

# MAINE STATE OF THE FOREST REPORT

**2021-2025**

**April 2026**

***(3/30/2026 Review Draft)***



MAINE DEPARTMENT OF  
**AGRICULTURE  
CONSERVATION  
& FORESTRY**



Amanda E. Beal  
Commissioner

Nancy McBrady  
Deputy Commissioner

Jo D. Saffeir  
Deputy Commissioner

18 Elkins Lane  
Augusta, ME 04333

(207) 287-3200  
[maine.gov/dacf](http://maine.gov/dacf)

# **2020-2025 Maine State of the Forest Report**

**Report to the  
132<sup>nd</sup> Maine Legislature, Second Regular Session  
January 2026**

**Maine Department of Agriculture, Conservation, and Forestry**

**Maine Forest Service**

**Patty Cormier, Director**

**Forest Policy & Management - Forest Health & Monitoring – Forest Protection**

[forestinfo@maine.gov](mailto:forestinfo@maine.gov), (207) 287-2791 [Maine Forest Service](#)

This and other reports on forest conditions in Maine can be found at:

<https://www.maine.gov/dacf/mfs/publications/index.html>

[https://www.maine.gov/dacf/mfs/policy\\_management/forest\\_inventory.html](https://www.maine.gov/dacf/mfs/policy_management/forest_inventory.html)

## **To Do:**

- Figure/table titles; captions, address accessibility
- Message from the state forester
- Update table of contents
- Proof-reading, additional reviews

# Maine State of the Forest Report, 2021-2025

A report to the Maine Legislature of forest conditions, trends, MFS programs, and emerging issues in Maine.

April 2026

Produced by:

Department of Agriculture, Conservation, and Forestry  
Maine Forest Service  
Forest Policy and Management Division  
22 State House Station  
Augusta, ME 04333-0022  
207-287-2791  
[www.maineforestservice.gov](http://www.maineforestservice.gov)

**Acknowledgements:** This document was produced with contributions from many colleagues at the Maine Forest Service. Morten Moesswilde compiled and edited the document. Contributors include Jereme Frank, Andrew Whitman, Greg Lord, Greg Miller, Allison Kanoti, Robby Gross, and Patty Cormier. We thank outside reviewers, and other MFS staff whose work informs this report. We recognize the important work by MFS personnel and many other partners whose efforts helped develop past reports and analyses, on which this report is based.

**Recommended Citation:** Maine Forest Service. 2026. Maine State of the Forest Report, 2021-2025: A report to the Maine Legislature of forest conditions, trends, MFS programs, and emerging issues in Maine. M. Moesswilde, ed. Maine Forest Service, Maine Department of Agriculture, Conservation, and Forestry, Augusta, ME. DOI: **ADD WEBLINK**

This publication is only available on-line at [www.maineforestservice.gov](http://www.maineforestservice.gov) by checking the publications link.

## Contents

Message from State Forester Patty Cormier .....	5
Introduction .....	1
Highlights of the 2021-2025 Report .....	3
<b>Part I. Maine’s Forest Condition .....</b>	<b>8</b>
Section 1. Forest cover .....	8
Section 2. Forest ownership.....	18
Section 3. Forest composition and structure .....	24
Section 4. Forest timber volume.....	35
Section 5. Forest growth, removals, and mortality .....	46
Section 6. Forest Harvest.....	55
Section 7. Wood processing.....	67
Section 8. Forest Carbon .....	71
Glossary: .....	75
<b>Part II. Maine Criteria and Indicators of Forest Sustainability .....</b>	<b>78</b>
Criterion 1. Soil Productivity.....	78
Criterion 2. Water Quality, Wetlands, and Riparian Zones: .....	80
Criterion 3. Timber Supply and Quality .....	84
Criterion 4. Aesthetic impacts of timber harvesting.....	93
Criterion 5. Biodiversity.....	94
Criterion 6. Public Accountability of Forest Owners and Managers .....	108
Criterion 7. Traditional recreation.....	113
Criterion 8. Forest carbon .....	114
<b>Part III. Maine Forest Service Programs and Emerging Issues .....</b>	<b>120</b>
Maine Forest Service (Bureau of Forestry, DACF) .....	120
Priorities and Emerging Issues .....	124
<b>Part IV. Supplemental Materials .....</b>	<b>135</b>
Source Data .....	135
Maine Statutes – Forest Resource Assessment Program .....	138
Literature Cited .....	141



