacity for sustainable production. We meet some of that consumption demand with wood drawn from distant places with weaker environmental and social oversight than exists in much of New England. These hidden costs are all too easy to ignore and will only be exacerbated if harvesting is reduced in New England while we maintain our present rates of consumption. Moreover, within New England, overly restrained harvesting in the south contrasts with, in many cases, overly heavy cutting in the north. Therein lies the *illusion of preservation*.

In this publication, we seek to address that illusion, first by quantifying the gap between production and consumption in New England's states. We found that, as a region, New England produces about three-quarters of the wood it consumes: 59% of its lumber and 80% of the raw material for paper (Fig. 1). More stark are the disparities *within* the region: southern New England states produce only 7% of the volume of wood consumed therein, despite being 60% forested. Vermont and New Hampshire produce a bit more than what's consumed: 104% and 147%, respectively. Finally, Maine produces 325% of the volume of wood products consumed therein. That means that 70% of New England's production comes from Maine, while 70% of the region's consumption occurs in southern New England.

Of course, southern New England is where most of the region's population resides, and it has less forest. But even if Rhode Island, Connecticut, and Massachusetts can't produce all the wood they consume, they *do* have the capacity to do far more in terms of both increasing production and reducing consumption, particularly in addressing the lumber deficit.

We therefore set forth an ambitious vision for 2060 that would not only remedy these production and consumption imbalances (Fig. 2) but also dramatically enhance protection of our forests and propel us toward meeting urgent climate and biodiversity goals.

1

PROTECT FORESTS.
We must permanently protect New England's forest in a mosaic of passively managed Wildlands (at least 10% of the entire landscape) surrounded by actively, ecologically managed Woodlands, covering at least 70% of the entire landscape in protected forest.

2

REDUCE CONSUMPTION.
We must reduce our consumption of lumber and paper by 25% while meeting our urgent housing needs, reorienting consumption to more durable products, and enhancing recycling and reclamation.

3

EXPAND ECOLOGICAL FORESTRY.
We must increase the acreage in ecological forest management and reorient production toward lumber and sustaining ecological values. Sustainably managing 20 million acres across the region—including all corporate forests and roughly 50% of family, nonprofit, and public forests, for example—to produce 0.4 cords of wood per acre per year would allow us to meet our needs as a region.

Collectively, these steps illustrate the sheer scale of what would be required to move beyond the illusion. To be clear, this is not simply a matter of ramping up production to erase the production–consumption imbalance. Rather, moving beyond the illusion requires a holistic and deliberate approach that safeguards the ecological, economic, and social values of New England's forest while sustainably meeting our resource needs. None of these steps will be easy. But in advancing them side by side, we have the opportunity to take regional responsibility and permanently safeguard the innumerable values our forests afford us in this era of uncertainty.

Forests cover

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yet only

25%

are protected.

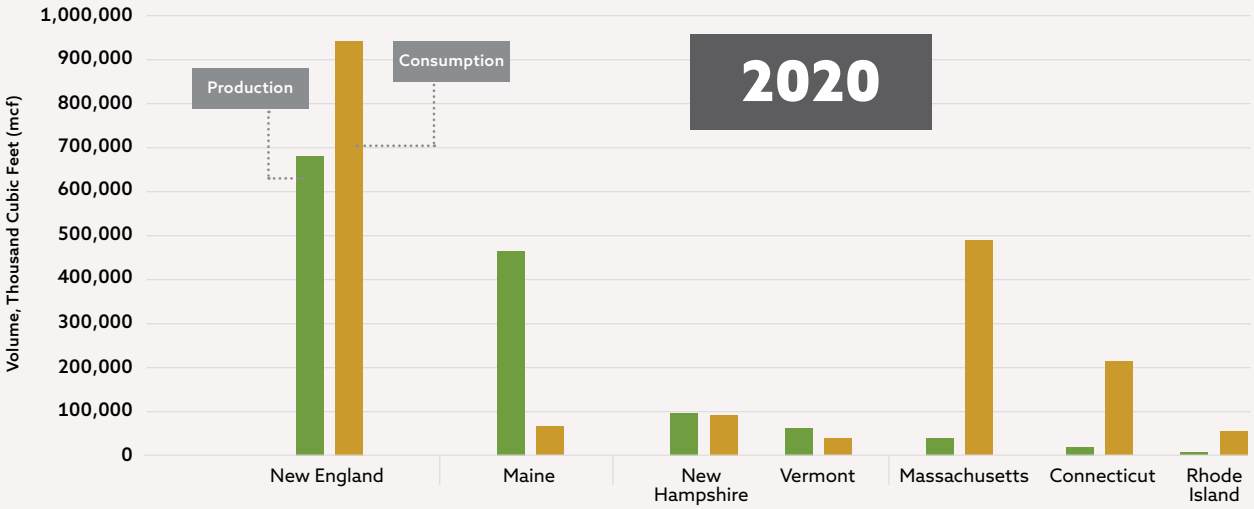
70%

of New England's **production** comes from Maine.

70%

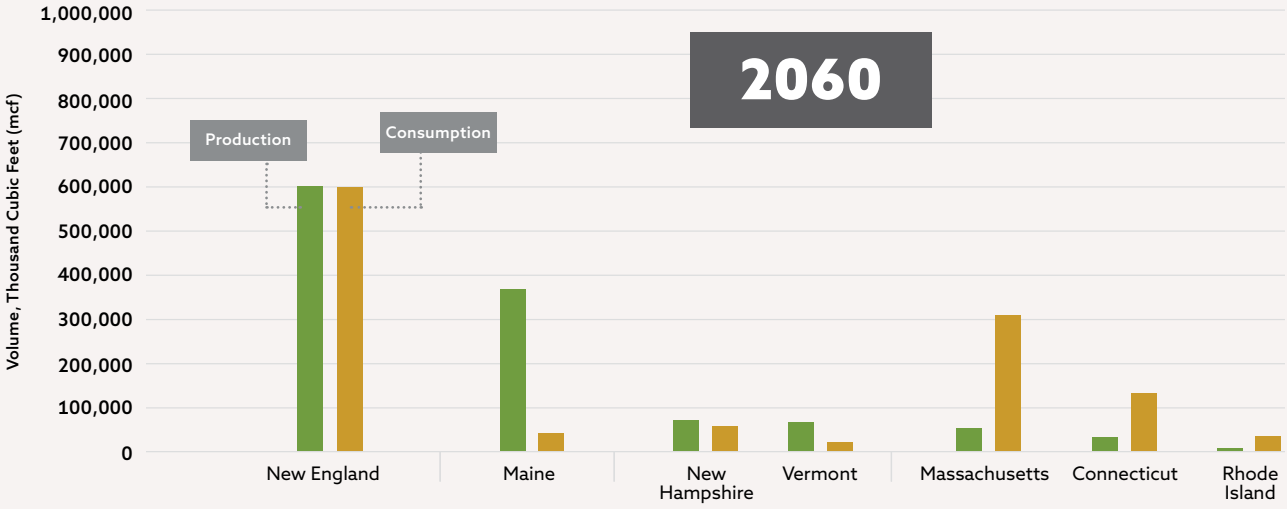
of New England's **consumption** occurs in southern New England.

FIGURE 1 Wood production and consumption in New England, circa 2020.



Present-day wood production numbers are derived from the USDA Forest Service's Forest Inventory and Analysis program, and consumption numbers are based on income-adjusted national per capita rates. These numbers include lumber and pulp and account for material recovered from waste streams; fuelwood is not included. A breakdown of numbers by product class (including fuelwood) is given in Table 4 of the Appendix, along with detailed methods.

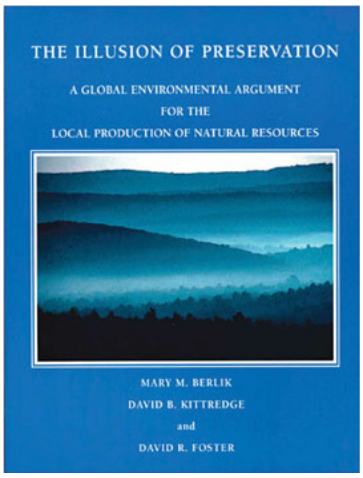
FIGURE 2 Wood production and consumption in New England, circa 2060.



This production and consumption scenario for 2060 reflects a reduction in lumber and paper consumption relative to today's levels, enhanced rates of recycling and recovery, and a reorientation of production toward more durable products. Fuelwood and other non-pulp uses of lower-grade material are not included. Generation of this scenario is described in the section "Sustainably Producing the Wood New England Consumes," with a breakdown of numbers by product class (including fuelwood) provided in Table 5 of the Appendix, along with detailed methods.

The Original *Illusion of Preservation*

In 2002, Harvard Forest published *The Illusion of Preservation*.



Led by undergraduate Mary Berlik, the paper pointed to a paradox captured by its provocative title: Massachusetts is justly proud of its abundant, diverse forests and history of conservation leadership, yet it produces almost none of the wood products it consumes, despite being 60% forested. Although the state applies the principles of conservation to protecting its forests from development—nearly 40% are permanently protected—it does not extend those principles to managing those ecosystems to supply the wood it uses.

Indeed, Berlik's analysis revealed that the forests of Massachusetts produced only 2% of the lumber and paper that its residents consumed. Recognition of that reliance on externalized wood production was both a rebuke to claims of conservation leadership and an opportunity to bring environmental responsibility back home. By reducing consumption toward levels found in Europe and Japan, by improving recycling and reuse, and by expanding sustainable harvesting across both private and public forests, Massachusetts could produce between 25% and 50% of its wood products (Berlik et al., 2002).

Designating more wild areas is a major priority as we seek to permanently preserve intact forest ecosystems to benefit nature and society. But, Berlik et al. argued, unless we also address the massive volume of wood we consume and how we procure it—namely, importing it from beyond our borders, where we can ignore any negative environmental and social consequences of its production—that preservation is an *illusion*. We must simultaneously advance the preservation of intact Wildlands while conserving additional lands for wood production and establishing a better balance between consumption and sustainable production. Striking that balance should start locally, right here at home, Berlik et al. suggested.

In 2005, *Illusion* co-authors David Foster and David Kittredge joined with a larger group of colleagues to release *Wildlands and Woodlands: A Vision for the Forests of Massachusetts* (Foster et al., 2005). That report expanded the argument, urging Massachusetts to permanently protect 50% of its landscape as forest and to manage it sustainably, with 10% as wild reserves. Together, Wildlands and actively managed Woodlands offer complementary, mutually reinforcing benefits and underpin the statewide vision: to minimize the loss of forest to development, greatly expand permanent Wildland reserves, and increase sustainable harvesting. Collectively, these steps would realize the full range of benefits from our forests and allow us to take more responsibility for our consumption of natural resources.

In 2010, *Wildlands and Woodlands: A Vision for the New England Landscape* extended this thinking to all six New England states (Foster et al., 2010). New England is roughly 80% forested, and the authors argued that at least 70% of the region should be permanently protected in forest, most of which would be sustainably managed, with at least 10% devoted to wild reserves. In 2017, with the release of *Wildlands and Woodlands, Farmlands and Communities: Broadening the Vision for New England* (Foster et al., 2017), this regional vision was expanded to explicitly include protecting farmland, producing more food within the region, and building more just and sustainable communities (see also Donahue et al., 2014).

It is within this integrated Wildlands and Woodlands vision that we now return to the question originally posed in *The Illusion of Preservation*, but this time widening the focus from Massachusetts to all of New England. How does the wood we consume compare to the wood we produce? How can a heavily forested region move beyond the illusion and advance climate and biodiversity goals by protecting even more of our forests and managing them effectively through passive and active means for their full suite of benefits? To dispel the illusion, we must honestly face this challenge and take responsibility.

Photo: Ross Caron

We must simultaneously advance the preservation of intact Wildlands while conserving additional lands for wood production and establishing a better balance between consumption and sustainable production. Striking that balance should start locally, right here at home.

New England's Forests, Then and Now

Today, the question of how to manage New England's forests has grown more urgent than ever. In a world of rapid climate change, accelerating biodiversity loss, and glaring inequalities in human well-being, addressing the social and environmental consequences of our consumption patterns is increasingly imperative.

Rightly so, many are looking to forests as a crucial "natural climate solution" to sequester and store carbon, as the backbone of a connected, intact landscape for protecting biodiversity, and as a place for recreation and restoring our well-being (Frumkin et al., 2017; Griscom et al., 2017; Watson et al., 2018). At the same time, the forest offers us the opportunity to build a bioeconomy that can help meet many material needs, especially for housing, more sustainably than by relying on steel, concrete, and plastic (New England Forestry Foundation [NEFF], 2021; United Nations Environment Programme [UNEP] & Yale Center for Ecosystems + Architecture, 2023). How can these urgent and inescapable social and environmental imperatives best be harmonized in the forests of New England?

Forest occupies most of the landscape across all six New England states (USDA Forest Service [USFS], 2020). Most wood production is in the northern states (particularly northern Maine), while most consumption is in the region's south, where most of the people are. To some degree, this pattern is logical and perhaps inevitable, but is it the most equitable and sustainable? The real issue isn't simply how much lumber, paper, and fuel is produced within the region as a whole; the issue is where and how our forests are managed to produce this wood, and how it is used.

