The New England Wood Supply Chain:

Opportunities for Mass Timber

The healthy and thriving forests of New England could change the ways we build cities. This report outlines the current status of New England forests and wood supply chains and associated transportation emissions. The report concludes by outlining opportunities and challenges for new infrastructure investments for mass timber.

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Introduction

Vast forest resources spread across New England, however relatively little of the wood required for the region's buildings come from local forests. The first half of this report sets out to explore the existing supply chain from forest to city.

The second half of the report evaluates the transportation impacts of sourcing wood from regional sawmills. Cost distances were calculated based on carbon emissions, and a lower carbon regional supply chain compares positively with conventional building materials.

The potential exists to build a more regional supply chain with positive economic and carbon impacts.

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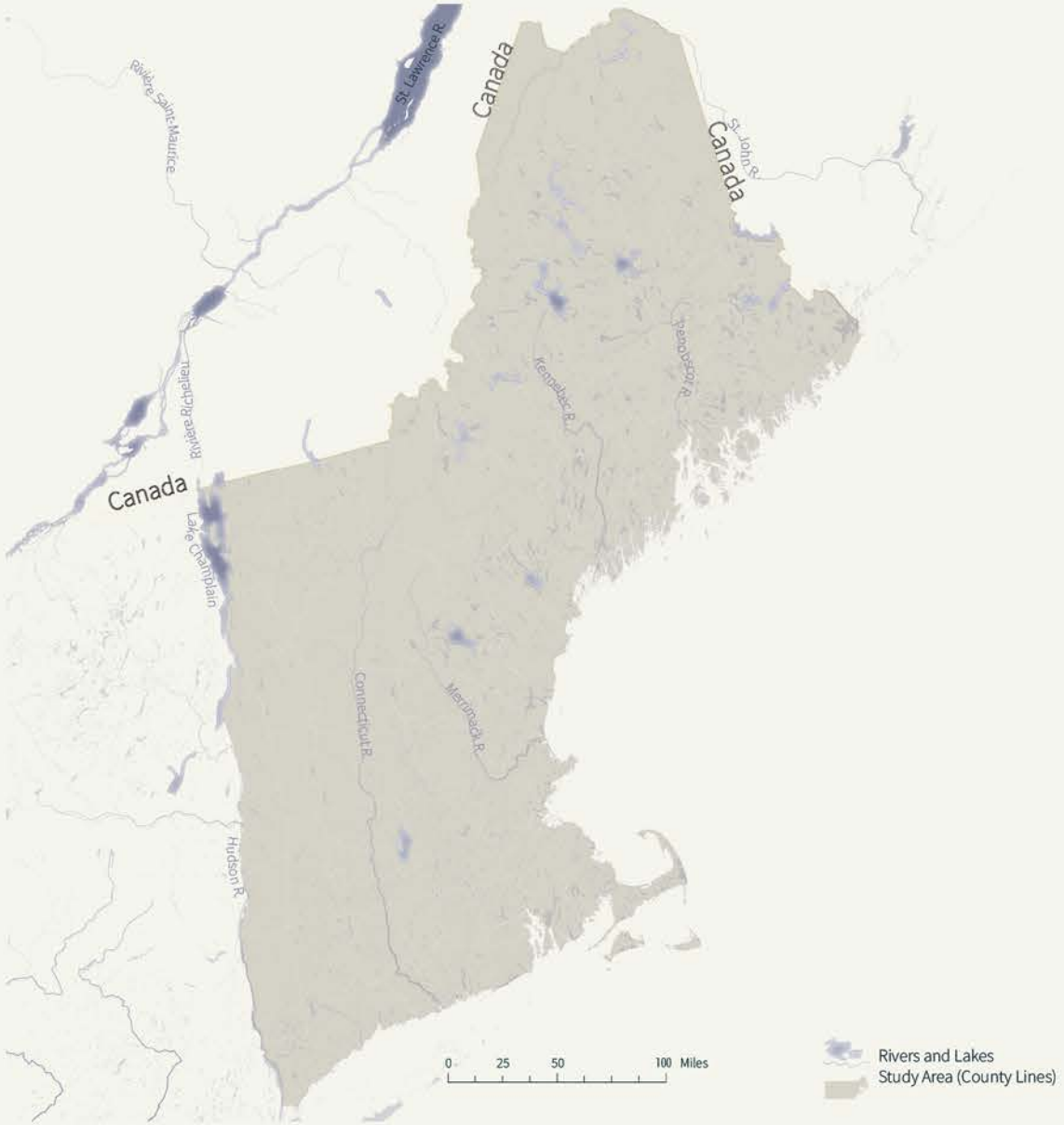

New England Region

The Atlantic Ocean, Hudson River, and Canadian border bound the greater New England region. These boundaries mirror regional transitions in forest type and forest products infrastructure.

Further west lie hardwood sawmills and a different forest type. A vast forest products supply chain infrastructure exists to the north of the US - Canada border. While significant for regional wood markets, the forest and infrastructure type differs notably from what exists in New England.

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New England Forests

New England has a unique combination of forest types, species distributions, forest ownerships, and trends in growth and harvesting. This initial section provides a snapshot of regional forests and establishes baseline conditions for the development of a regional wood supply chain.

Forest Biomass

Forest biomass is higher in southern and central New England and lower in the furthest northern reaches of Maine. This results from the growing season, underlying ecological productivity of different landscapes, and legacies of land use over preceding centuries.

0 Forest Biomass (Mg/Ha) 242

Source: USDA Forest Service, Northern Research Station, 2013

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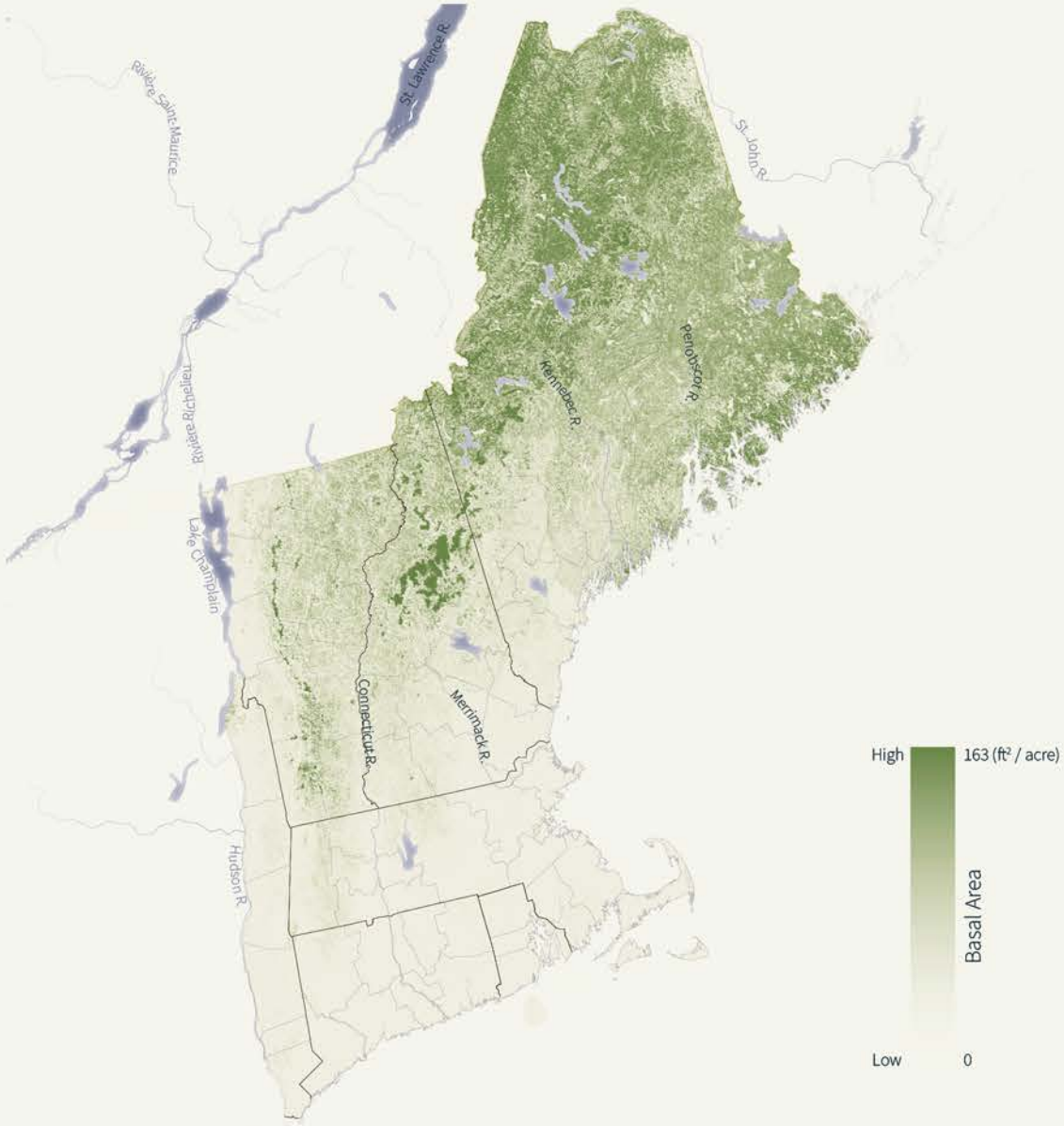

Norway, White, Red, Black spruce

Red and Jack pine

Balsam fir

Structural Species: Spruce, Pine, Fir

Spruce, Pine and Fir (SPF) are the primary structural building materials grown in New England. These species, all of which are approved for structural use, grow primarily in Northern Maine.

Structural Species Locations

Source: USDA Forest Service, Northern Research Station, 2013

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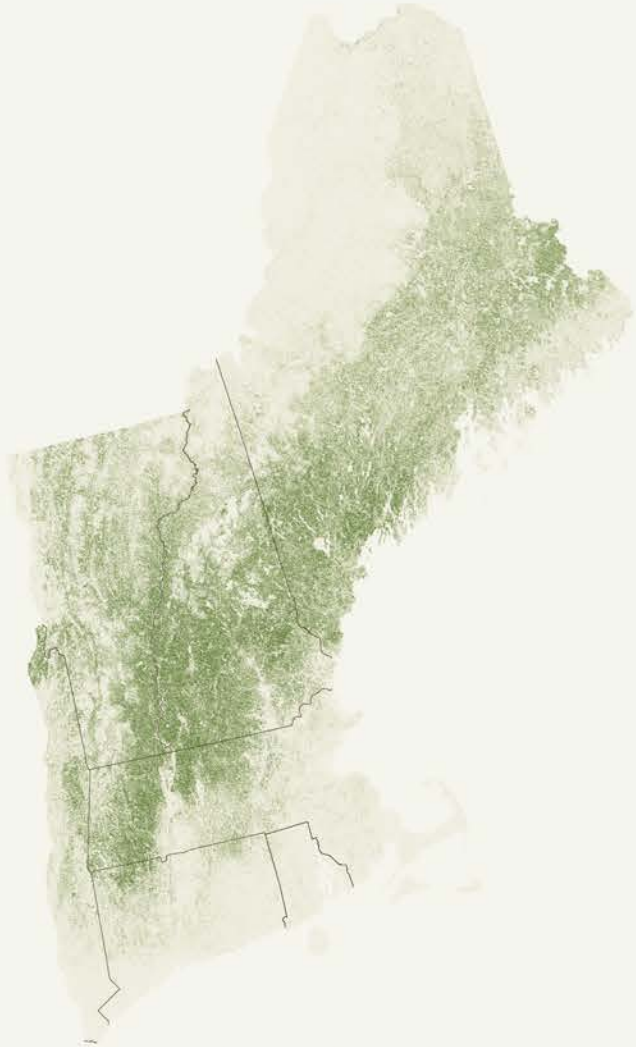
Eastern white pine



Eastern hemlock

While the current supply of SPF is concentrated to the north, Eastern white pine and Hemlock are both under consideration for structural use in Cross Laminated Timber and other products, and grow in high densities in central and eastern New England. This species location presents significant opportunities for increased wood utilization and infrastructure development to support a new wood supply chain.

0 (ft^2 / acre) Basal Area 177 (ft^2 / acre)

Pine / Hemlock Species Locations

Source: USDA Forest Service, Northern Research Station, 2013

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Current Supply

Red spruce

Balsam fir

Potential Supply

Eastern white pine

Eastern hemlock

The current log supply for structural lumber exists in northern Maine. The primary species include Red spruce and Balsam fir.

Eastern hemlock and Eastern white pine are both under consideration for use in mass timber products. If approved for mass timber use, a new supply chain infrastructure could develop in central and southern New England.

Current / Potential Supply

Source: USDA Forest Service, Northern Research Station, 2013

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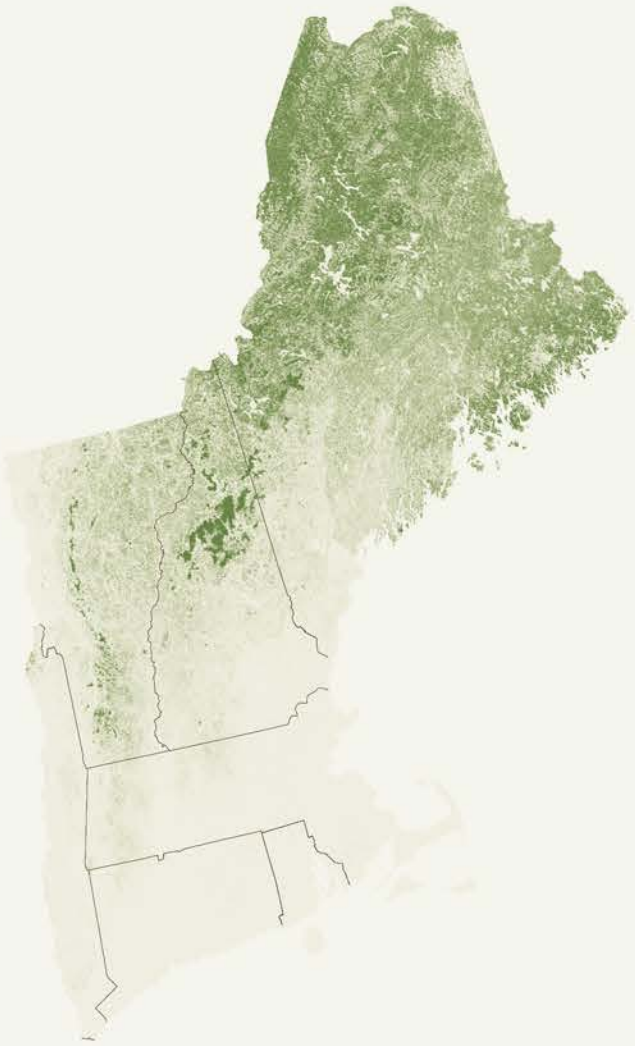
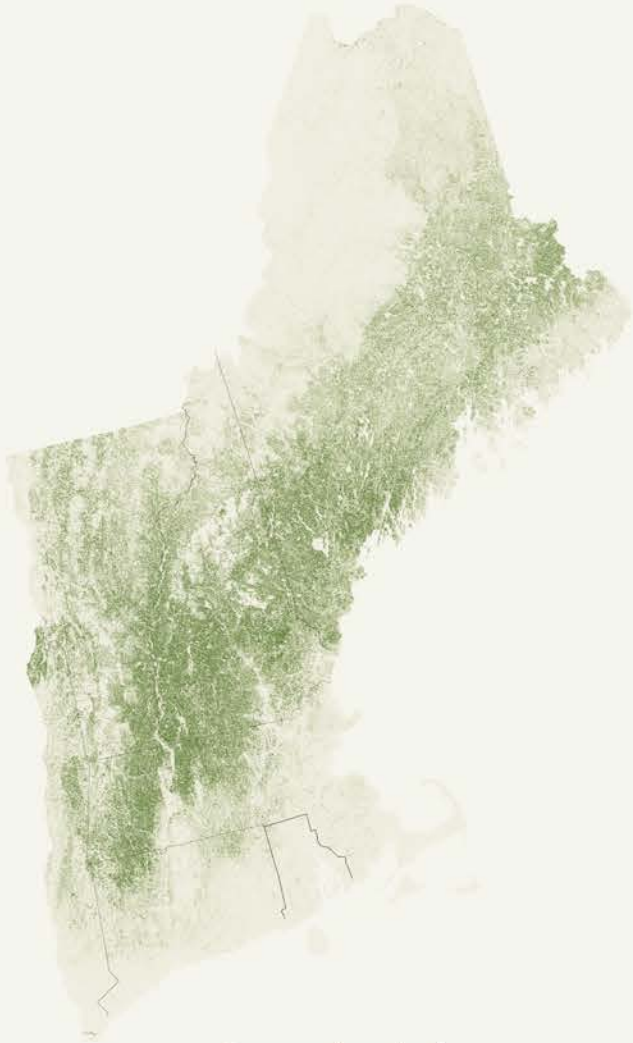


Spruce, Pine, Fir



Eastern hemlock

Eastern white pine

Species Distribution (Ft^2 per Acre)