*Photo credit: Nicole Rogers*

## Message from State Forester Patty Cormier

Maine's forest resources are the cornerstone of the state's environmental health, cultural identity, and economic prosperity. As the most forested state in the nation, with approximately 88% (17.4 million acres) of its land base covered in trees, Maine's "working forest" provides essential services ranging from carbon sequestration to global timber products. Drawing from the transcendentalist roots of Henry David Thoreau, Maine's relationship with its forests is often one of profound optimism and stewardship, and the ability to travel miles without seeing another person offers a rare opportunity for solitude and introspection that is increasingly lost in the modern world. The beauty of the Maine woods is in the eye of the beholder, and most distinctive is that Maine's forest lands are both a working forest and a cherished public resource.

This report serves as a critical baseline to ensure resources are managed sustainably for future generations. The primary intent of this report is to identify key information and priorities that support a long-term resource strategy. It focuses on three national themes identified by the USDA Forest Service: conserve working forestlands, protect forests from harm, and enhance public benefits. I am pleased to present this report and thank all those who helped with its development, as well as all those who work hard to look after Maine's forest land.

The state's forests are not only vast but also uniquely structured and vital to its residents. The economic impact cannot be overstated; the forest products sector contributes approximately \$8.3

billion to Maine's economy annually, supporting roughly 29,000 jobs across all Maine's sixteen counties. The contributions of Maine's forests to climate resilience are increasingly a focus of conversations. Maine's forests and wood products currently offset over 90% of the state's gross greenhouse gas emissions, playing a vital role in achieving carbon neutrality by 2045. We are unique here in Maine when it comes to ownership and access to Maine's forestland. In a rare model for the eastern U.S., about 92% of Maine's forest land is privately owned, yet much of it remains open for public recreation through a long-standing tradition of shared stewardship.

By integrating the latest data from the [Forest Inventory and Analysis \(FIA\)](#) program with multiple other data sources, this report highlights the ongoing resilience of the forest while addressing emerging challenges, such as shifting paper markets and the impacts of a changing climate. At the Maine Forest Service, we consider this report to be dynamic and evolving, rather than a static snapshot. We continuously monitor trends and conditions, and we invite your comments on how to improve the report over time. Receiving input and feedback from a range of perspectives is critical to assessing the complex information available on this broad topic.

After over seven years in the position of State Forester and seven years of involvement with the National Association of State Foresters, I have been struck by how distinguished Maine's forest resources truly are in comparison to other parts of our region, never mind other parts of the country. Those of us who care about our forests need to find ways to work collaboratively to resolve forestry issues if we are to maximize our effectiveness and achieve the benefits of a stable public policy and avoid divisive debates. That same stable policy environment creates predictability for landowners, forest products firms, and investors as they make decisions, which, in turn, helps keep Maine's forest products industry competitive and innovative. The discussions resulting from this report will improve our understanding of the issues and of one another's perspectives, and foster an open and constructive dialogue.

I hope you find this report both interesting and informative. My thanks to the many people who worked on sections of this report. Multiple staff from the Forest Policy & Management Division contributed analyses, writing, and material from other reports, and the Forest Health and Monitoring and Forest Protection Divisions also contributed important information. The work of field staff, especially the Forest Health and Monitoring Division's Forest Inventory Analysis crews provide critical, high-quality data. Monitoring and compiling key information about Maine's forests ultimately involves all Maine Forest Service employees who show their dedication every day. Their efforts contribute enormously to a broad understanding of Maine's forests, the challenges and immense opportunities they represent, and the deep connections they foster among all Mainers.