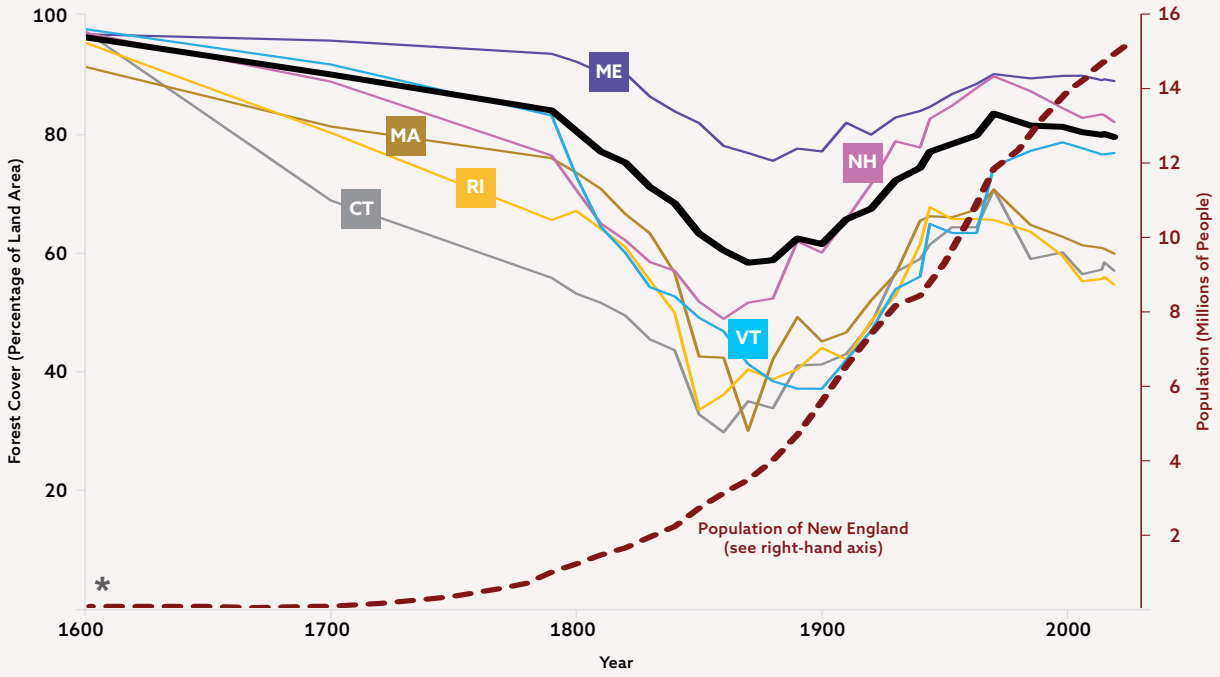
The forests of New England offer a powerful story of ecological recovery. Before the arrival of Europeans, the region's forests covered more than 90% of the landscape and supported an Indigenous population of likely 75,000 people (Denevan et al., 1992). Upon European arrival and the subsequent genocide, that land was violently expropriated and steadily cleared to form an agrarian landscape of fields, pastures, woodlots, and associated infrastructure. This reduced forest cover in southern and central New England to roughly 35% of the landscape by the late 19th century (Fig. 3). By contrast, the northernmost parts of the region saw little clearing and instead became dominated in the 19th century by industrial extraction of timber, and later pulp. With agricultural decline in the late 19th and 20th centuries, the southern forest grew back substantially, peaking in acreage around 1970 before declining again in the face of suburban sprawl (Thompson, Plisinski, et al., 2017).

The persistence of forest in far northern New England and the recovery of forest in the central and southern parts has made New England the most heavily forested region in the United States: it remains about 80% wooded, ranging from just under 60% in the southern states to almost 90% in Maine (USFS, 2020). This forest confers immense ecological benefits simply by being forested: providing wildlife habitat, enhancing water and air quality, mitigating flooding, and absorbing carbon, along with countless other social and cultural benefits for health, recreation, and traditional lifeways. But we delude ourselves if we blithely assume the region's considerable forest cover guarantees those benefits in perpetuity. It does not. Approximately 25% of New England's landscape is protected from development today (Foster et al., 2017), but unless we dramatically expand those protections, our forests and their myriad benefits remain vulnerable to conversion or poor management.

However, the notion that preserving more wild forest in our own backyard is the best way to counteract poor management elsewhere—that notion is at the heart of the *illusion of preservation*. Can we just protect our forest for its ecological benefits and let someone else worry about managing the "production forest" that supplies us with the wood we need?

Photos: (above) Mariel Hohmann; (pg. 7) Wendy Ferris

FIGURE 3 New England forest cover and post-settlement population over time.



European settlers steadily cleared the forests of southern and central New England, whereas by the 19th century, the northernmost parts of the region were increasingly oriented toward industrial extraction of wood. The abandonment of farmland in the mid-19th century allowed for the rebound of southern forests until the last decades of the 20th century, when forest conversion started outpacing forest recovery. Sources of data through 2015 are given in Foster, Gould, et al., 2023; data for subsequent years are from the US Census Bureau and the USDA Forest Service's Forest Inventory and Analysis program. **Importantly, the population of the region before European settlement was not zero, though the scale of this figure may give that impression. Rather, the lands and waters of what is now called New England likely sustained at least 75,000 people over the millennia.*

The application of ecological forestry includes a focus on the retention of trees and other important forest elements to help provide continuity and complexity within the forest through time. The white pine in the foreground has been marked with an "L" to designate it as a legacy tree, which will be retained in the forest.

The authors of this paper have encountered many people who, through word or deed, seem to be making that assumption. To us, that is a dangerous position.

In recent years, there have been calls to eliminate harvesting on substantial areas of New England's forests—especially on state and federal lands—to maximize their ecological values, particularly their capacity to store carbon (e.g., RESTORE: The North Woods; Standing Trees). Some call this "proforestation" (Moomaw et al., 2019). We wholeheartedly support expanding Wildlands, which yield irreplaceable benefits to nature and society and yet cover less than 4% of New England today. However, this strategy by itself will fail to provide the full suite of benefits we seek from our forests—here in New England and beyond. If we reduce harvesting within New England while maintaining our high levels of consumption, we are merely shifting that wood production elsewhere, including to regions with greater amounts of intact forest and biodiversity and weaker environmental oversight than exists in much of New England (Pfaff & Walker, 2010; Wiedmann & Lenzen, 2018). Because of this leakage, reduced cutting at home will do little to decrease carbon dioxide in the global atmosphere and protect global biodiversity; it will simply extend the *illusion of preservation*. Unless the very real need to create more Wildlands is matched by the equally real need for sustainable harvesting to address our wood product demands, it is not really proforestation but rather the *illusion of proforestation*. Addressing that illusion requires a comprehensive and integrated approach that may logically begin with Wildlands but—for as long as we use wood products—must also include responsible, productive use of Woodlands.

We are not, of course, opposed to responsible national and global wood markets. But we do believe that the forests of any region *should* make a contribution to addressing the region's own needs that is proportional to their sustainable capacity. Plus, people should embrace their necessary reliance on the forest, not hide it in some other part of the world. Given New England's favorable climate and abundant, productive forests, as well as New Englanders' strong capacity to apply strict environmental oversight, few places on earth should be better poised to be a leader in advancing forest protection and the sustainable harvesting of natural resources while upholding ecological and social values.

In this document, we begin by analyzing the imbalance in consumption and production of wood among the six New England states. Then we identify three key steps, to be taken between now and 2060, that are needed to remedy those imbalances, while simultaneously addressing urgent climate and biodiversity goals. These steps include (1) permanently protecting New England's forests in a mixture of passively managed Wildlands and actively managed Woodlands; (2) reducing and reorienting consumption while enhancing recycling; and (3) advancing ecological forest management over a much greater portion of the New England landscape to provide a sustainable supply of wood.

We set forth these steps not as an exact prescription but rather as one vision for safeguarding the ecological, economic, social, and cultural values of New England's forest, while sustainably meeting our wood product needs.

Photos: (pg. 8) Tony D'Amato; (above) Sarah Nelson

Revisiting *The Illusion of Preservation*: 2020 New England Analysis

Is New England producing as much wood as the region consumes? In a word, no. Today, New England produces the equivalent of about 76% of the wood it consumes: 59% of its lumber and 80% of the raw material (pulp and mill waste) needed to produce the paper consumed (Fig. 4; see methods and Table 4 in the Appendix).

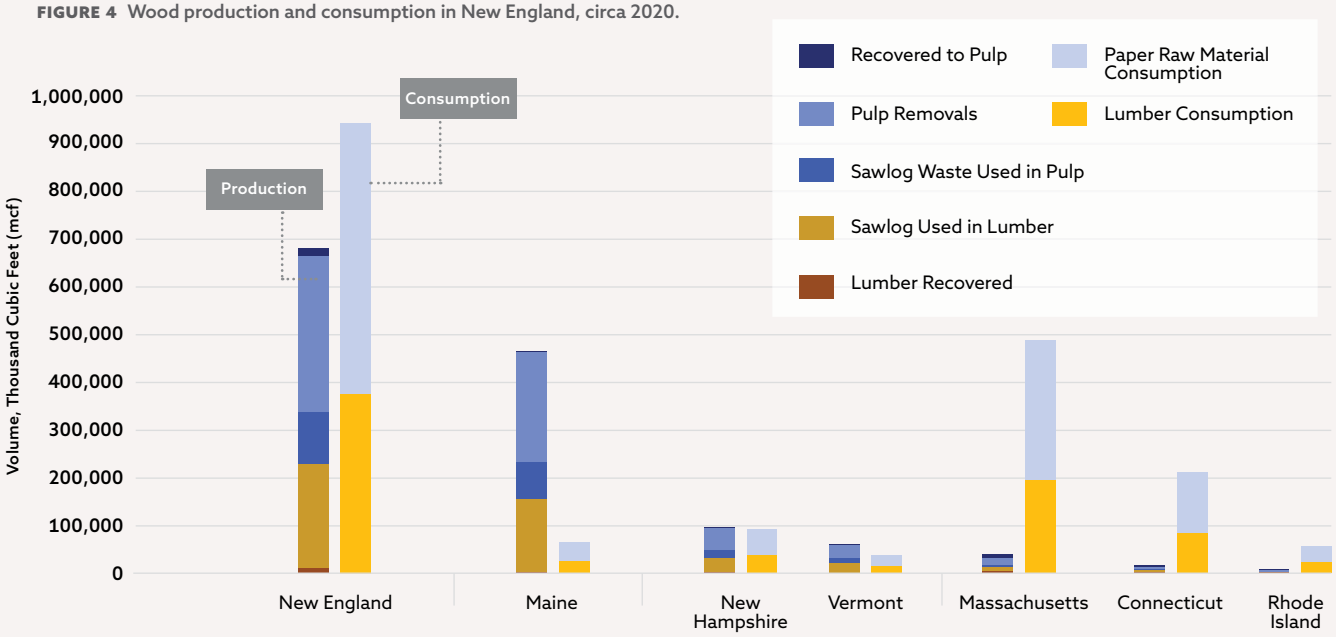
Producing three-quarters of the wood products consumed may seem encouraging on a broad scale, but it's the disparities *within* the region that are at the heart of the illusion: collectively, the southern New England states of Massachusetts, Connecticut, and Rhode Island produce a mere 7% of the wood consumed therein, despite being roughly 60% forested (a finding similar to the original *Illusion* paper for Massachusetts). Together, Vermont and New Hampshire are at parity with regard to lumber, while producing more paper raw material than consumed, leading to a balance of 117%. Finally, Maine produces substantially more lumber and paper raw material than it consumes: upwards of 325%. In fact, 70% of New England's production comes from Maine, while 70% of the region's consumption occurs in southern New England. For a region that is 80% forested, our region-wide deficit and these within-region disparities are striking. Even with 15 million people, there are two acres of forest for every New Englander—about the same ratio of forest to people for the United States as a whole, which is close to achieving a net balance in its overall wood production and consumption (Howard & Liang, 2019). We do not appear to be doing our fair share, especially in southern New England.

Photo: Ross Caron

These disparities show that the illusion—that is, the shortfall in production compared to consumption in a region that touts its conservation ethic—isn't just a global or national phenomenon but operates *within* the New England region as well. Most pulp and lumber consumption occurs in the more populous southern New England states, which produce much less of that material than their proportion of the region's forests. Meanwhile, northern New England—especially Maine—produces much of the region's wood products. However, the long legacy of heavily extractive forest practices in parts of northern New England has come at a price: because of overcutting, much of the northern New England forest is poorly stocked from a harvestable tree perspective (Granstrom et al., 2022; Gunn et al., 2019), leaving fewer opportunities to support the declining local industries and rural, forest-dependent economies that are hurting and depopulating (Irland, 2020; Sayen, 2023). In addition, the northern New England forest supports far less carbon than elsewhere in the region (though this is also due to inherent differences in forest types, soils, and climate; Fig. 5). Conversely, while southern New England cannot produce all the wood it consumes, it does have the capacity to do far more, particularly in addressing the lumber deficit.

This situation does not need to persist. We can move beyond the illusion by producing a larger proportion of the wood products consumed in New England without sacrificing goals surrounding climate change and biodiversity protection. To do this will require stabilizing forest loss, reducing consumption, and reorienting the goals and geography of production.

FIGURE 4 Wood production and consumption in New England, circa 2020.



Present-day wood production numbers are derived from the USDA Forest Service's Forest Inventory and Analysis program, and consumption numbers are based on income-adjusted national per capita rates. These numbers include lumber and pulp and account for material recovered from waste streams. Fuelwood is not illustrated, as it is assumed that consumption is equal to production. Precise numbers by product class (including fuelwood) are given in Table 4 of the Appendix, along with detailed methods.

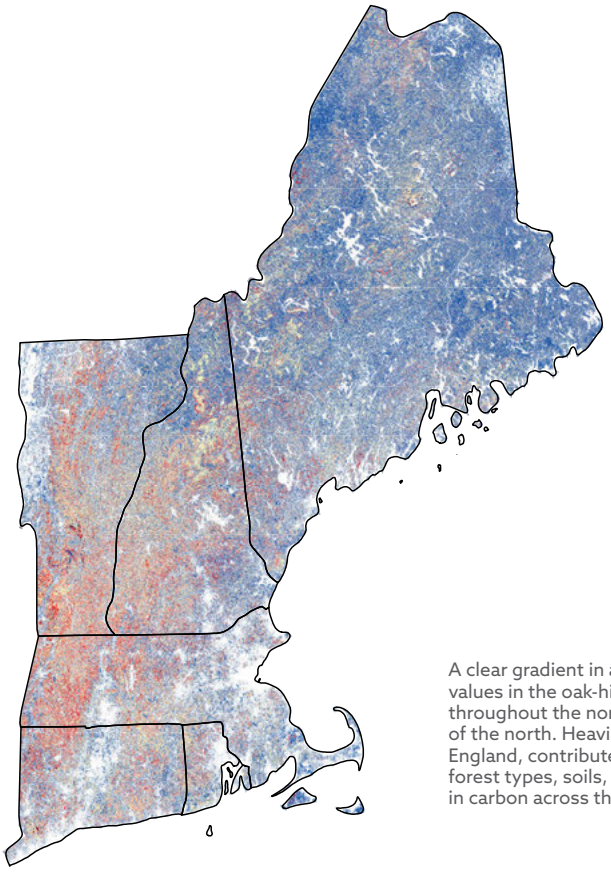
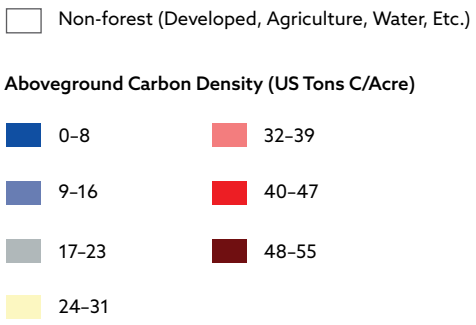


FIGURE 5 Aboveground forest carbon in New England.