Source: USDA Forest Service, Northern Research Station, 2013

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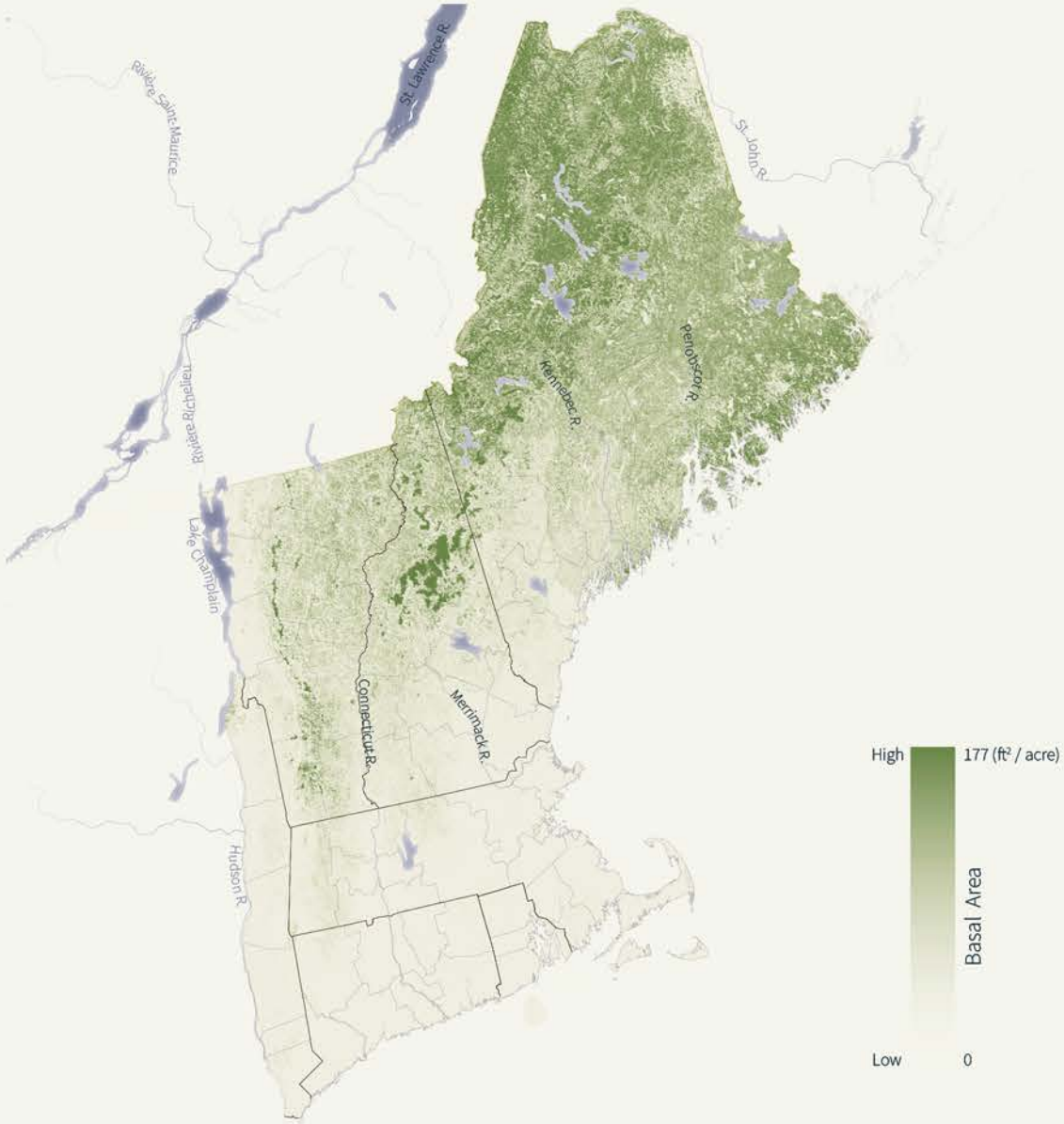

SPF (Certified for Structural Use)

Eastern hemlock

Eastern white pine

Potential for Mass Timber Use

Eastern hemlock and Eastern white pine are both under consideration for use in mass timber panels. These species are located to the south of the primary SPF log supply in northern Maine.

Source: USDA Forest Service, Northern Research Station, 2013

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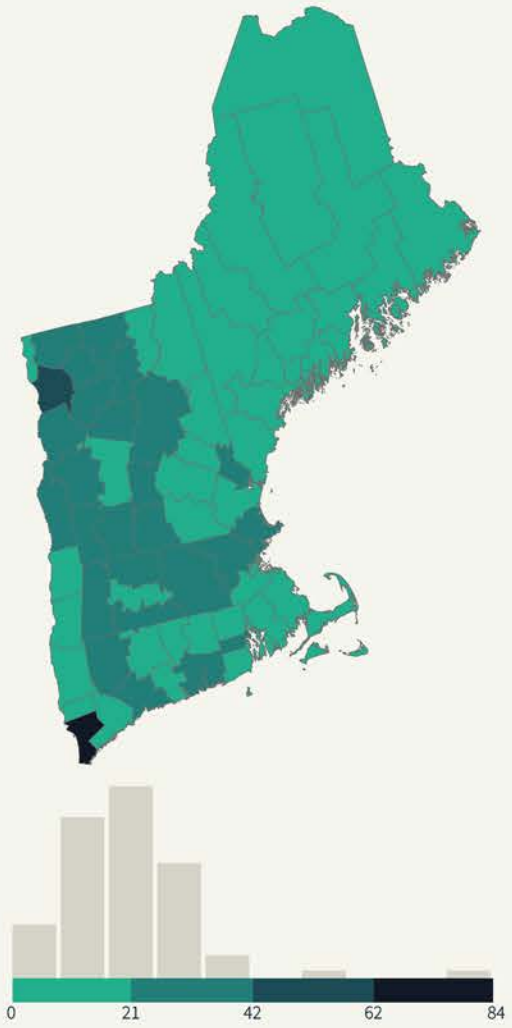
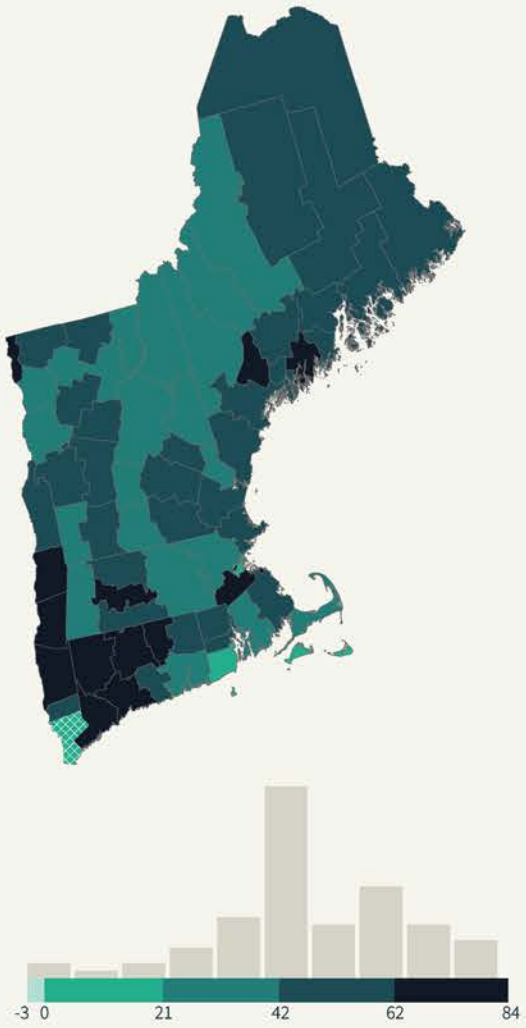
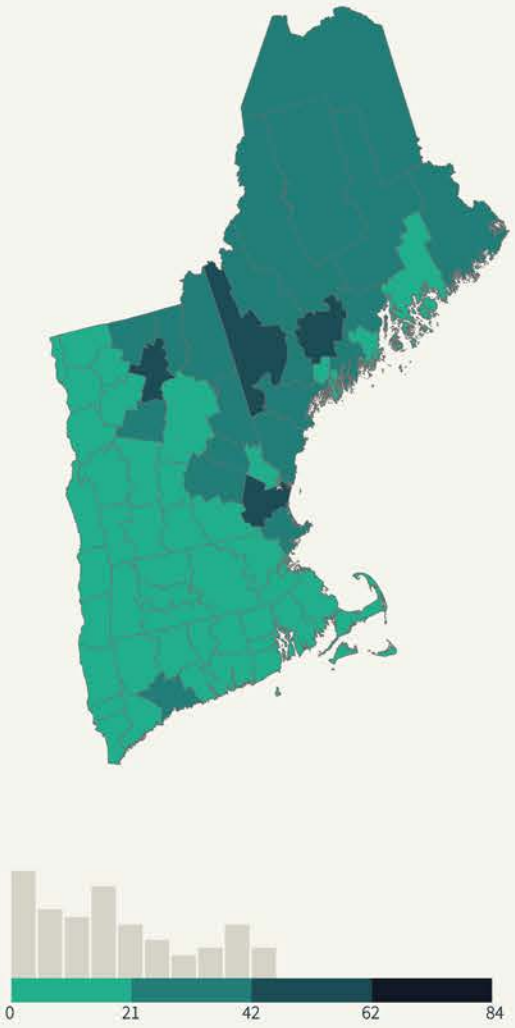


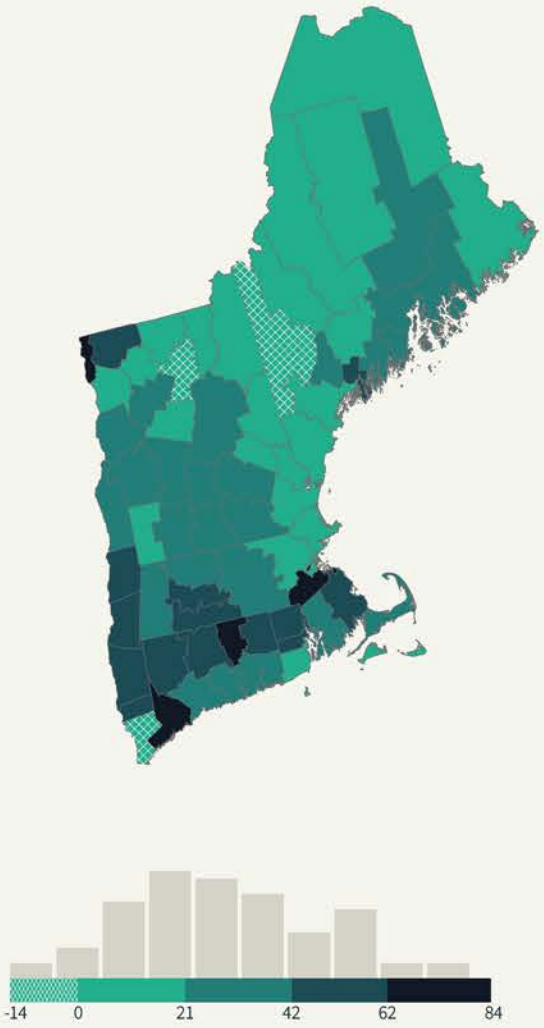
Average Annual Mortality
(Ft^3 per Acre)



Annual Net Growth
(Ft^3 per Acre)



Average Annual Removal
(Ft^3 per Acre)



Annual Growth minus Removals
(Ft^3 per Acre)

County-Level Growth and Removals

Source: USDA Forest Service, Northern Research Station, 2013

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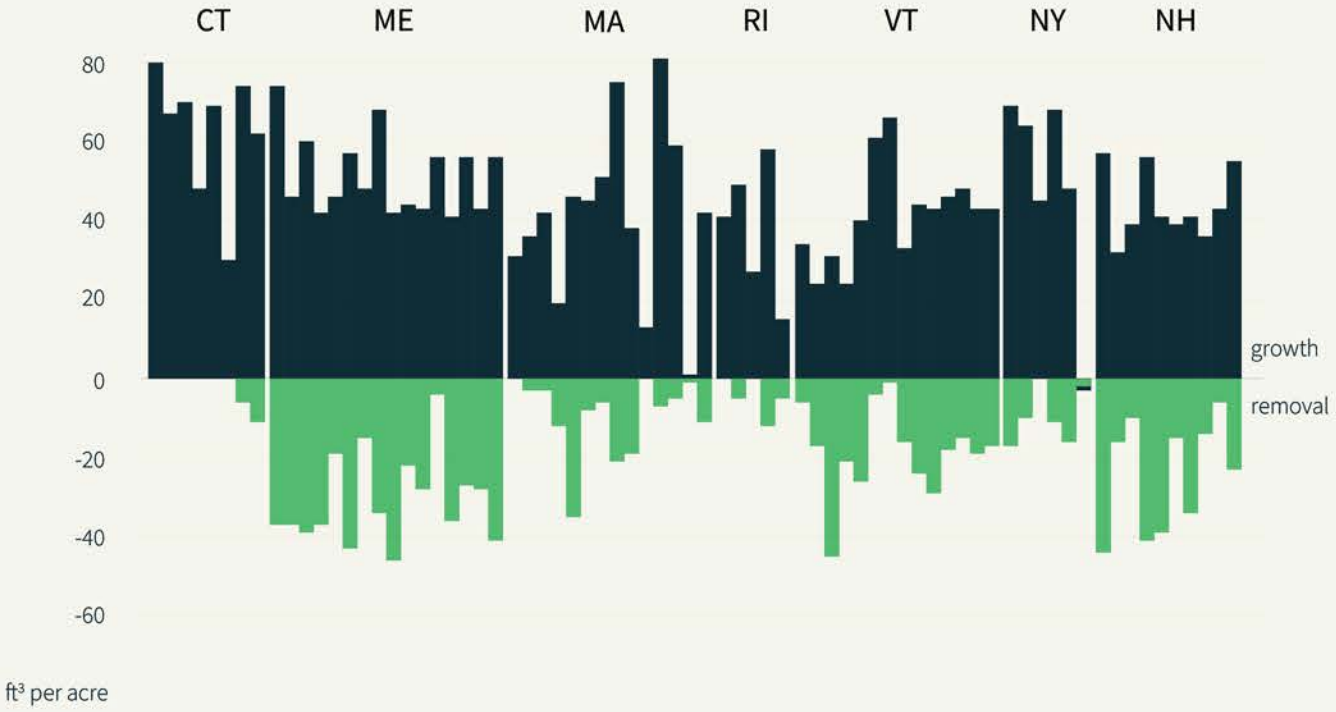


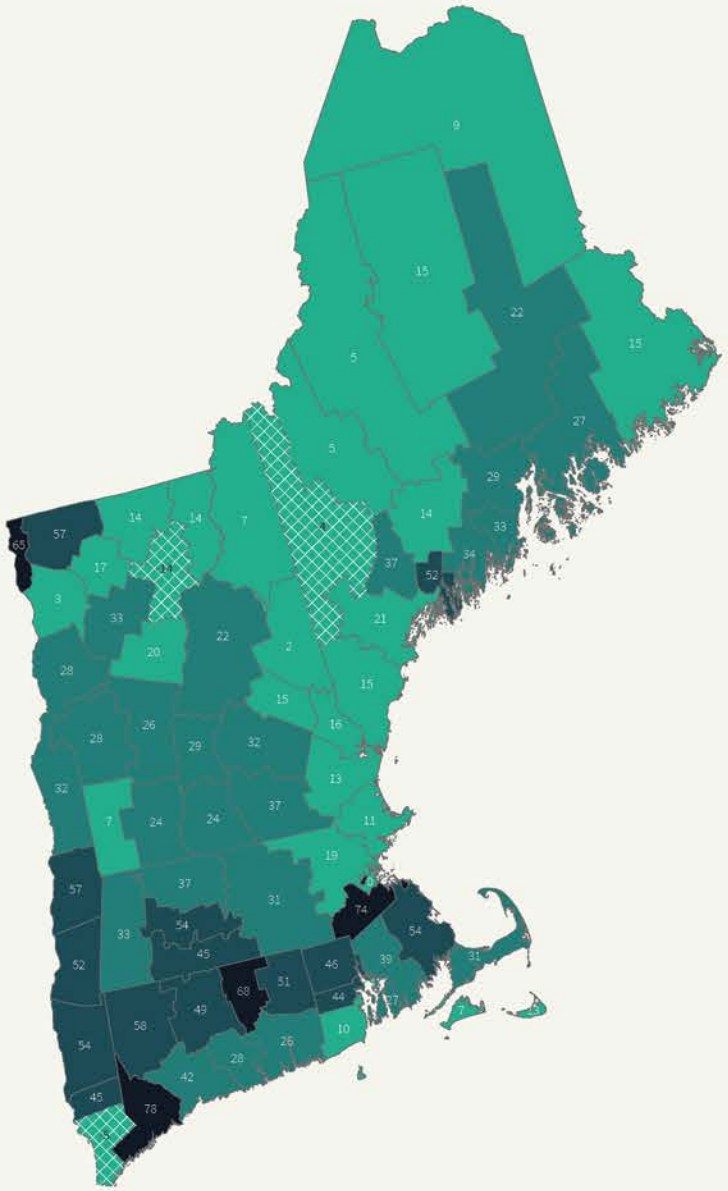
Growth and Removals Comparison

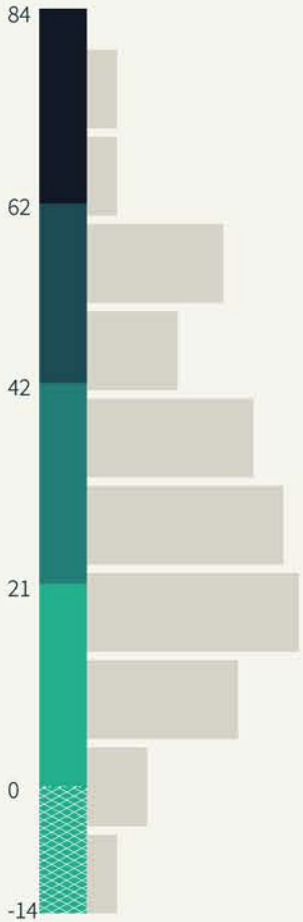
Across New England, timber growth dramatically exceeds removals. Removals include harvesting as well as non-harvest timber removal.