## Introduction

The State of the Forest report for Maine is prepared every 5 years by the Maine Forest Service (MFS), a bureau within Maine's Department of Agriculture, Conservation, and Forestry. Its primary purpose is to inform Maine's citizens about the condition of Maine's forests, forest sustainability, and the state's forest economy.

MFS has produced reports on various aspects of the forest for decades. Legislative direction for the State of the Forest report came with the establishment of MFS's Forest Resource Assessment Program beginning in 1997, through Title 12, Chapter 805, Subchapter 4-A. The statute identified multiple components of the report to be submitted to the legislative oversight committee, including describing forest conditions, evaluating progress toward sustainability standards, identifying changes in forest ownership, and recommending actions to address specific needs. (The full statute is cited in Part 4.)

In addition, the 2008 Farm Bill required states that receive federal funding to develop State Forest Action Plans every 10 years. Thus in 2010 and 2020 the State of the Forest Report and the State Forest Action Plan were combined into a single document, and a similar approach may be warranted in 2030.

This report is organized into three main parts. **Part 1** reports on basic forest conditions and trends in key metrics to describe the forests of Maine and their primary ecological and economic attributes. **Part 2** addresses criteria of forest sustainability, providing additional assessments of established indicators. **Part 3** provides an overview of MFS programs and highlights important emerging issues and trends that merit further attention, and, where possible, makes recommendations on needed actions by MFS and Maine's forestry community.

MFS relies on numerous data sources to develop this report. As part of the Forest Resource Assessment Program, MFS is continually striving to acquire more and better-quality data sources to evaluate forest conditions from a variety of perspectives, ecological, social, and economic. However, readers should recognize that there are limits to the quality and quantity of available data, and that the certainty of analyses decreases as more specific questions are addressed using necessarily smaller and smaller subsets of available data. (Forest inventory data collected in 2023 were the most recent data available for this report.) Similarly, some types of data are unavailable or too limited to allow statewide or even regional assessment. **Part 4** includes supplemental materials, including an overview of these data sources and their limitations in greater detail, and provides other materials that support some of the analyses presented. Ongoing forest inventory, monitoring, and research are critical functions for MFS and others to maintain and enhance, in order to further our understanding of Maine's forests, and involves many partners. With rapidly evolving technologies for data acquisition and analysis, we anticipate that more questions may be addressed with greater precision in the future. Part 4 also lists the many studies, peer-reviewed articles and reports from many different entities that were consulted in the preparation of this report.

No single report can address the full range of economic, ecological, and social values concerning Maine's vast and diverse forests. Nonetheless, it's our hope that this report addresses many fundamental questions about Maine's forests, and stimulates further discussion of conditions,

indicators, issues and trends to further inform policy decisions. While comprehensive, this report is not (and perhaps cannot be) exhaustive. MFS looks forward to an ongoing, robust discussion of the current and future values of Maine's forests to all of Maine's people.

Abbreviations for data sources (sources are further described in Part IV, Supplemental Information):

FIA = Forest Inventory & Analysis plot data (a partnership of MFS and the USDA Forest Service FIA program). EVALIDATOR refers to the publicly accessible data analysis tool provided by USDA Forest Service for FIA data.

MFS = data compiled by Maine Forest Service (includes; Timber harvest acres and silvicultural activity data from Landowner Reports; wood harvest and processing volumes from Wood Processor Reports; Tree Growth enrollment data from annual reports by individual towns and Maine Revenue Service)

Other abbreviations/data sources are as noted in text or Supplemental information.

## Highlights of the 2021-2025 Report

Maine's forests are abundant, diverse, and productive. Maine is unique in the role forests play in all aspects of life, and in the vastness of its forest tracts. Maine's forests produce diverse wood products across a vast timberland that sustains a robust forest products industry — from paper mills to lumber. This nature-based economy helps support the rural economy and underpins an important part of Maine's cultural identity. The diversity of temperate and boreal forests hosts abundant habitats for wildlife, as well as intact plant communities and species that are uncommon or absent elsewhere in eastern United States.