A clear gradient in aboveground carbon spans New England, with the greatest carbon values in the oak-hickory forests of southern New England, slightly lower values throughout the northern hardwoods, and the lowest values in the spruce-fir forests of the north. Heavily extractive forest practices, as in some parts of northern New England, contribute to this reduced aboveground carbon, but inherent differences in forest types, soils, and climate, among other factors, also contribute to the gradient in carbon across the region. Data are from MacLean et al., 2021.

Steps toward Addressing the Illusion

Can New England remedy the illusion—taking responsibility for our consumption and sustainably producing as much wood as we consume—while retaining and enhancing all the other social and ecological benefits of a diverse, healthy forest?

We believe this is possible.

Of course, there is no reason that each region must produce every stick of its own wood—just as New England can't reasonably be expected to grow all its own food. But as a heavily forested region, New England *could* achieve a net balance in its ratio of wood consumption to production. By analyzing what it would take to do so, we can establish useful benchmarks that highlight the opportunities, challenges, and choices to be made to achieve this.

Moving beyond the illusion will require three steps:

1. **PROTECT FORESTS.**
   Permanently protect forests from conversion to non-forest while establishing significant wild reserves.

2. **REDUCE CONSUMPTION.**
   Reduce the consumption of wood (and of all other materials) while concentrating wood use where it is the most environmentally friendly option.

3. **EXPAND ECOLOGICAL FORESTRY.**
   Expand the practice of ecological forestry and shift production toward more enduring forest products.

STEP 1: PROTECT FORESTS

Protect New England's forests, retaining at least 70% of the region in permanently protected Wildlands and Woodlands

Ensuring that forests remain forests is crucial for addressing the biodiversity and climate crises (Griscom et al., 2017; Watson et al., 2018) and for realizing the innumerable benefits we derive from forests, including wood products. However, we are losing forests at a rapid clip: per USFS Forest Inventory and Analysis (FIA) data, approximately 30,000 acres are permanently converted each year. Some forest transitions to agricultural uses and wetlands each year, while other areas revert to forest, which counterbalances the conversions a bit, leading to a net annual loss of about 25,000 acres. Conversions are due largely to residential and commercial sprawl but also to renewable energy development, especially large solar arrays (Manion et al., 2023; Thompson, Plisinski, et al., 2017). These conversions permanently perforate the forest, reducing its ecological integrity and connectivity and making it more difficult to manage holistically.

To stem this ongoing loss and fragmentation, we need to take two steps side by side: decrease the rate of forest loss and accelerate forest protection to meet or surpass the Wildlands, Woodlands, Farmlands & Communities (WWF&C) goal of permanently protecting at least 70% of New England in forest by 2060. Here we summarize points explored in greater detail in *Wildlands and Woodlands, Farmlands and Communities: Broadening the Vision for New England* (Foster et al., 2017).

Minimizing forest loss will require flexible and creative zoning and incentives that encourage more complete, integrated use of the 11% of the landscape that is already developed, especially to meet our housing needs. This means green renovation of the region's 19th-century industrial landscape—old factories, rail yards, riversides and harborsides, and main streets in our cities, mill towns, and villages. It means adaptive redevelopment of sprawling 20th-century malls and commercial strips. It means converting office space to housing as virtual work habits take hold, and clustering new development along improved rail lines and bikeways. It means employing already-built spaces to accommodate solar development, and planning carefully to lessen the impact of much-needed renewable energy development on farmlands and forests (Manion et al., 2023).

Permanent protection of forest and farmland from conversion will ensure that these smart planning choices endure. Protection can take the form of conservation easements on private land or direct ownership by federal, state, or local governments or by tribes and nonprofit organizations, such as land trusts. While easements remain an essential option for smaller forests owned by families and conservation organizations, their application on large industrial ownerships in northern New England must change to stipulate and enforce forestry practices that greatly improve ecological outcomes (Thompson et al., 2023). Otherwise, permanent protection of industrial lands may best be achieved by acquisition in fee by public, nonprofit, or tribal owners. In the long run, permanently protected forest provides the only secure basis for the practice of ecological forestry, whether for passively managed Wildlands governed by natural processes or for actively managed Woodlands that can support sustainable production and safeguard ecological and social values.

The present trajectory of land protection funding will not achieve our permanent protection goals, despite the will and tools to do so. We have created successful policy and incentive tools: land protection funding at the local, state, and federal levels; an enhanced federal tax incentive; state tax credits; and the USFS Forest Legacy Program, among others. There is broad interest among family forest owners (FFOs) in the Northeast to keep their land in forest: 91% of FFOs owning over 10 acres, which constitutes 90% of FFO-owned land, want their land to stay wooded (Butler et al., 2021). Our failure to protect our forests at the rate needed to reach our goals is due to our failure to secure the necessary funding rather than a lack of interest. We need investments in these strategies by federal and state governments, philanthropies, communities, and individual landowners because our well-being—that of humans and non-humans alike—depends on it.

The WWF&C initiative aims to protect at least 80% of New England: 70% in forest, 7% in farmland, and 3% in grasslands and wetlands. The forest goal includes at least 10% of the region in Wildlands (an expansion from prior calls for 10% of forests) and 60% in Woodlands. Protecting that much forest, and managing it both passively and actively by the high standards of ecological forestry, is consistent with or exceeds many international, national, and state targets that acknowledge the crucial role of both wild and working lands in addressing the climate and biodiversity crises. These include the Kunming-Montreal Global Biodiversity Framework (Target 3), the Biden administration's "30 by 30" commitment (Executive Order 14008), and Vermont's Community Resilience and Biodiversity Protection Act (Act 59), among others.

Wildlands and Woodlands are not opposing management strategies. For too long, this binary view has divided people who should be working together. They are complementary, and land protection efforts should encompass both.

Wildlands covering at least 10% of the landscape

We advocate for greatly expanding the roughly 450 Wildlands that currently cover 3.3% of New England (Foster, Johnson, et al., 2023) and tripling this area to reach at least 10% of the region, in line with the WWF&C goal. As we will show, even 20% Wildlands would be compatible with a regional reorientation of meeting our wood product needs.

We follow the WWF&C initiative in defining Wildlands as tracts that are permanently protected to allow natural processes to shape the landscape, with human intervention limited to such activities as trail maintenance, strategic control of invasive species, and traditional practices of foraging and collecting plant materials (Foster, Johnson, et al., 2023). This intent and management must be secured by easements or other legal mechanisms, statutes, or well-established policies. Wildlands can range from million-acre tracts in northern New England, to 10 or fewer acres in more settled areas. Collectively, they should encompass a broad representative sample of the region's forests and wetlands and include some vast areas that support the full array of landscape-scale processes and natural disturbances—such as wind, ice, and insect damage—that generate a diversity of successional stages and habitats. Such wild forests provide unique ecological conditions and societal benefits that complement those found in actively managed forests. Moreover, they can provide important benchmarks by which to compare the ecological conditions and dynamics of actively managed forests in order to inform management and conservation strategies and to interpret how natural systems are responding to global changes.

Woodlands covering 60% of the landscape

Meeting our wood production needs will also require substantial forest land that is both permanently protected from development and available for long-term ecological management to meet our needs far into the future. We envision Woodlands covering 60% of the New England landscape and serving as a crucial complement to Wildlands in sustaining a full suite of ecological and social values, including diverse and well-connected habitat, clean water, carbon storage, and recreation. We will return to the management of these Woodlands in Step 3.

STEP 2: REDUCE CONSUMPTION
Reduce wood consumption by 25%, reorient consumption to more durable products, and enhance wood product recycling

To determine how much New England wood production is needed, we first asked how much present consumption might realistically be reduced while still meeting societal needs. The environmental impact embodied in all the products we routinely consume is frequently overlooked, so limiting consumption is the fundamental place to start a discussion on resource production. Here we focus on wood, but a similar argument is warranted for *all* types of consumption.

Wood products such as lumber and paper meet real needs, and while harvesting and production is by no means free of emissions (Peng et al., 2023), wood products are, in many cases, environmentally preferable to carbon-intensive alternatives such as steel, concrete, and plastic (Food and Agriculture Organization [FAO], 2016; Hart et al., 2021). At the same time, there are important ways we can reduce net consumption while still achieving a better balance of wood use relative to other materials. For example, we might prefer paper packaging to plastic, but we ought to strive for far less packaging overall. It is difficult to calculate with precision how much wood consumption can practically be reduced, but we can get a meaningful estimate of the size of the opportunity, working from established trends in lumber and paper consumption and from available projections of declining population growth and demand for housing. As will be explored further, we believe that by 2060, New England could reasonably achieve a 25% reduction in both lumber and paper consumption.

While we foresee some continued wood-fueled heating and even electricity generation, especially in rural areas, on the whole we believe that low-market-value wood should be reoriented away from rapidly consumptive uses (e.g., combustion) and toward more durable products. Examples include wood fiber insulation, thermally modified siding and decking, and other innovations that may emerge. Periodically thinning and removing lower-value trees is an important strategy in ecological forestry (described in Step 3); even high-value trees have a large proportion that cannot be marketed as sawlogs. The more this material can be used in products that lock up carbon rather than quickly releasing it into the atmosphere, the better.

Reduce lumber consumption by 25% while meeting housing needs

Can lumber consumption in New England be reduced in the coming decades, even with the critical need to replenish and expand housing? Like many US regions, much of New England faces a severe housing shortage, especially affordable housing (Landsmark, 2020). This is due not only to the sheer lack of housing units but also to some of the highest vacancy rates in the nation—for example, those associated with second homes in Vermont and Maine (US Census Bureau, 2023b). We have therefore looked to anticipated trends in housing needs—leaning, in particular, on the *Buildings Sector Report* of the Massachusetts 2050 Decarbonization Roadmap Study (Commonwealth of Massachusetts, 2020)—to gauge future lumber consumption in the region. In recent decades, housing starts have been the single most important driver of demand for lumber (Howard & Liang, 2019), such that housing trends can serve as a good indicator of overall regional lumber consumption. Notably, a 50% slowdown in the rate of housing growth, like the one precipitated by the 2008 global financial crisis, translates to about a 25% decline in consumption of lumber. Assuming that relationship will hold, we have extrapolated projections of population and housing needs to arrive at a 25% reduction in lumber consumption by 2060. (See Appendix for more details on projections.)

We feel this estimated reduction is robust, even as various factors may either boost or diminish lumber consumption.

Photo: Adella Catanzaro

For example, mass timber could replace concrete and steel in larger buildings (e.g., multifamily housing), thereby increasing wood consumption and potentially yielding considerable carbon benefits (NEFF, 2021; UNEP and Yale Center for Ecosystems + Architecture, 2023), as long as increased demand is met with sustainable forest stewardship practices. On the other hand, there are other ways in which lumber consumption may be reduced, even while meeting housing needs. For example, if the trend toward remote work continues, some existing office buildings could be converted to mixed uses, including retail and housing. Moving toward clustered development with multifamily buildings allows for more efficient use of materials, energy, and transportation; protects forests and farmland; and counteracts the decline in shared civic spaces. This transition is underway in Massachusetts, where multifamily housing is growing faster than single-family homes (Commonwealth of Massachusetts, 2020). Vermont recently passed legislation that would end single-family-unit zoning to reduce barriers to multifamily housing development (Vermont HOME Act of 2023, Act 47). Because multifamily units are on average much smaller than single-family units—even with the same number or more occupants (US Census Bureau, 2023c)—building more multifamily housing would, on balance, save lumber.

We can also reduce the average size of new single-family houses. In 1975, the average new single-family house in the Northeast was about 1,600 square feet; now, it's nearly 2,800 square feet (US Census Bureau, 2023c). Since families are getting smaller, it's unclear why larger houses are warranted—unless it might be to store all the other stuff we don't actually need. If the average new house built between now and 2060 were 2,000 square feet instead of 2,800, that would represent a reduction of over 25% and considerable savings in lumber while addressing the severe deficit in smaller, more affordable homes.

Reduce paper consumption by 25% by 2060 while shifting to more durable wood products

In contrast to lumber consumption, pulp (and paper) consumption fluctuates little but has shown long trends over time. Pulp consumption peaked around the turn of the 21st century, then dropped by roughly 25% a decade later (Howard & Liang, 2019). It has been holding steady ever since, with ongoing declines in newsprint and writing paper counterbalanced by a demand for packaging, which now accounts for over half of paper use (Environmental Paper Network, 2018). If we could undertake an average annual reduction in paper use of 0.5%–1.0%, a further decline of 25% by 2060 would be achievable. This would bring US per capita paper consumption, which is almost four times the global average, nearly down to the level of such countries as Canada, Denmark, Finland, and Spain (FAO, 2020).

A continuing decline in the demand for paper is desirable from an environmental perspective. However, coupled with diminished investment in long-term forest stewardship on some ownerships and eroding industrial infrastructure, that decline has hit the northern New England paper industry and surrounding communities hard (Sayen, 2023). As echoed by many others (NEFF's Exemplary Forestry initiatives, Vermont's Forest Future Strategic Roadmap), we believe that the region has an opportunity to reinvent itself around more durable wood products with ecological forest management, which we address in Step 3.

Increase recycled content in paper to 50%, and increase wood reclamation to 75%

In addition to reducing consumption of wood products, we can continue to improve how much paper we recycle and how much wood waste we reclaim for reuse as lumber, paper, and fuel.

Historically, about one-third of paper content has been recycled paper, with the rest more or less an equal mix of trees cut specifically for pulp and residue from sawmills (Environmental Protection Agency [EPA], 2016). The exact mix varies by product, region, and available materials. In recent years, the recycled content has been increasing (American Forest & Paper Foundation, 2022; EPA, 2023). Accordingly, we have set an ambitious but viable goal of raising average recycled content to 50% by 2060.

Reclaimed wood comes from municipal solid waste (MSW) and construction and demolition materials (C&D). MSW includes discarded wood products such as furniture and pallets as well as woody yard waste; C&D includes both clean wood and painted, stained, or treated wood. These distinctions determine to what extent the waste can be reused for lumber, pulp, or chips to be combusted for energy (Falk & McKeever, 2012; Morris, 2016).

Of late, a little more than one-half of this wood waste, by mass, is reclaimed (Falk & McKeever, 2012). There is also a considerable amount of wood waste in landfills that is not currently recovered but that *could* be. We used 2010 estimates—the most recent we were able to find—to determine how much this waste stream could augment the region's wood supply and reduce the amount of wood removed from the forest. For 2060, we set a goal of reclaiming half of the remaining waste wood that is presently left on the table, after accounting for reduced consumption. The contribution of reclaimed wood to the region's supply would be modest: it could supply approximately 4% of the region's lumber and 6% of the material for making paper. The amount that could be chipped and burned is a bit larger.