The distribution by county reflects the mean growth across all counties of 46.6 ft^3 per acre, compared with the mean removal value of 17.8 ft^3 per acre.

Source: USDA Forest Service Forest Inventory and Analysis (FIA)

For all but three New England counties, growth exceeds removals (shaded green). The margin is larger in southern New England than it is in Northern New England.





Growth Minus Removals (Ft^3 per Acre)

Source: USDA Forest Service Forest Inventory and Analysis (FIA)

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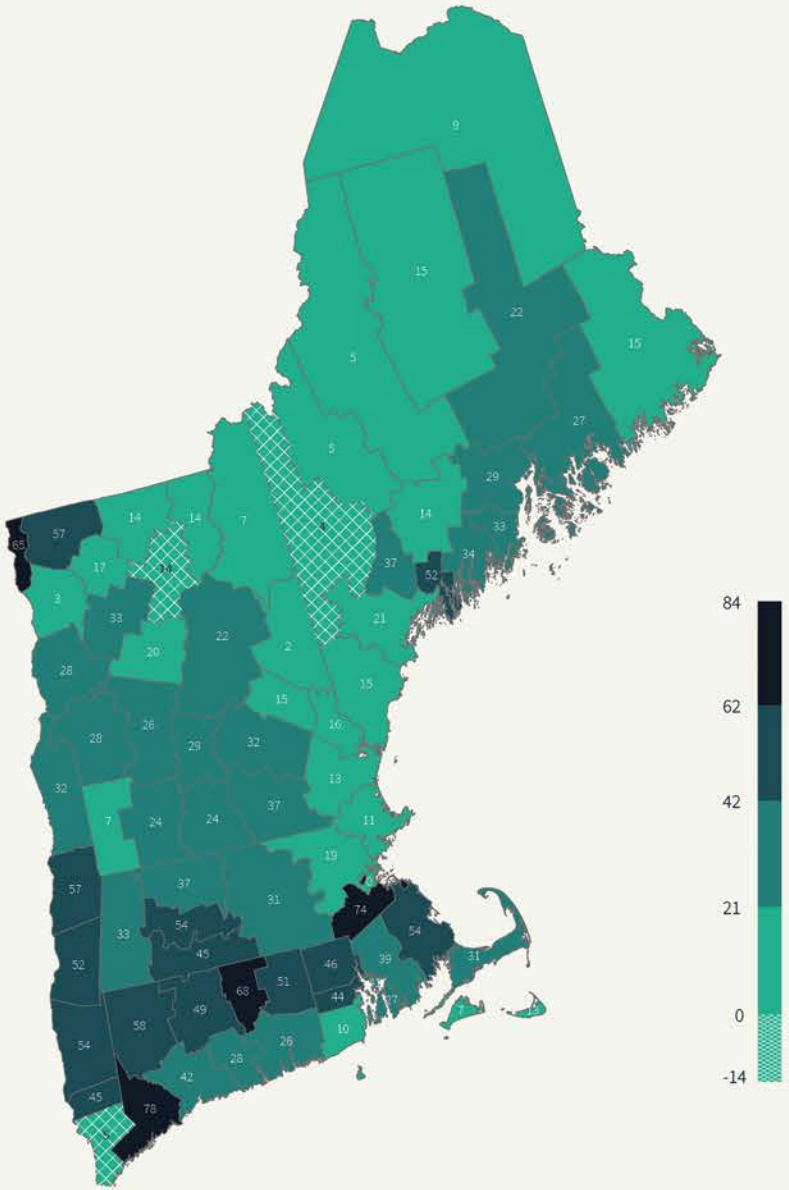
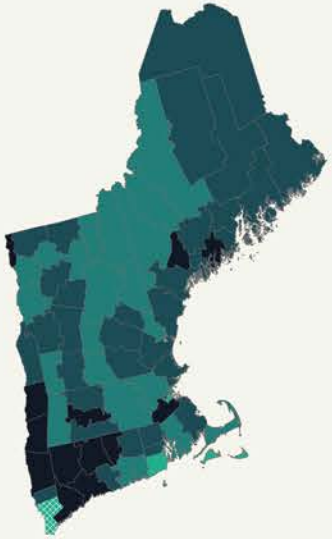
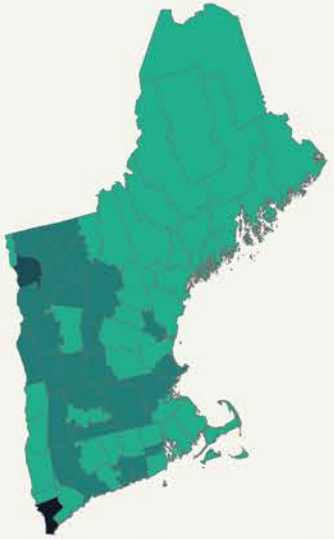


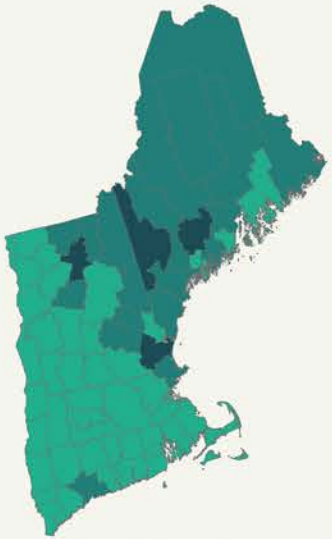
Growth Minus Removals (Ft³ per Acre)



Annual Net Growth (Ft³ per Acre)



Average Annual Mortality (Ft³ per Acre)



Average Annual Removal (Ft³ per Acre)

At a county level, this slide indicates the relationship between biomass growth, mortality, and removals. For all but three New England counties, growth exceeds removals. The margin is larger in southern New England than it is in northern New England. Removals are greatest where there are concentrations of sawmills.

Source: USDA Forest Service Forest Inventory and Analysis (FIA)

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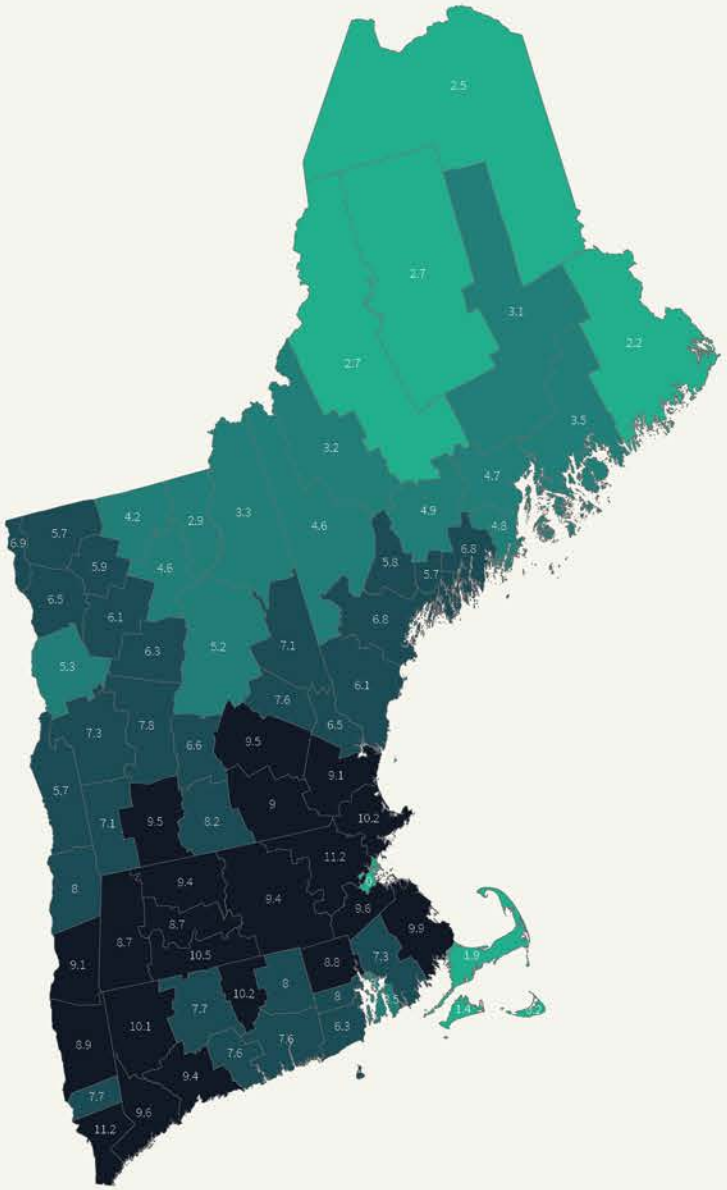
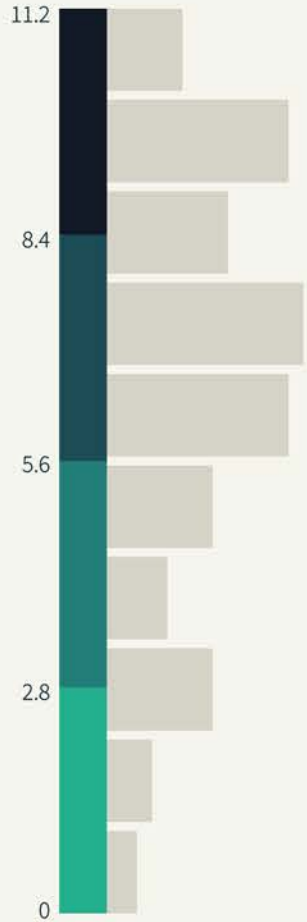
Wood Supply Chain Infrastructure

The existing supply chain for New England wood goes back centuries. This section describes the existing flow of wood from forest through finished product, as well as constraints and opportunities within the supply chain. The section concludes with a routing analysis that compares regional wood products to building alternatives.





Standing Sawlog Volume (MBF/Acre)

Source: USDA Forest Service Forest Inventory and Analysis (FIA)

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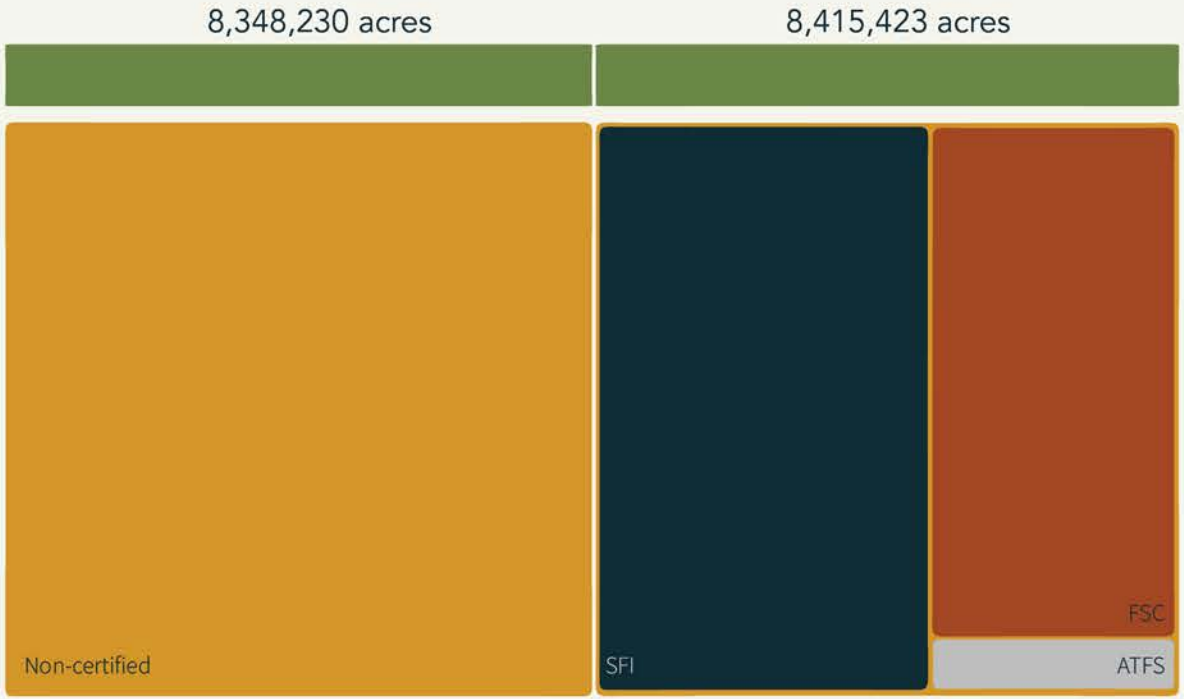

Timberland Acreage in Maine by Certification Type

Five of the six SPF sawmills that could provide lamstock to CLT manufacturers are located in Maine. Maine is also the only state with reported forest certification data in New England.

Certifications include (by acreage) the Sustainable Forestry Initiative (SFI), Forest Stewardship Council (FSC), and American Tree Farm System (ATFS).

Source: Maine Forest Products Council, 2020.

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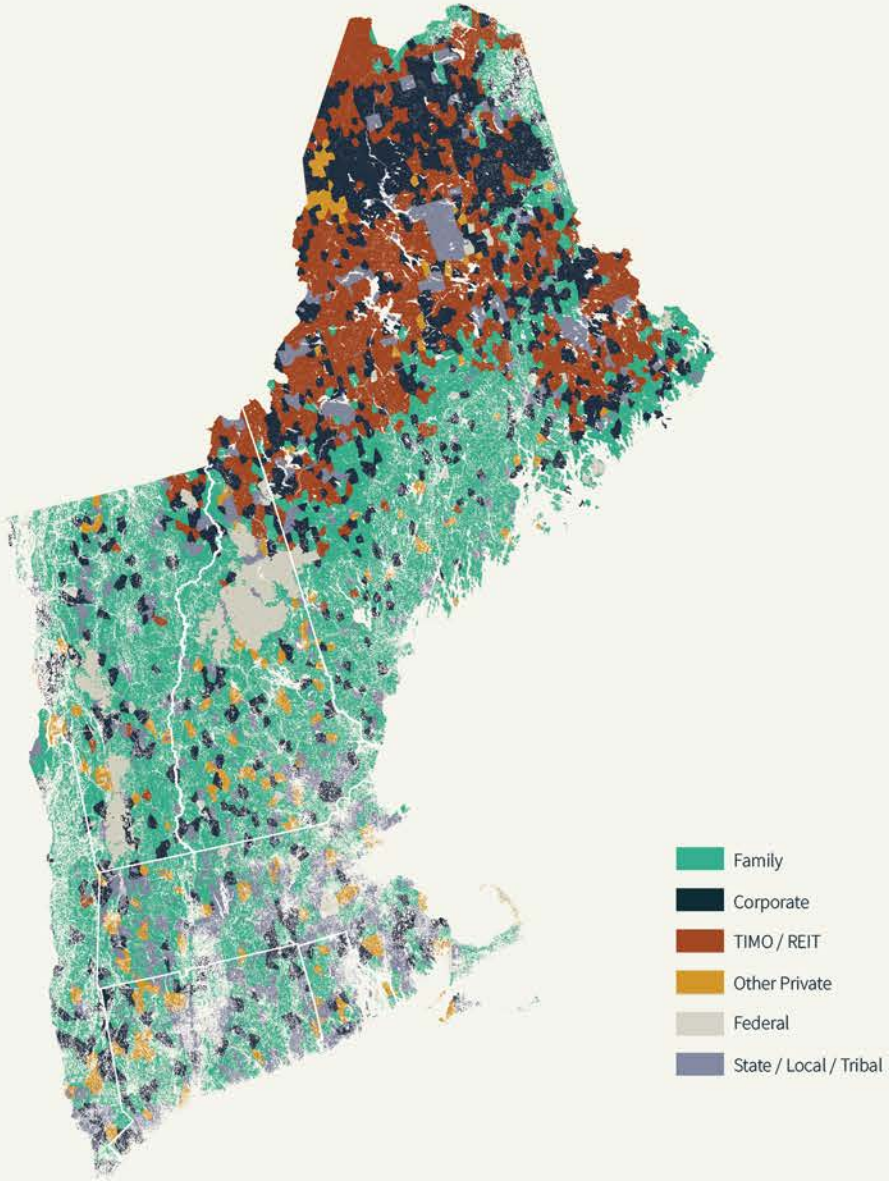

Forestland Ownership

Forestland ownership patterns impact landowner goals and harvest levels. Private investors and corporate owners account for a significant proportion of Maine's forestland, while family and other private owners are more common further south.