### Part 1: Maine's Forest Condition

**Forest Cover:** With an estimated 17.4 million acres of forest land, Maine remains the most forested state in the nation, with over 88% of the land surface covered by forests. Maine still has the largest contiguous block of undeveloped forest land east of the Mississippi: This includes approximately 10.5 million acres of unorganized territory, which remain largely undeveloped forest land, much of which is actively managed for timber production. Forest cover dominates the landscape in all regions of the state, with the lowest percentage in the southern region with 71% forest cover. Ninety-six percent of forest land is considered timberland where forest management can occur.

**Forest Ownership:** Ninety-two percent of Maine's forests are in private ownership. Corporate and industry ownership constitutes 59% of forestland, while individual/family ownerships account for 29.3% of forestland. Approximately 95,000 ownerships range 10 to 1000 acres in size, comprising 4.3 million acres. State and local governments own 7% of forestland, and 1% of forest land is federally owned. Over 11.2 million acres are enrolled in Maine's Tree Growth Property Tax program, constituting 67% of timberland.

**Forest Composition and Structure:** Maine's forests are dominated by two forest type groups: northern hardwoods (maple-beech-birch) and spruce-fir, which together comprise 75% of the forest. However, Maine's forests include over 30 individual forest types, and Maine's geography results in a diverse forest. MFS's most popular publication, [Forest Trees of Maine](#), lists over 70 tree species.

Forests of Maine are structurally dominated by poletimber- and sawtimber-sized trees over 5 inches in diameter at breast height (dbh), which constitute 40.1 and 32% of the forest, respectively. In recent years, forestland in sawtimber-sized forest stands has increased in area, though forestland dominated by large sawtimber (>16 inches dbh) occupy a relatively small area, averaging 2% of timberland statewide.

**Forest Timber Volume:** Sound volumes from timberland have increased 12.8% from 2003 to 2023, from 24.7 to 27.9 billion cubic feet. Sawlog volume has increased 11.4%, from 10.8 to 12.1 billion cubic feet in the same period statewide. Sound volume is dominated by four tree species in Maine: white pine, red maple, red spruce, and balsam fir. Between 2003 and 2023, the greatest volume increases have been in the southern megaregion, though volumes have increased in all regions of the state.

**Forest Growth and Harvesting:** The statewide growth-to-harvest ratio has increased markedly, from 0.83 in 1998 to 1.66 in 2023. Growth-to-harvest ratios exceed 1.0 in all regions of the state, though ratios and their trends vary in different parts of the state. Forest harvest acres have declined significantly, from averaging over 500,000 acres to just under 300,000 acres. Annual decreases continue, though harvested volumes have declined less. Average annual mortality is relatively constant, at just over 1%, though mortality rates vary significantly by species. Maine's forests regenerate naturally and abundantly, averaging hundreds or thousands of seedlings per acre of multiple species.

**Wood Processing:** Maine mills processed 883 million board feet of sawlogs in 2023, an increase of 48% from 2009 and including 637 million board feet harvested in Maine. By contrast pulpwood processing fell from 7.99 million green tons to 5.27 million green tons in the same period as several mills closed. At the same time, harvest area and volume as reported by Maine's landowners and mills have declined since 2000, from over 500,000 to less than 300,000 acres and from ~15 million green tons to ~ 11 million green tons harvested annually. Nonetheless, Maine's forest products industry continues to be an economic cornerstone across the state and especially in many rural communities.

**Forest carbon:** Forest carbon stocks have increased steadily over the last 20 years, to an estimated 1588 million metric tons. This increase has been due, in large part, to increases in forest growth and decreases in harvest levels. The high proportion of vigorous, young forests grows and sequesters carbon rapidly and, along with reduced harvest, this leads to more wood and therefore more carbon in the forest. As of 2021, the sequestration capacity of Maine's forests is equivalent to about 91% of Maine's Scope 1 and 2 emissions. Forests in most states do not sequester carbon and offset state-wide Scope 1 and Scope 2 emissions anywhere close to this level.