STEP 3: EXPAND ECOLOGICAL FORESTRY

Increase the amount of Woodland acreage in ecological forest management and reorient sustainable production toward lumber

Why increase active forest management and regional lumber production? Simply put, because we use wood and we have forests that are capable of sustainably producing most of what we need but currently do not. Instead, we import a full quarter of the wood we consume—and nearly half the lumber—including from places where environmental and social protections are less assured (Wiedmann & Lenzen, 2018). We believe New England can lead the way in sustainable wood production by practicing and promoting ecological forestry here at home. (Leading the way will also require renewed investment in all facets of the forest-based economy, which we discuss in Box 3.)

Amplifying the practice of ecological forestry

Numerous ecologically and socially responsible models of forest stewardship have been advanced that would allow New England to produce the wood it needs while maintaining a full range of benefits from its forests (e.g., Himes et al., 2022; Lansky, 2002; Seymour & Hunter, 1992). Central to these calls—which have encompassed both permanently protected Wildlands and limited areas that are intensively managed for production—has been amplifying the practice of ecological forestry across the remaining majority of working forests. We embrace the broad goal of ecological forestry "to sustain healthy productive forests . . . with native species diversity and a full array of ecosystem services" by managing them in ways that "bring them closer . . . in structure, function, and composition to healthy, natural forests at all stages of successional development" (Palik & D'Amato, 2017).

The practice of ecological forestry is centered on an understanding of the dynamics of forests in the region prior to their widespread simplification by intensive post-European settlement land uses (Nowacki & Abrams, 2008; Thompson et al., 2013). Accordingly, old-growth and other forests that are not actively managed but are instead permanently protected as Wildlands are an integral part of ecological forestry. Indeed, the first step of ecological forestry is to designate sufficient Wildlands. In our vision of permanently protected, heavily forested landscapes, ample Wildlands would be embedded within Woodlands managed according to the principles of ecological forestry. These complementary strategies need not be separated into different properties: passively managed areas may also be located within actively managed Woodland properties (Box 1). Ecological forestry does not prescribe a single type of silvicultural treatment. Instead, it adheres to core principles that focus on encouraging ecosystem complexity and harvesting trees in ways that seek to emulate natural patterns for a given site and ecosystem while acknowledging the broader landscape contexts of the site (Palik et al., 2020). Ecological forestry can therefore encompass, for example, forests managed to restore multiage conditions akin to those found in old growth, as well as forests harvested on long rotations that periodically re-create complex early-successional conditions similar to those that follow larger natural disturbances.

Photo: Tony D'Amato

Ecological forestry works carefully to protect and enhance the natural values of forests—wildlife habitat, clean water, and carbon storage, among myriad others—even while harvesting wood. This means retaining a proportion of the stand in legacy trees that develop naturally and eventually die, thereby helping restore the large living trees and deadwood that are frequently lacking in our second-growth forests. For most of our ecosystems for which stand-replacing disturbances are rare, regeneration harvests should focus on creating vertical and horizontal variation in the structure of the forest by removing individual trees and groups while maintaining a proportion of larger, older trees. This leads to a variety of light and environmental conditions across the stand as well as seed sources. Ecological forestry also means cutting in ways that maintain good forest "stocking"—in other words, supporting the presence of enough healthy trees to maintain high rates of growth as well as robust tree regeneration following harvests.

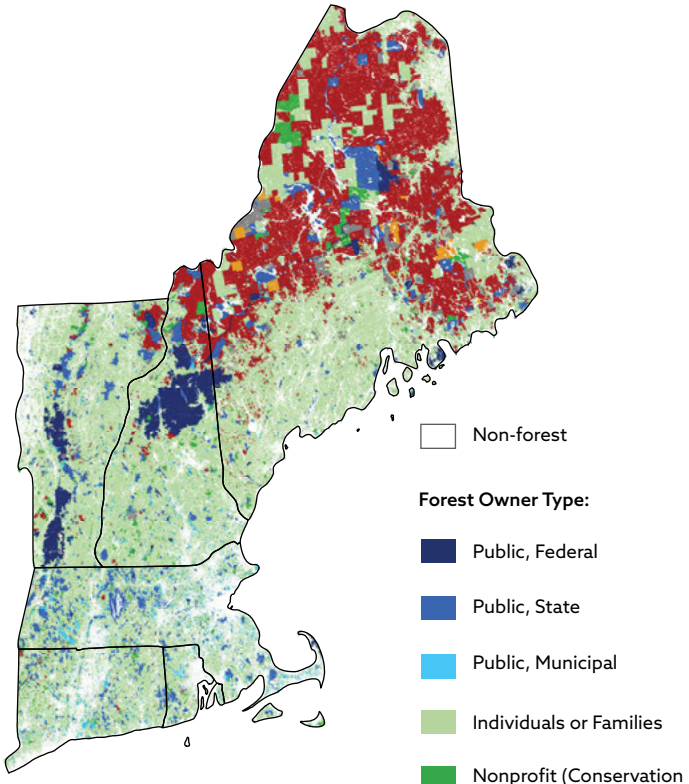
The aim of ecological forestry is thereby to harvest wood products in ways that restore and sustain natural forest conditions—large snags and downed wood, a diversity of tree species and sizes, and canopy layers and gaps—rather than maximizing total yield in the short run. It may not produce as much harvestable wood as rapidly as do intensive plantations, periodic high-grading that removes only the best trees, or short-rotation forestry. But it does produce a steady output of long-lived wood products that are often of high market value, all while protecting other ecological values of healthy, diverse forests. Low-market-value materials such as pulp and chips are an ancillary by-product of management for timber, not an end in themselves. Still, plenty of such material is derived from periodic thinnings, from regeneration harvests that mimic natural dynamics, and from the tops of timber trees and sawmill waste—material that could, as previously noted, be reoriented toward more durable products.

Ecological forestry seeks to create a desired future condition of forest composition well-suited to the soil and environment of the specific site as well as the compositional and structural complexity seen in natural forests. Although the mounting impacts of climate change challenge our ability to restore historic forest conditions, the principles of ecological forestry are consistent with strategies being advanced to adaptively manage forests into the future (D'Amato & Palik, 2021).

New England forest ownerships: Family/nonprofit, corporate, and public

To calculate how much wood New England could sustainably produce through ecological forestry, we considered three dominant types of forest ownership: family and nonprofit, corporate, and public. An additional 200,000 acres of tribal forest lands are not included in our analysis, but we strongly feel that these areas should be expanded and could make important contributions to the vision expounded here. Urban and suburban forests have enormous value—providing habitat, lessening the urban-heat-island effect, and affording millions of residents contact with nature, among other benefits (Weinbrenner et al., 2021; Wolf et al., 2020). However, these would not make a substantial contribution toward regional production, and so we have excluded them from our analyses (Fig. 6; Table 1).

FIGURE 6 Forest ownerships across New England.



Roughly 40% of the forested landscape in New England is held by individuals, families, or nonprofit organizations. Corporate ownerships, concentrated in the northern parts of the region, also constitute nearly 40%. Just under 20% of New England's forest is publicly held and includes federal lands such as the White Mountain National Forest and the Green Mountain National Forest, as well as state lands and community forests. Only 1% is held by tribes. Data are from The Nature Conservancy (2014), Sewell (2015), Thompson, Plisinski, et al. (2017), USGS (2016), and USGS (2021).

BOX 1

Ecological Forestry in Practice: From Family Forests to Former Corporate Lands

There are many examples of ecological forestry in practice across New England's diverse forest types and ownerships, with applications ranging from family forest owners working with innovative consulting foresters to large corporate timberlands managed by companies with commitments to long-term ecological stewardship, such as Baskahegan Company in Maine. The following three examples highlight different ownerships in which the principles of ecological forestry are applied to achieve diverse objectives.

Family Forest Owners: Harry and Michelle Webb

In Hardwick, Massachusetts, Harry and Michelle Webb own 142 acres of land that abuts Massachusetts Division of Fisheries and Wildlife land and the Quabbin Reservoir watershed. Typical of family forest owners, the Webbs have a mix of goals, including increasing the quality and quantity of wood products, maintaining forest health, and diversifying wildlife habitat. To achieve these goals, the Webbs have worked with consulting forester Mike Mauri since 1999 to implement a range of commercial and noncommercial ecological forestry practices, including five timber harvests. These harvests featured retention of biological legacies, establishment of patch reserves, use of continuous cover regeneration systems, increases in forest complexity and tree diversity, and control of invasive plants. The total volume of these harvests was 357,535 board feet of sawlogs, 385 cords of firewood (with 61 cords used by the Webbs to heat their home), 209 cords of pulpwood, and 295 tons of biomass. Converting all volumes to board feet, that's an average of 3.76 thousand board feet per acre. Because of the Webbs' focus on improving the quantity and quality of the wood growing in the forest, their property currently has nearly one million board feet of standing sawtimber volume (998 MBF) and over 1,200 cords of low-grade material. An appreciable amount of durable wood products will be harvested in the future. The Webbs have placed a conservation easement on a portion of the property, with plans to place an additional easement to allow for the implementation of ecological forestry on the rest of the land, ensuring that the forest will continue to produce essential ecosystem services in perpetuity, including the production of durable wood products.

Photo courtesy of Harry and Michelle Webb

Green Mountain National Forest

The Green Mountain National Forest (GMNF) was established in 1932 and covers 420,000 acres across the core of the Green Mountains in Vermont. This federal ownership, which represents 10% of Vermont's forests, applies ecological forestry across multiple scales. This includes zoning that encompasses diverse objectives and values, ranging from protected Wildlands (25% of ownership) to areas designated for multiple uses, such as applications of ecological silviculture to sustain and restore forest communities and habitat conditions that were greatly reduced by historic, intensive land use (45% of ownership). Such silviculture includes using extended rotations to grow older and larger trees, and regenerating forests using silvicultural strategies that promote multiage trees across the forest. Ecological forestry on the GMNF also includes variable retention harvests that mimic higher severity disturbances, such as thunderstorm microbursts, which provide complex young forests for early successional wildlife species while protecting mature trees and groups of trees from the previous stage of the forest (USFS, 2006). Annual harvest levels from the GMNF range from 4 to 10 MBF (roughly 2% of Vermont harvests). The planning and implementation of ecological forestry on these federal lands entail resource specialist and stakeholder input that exceeds that of any other ownership in New England. In addition, the core blocks of permanently protected forest land stretching along the Green Mountains play an outsized role in state and regional planning aimed at maintaining connected and resilient forest landscapes into the future (Loeb & D'Amato, 2020; Sorenson & Zaino, 2018).

AMC Maine Woods Initiative

The Appalachian Mountain Club's Maine Woods Initiative was established in 2003 to promote backcountry recreation, sustainable forestry, ecological restoration, and land conservation in the 100-Mile Wilderness region of Maine. Since that time, AMC's ownership has grown to 114,000 acres of former commercial timberland. Nearly half of this land will never be harvested—ecological reserves constitute 28% of the land, with another 18% non-forested and protected for sensitive ecological features—with the remainder dedicated to long-term stewardship following ecological silvicultural principles. Most of this land is under conservation easements to ensure that the forest benefits provided by these parcels are guaranteed in perpetuity. Much of the land had been heavily harvested prior to acquisition, and active management is now focused on establishing higher stocking and restoring structural and compositional complexity in ways that mimic natural disturbances. This includes maintaining a continuous tree cover when regenerating the forest by using an irregular shelterwood system and promoting large old legacy trees during the harvest. AMC also applies both pre-commercial and commercial thinning in young stands to improve timber quality and accelerate structural and compositional development toward mature and old forest conditions. A portion of these lands are enrolled in carbon markets, which provide additional revenues that help support the practices required to restore ecologically mature forest conditions.

Photos: (top) Jacob Seidel; (bottom) David Publicover

FAMILY AND NONPROFIT FOREST: 14 MILLION ACRES

Family forest ownership (FFO) is the leading category in New England, at roughly 12.6 million acres, or 40% of the forested landscape. To this we have added another million acres of forest owned by private nonprofit organizations (primarily land trusts), because the factors that guide forest management decision-making are similar for these lands and tend not to be rigidly determined by economic considerations.

Family forests are by far the dominant type of ownership in southern New England, throughout most of Vermont, and in southern New Hampshire and Maine. These lands are typically owned for their amenity values like recreation, wildlife, and beauty, which require little active management. Only about 15% of FFOs in the Northeast have formal forest management plans, and participation in government forestry incentive programs is extremely low. The average age of landowners is nearly 65 years old, and many are currently making decisions about the future ownership and use of their land (Butler et al., 2021). Moving beyond the illusion and addressing our collective consumption not only means ensuring forest cover through land protection that endures across generations; it also means convincing FFOs to become engaged in making management decisions toward *both* passive and active management at levels not yet seen in the modern era. It will take a cultural shift to make this happen—perhaps one in which the ecological forestry approach can help. This may be aided by programs like the Cold Hollow to Canada Woodlots Program that support neighbor-to-neighbor collaboration and resources on conservation-based estate planning (e.g., Catanzaro et al., 2020).

CORPORATE FOREST: 12 MILLION ACRES

Corporate forest ownership in New England almost equals FFOs in area, at 12.2 million acres, or a bit less than 40% of the region's forest. These corporate lands lie primarily in a broad band across northern Maine, through New Hampshire north of the White Mountains, and into northeastern Vermont.

The ownership of corporate forestland has transformed dramatically over the past several decades, shifting from vertically integrated forest product companies to, in many cases, institutional investors in the form of timber investment management organizations (TIMOs) and real estate investment trusts (REITs; Sass et al., 2021). These new owners often focus on shorter planning horizons—a decade or two—over which forests are

TABLE 1 Acreage of forest ownerships across New England.