Source: Sass, Emma M.; Butler, Brett J.; Markowski-Lindsay, Marla A. 2020. Forest ownership in the conterminous United States circa 2017: distribution of eight ownership types - geospatial dataset. Fort Collins, CO: Forest Service Research Data Archive. https://doi.org/10.2737/RDS-2020-0044

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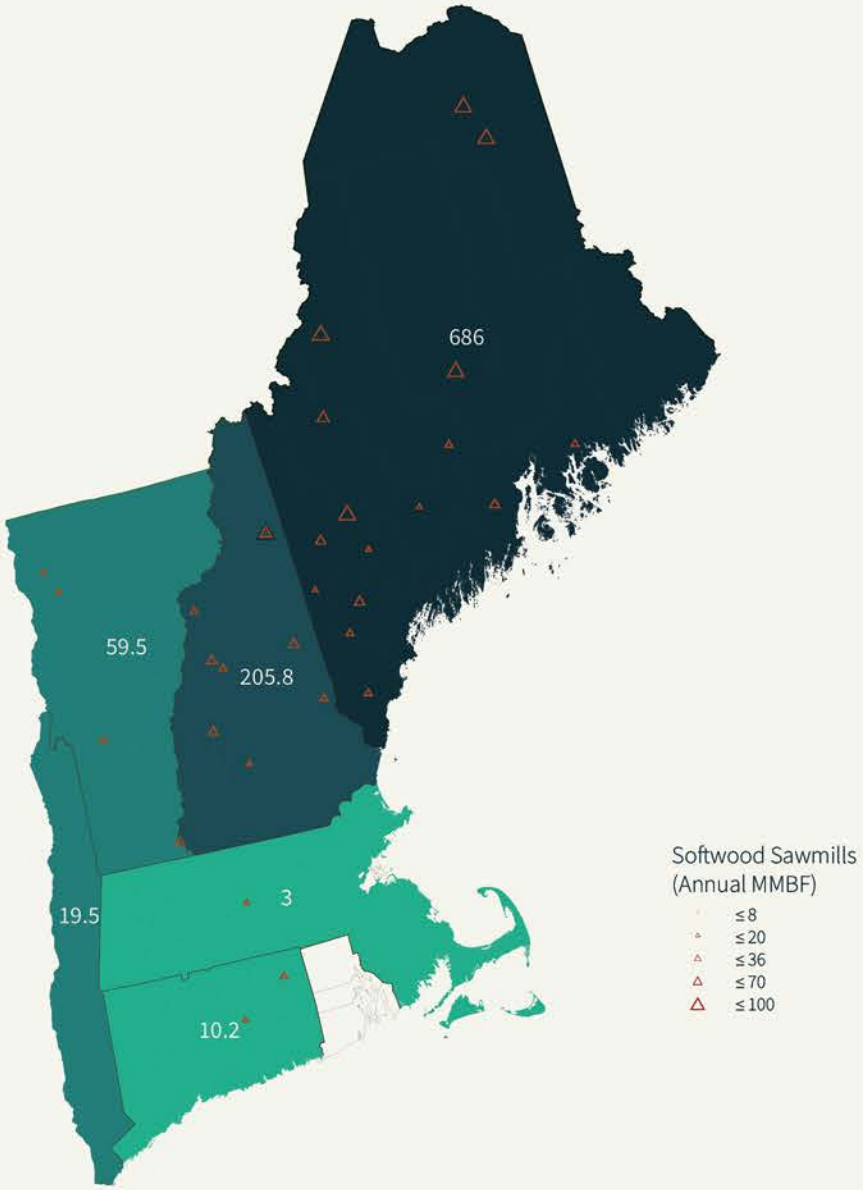
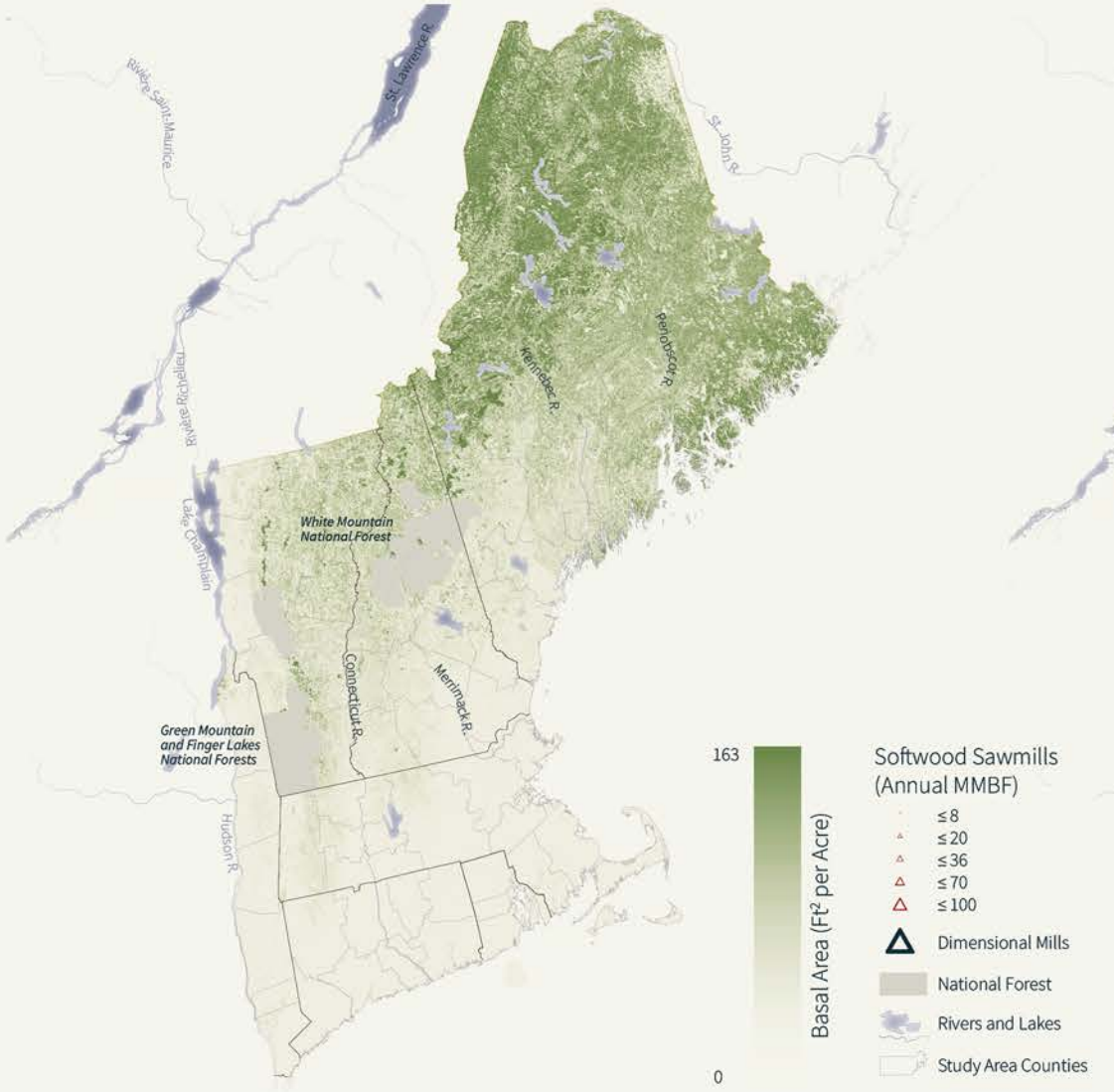
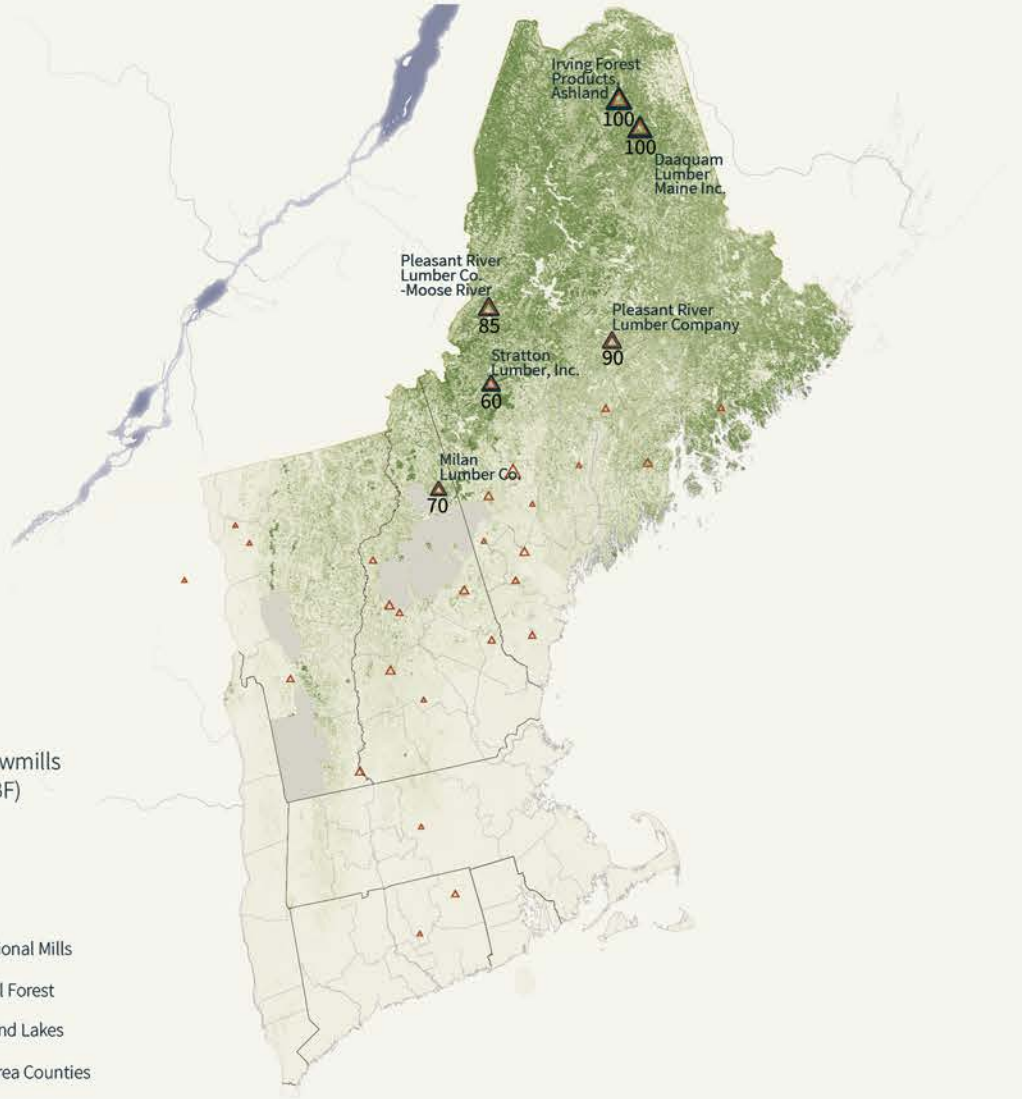


Softwood Sawmill Capacity

Softwood sawmill capacity concentrates near SPF log supply in Maine and Northern New Hampshire. Maine alone accounts for 86% of all structural / dimensional sawmill capacity and 69% of total softwood sawmill capacity.

Source: USDA Forest Service Forest Inventory and Analysis (FIA)





SPF Basal Area

Softwood Sawmills

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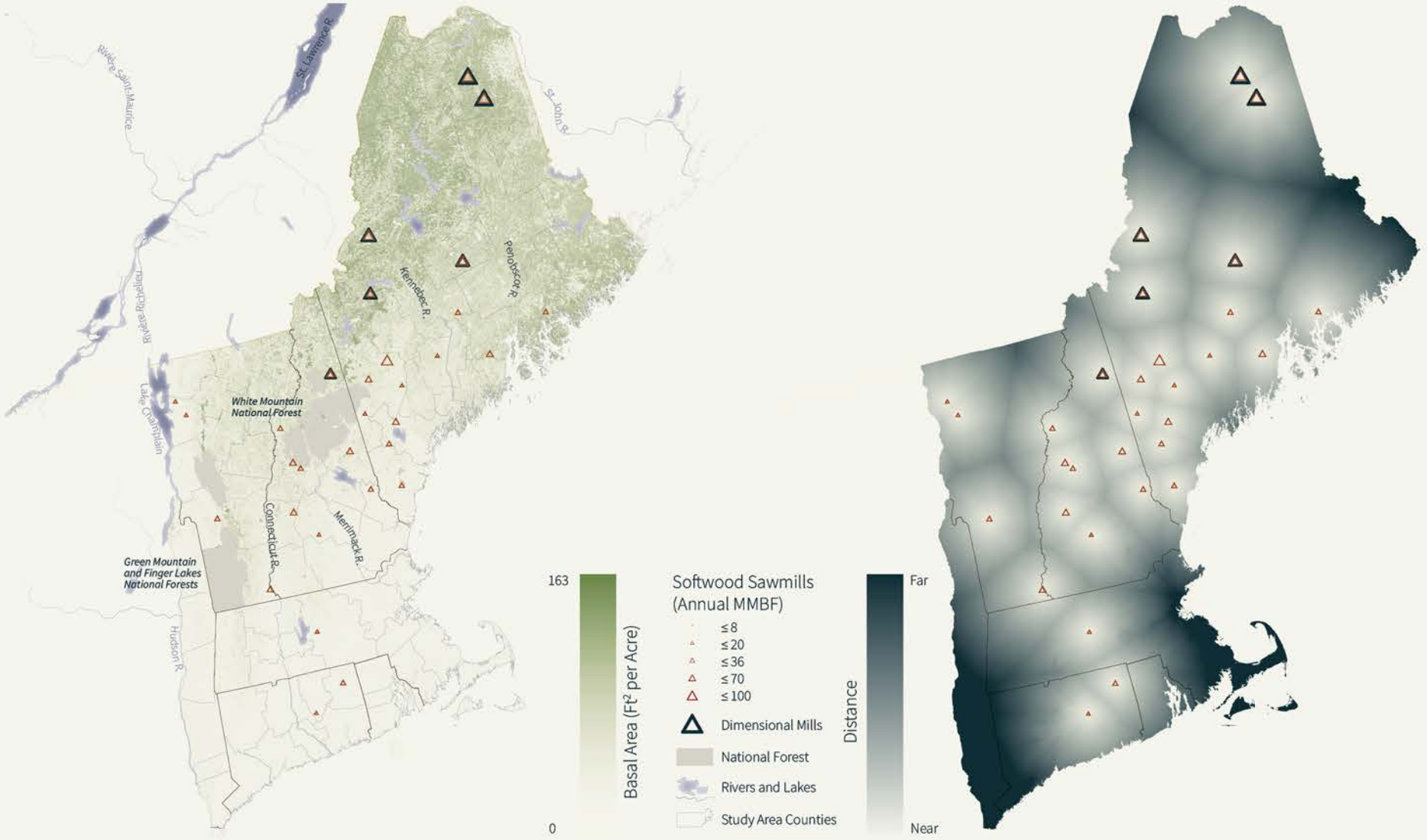

Softwood Sawmills

Woodshed Delineations

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Dimensional Sawmill Woodsheds

Every sawmill occupies an area where that facility is the closest purchaser for any harvested volume. While log specifications vary significantly by facility and finished product, the six SPF sawmills in Maine and New Hampshire encompass large woodsheds with minimal supply constraint due to competitive log purchasing.

The color ramp reflects the distance that a log must travel to the closest sawmill that could produce material for CLT manufacturing.

Source: Curtis, Oliver J.; Springboard Forestry, 2020.