## Part II. Maine Criteria and Indicators of Forest Sustainability

In 1997, legislation directed the MFS to develop indicators and benchmarks for seven criteria. Technical groups of scientists from the University of Maine, environmental organizations, and industry developed indicators and benchmarks, some of which still lack monitoring programs.

**Criterion 1. Soil productivity:** Although Maine lacks a systematic soil monitoring program, timber harvesting may have only modest impacts on soil productivity. FIA data with small sample sizes found 96% of FIA plots had minimal compaction and limited bare soil. Other sources suggest that short-term impacts of harvesting may be modest. However, the long-term and cumulative effects of forest operations on soil productivity remain uncertain.

**Criterion 2. Water Quality, Wetlands, and Riparian Zones:** Although Maine lacks a systematic aquatic monitoring program for Criterion 2, limited information suggests progress toward minimizing water quality impacts from timber harvesting. Most (94.2%) of Maine's streams in forested watersheds were classified as high-quality (AA or A) by the Maine DEP. Water quality BMPs have been highly effective at protecting water quality at 70% of harvested sites, close to the previously set benchmark of 75%. Voluntary efforts by private landowners, MFS, and partners are greatly reducing restrictions on fish passage caused by stream crossings on logging roads.

**Criterion 3. Timber Supply and Quality:** Maine's growth-to-harvest ratio improved significantly, reaching 1.66 statewide, exceeding the previously established benchmark. Most species show

positive ratios. However, sawlog quality benchmarks have not been reached, with only red oak achieving the 10% improvement target. The degree to which current mortality could be captured by timber harvesting is uncertain and likely locally highly variable.

**Criterion 4. Aesthetic impacts of timber harvesting:** Over 50% of timberland is enrolled in certification programs with third-party verified aesthetic standards, and many loggers have completed training on harvesting aesthetics. Information and resources to address aesthetic impacts have become widely available, but no systematic assessment of such impacts has been conducted.

**Criterion 5. Biodiversity:** Biodiversity benchmarks show mixed results. Certified forest acreage (9.5M acres) exceeded previously set targets. Forest area remains stable at 17.44M acres. Stand structure, forest fragmentation (46.9% near roads), representativeness of conservation areas, and large-tree benchmarks remain below targets. While acreage with oak mast trees may be increasing, this has not offset the decline in acreage of American beech mast trees.

**Criterion 6. Public Accountability of Forest Owners and Managers:** Licensed Forester supervision was achieved on 79% of all harvested acres, and 41.4% of harvested acres on small ownerships, though both remain somewhat below their respective benchmarks. Certified forest acreage reached 9.5M acres, close to its 10M-acre benchmark. Logger certification is likely approaching 90%. The estimated acreage of small woodland ownerships with Forest Stewardship or equivalent plans remains lower than its 400,000-acre benchmark.

**Criterion 7. Traditional recreation:** The benchmarks for this criterion have both been achieved. Over 10.8 million forest acres remain open to public recreation, and conservation land for public use reached 4.2 million acres, well exceeding the 2005 target of 1.28 million acres. At the same time public interest in outdoor recreation has increased.

**Criterion 8. Forest carbon:** Maine's forests are a significant carbon sink, sequestering up to 91% of the state's gross GHG emissions. Soil carbon pools account for 58% of forest carbon, with live aboveground biomass pools accounting for about 24%. Forest carbon stocks have slowly increased, driven by growing timber inventory, which is expected to continue for the coming decades. Although there are no benchmarks for forest carbon, the contribution of Maine's forest carbon sequestration rates to achieving net-zero goals surpasses those of other states.

### Part III. Maine Forest Service Programs and Emerging Issues

**Maintaining the forest land base:** Maine's 17-million-acre forest faces conversion, parcelization, and fragmentation pressures, which are driven in part by ageing landowners and land transfers to new owners. MFS promotes forest stewardship by landowners through 12 district foresters, education, technical assistance, and expanding financial incentives. Ownership tracking remains data-challenged, but new carbon program reporting is emerging. Only about 40% of landowners who harvest currently engage with licensed foresters, highlighting ongoing outreach needs.