	ALL FORESTLAND (MILLION ACRES)									
	PRIVATE				PUBLIC				TRIBAL	TOTAL
	FFO	CORPORATE	OTHER	TOTAL	FEDERAL	STATE	LOCAL	TOTAL	TOTAL	
Connecticut	0.9	0.3	0.1	1.3	<0.1	0.2	0.3	0.5	<0.1	**1.8**
Maine	5.2	10.0	0.4	15.6	0.3	1.2	0.2	1.7	0.2	**17.5**
Massachusetts	1.3	0.3	0.2	1.9	0.1	0.6	0.4	1.1	<0.1	**3.0**
New Hampshire	2.3	0.8	0.3	3.4	0.9	0.2	0.3	1.3	<0.1	**4.7**
Rhode Island	0.2	0.1	<0.1	0.3	<0.1	0.1	<0.1	0.1	<0.1	**0.4**
Vermont	2.7	0.7	0.1	3.5	0.5	0.4	0.1	1.0	<0.1	**4.5**
Total	**12.6**	**12.2**	**1.1**	**26.0**	**1.8**	**2.7**	**1.3**	**5.7**	**0.2**	**31.9**
% all forestland	**39%**	**38%**	**3%**	**82%**	**6%**	**8%**	**4%**	**18%**	**1%**	**100%**

Percentages may not sum to 100 due to rounding. Data are from Butler et al. (2021).

managed for their greatest economic return, which may lead to conversion and development but also includes the sale of conservation easements, mitigation bank credits, and carbon offsets. Most of the benefits and profits from these lands do not accrue locally: TIMOs and REITs serve investors—pension funds, endowments, insurance companies, private equity firms, high-net-worth individuals—who typically live far from these forests and the communities therein (Gunnoe et al., 2018). Shorter horizons have led to reduced investment in silvicultural treatments historically used to increase growth and quality of forest products, such as pre-commercial thinning (D'Amato et al., 2018).

Prioritization of economic returns has not only contributed to the overharvesting of these lands but also limited the near-term opportunity to produce higher-market-value wood, like sawlogs. In many cases, the reliability of these lands for long-term wood production may also be reduced. This has led to calls for a shift to ecological forestry to restore forest conditions (e.g., Walker et al., 2023). Such a shift may be more challenging to justify on corporate ownerships, where high expected returns on investment prevail, in contrast to other ownerships that prioritize ecological values over economic ones (see examples in Box 1). However, the adoption of ecological forestry principles may be encouraged by incentives for increasing levels of on-site carbon storage, as through carbon offset projects. Nevertheless, on corporate ownerships, more holistic and long-term applications of ecological forestry practices that encompass a broader suite of ecological values beyond carbon will likely require either greater consumer willingness to pay premiums for wood products or acquisition by other owners more inclined to adopt these values on their own.

PUBLIC FOREST: 6 MILLION ACRES

Public ownership in New England spans 5.7 million acres, or almost 20% of the region's forests. The federal government owns 1.8 million acres, primarily the White Mountain National Forest in New Hampshire and Maine, and the Green Mountain National Forest in Vermont. State forests, parks, and wildlife management areas cover 2.7 million acres and are fairly evenly distributed among the states, though Maine and Massachusetts have most of the acreage. Municipally owned forests, which include town forests and watershed lands, cover another 1.3 million acres. Whereas national and state forests were largely purchased from private owners in the first half of the 20th century (Meyer et al., 2014), local community forests have been slowly but steadily acquired to this day and represent an important part of the public land base, including as a potential source of revenue for rural communities (Community Forest Collaborative, 2011; Lyman et al., 2014).

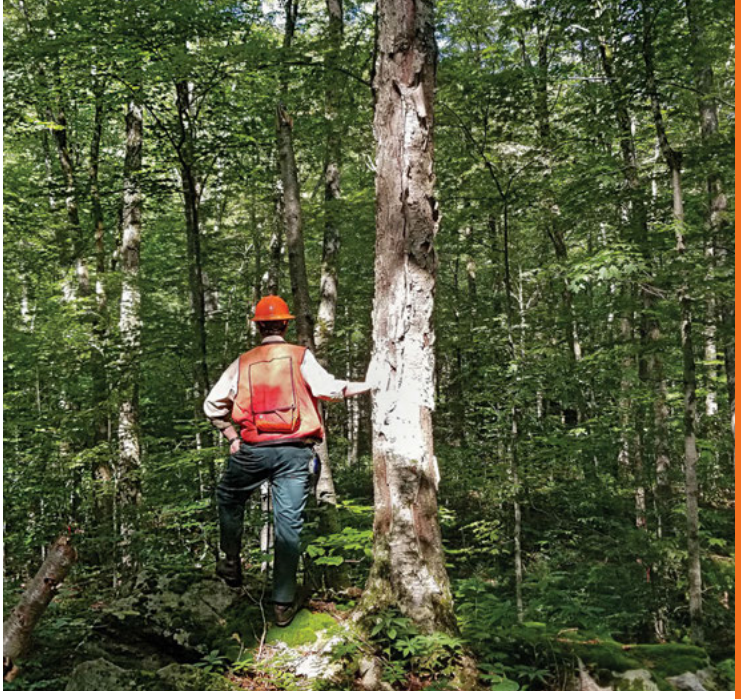


Photo: Joanel Lopez

Management on public lands is guided by organizational mission. For example, municipal watersheds are focused on producing clean water, state wildlife agencies are tasked with restoring and maintaining wildlife habitat, and the USFS is charged with sustaining the "health, diversity, and productivity" of national forests "to meet the needs of present and future generations." Beyond their missions, public lands must respond to evolving demands to fulfill the public's needs and interests, including recreation and climate change mitigation.

Forest management on public lands often involves extensive planning processes that engage teams of natural resource professionals who help determine where and how to implement management activities, such as establishing wild reserves; designing, siting, and scheduling timber harvests; and expanding recreational activities to maximize limited budgets and staffing resources in a way that both advances the organizational mission and balances objectives.

Only a fraction of the actively managed areas on public lands is treated each year given the large acreages relative to staffing levels. This means that the volume of wood harvested from public lands—especially federal lands—in the region is minimal (Oswalt et al., 2019; Thompson, Canham, et al., 2017). Even with these low volumes and robust planning processes and oversight, there is mounting public debate surrounding appropriate management of these forests, particularly in the face of climate change. This has led to further reductions in harvesting and uncertainty among policymakers about the value of harvesting in public forests. This means that in many ways, we may be compromising some of the best examples of sustainable, multi-objective forest stewardship in our region (e.g., on the Green Mountain National Forest; Box 1) while doubling down on industrial production within or beyond the region.

Sustainably Producing the Wood New England Consumes

How much wood could ecological forestry in New England sustainably produce, and how much acreage would be needed for us to meet more of our wood product needs?

The yield of an acre of forest depends on many factors—forest type, site quality, and condition—but we simplified this question by applying a broad, conservative estimate: by 2060, sustainably managed forests in New England could produce an average of 0.4 cords of wood per acre per year (with 1 cord equaling 85 cubic feet of solid wood). We estimated that such production would on average be divided into 60% sawlogs and 40% low-market-value wood that could be used for pulp, fuelwood, or other products, such as insulation. This ratio is the inverse of what harvests yield today.

Using that rate of 0.4 cords/acre/year, we explored several scenarios to evaluate how much wood New England's forests could produce in 2060. The WWF&C vision calls for designating at least 4 million acres (10% of the total landscape) as wild reserves, satisfying that crucial first element of ecological forestry. If *all* the remaining 27.5 million acres of Woodlands were actively managed, they could produce 11 million cords annually—or about 936,000 mcf (thousand cubic feet). That's about 15% more than what we produce today and, by 2060, would more than meet our needs. This is not a likely scenario, nor are we advocating for it, but it illustrates the potential magnitude of sustainable output from our forests.

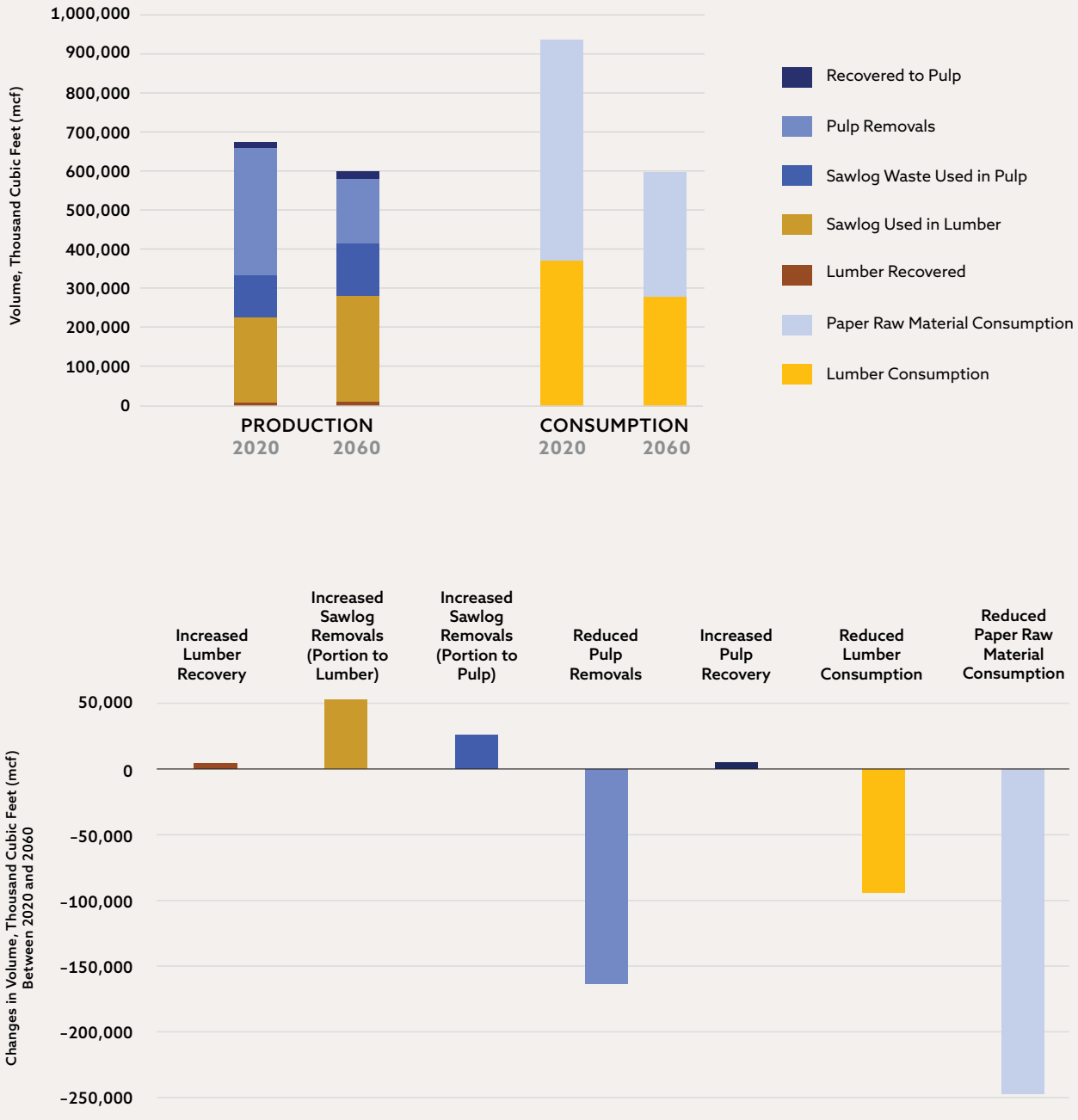
A more attainable but still ambitious scenario would be to devote about 20 million acres—just under half of New England's land, or just under two-thirds of our forest—to productive ecological forestry. By 2060, that would yield roughly 8 million cords annually, or about 680,000 mcf (Fig. 7; Table 5). With the requisite investments in milling capacity and workforce, this would satisfy all of the region's lumber demand and all of its raw materials for paper. It would also yield an amount of lower-grade wood equal to about two-thirds of what we currently burn for energy, much of which might be put to more durable uses. Importantly, this scenario does not require an overall increase in what we currently harvest from our forest. But, by reorienting management toward growing mature trees and higher-grade wood, it would increase our lumber production by 25% (Fig. 8; Table 5). To our minds, this is an achievable step that would go a long way toward managing our forests more responsibly to meet our needs while addressing the climate crisis (Giffen et al., 2022; Walker et al., 2023).

Where in New England might that 20 million acres of actively managed forests be located, and how might it be distributed across the 32 million acres of our three categories of forest ownership—family, corporate, and public? We have chosen one plausible scenario to illustrate the opportunities and challenges presented by these different ownerships (Table 2).

First, we withdrew 4 million acres of Wildlands (including the existing 1.3 million acres), drawing new Wildlands in roughly equal areas from family, corporate, and public forests. Then, to arrive at 20 million acres of actively managed Woodlands, we designated the remaining 11 million acres of corporate lands to ecological forestry production. To that we added about 7 million acres of family forests, and 2 million acres of public forests—about half the remaining land in both those categories. (By comparison, putting half of our family forests under management would be similar to the proportion in Scandinavian countries today [Juutinen et al., 2020]).

Managing 20 million New England acres by ecological forestry would require dramatic changes in the way many of those Woodlands are currently managed (Box 2). To reach the same end by 2060 would take strikingly different initial approaches between the family forests of the south and the corporate forests of the north. For the foreseeable future, families would have to be willing to sustainably harvest more, whereas corporate owners would have to cut less. That is because these two forests are presently in very different conditions. Of late, a large percentage of family forests have seen only sporadic low-intensity harvesting, or no cutting at all. There is nothing wrong with that from an ecological point of view. From a silvicultural point of view, however, there's ample opportunity to manage these stands sustainably. Initially, much low-market-value wood could be removed, along with some timber, to improve the market value of the remaining trees by giving them more room to grow. The result would be mature stands stocked with well-formed and more economically valuable oaks, pines, hickories, maple trees, and more.

FIGURE 7 Differences in production and consumption from 2020 to 2060 and contributing components.



We are calling for a substantial but achievable 25% reduction in consumption, plus an increase in paper recycling, as shown in the top panel. Production would modestly decline and, crucially, would be reoriented toward more durable products, especially lumber. This would enable us to sustainably close the gap between consumption and production. The bottom panel illustrates the specific elements of closing that gap: reduced consumption in both lumber and paper products, increased production of sawlogs via ecological forestry, and a reduction in pulpwood removals. Recovering more lumber and pulp from the waste stream contributes only a small bit of material, but reducing what ends up in landfills is nonetheless a worthy goal. Fuelwood is not illustrated, as we assume that consumption is equal to production, even as the 2060 scenario promotes a shift away from combustion of lower-grade material toward more durable uses. A state-level breakdown of numbers by product class (including fuelwood) is given in Tables 4 and 5 of the Appendix, along with detailed methods.

TABLE 2 Wildland and Woodlands in New England, circa 2020 and 2060.