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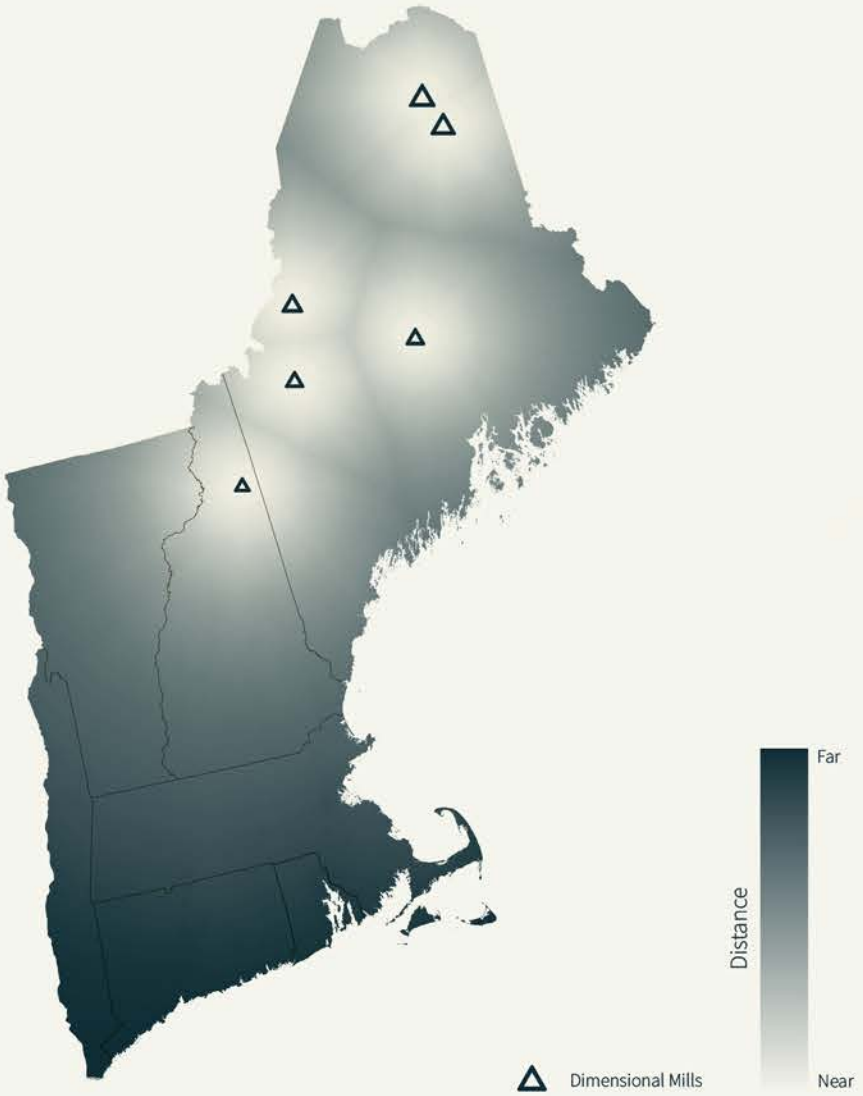
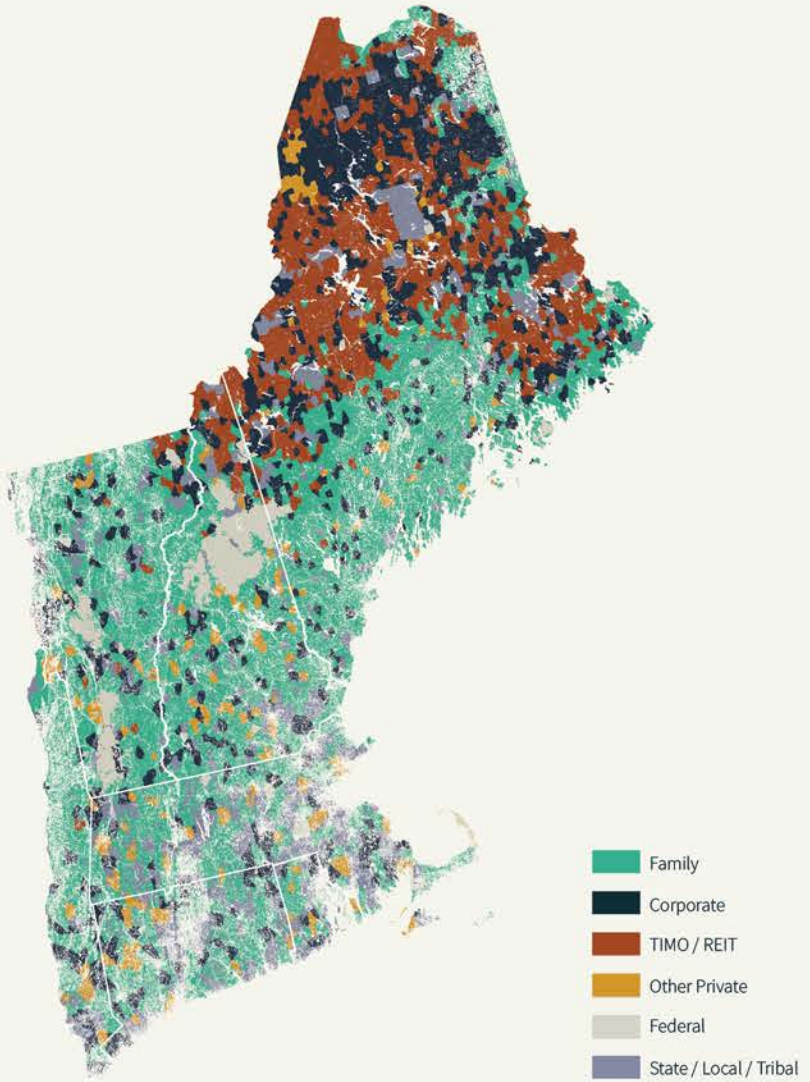


Dimensional Sawmill Woodsheds



Forestland Ownership

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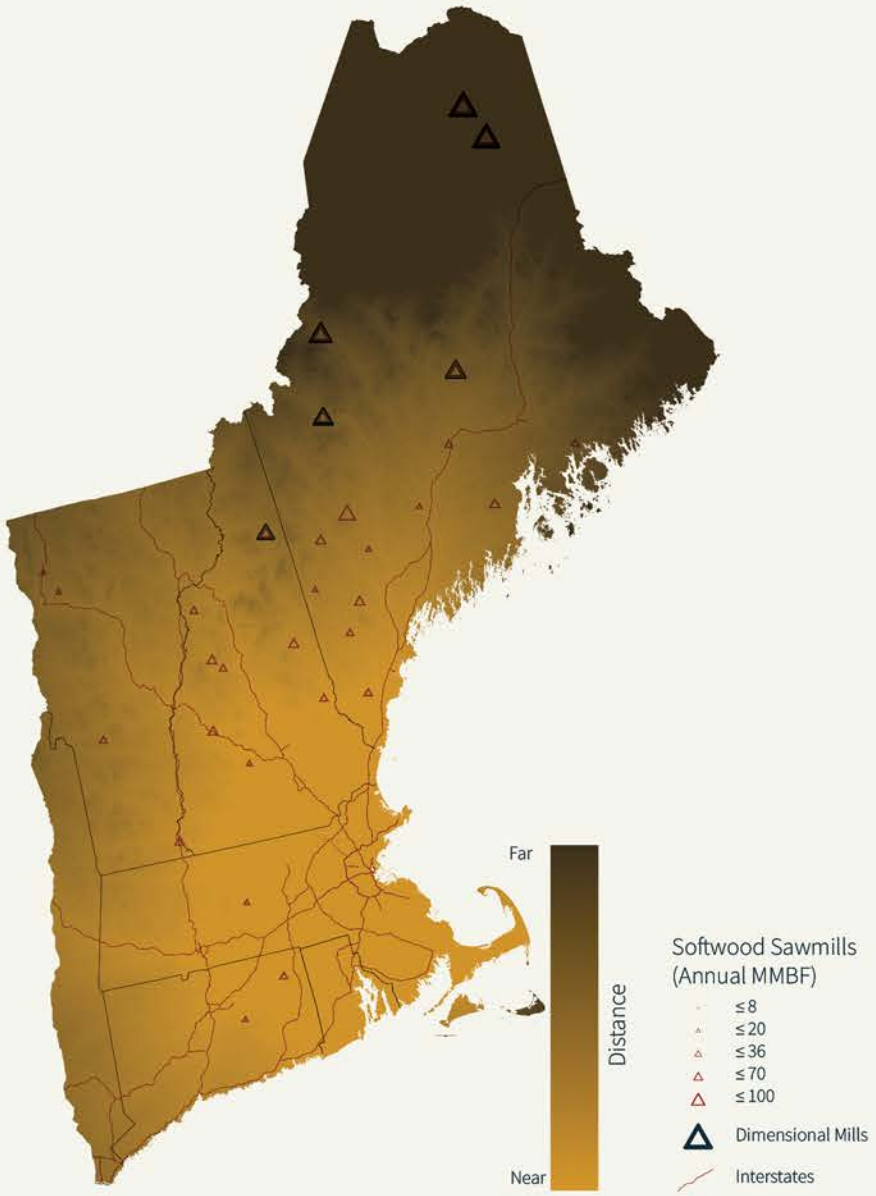
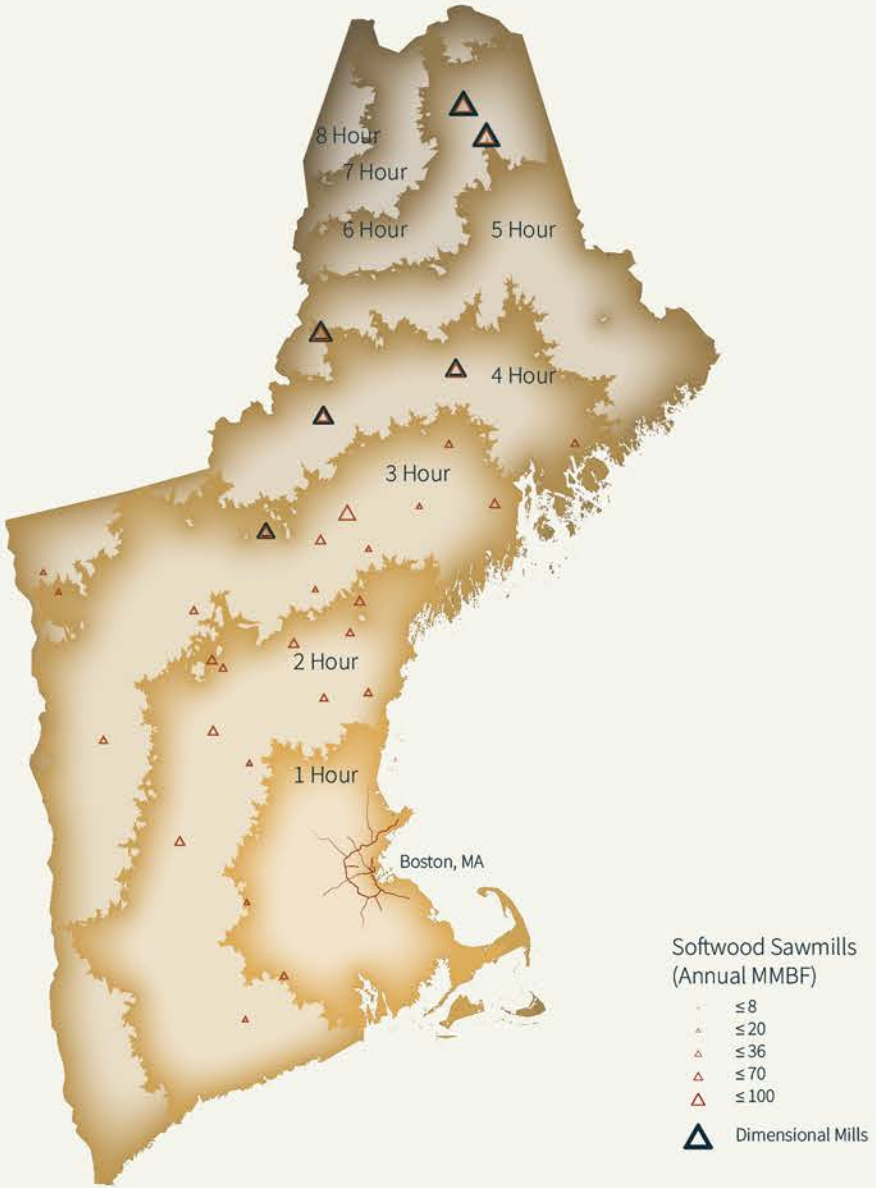


Wood Travel Distance by Cost

A routing algorithm provides a cost distance for every location in the region traveling by existing road network to Boston. The routing analysis assumes travel speeds based on posted speed limits and exclusive use of trucks for lumber transportation within the New England region.

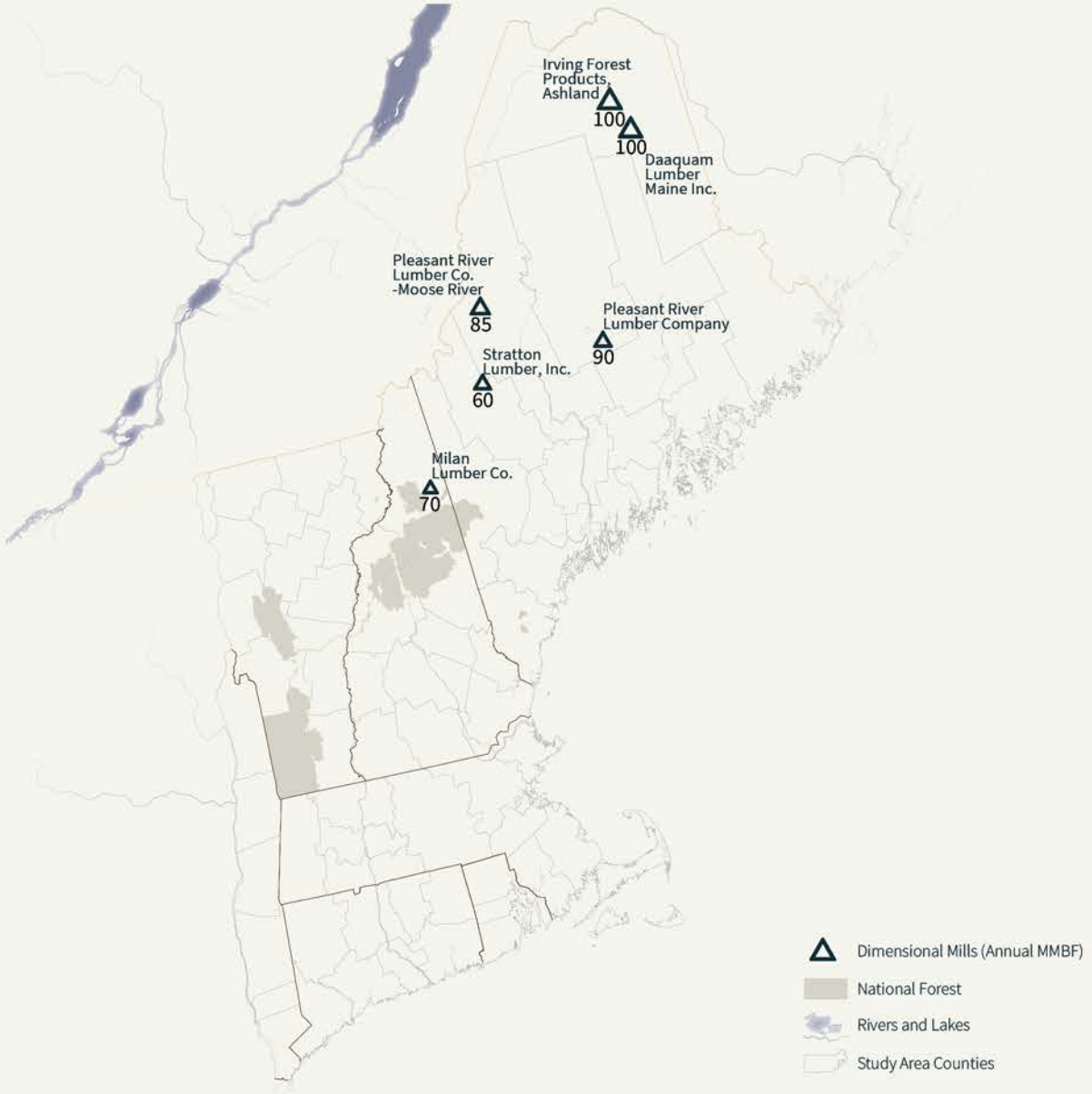
Source: Curtis, Oliver J.; Springboard Forestry, 2020.



Hourly Time Increments

SPF sawmills exist between two and six hours from Boston, based on a hourly time classes. Most SPF sawmills include drying capabilities, allowing for the transport of lower-weight dimensional lumber for final use or remanufacturing closer to the building site.

Source: Curtis, Oliver J.; Springboard Forestry, 2020.



SPF Sawmill Capacity

Sawmills that could provide feedstock for CLT manufacturing produce 60 -100 million manufactured board feet (MMBF) of lumber per year.

For scale, the average U.S. house requires approximately 15 thousand board feet (MBF) of lumber to construct.

Manufactured board feet differs from standing board foot volume due to the difference between the log rules used to calculate volume and actual mill efficiency.

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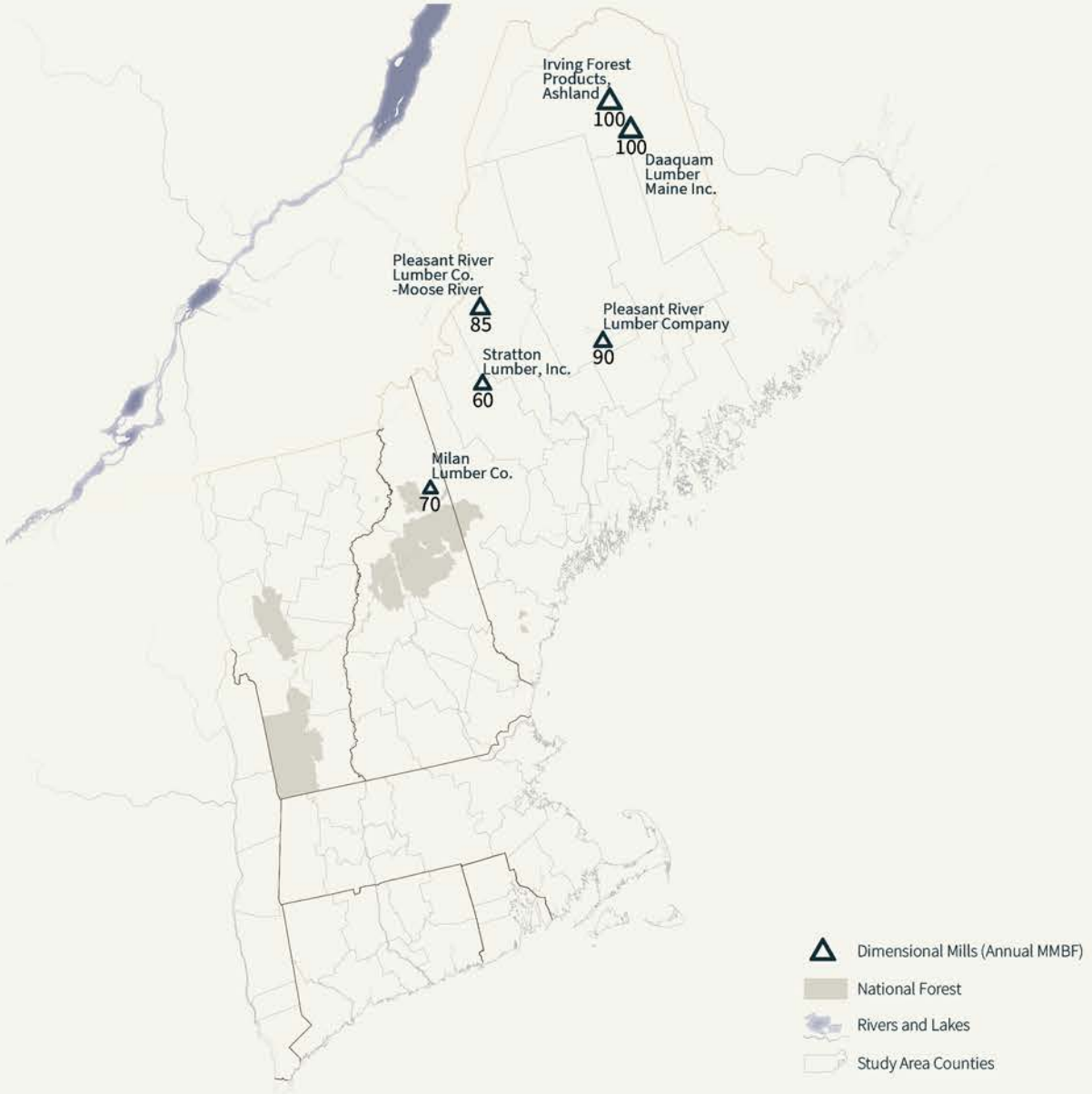
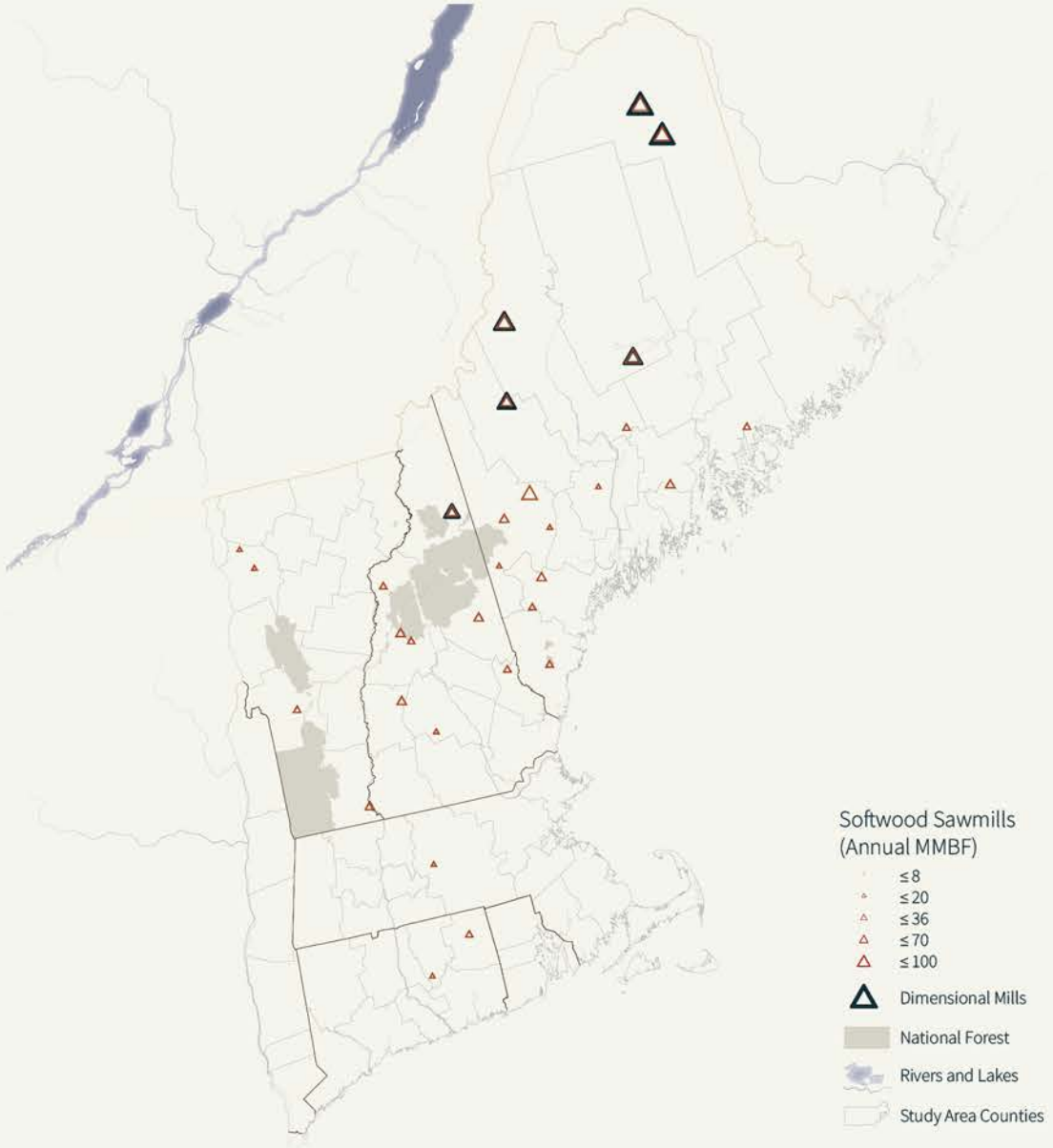


Certification / Chain-of-Custody

Sawmills have chain of custody (COC) certification in order to track certified logs into certified lumber. COC certification is not required, but does allow mills to access some lumber markets. COC certification also exists for lumber remanufacturers and mass timber manufacturers.

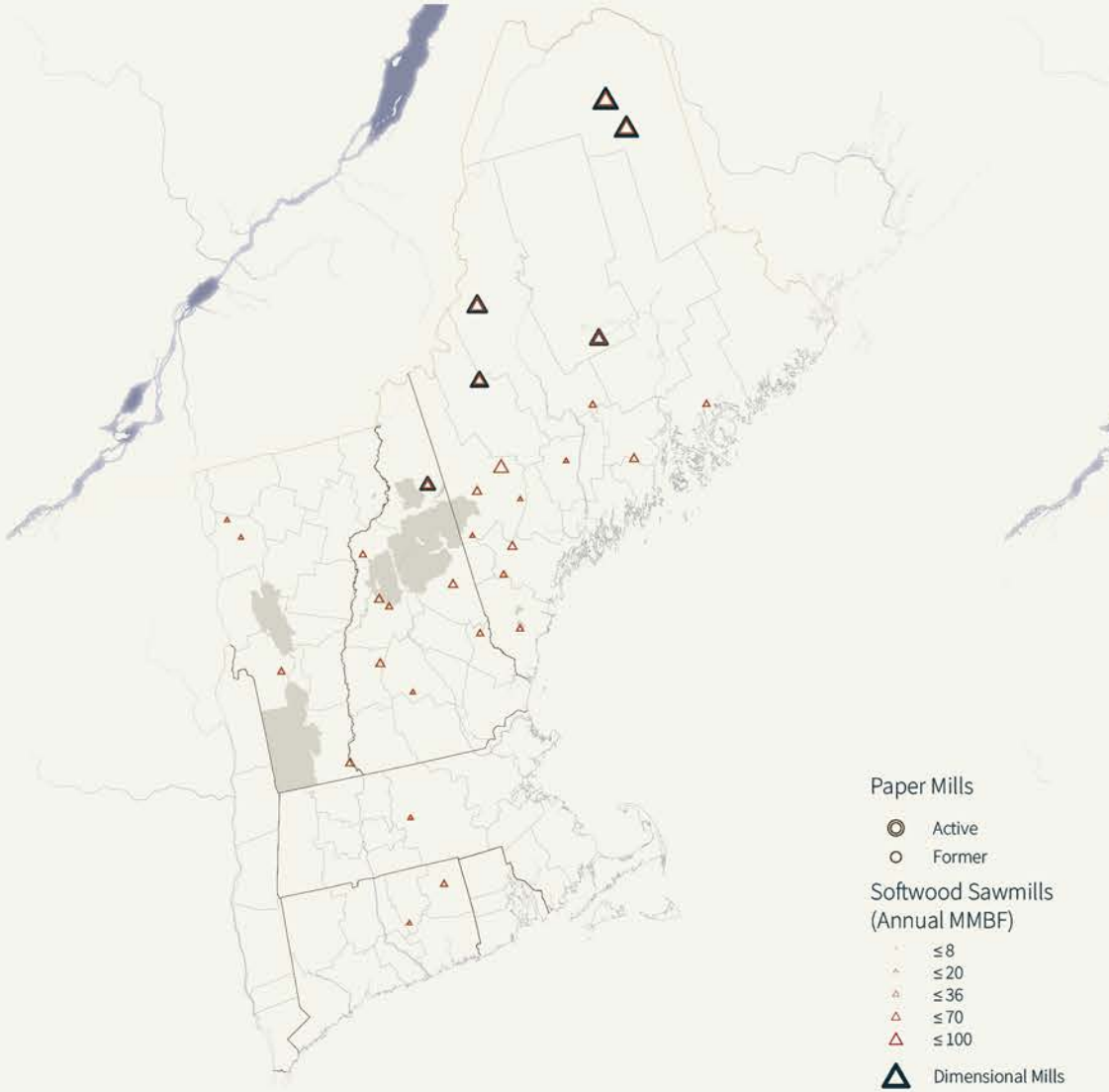
Name	Forest Stewardship Council (FSC)	Sustainable Forestry Initiative (SFI)
Daaquam Lumber Maine Inc.	x	
Irving Forest Products, Ashland	x	x
Pleasant River Lumber Co. -Dover-Foxcroft	x	
Pleasant River Lumber Co. -Moose River		
Milan Lumber Co.		
Stratton Lumber, Inc.	x	

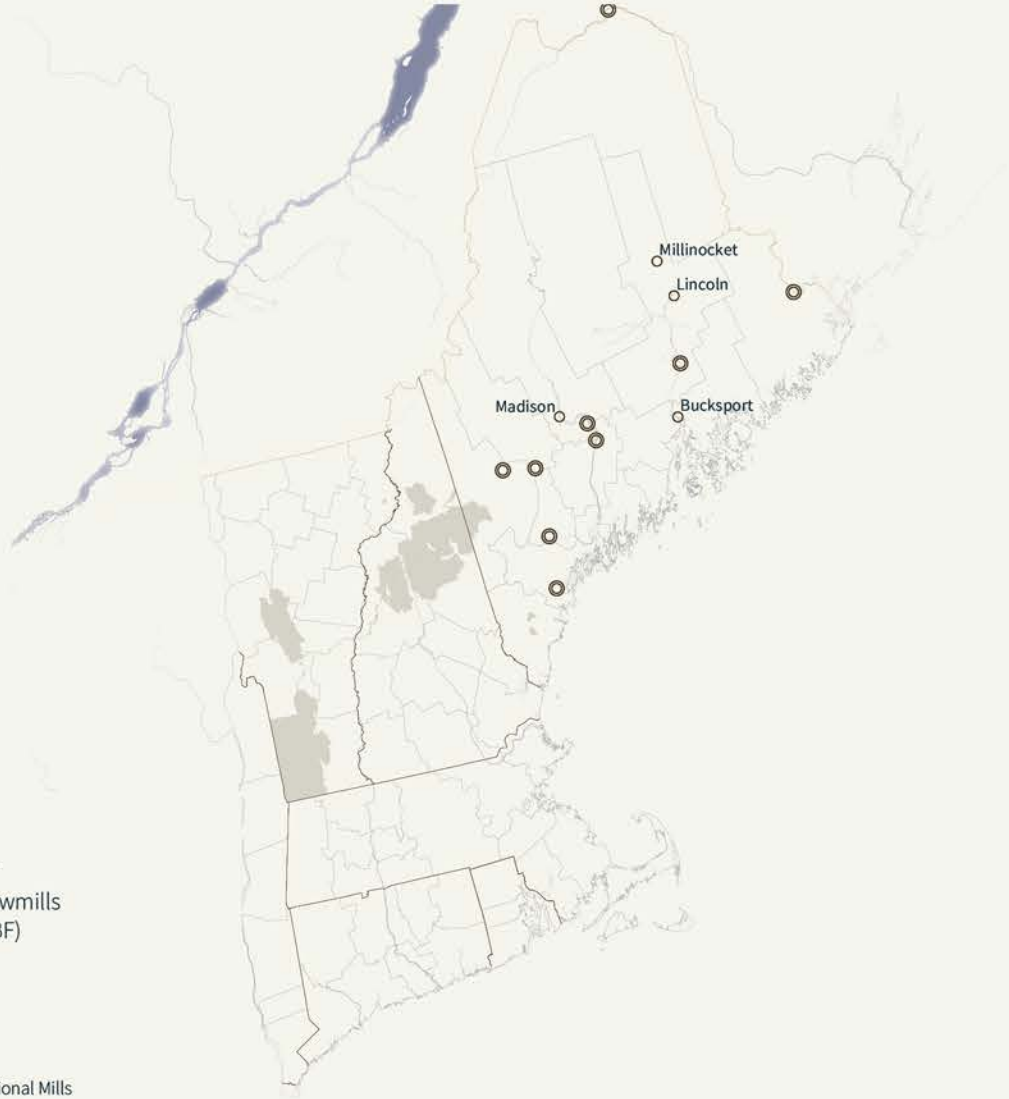
Source: Northeastern Lumber Manufacturers Assoc. (NELMA), April 2020



Existing Sawmill Infrastructure

New England has a strong industry of small softwood sawmills oriented towards board and non-structural lumber markets. Many of these small sawmills have the potential to expand if markets for Eastern hemlock and Eastern white pine were to develop.