	2020 (MILLION ACRES)		2060 (MILLION ACRES)		
	WILDLANDS	WOODLANDS	WILDLANDS	HARVESTED WOODLANDS	ADDITIONAL WOODLANDS
FFO, etc.	0.3	13.4	1.0	7.0	5.7
Corporate	<0.01	12.2	1.0	11.0	0.2
Public	1.0	4.7	2.1	2.0	1.6
Total	**1.3**	**30.3**	**4.1**	**20.0**	**7.6**

At 1.3 million acres today, Wildlands cover less than 4% of the New England landscape. Following the WWF&C vision, we call for designating at least 4 million acres (10% of the total landscape) as wild reserves by 2060. At the same time, we must rigorously protect Woodlands. Devoting 20 million acres of Woodlands to productive ecological forestry could, at an average rate of 0.4 cords per acre per year, enable us to sustainably meet our wood product needs. Another 7.6 million acres of Woodlands would still be available—some might be returned to the region's tribes, some might go to even more preserved Wildlands, some might go to increased ecological forestry, some might go to farmland and agroforestry, as future needs dictate. A state-level breakdown is given in Table 3 in the Appendix. Data are from Butler et al. (2021) and Foster, Johnson, et al. (2023). Due to rounding, totals may not precisely match column summations.

By contrast, a large part of the corporate forests in the north have been heavily cut for many decades to maximize wood output and financial returns. Many lack trees older than about 50 years, and their stocking levels of large trees are low (Giffen et al., 2022; Granstrom et al., 2022). To reach a stage where harvests that contribute to long-term, high-quality timber production can resume, these homogenized, often young forests need to see less harvest than growth for a few decades, receive investments such as pre-commercial thinning, and adopt silvicultural systems that retain more mature trees and promote multiaged forests (Kenefic et al., 2014). These activities would ultimately restore the productive capacity of the young, dense forests now dominating much of the landscape while advancing climate change mitigation (Meyer et al., 2022; Walker et al., 2023).

In summary, bringing ecological forestry to the entire region would require several decades of reduced cutting in the industrial forests of the far north, matched with increased and improved cutting in the less actively managed family forests of southern and central New England (Fig. 8). This includes not only Connecticut, Rhode Island, and Massachusetts but also a large part of Vermont, New Hampshire, and southern Maine. Once a few decades have passed and ecological silviculture has been widely adopted, we believe that an average sustained yield of 0.4 cord/acre/year is reasonable.

Many foresters might argue that well-managed New England forests could produce more than that—perhaps 0.5 cord per acre—which would reduce the acreage required to meet our resource needs down to 16 million acres. That may well be, but using a conservative rate of 0.4 cords/acre/year leaves ample room for levels of retention that protect ecological values and sustain high levels of carbon storage within the forest. It also hedges against the real possibility of extreme events and compounding climate impacts causing decline and mortality in some forests (Seidl & Turner, 2022; US Global Change Research Program, 2023). Plus, we suspect that in practice, many family forest owners who harvest at all will prefer to cut lightly. This tendency complicates what some have advocated for: that all cutting on public forests should cease and that all public forests should become Wildlands. If that were to happen, it would require even more harvesting on family forest land to responsibly meet our needs.

That said, different ways of distributing the requisite 20 million Woodland acres across ownerships are certainly plausible. In principle, a full 20% of the region (8 million acres of forest) or more could be dedicated to Wildlands while still achieving the sustainable wood production targets we have outlined. There have been calls for large Wildlands to be acquired from the corporate forest of northern New England. That could well be accompanied by the parallel creation of more community forests and the rematriation of tribal lands, drawing from many of the same lands. We support movement of land into the hands of local and regional owners and stewards who are most inclined to keep forests as forest and to practice responsible ecological forestry.

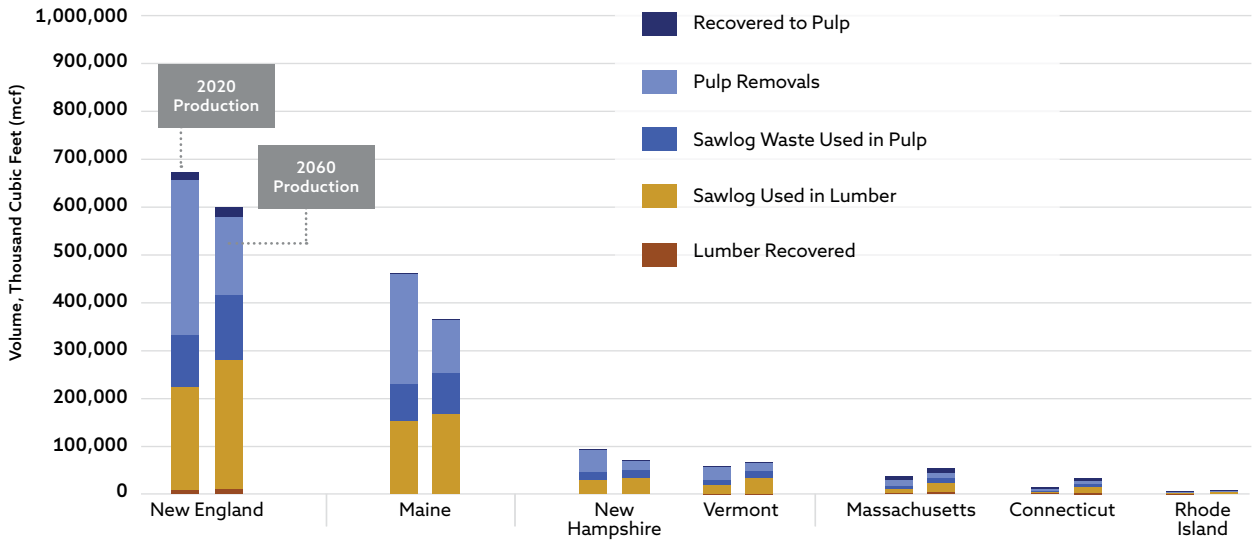
In short, the forest acreage is available whereby, with good management, New England could largely meet more of its own wood needs while more squarely addressing the looming crises of biodiversity loss and climate change. However, achieving anything like this by 2060 will require a radical reordering of priorities around how we value and manage our forests and, crucially, enduring investments in local forest-based economies and the associated infrastructure and workforce (Box 3). The gap between our consumption and our production is a consequence of the market-driven global economy, enormously high rates of consumption, and a society increasingly out of touch with the sources of the products we consume. Moving beyond the *illusion of preservation* will not be easy.

BOX 2

How Much Forest Is Currently Being Managed?

The vision we set forth—20 million acres managed by ecological forestry—logically begets the question, *How much acreage is currently managed by ecological forestry—or currently managed at all?* There is no easy answer to this question because we simply don't know. Resources like Maine's annual silvicultural activities reports document how much land is subject to harvest in any given year. And the Forest Cutting Plans required in Massachusetts for removals of over 25,000 board feet can serve a similar purpose. But such resources rely on compliance and self-reporting (e.g., via landowner surveys), are not applicable to all harvests, and are not aggregated or standardized across the region, nor do they exist for all states. Moreover, a snapshot of harvest activities in any given year cannot tell us how much land is under active management, let alone ecological forest management. Summaries based on data from continuous forest inventories, like FIA, can suggest rough probabilities of harvests over time. For example, an analysis extending across the Northeast and Great Lakes region found annual harvest probabilities of 2.9% for non-corporate private lands, 3.6% for corporate, 1.6% for state, 1.0% for federal, and 2.4% for municipal (Thompson, Canham, et al., 2017). But again, such metrics do not equate to active management per se, especially if rotations are variable and extend beyond plot resampling periods. Nor do they resolve the types of harvests that may have occurred, such that high-grading and single-tree selection by horse may be rolled into the same broad trends (though there have been efforts to classify harvest types and outcomes based on pre- and post-harvest FIA data; e.g., Belair & Ducey, 2018). And so all told, we cannot reliably quantify how much of New England's forest is under active management—by ecological forestry or otherwise. A standardized, region-wide effort to do so would provide important baseline information as well as a means to hold ourselves accountable to achieving the exemplary stewardship goals we envision.

FIGURE 8 Wood production in New England states, circa 2020 and 2060.



For New England as a whole, we envision a modest decline in production by 2060, even as we call upon southern states to increase production and double or triple the volume of sawlogs removed. Most of the decline would occur in Maine. There, the reorientation of production from lower-grade wood to sawlogs would not only increase stumpage values but could also foster a larger value-adding supply chain and reinvigorate vibrant, forest-based economies. Note that fuelwood is not illustrated, as it is assumed that consumption is equal to production, even as the 2060 scenario promotes a shift away from combustion of lower-grade material toward more durable uses. A breakdown of numbers by product class (including fuelwood) is given in Tables 4 and 5 of the Appendix, along with detailed methods.

BOX 3

Rebuilding Economic Vitality

Maine and other parts of rural northern New England are the only reason our regional deficit in local wood production isn't greater than it already is. However, that sheer amount of concentrated production, against a backdrop of shifting global markets, has come at a cost, and historically timber-dependent communities have suffered from economic decline and population loss in recent decades. This has been compounded by a shift in forest land ownership to large multinationals and investment companies; a lack of investment in wood processing infrastructure, the workforce, and local communities; a gradual decline of the New England paper industry in favor of other national and international operations; and the shipment of raw timber to Canadian mills and processing facilities overseas. Despite state and national subsidies, the result has been an ongoing ecological deterioration of the northern forest, a decline in the forest-based economy, and an aging and shrinking population (Irland, 2020; Sayen, 2023). Meanwhile, southern New England has seen a collapse of its forest industry over the last couple of decades, with mills across the region closing.

The economic base of rural, forested New England needs to be rebuilt. Many are working to do so: coalitions and organizations like the Northern Border Regional Commission, the Northern Forest Center, and the Vermont Sustainable Jobs Fund, among others, are striving to revitalize forest-based economies and communities. A revived timber economy that emphasizes within-region ownership, investment, and consumption can provide a diverse array of steady jobs in areas that have increasingly struggled to foster and maintain a skilled workforce and provide employment. This can go hand-in-hand with the continued growth of nature-based recreation and tourism, including trail networks, as well as resorts and home construction. Using local wood from the surrounding forest in new and renovated buildings will keep more of the dollars spent on construction within the local economy. Existing and often abandoned wood product manufacturing plants in these communities could be restored as facilities for creating carbon-friendly construction materials, such as mass timber and wood insulation. We contend that protection of the region's forests must accompany any such development, and that if timber harvesting is to remain an important part of the solution, it must promote the ecological integrity and recreational value of that forest, which is a big part of the region's attraction.

The advent of carbon markets and evolving forest carbon programs represent another avenue in which forest landowners may engage. At their best, such programs may provide the financial means for rematriation of lands to tribes, avoided forest conversion, and ecological forestry that allows carbon to accumulate in the forest, even as careful harvesting continues. However, there are open questions surrounding how the enrollment of large timberlands, in particular, may affect the local economies and workforces of forest-dependent communities and increase leakage of production elsewhere. These concerns must be addressed, and we believe profits associated with such programs should accrue as much as possible to local residents, communities, and tribes, and not just be a windfall to absentee owners who have cut too heavily in the past.

Photos: (top) Caitlin Littlefield; (bottom) Tony D'Amato

The economic base of rural, forested New England needs to be rebuilt.

A Vibrant Future for Our Forests and Communities

New England's forests provide immense benefits simply by existing, yet we must reorient how we engage with our forests if we are to take responsibility for our consumption and rein in our reliance on other regions of the country and globe to feed our lifestyles.

However, we do not have a holistic, region-wide system in place to encourage superlative forest stewardship oriented around the common good. On the contrary, we have an entrenched system that rewards either piecemeal development or heavy cutting that maximizes short-term economic returns on industrial lands. Our incentive programs have failed to engage a substantial segment of family forest owners in long-term active forest management. At the same time, an increasingly pervasive attitude holds that no forest management is the most environmentally sound approach one can take. We wholeheartedly agree that passive management is an ecologically sound approach and, indeed, that Wildlands are a foundational aspect of ecological forestry. However, these two dynamics—ongoing forest loss and degradation on the one hand, and mounting pressures to curtail all harvesting on the other—are only exacerbating ethical and ecological costs in a world where natural resource consumption is simply a fact of life. Meanwhile, the other social and ecological benefits of the forest lie largely unprotected: much of New England is forested, but the forests are not rigorously, permanently protected as such.

Given the scale of the planetary emergency that we face, we do not believe the illusion can be dispelled by merely tweaking tax policies and market incentives. Rather, a broad movement among family forest owners, similar in scale and spirit to the Victory Gardens of World War II, will be needed—and one that must be carried on for decades, often through successive owners. At the same time, an equally broad shift in the incentive structure for large tracts of forest currently in the hands of corporate owners will also be needed. All told, we believe this transformation will require not only a cultural shift in how we think about our forests but also a massive public investment scaled to the environmental and societal challenges we face and designed to support an enduring ecological approach to stewardship.

Consider the ambitious but necessary provisions we have called for:

Protecting Forests

- Greatly accelerating protection of forests by either fee purchase or conservation easements, aiming to safeguard at least 70% of the landscape by 2060
- Setting aside at least 10% of New England in Wildlands
- Implementing no-net-loss policies that strongly encourage clustered development and redevelopment to prevent loss of forest to low-density rural sprawl

Reducing Consumption

- Reducing overall wood consumption by 25%, while committing to building affordable housing and replacing steel and concrete construction with wood wherever possible
- Reducing paper consumption by 25%
- Improving paper recycling and wood reclamation by 50%

Expanding Ecological Forestry

- Reorienting productive forest management away from pulp and toward timber through the widespread adoption of ecological forestry aimed at durable, high-market-value products
- Increasing the proportion of family and nonprofit forest that is carefully managed for both ecological values and wood production to at least 50% of such land, or about 7 million acres
- Investing strategically in forest industry infrastructure across the region—not only in northern New England—to produce a realistic but substantial amount of the wood products New England uses while expanding employment opportunities

Photo: Tony D'Amato

Collectively, these steps constitute a coherent vision aimed at safeguarding the ecological, economic, and social values of New England's forest while sustainably meeting our resource needs. Our intention with this vision is to be illustrative, not prescriptive. There are certainly other ways in which we could collectively and creatively envision a sustainable, vibrant future for our forest and communities, with the benefits we derive from the land widely and equitably shared. Determining how, precisely, we achieve such a future is the next challenge we must confront. Our forest has long blessed us with its resilience and countless other gifts; it is time we reciprocated by caring for it with real rather than illusory values.

APPENDIX

TABLE 3 Wildland and Woodlands in New England states, circa 2020 and 2060.

2020: State of Wildlands & Woodlands

WILDLANDS (MILLION ACRES)

	PRIVATE		PUBLIC	TOTAL
	FFO, ETC.	CORPORATE		
Connecticut	0.01	<0.01	0.02	**0.03**
Maine	0.25	<0.01	0.45	**0.70**
Massachusetts	<0.01	<0.01	0.11	**0.12**
New Hampshire	0.03	<0.01	0.21	**0.24**
Rhode Island	<0.01	<0.01	<0.01	**<0.01**
Vermont	0.03	<0.01	0.17	**0.21**
New England	**0.32**	**0.01**	**0.96**	1.29

WOODLANDS (MILLION ACRES)

	PRIVATE		PUBLIC	TOTAL
	FFO, ETC.	CORPORATE		
Connecticut	0.99	0.30	0.48	**1.77**
Maine	5.35	10.00	1.25	**16.60**
Massachusetts	1.50	0.30	0.99	**2.78**
New Hampshire	2.57	0.80	1.09	**4.46**
Rhode Island	0.20	0.10	0.10	**0.40**
Vermont	2.77	0.70	0.83	**4.29**
New England	**13.4**	**12.19**	**4.74**	30.31

2060: Target for Wildlands & Woodlands

WILDLANDS (MILLION ACRES)

	PRIVATE		PUBLIC	TOTAL
	FFO, ETC.	CORPORATE		
Connecticut	0.07	0.02	0.18	**0.28**
Maine	0.41	0.82	0.61	**1.84**
Massachusetts	0.11	0.02	0.40	**0.53**
New Hampshire	0.19	0.07	0.47	**0.72**
Rhode Island	0.01	0.01	0.04	**0.06**
Vermont	0.20	0.06	0.36	**0.62**
New England	**1.00**	**1.00**	**2.05**	4.05

WOODLANDS (MILLION ACRES)

	PRIVATE		PUBLIC	TOTAL
	FFO, ETC.	CORPORATE		
Connecticut	0.93	0.28	0.32	**1.52**
Maine	5.19	9.18	1.09	**15.46**
Massachusetts	1.39	0.28	0.70	**2.37**
New Hampshire	2.41	0.73	0.83	**3.98**
Rhode Island	0.19	0.09	0.06	**0.34**
Vermont	2.60	0.64	0.64	**3.88**
New England	**12.70**	**11.20**	**3.65**	27.55

To reach the 2060 target of having at least 10% of New England's landscape in Wildlands, we added to the existing 1.3 million acres by withdrawing roughly 1 million acres each from family, corporate, and public forests. We then applied the resulting regional proportions of Wildlands by ownership to the respective ownerships in each state. The remainder of the forest in each state would be protected as Woodlands, 20 million acres of which would be needed to meet our needs by 2060. The total acreage in each ownership may well shift between 2020 and 2060—for example, a family forest may turn into a community forest, or corporate land may be acquired by a conservation organization. We did not attempt to predict such land transfers in coarsely identifying target acreage for Wildlands and Woodlands by current ownership. Data are from Butler et al. (2021) and Foster, Johnson, et al. (2023). Due to rounding, totals may not precisely match column and row summations.

Photo: David Foster

SUPPLEMENTAL METHODS

Quantifying the 2020 Net Balance between Wood Production and Consumption in New England States

To examine the regional deficit, we used a net-balance approach to compare wood production and consumption for the region as a whole and for each of the six New England states. Importantly, our goal was not to provide a definitive accounting of all the harvesting, processing, procuring, trade, and use of wood products in New England but rather to provide reasonable estimates of the production and consumption of lumber, paper (pulp), and fuelwood within states and across the region as a whole. This highlights the size and shape of the imbalances. A schematic of these calculations is given in Fig. 10, and one for 2060 is given in Fig. 11.

- Our estimates of New England lumber and pulp **consumption** are drawn from recent national per capita data (Howard & Liang, 2019), adjusted by population and median household income for each New England state (median income is at or higher than the US median for all states but Maine; US Census Bureau, 2023a). We relied on these national consumption rates because we were unable to enumerate the quantities and determine the origins of all the wood products purchased by New Englanders. It is important to note that our income adjustment tracks with the correlation between income classes and expenditure patterns for a range of product classes (e.g., dwellings, furniture, household products; US Bureau of Labor Statistics, 2023). But because new housing starts in New England have, in fact, lagged housing starts elsewhere in the country—and those starts represent roughly 30% of annual lumber use (Howard & Liang, 2019)—our income adjustment may inflate New England lumber consumption in recent years. (Were we to not apply the income adjustment to lumber, total regional consumption may be about 6% lower.) However, given the correlation between income and expenditures (noted above) and the potential for our production numbers to be a bit high (described below), we feel this adjustment is reasonable.

- Wood **production** numbers come from the USFS's FIA program (Bechtold & Patterson, 2005). We explored other sources, including USFS Timber Product Output numbers and reports (e.g., Oswalt et al., 2019) and state harvest reports when available. But we elected to use FIA because data collection is standardized across states, and recent inventory data were available (the average FIA plot remeasurement year was 2015). If anything, FIA removal data likely overestimate the amount of material that actually leaves the forest and makes it into production. (FIA removals for Maine are nearly 33% greater than the volumes given in Maine's annual wood processor reports, 41% more

for sawlogs alone; Vermont's FIA and state harvest report removals roughly match for total volumes, but FIA gives 24% greater volume for sawlogs. Were we to substitute the Maine report volumes into our equation, regional production could be 17% less—or even lower if FIA removals overestimate actual volumes removed in other states, too.) So, applying FIA numbers gives us a more optimistic accounting of the deficit between production and consumption than not—but it also mitigates the fact that our consumption numbers may be a bit high. It was not tractable to determine exactly the types of wood products produced or consumed within the region or flowing across state or national borders; thus, for example, New England sawlogs that are sent to Canadian sawmills are credited as lumber being produced within the region.

- We assumed that of the average sawlog harvested in New England, two-thirds becomes lumber, and one-third becomes other material (a lumber recovery factor of 8 bf lumber/ft^3 of logs; Hubbard et al., 2020; Puettmann, 2020). We allocated that one-third to making paper. In reality, some of that sawmill waste is burned for energy or used in other ways (e.g., animal bedding or insulation), but determining precisely how much was not feasible. Similarly, we used a formula of one-third pulp logs, one-third sawmill waste, and one-third recycled content as an approximation for making all grades of paper, across printing sheets, newsprint, packaging, and other types (EPA, 2016; Van Ewijk et al., 2018). This means that the volume of paper consumed in New England is actually three times the volume of pulpwood consumed here, and that the raw material from the forest required for that paper (pulp and sawmill waste combined) is twice the amount of pulp consumed.

- As for fuelwood, we could find no reliable data on the amount consumed in New England. Instead, we assumed that the amount consumed within each state equals the amount produced therein. We acknowledge that this assumption likely disguises some fuelwood flows among the six New England states, but we consider wood fuel flowing in and out of New England as a whole to be negligible.

- We also accounted for the contribution of wood recovered from construction and demolition as well as municipal solid waste (Falk & McKeever, 2012; Morris, 2016). We added these volumes to production before subtracting consumption in our net-balance approach. These recovered volumes are quite small—only about 5% of total consumption—and most goes to fuel, some goes to paper, and a tiny bit is reused as lumber.

Photos: (pg. 32) Tony D'Amato; (above) Brian Donahue

SUPPLEMENTAL METHODS

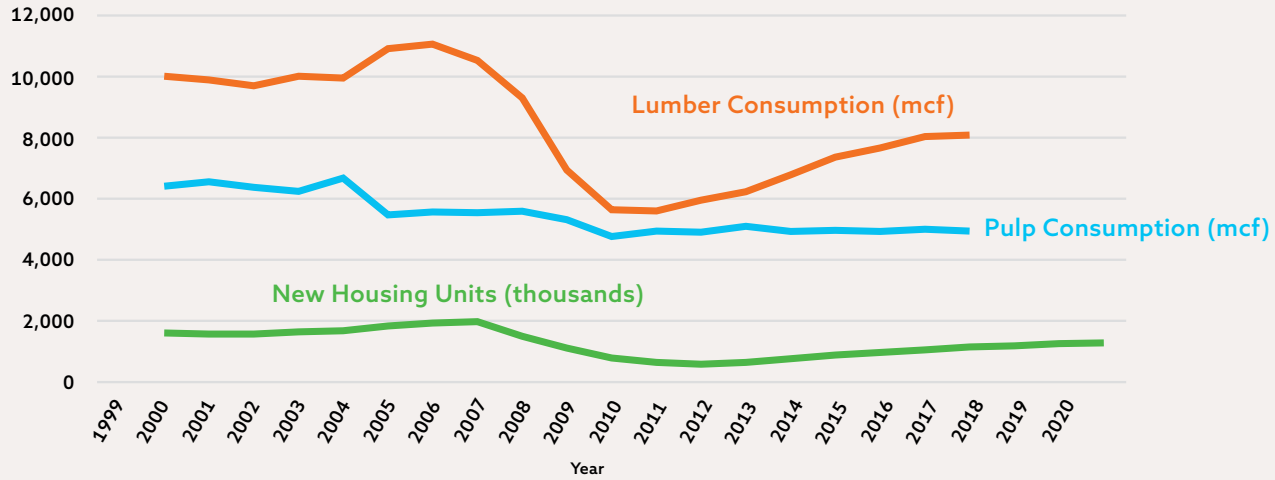
Regional Lumber Demand in Relation to Population and Housing Growth Projections

According to the Massachusetts 2050 Decarbonization Roadmap Study (Commonwealth of Massachusetts, 2020), housing stock for Massachusetts, which comprises about half of the New England population, is projected to rise 8% this decade but then sharply decline with an anticipated slowdown in population growth. In all, housing inventory in Massachusetts is projected to rise only 13% from 2020 to 2050, or an annual rate of about 0.4%—just half the rate of increase between 2000 and 2016. (Meeting the backlog of affordable housing needs is built into this projection.) By mid-century, the state will need substantially less lumber to meet its housing demand.

Population projections can be used as a proxy to compare housing growth in other New England states to that in Massachusetts. Overall, the region's population is projected to grow at an annual rate of only about 0.2%, concentrated in the southern states and New Hampshire (EPA, 2018). This suggests that the housing growth rate for all of New England may be even less than for Massachusetts, or less than half of today's rates. Accordingly, if the relationship between housing starts and lumber consumption holds, we might reasonably expect a decline of at least 25% in annual lumber consumption by 2060.

These population and housing growth projections were made before the pandemic. They may be wrong. Future pandemics, the arrival of climate refugees, and other factors may spur more housing growth in the region. In fact, all three northern New England states experienced unexpected increases in net migration during 2020–2021, placing pressure on already tight housing markets (US Census Bureau, 2023a). This influx may continue as the flexibility of remote work and a desire to escape climate disasters in other parts of the country bring more affluent residents to the rural landscapes of northern New England, which may in turn add some increased demand for housing, at least in these areas.

FIGURE 9 National trends in lumber and pulp consumption relative to new housing units.



At a national scale, lumber consumption tracks the construction of new housing units, as exemplified in the decline associated with the 2008 global financial crisis. In recent years, a long-running decline in pulp consumption has been counterbalanced by demand for packaging, which now accounts for over half of paper use (Environmental Paper Network, 2018). Data are from Howard and Liang (2019) and the US Census Bureau (2023c).

Photo: Faith Rand

FIGURE 10 Schematic of quantifying the 2020 net balance between wood production and consumption in New England.

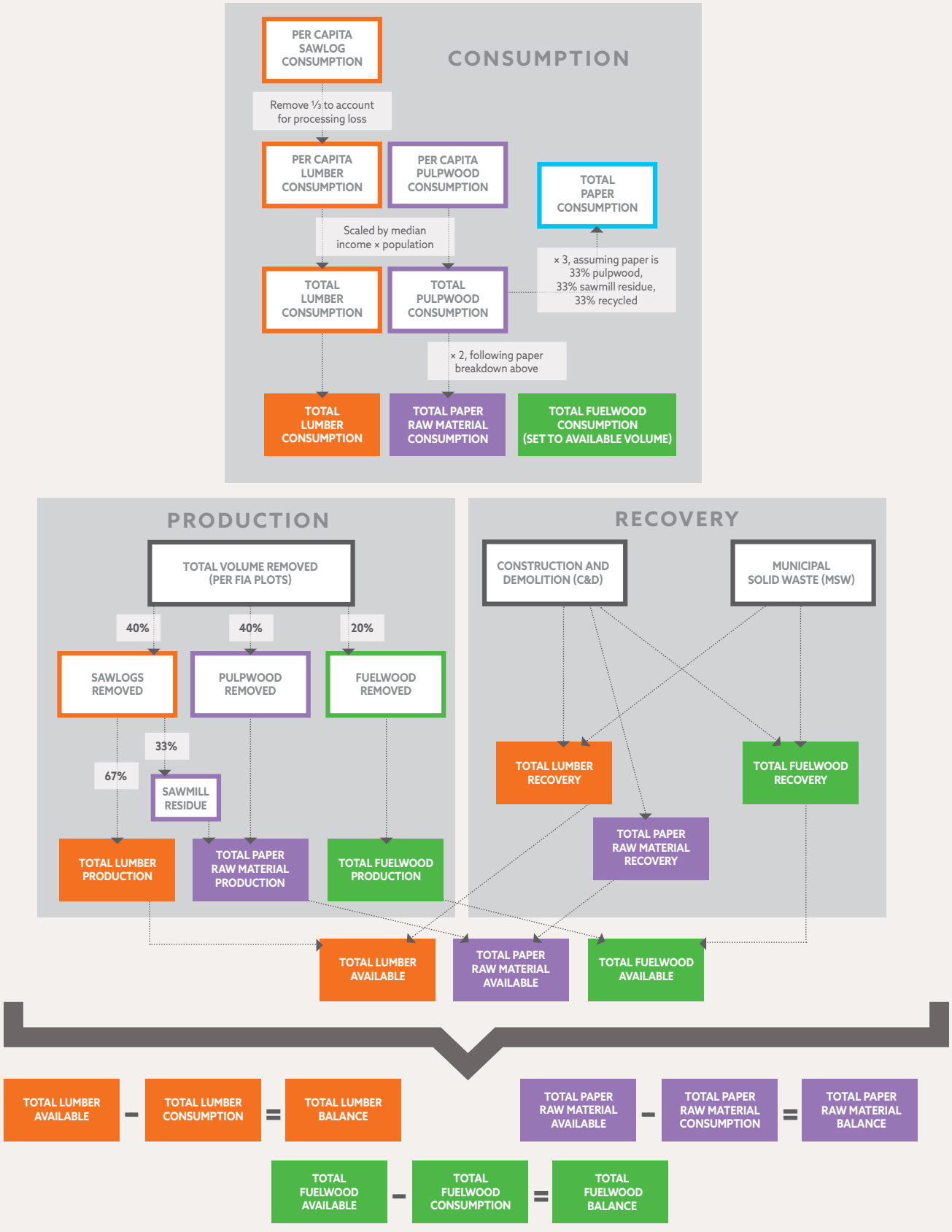


FIGURE 11 Schematic of quantifying the 2060 net balance between wood production and consumption in New England.