Paper Mills
Active
Former
Softwood Sawmills
(Annual MMBF)
≤ 8
≤ 20
≤ 36
≤ 70
≤ 100
Dimensional Mills
Rivers and Lakes
Study Area Counties

Sawmills

Paper Mills

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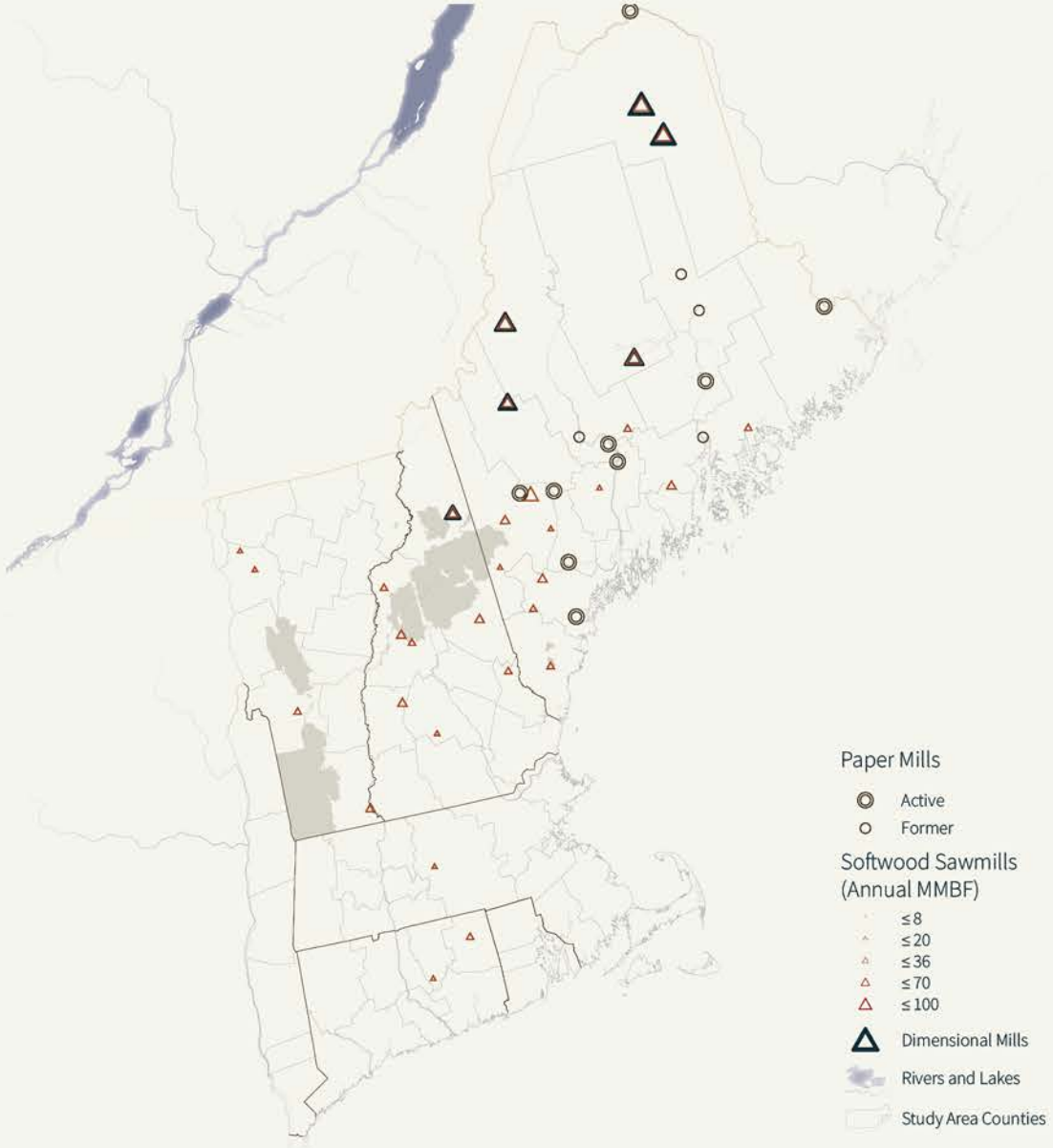

Mill Sites

This map depicts all sawmills, including SPF mills as well as smaller facilities that focus on boards, hardwood, and other solid wood products.

Many of these locations represent potential sites for future wood products infrastructure investments. These sites have existing space, power, and access. In addition, many of these facilities exist in economically depressed areas with significant raw log supply.

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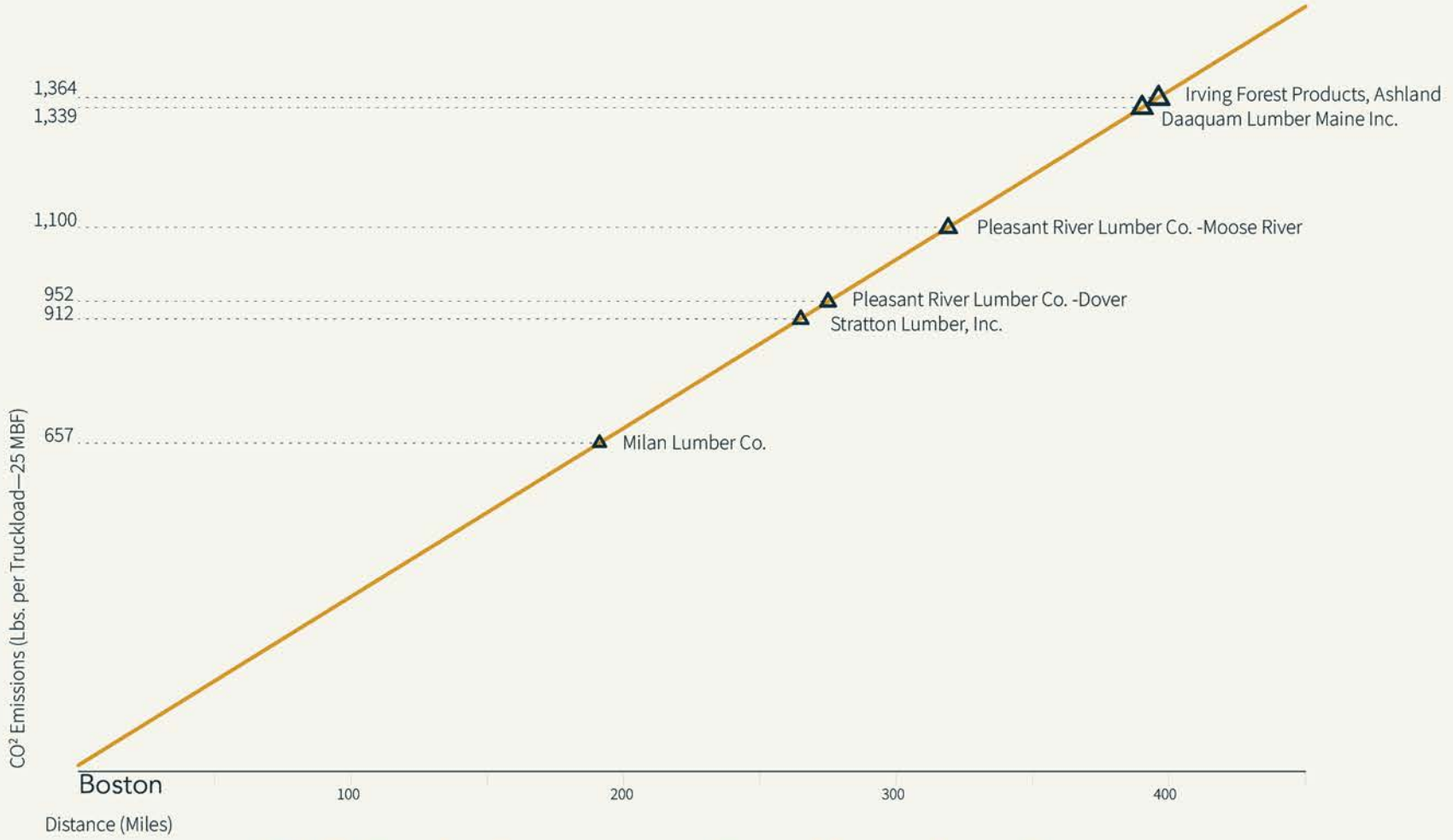
Carbon Implications

The development of a regional mass timber supply chain could have significant implications for reducing embodied carbon in buildings. This section outlines the carbon impacts of transportation and forest growth / removals.

Wood Transportation



CO² Emissions per Truckload to Boston

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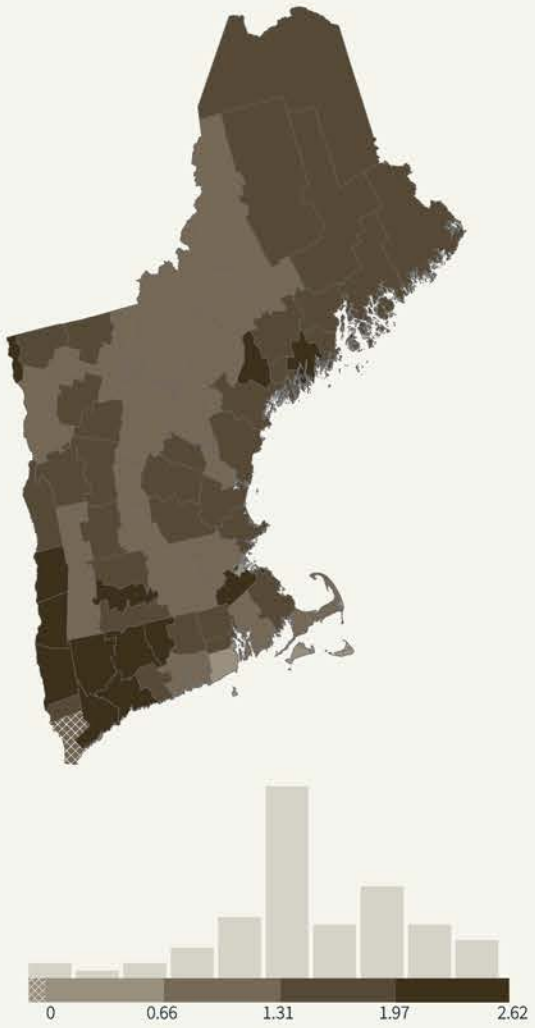
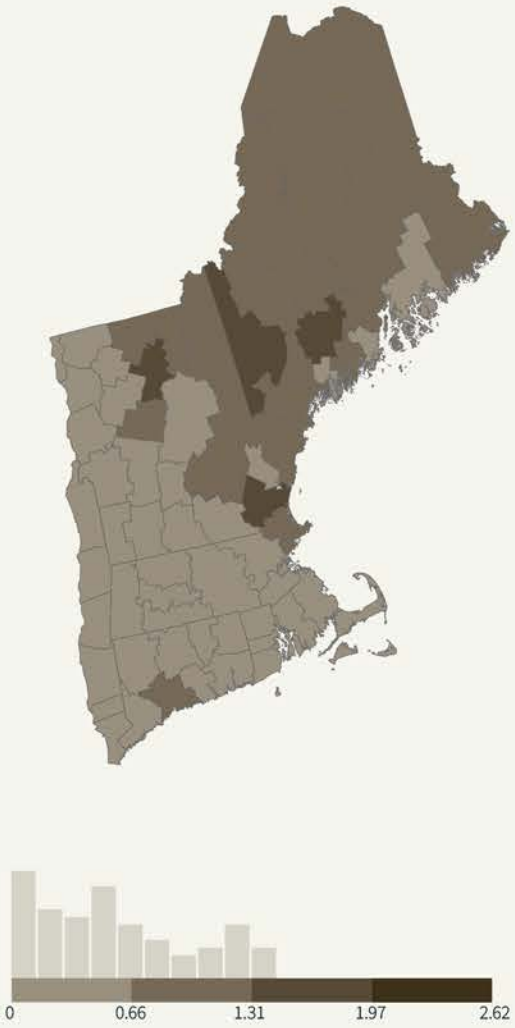
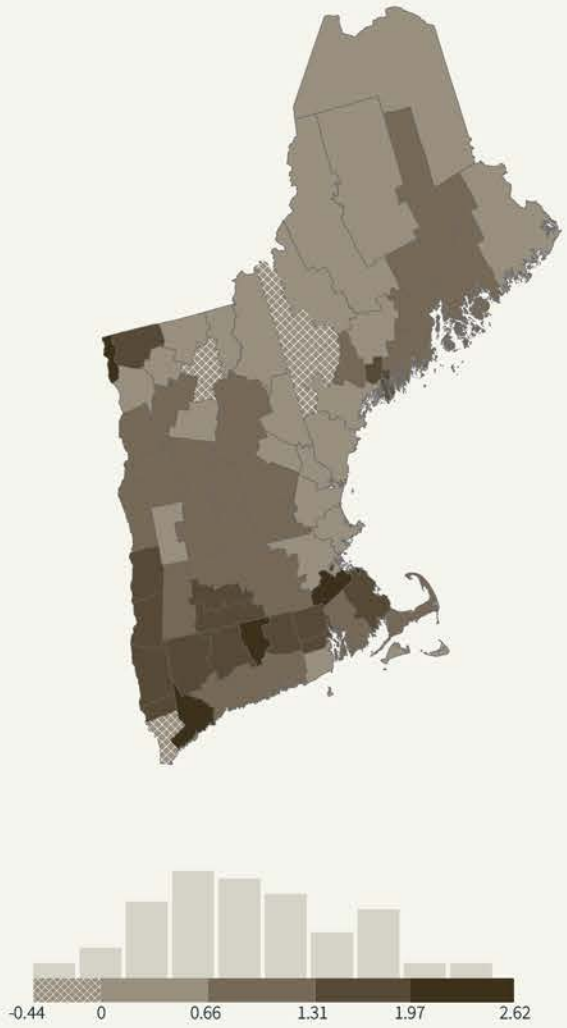
Average Annual Mortality
($MTCO^2e$ per Acre)



Annual Net Growth
($MTCO^2e$ per Acre)



Average Annual Removal
($MTCO^2e$ per Acre)



Annual Growth minus Removals
($MTCO^2e$ per Acre)

Forest Carbon Growth and Removals

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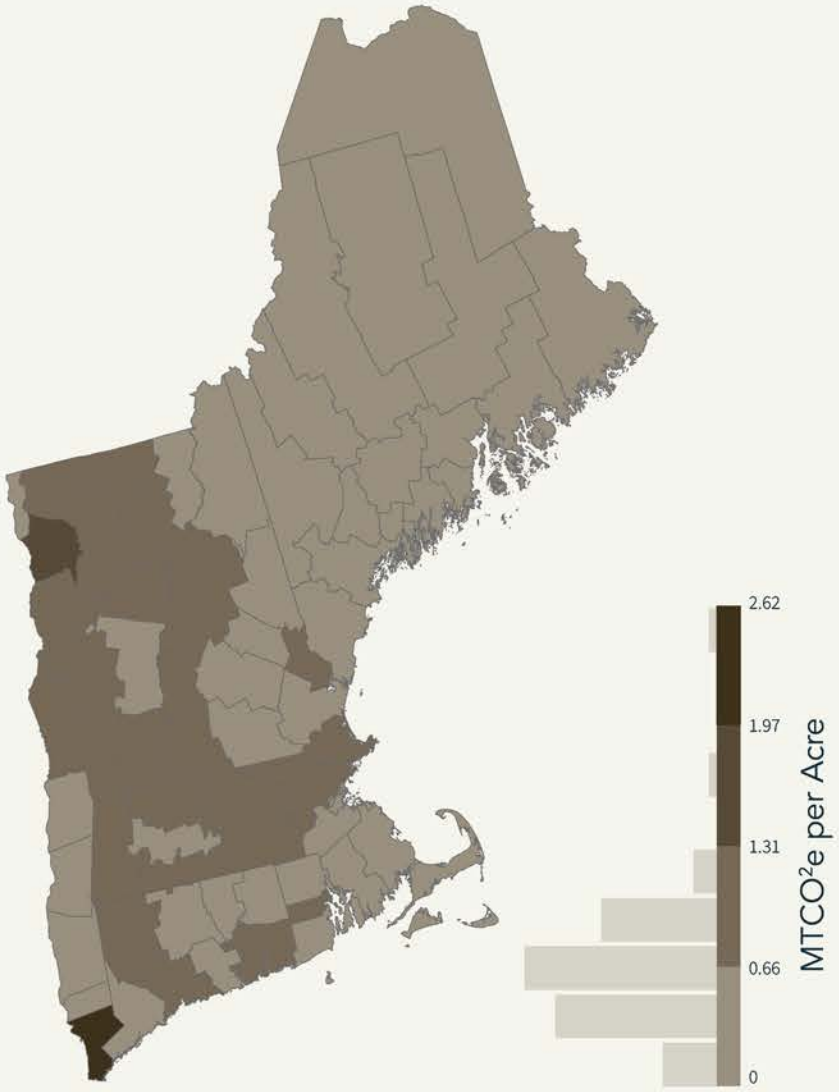
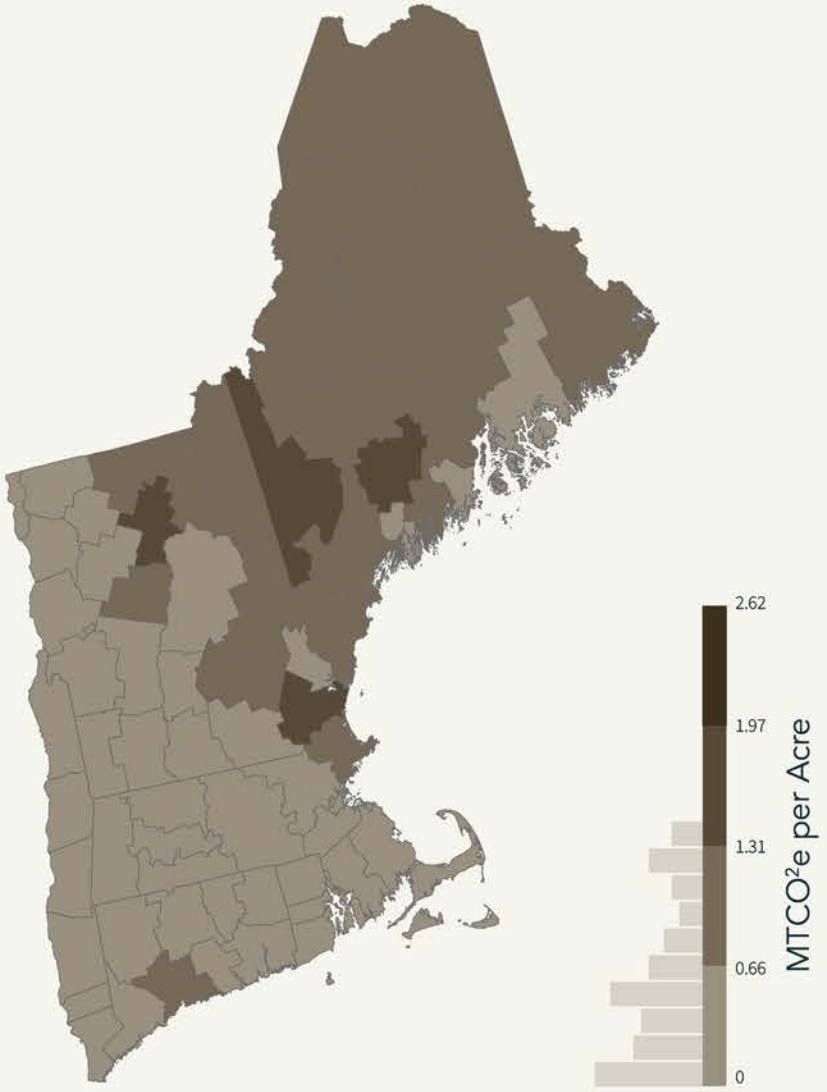