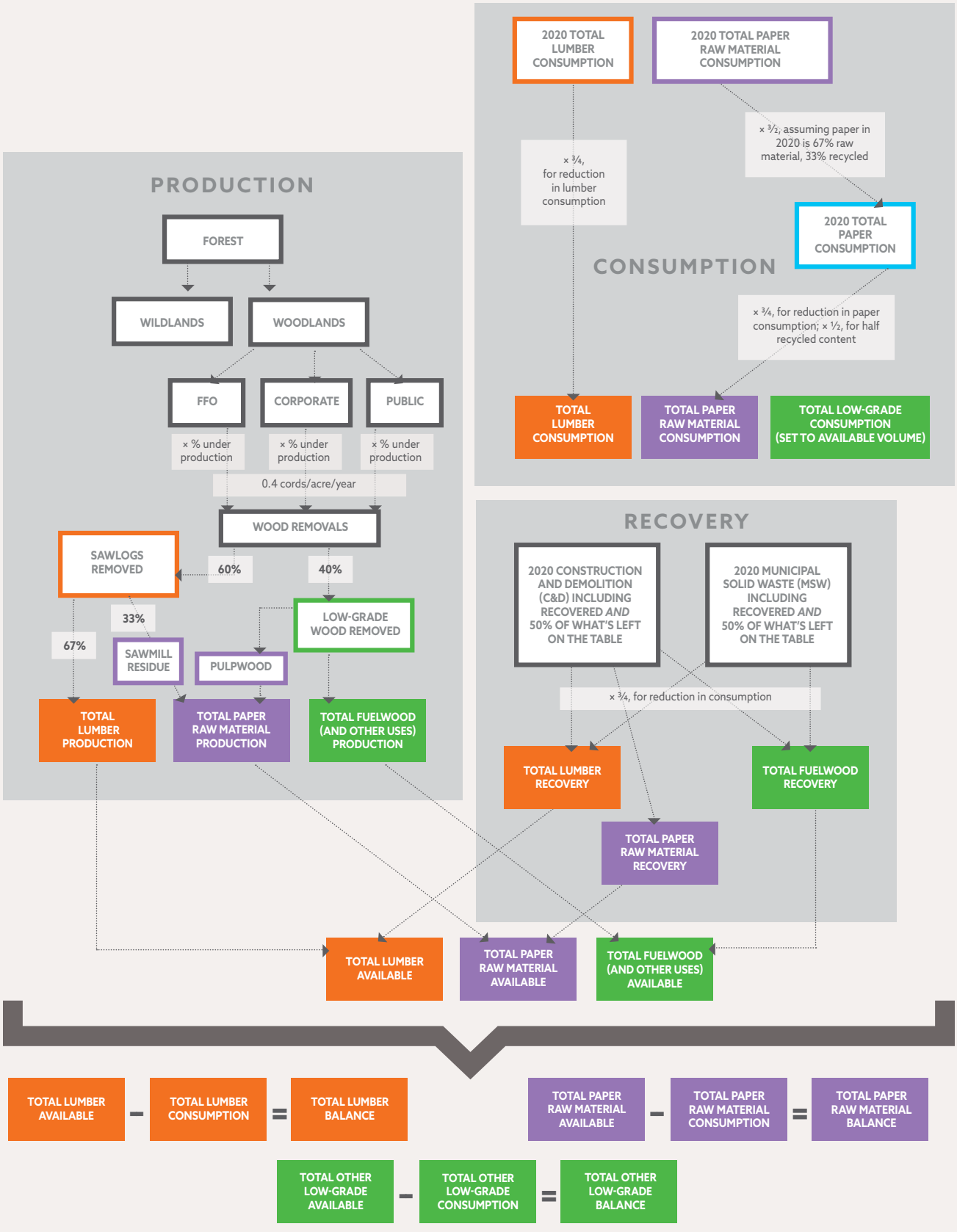


TABLE 4 The net balance of wood production and consumption in thousand cubic feet (mcf) in New England, circa 2020.

2020	SAWLOGS	LUMBER	SAWMILL WASTE (FROM SAWLOGS)	PULPWOOD	RAW MATERIAL FOR PAPER (PULP PLUS MILL WASTE)	FUELWOOD	TOTAL
New England							
PRODUCTION	327,000	217,900	109,000	327,000	435,800	163,500	**817,200**
RECOVERY		8,000			14,700	34,000	**56,700**
CONSUMPTION		(375,600)		(282,600)	(565,400)	(197,500)	**(1,138,500)**
BALANCE		(149,700)			(114,900)	—	**(264,600)**
%		59%			79%	100%	**76%**
Connecticut							
PRODUCTION	5,200	3,400	1,700	5,200	6,900	2,600	**12,900**
RECOVERY		1,900			3,500	8,100	**13,500**
CONSUMPTION		(83,900)		(63,200)	(126,300)	(10,700)	**(220,900)**
BALANCE		(78,600)			(115,900)	—	**(194,500)**
%		4%			6%	100%	**6%**
Maine							
PRODUCTION	231,000	154,000	77,000	231,000	308,000	115,500	**577,500**
RECOVERY		700			1,300	3,100	**5,100**
CONSUMPTION		(25,600)		(19,200)	(38,500)	(118,600)	**(182,700)**
BALANCE		129,100			270,800	—	**399,900**
%		618%			828%	100%	**325%**
Massachusetts							
PRODUCTION	13,400	8,900	4,500	13,400	17,800	6,700	**33,400**
RECOVERY		3,800			6,900	15,800	**26,500**
CONSUMPTION		(194,100)		(146,000)	(292,100)	(22,500)	**(508,700)**
BALANCE		(181,400)			(267,400)	—	**(448,800)**
%		5%			6%	100%	**7%**
New Hampshire							
PRODUCTION	45,900	30,600	15,300	45,900	61,200	23,000	**114,800**
RECOVERY		700			1,300	3,100	**5,100**
CONSUMPTION		(35,800)		(27,000)	(53,900)	(26,100)	**(115,800)**
BALANCE		(4,500)			8,600	—	**4,100**
%		87%			116%	100%	**104%**
Rhode Island							
PRODUCTION	2,300	1,500	800	2,300	3,000	1,100	**5,600**
RECOVERY		600			1,100	2,500	**4,200**
CONSUMPTION		(21,800)		(16,400)	(32,900)	(3,600)	**(58,300)**
BALANCE		(19,700)			(28,800)	—	**(48,500)**
%		7%			9%	100%	**10%**
Vermont							
PRODUCTION	29,200	19,500	9,700	29,200	38,900	14,600	**73,000**
RECOVERY		300			600	1,400	**2,300**
CONSUMPTION		(14,400)		(10,800)	(21,700)	(16,000)	**(52,100)**
BALANCE		5,400			17,800	—	**23,200**
%		138%			184%	100%	**147%**

We calculated net balances for lumber, the raw material required for paper (pulp plus sawmill waste), and fuelwood; these are in darker gray, and their sources are in lighter gray. Balances are calculated by summing production (+), recovery (+), and consumption (–); percentages give the degree to which production meets demand and are calculated as production divided by the sum of the absolute value of consumption minus recovery. Percentages may not sum to 100 due to rounding. Data are from Howard and Liang (2019) and the USDA Forest Service's Forest Inventory and Analysis program.

TABLE 5 The net balance of wood production and consumption in thousand cubic feet (mcf) in New England, circa 2060.

2060	SAWLOGS	LUMBER	SAWMILL WASTE (FROM SAWLOGS)	PULPWOOD	RAW MATERIAL FOR PAPER (PULP PLUS MILL WASTE)	FUELWOOD & OTHER LOW-GRADE PRODUCT	TOTAL
New England							
PRODUCTION	405,300	270,100	135,100	163,400	298,400	110,300	**678,800**
RECOVERY		11,700			19,600	38,200	**69,500**
CONSUMPTION		(281,800)			(318,000)	(148,500)	**(748,300)**
BALANCE		—			—	—	—
%		100%			100%	100%	**100%**
Connecticut							
PRODUCTION	19,500	13,000	6,500	6,500	13,000	6,500	**32,500**
RECOVERY		2,800			4,700	9,100	**16,600**
CONSUMPTION		(63,000)			(71,100)	(15,600)	**(149,700)**
BALANCE		(47,200)			(53,400)	—	**(100,600)**
%		22%			20%	100%	**24%**
Maine							
PRODUCTION	251,900	167,900	84,000	112,300	196,200	59,200	**423,300**
RECOVERY		1,100			1,800	3,400	**6,300**
CONSUMPTION		(19,200)			(21,600)	(62,600)	**(103,400)**
BALANCE		149,800			176,400	—	**326,200**
%		928%			991%	100%	**436%**
Massachusetts							
PRODUCTION	29,000	19,300	9,700	9,700	19,300	9,700	**48,300**
RECOVERY		5,400			9,100	17,800	**32,300**
CONSUMPTION		(145,500)			(164,300)	(27,500)	**(337,300)**
BALANCE		(120,800)			(135,900)	—	**(256,700)**
%		14%			12%	100%	**16%**
New Hampshire							
PRODUCTION	51,100	34,000	17,000	17,000	34,000	17,000	**85,000**
RECOVERY		1,100			1,800	3,500	**6,400**
CONSUMPTION		(26,900)			(30,300)	(20,500)	**(77,700)**
BALANCE		8,200			5,500	—	**13,700**
%		132%			119%	100%	**119%**
Rhode Island							
PRODUCTION	4,600	3,100	1,500	1,500	3,100	1,500	**7,700**
RECOVERY		800			1,400	2,800	**5,000**
CONSUMPTION		(16,400)			(18,500)	(4,300)	**(39,200)**
BALANCE		(12,500)			(14,000)	—	**(26,500)**
%		20%			18%	100%	**23%**
Vermont							
PRODUCTION	49,200	32,800	16,400	16,400	32,800	16,400	**82,000**
RECOVERY		500			800	1,600	**2,900**
CONSUMPTION		(10,800)			(12,200)	(18,000)	**(41,000)**
BALANCE		22,500			21,400	—	**43,900**
%		318%			288%	100%	**215%**

After reducing consumption, increasing recovery, and reorienting production toward more durable products, we calculated what was needed to achieve regional net balances for lumber, the raw material required for paper (pulp plus sawmill waste), and fuelwood (plus other lower-grade materials); these are in darker gray, and their sources are in lighter gray. Balances are calculated by summing production (+), recovery (+), and consumption (–); percentages give the degree to which production meets demand and are calculated as production divided by the sum of the absolute value of consumption minus recovery. Percentages may not sum to 100 due to rounding. Projections are based on data from Howard and Liang (2019) and the USDA Forest Service's Forest Inventory and Analysis program.

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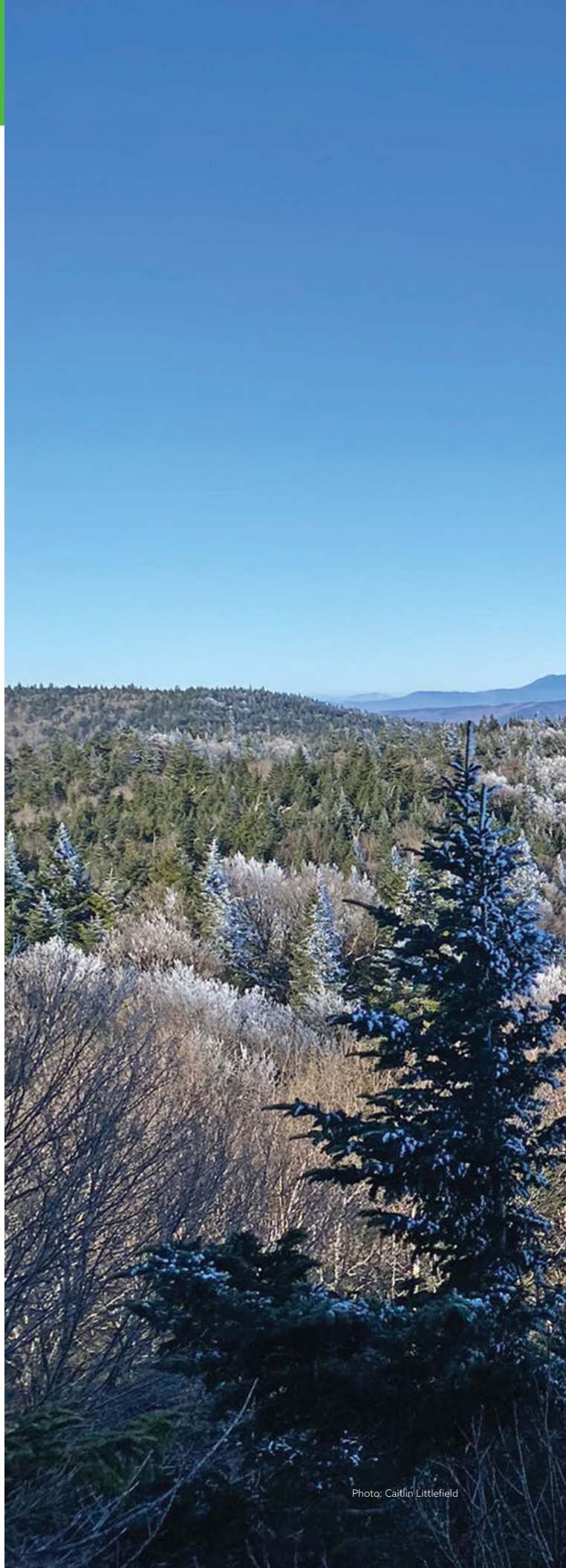

Design: Penny Michalak; copyediting: Jamie Thaman

Photo: Caitlin Littlefield

Given New England's favorable climate and abundant, productive forests, as well as New Englanders' strong capacity to apply strict environmental oversight, few places on earth should be better poised to be a leader in advancing forest protection and the sustainable harvesting of natural resources while upholding ecological and social values.

Photos: (front cover) main: Tony D'Amato; circles, top to bottom: Ross Caron, Shutterstock/Elena Elisseeva, Tony D'Amato; (back cover) Tim Stout