Average Annual Mortality



Average Annual Removal

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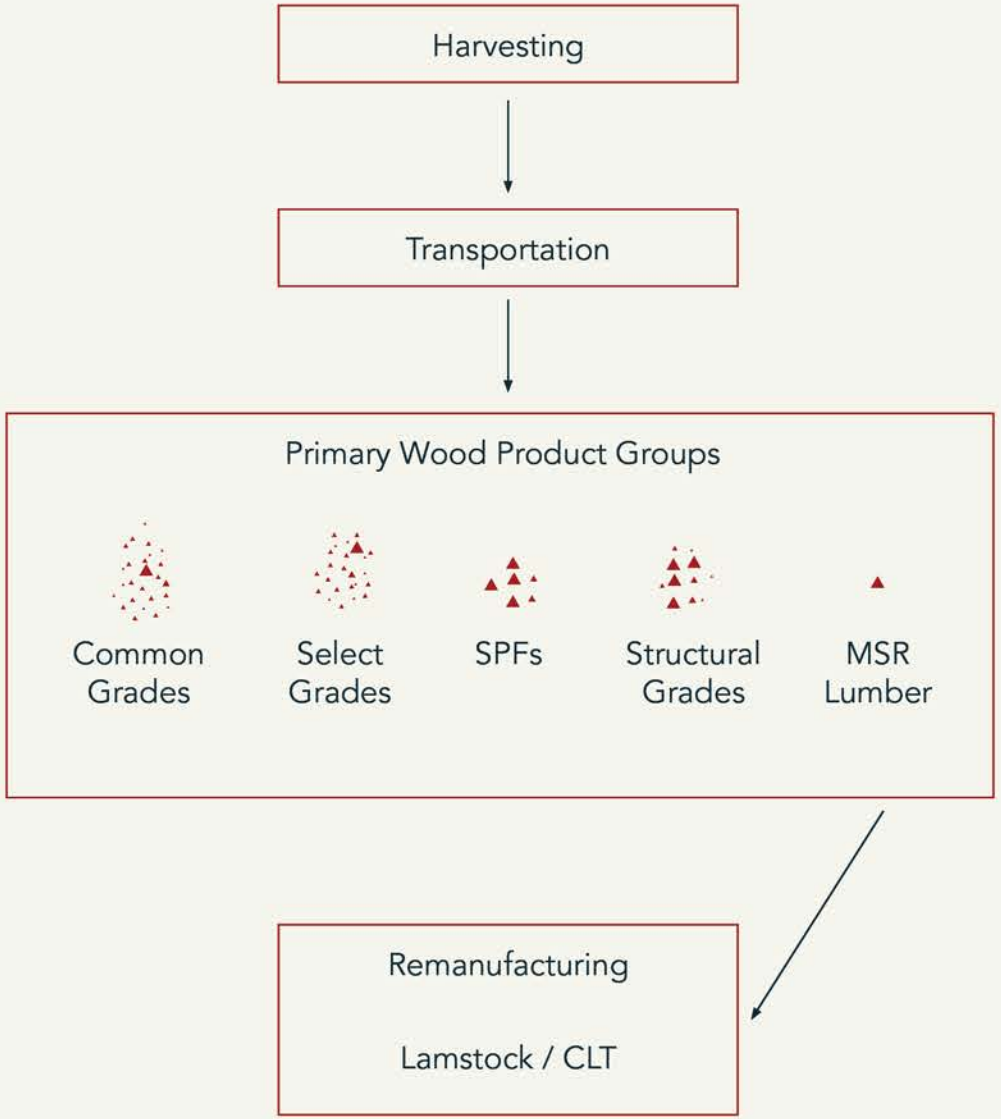
Gap Analysis / Next Steps

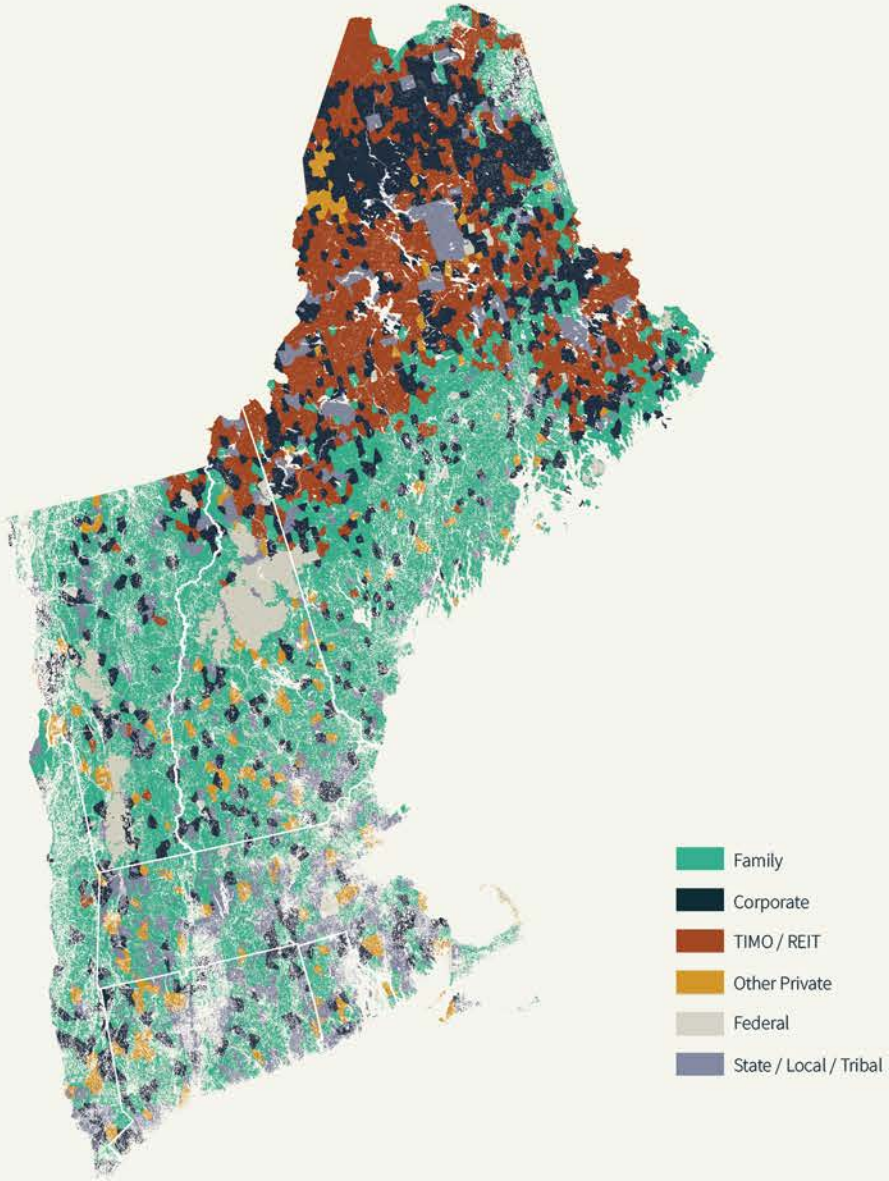
Opportunities exist for investment in a low carbon impact regional wood supply chain to deliver mass timber as a lower carbon material than conventional building materials. This section provides recommendations for where these investments could take place, and next steps for ongoing research and project development.



Supply Chain Infrastructure

New England's forests provide a wide range of wood products, however only a small subset could supply material for mass timber manufacturing. Identification of lumber supply, drying capacity, and remanufacturing are necessary to the development of low-carbon regional mass timber option.

A chasm exists in New England between raw fiber supply (trees) and finished buildings. Developing a supply chain for mass timber will require shifts to existing sawmill infrastructure and significant investments in remanufacturing, drying, fabrication, and assembly.



Harvesting

While northern New England has a long history of forest management, southern New England forests are unlikely to see a dramatic increase in harvest. Family and other private landowners, who make up most of southern New England ownership, typically own forestland not to manage for timber, but for aesthetic, recreation, or other purposes. Improving forest management and shifting timber harvest in New England is a long-term project and unlikely to occur as a result of mass timber building product demand.

Source: Sass, Emma M.; Butler, Brett J.; Markowski-Lindsay, Marla A. 2020. Forest ownership in the conterminous United States circa 2017: distribution of eight ownership types - geospatial dataset. Fort Collins, CO: Forest Service Research Data Archive. https://doi.org/10.2737/RDS-2020-0044

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Potential Lamstock Supply

Lamstock, the primary input for mass timber manufacturing, could potentially come from any of the six SPF sawmills in northern New England. The circle denotes an ideal location for facilities that would intercept existing SPF supply. These locations would also access anticipated future Eastern hemlock and Eastern white pine lumber supply.

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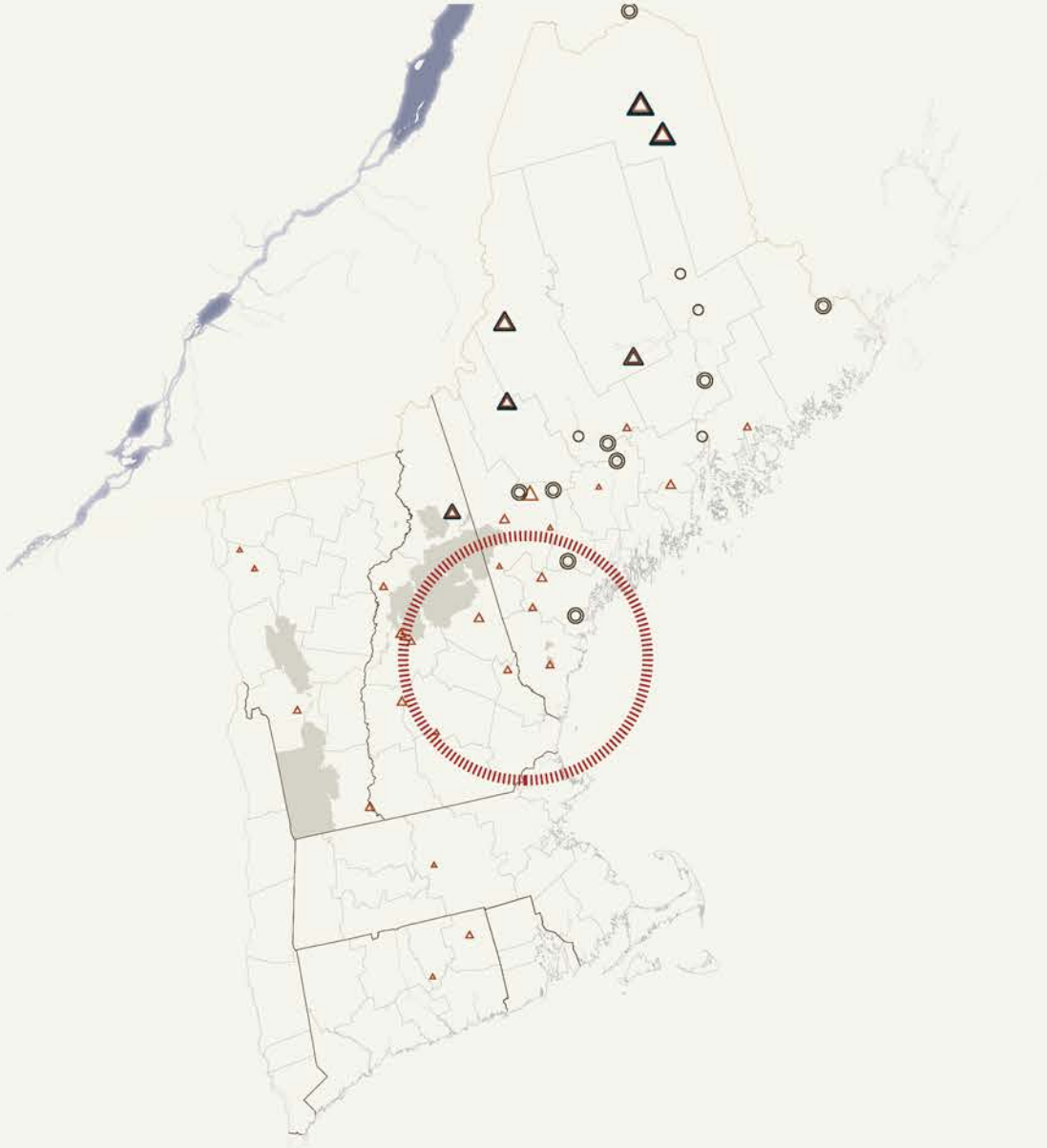


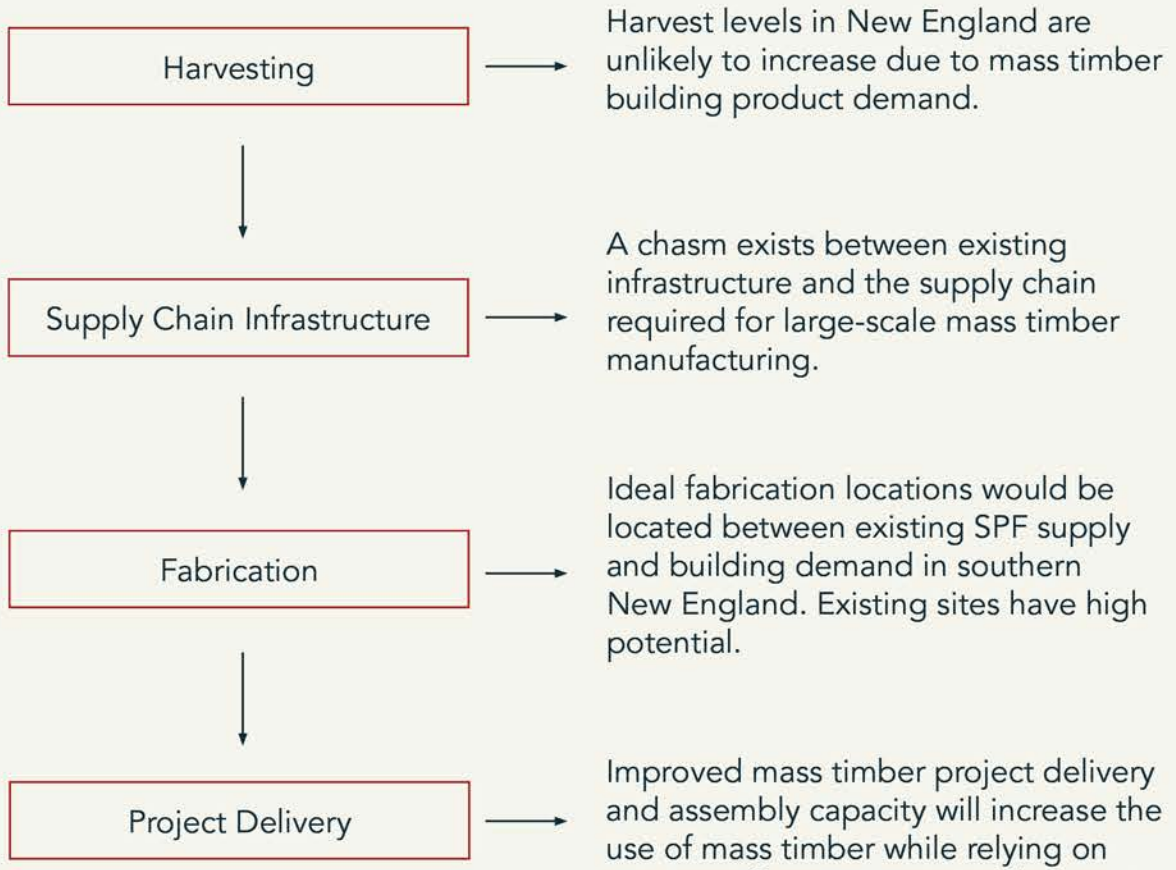
Remanufacturing and Fabrication

Opportunities for infrastructure investment exist along the travel route from existing SPF sawmills to major building centers, including Boston.

New lumber remanufacturing and fabrication facilities could co-locate on one of the many small or closed mill sites in this area. By locating between supply and demand, transportation, market, and carbon efficiencies are realized in the material supply chain.

Proximity of fabrication to final project location also improves ease of project delivery and assembly.

Gap Analysis Summary



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Next Steps

- Analysis of competitive wood supply baskets / mass timber
- Demand projections for greater Boston region
- Differentiation of New England forest management practices
- Estimation of future wood demand based on mass timber adoption
- Evaluation of mass timber project delivery gaps