**Forest condition and structure:** The sustainability of Maine's forests depends on response of forest management to the composition and structure of the forests. Historically, a diversity of forest types and age/size-classes has supported a robust Maine's forest products industry, ongoing wood supply, and a resilient forest. Maine's forests show a strong diversity of forest types

and growth-to-removal ratios exceeding 1.5, but face challenges including passive management, short-term harvesting practices, and declining low-grade wood markets. MFS promotes active, climate-resilient silviculture focused on growth and quality improvements, adequate regeneration, and developing the full range of forest structures, from early- to late-successional forests, while balancing timber production with biodiversity, habitat, recreation, and carbon objectives.

**Forest Products Markets:** The forest products sector of Maine's economy remains vital to the state's overall economic health. A recent report found that the sector in 2024 contributed \$8.3 billion in economic output (including multipliers), 29,000 jobs, and \$2.1 billion in labor income. The industry has seen both investments in solid wood products manufacturing (especially sawmills) as well as paper and pulp mill closures. Multiple economic pressures and policies at the state, federal, and international level have affected business decisions in all sectors, including the forest products industry. Maine's wood products industry has invested in capacity and in the development of innovative products, supported by active, cutting edge research led by the University of Maine.

**Workforce retention and development:** Maine's logging workforce has declined significantly, dropping from 3,900 to under 3,000 employees between 2017 and 2021. Rising costs, market downturns, rural population decline, housing, childcare, transportation and equipment costs, immigration policy, and other factors have restricted the availability of forestry labor, compounding challenges for logging, trucking, skilled manufacturing trades, and related employment. Industry and universities have pursued creative recruitment, training, and apprenticeship programs to address workforce gaps, though intergenerational transfer of knowledge and experience may become a more significant challenge.

**Real-time forest inventory, assessment, and analyses:** MFS partners with USDA to conduct forest inventory, timber supply projections, and predictive modeling of forest conditions. These and multiple other data sources provide essential underpinning for MFS analyses and mandatory reports. MFS's Forest Resource Assessment Program and related efforts seek to inform landowner decisions, industry development, biodiversity assessments, carbon accounting, and climate policy. The MFS works with the University of Maine and the forest industry to track trends in forest conditions and resources that are vital to sustaining multiple forest resources. A key challenge is managing existing data reporting responsibilities while making improvements using new technologies and analytic tools.

**Forest health, native and exotic pests:** Maine's forests face escalating threats from invasive insects, diseases, and plants, compounded by climate change altering pest dynamics. Increasingly, these forest health threats are influenced by climate change, changes in precipitation patterns, extended growing seasons, and higher minimum winter temperatures. Emerald ash borer, hemlock woolly adelgid, beech leaf disease, and native outbreaks such as spruce budworm pose significant risks. They require improved detection, stronger landowner engagement, and more robust control and prevention measures to limit the introduction and spread of these threats to forest health.

**Wildfire response capacity:** Maine faces growing wildfire risks from climate-driven drought, aging facilities, and a declining workforce of Forest Rangers and volunteer capacity. Wildfire occurrence has increased to 681 annually, with 95% human-caused, while acres remain low with effective

suppression efforts. Sustained investment in equipment, recruitment, aviation programs, and public education is critical to maintaining wildfire preparedness and response.

**Forest Conservation:** Maine's forest wildlife and biodiversity face overlapping challenges, including habitat fragmentation, invasive species, climate change, and imbalances in acreage in different forest age and structure classes requiring balanced management across diverse regional conditions. Forest conservation measures have significantly increased the amount of forest land protected from development, while forest-based recreation has become a major industry in many areas of rural Maine.

**Climate Change:** Climate change is accelerating threats to Maine's forests through warming temperatures, forest-damaging extreme weather, shifting ranges of forest species, and intensified pest pressures. The MFS helps landowners understand forest carbon programs. Demand for carbon offsets and new climate-friendly biobased wood products may create innovative opportunities and new markets. MFS is actively monitoring, educating the public and landowners, and managing wildfire risk to build forest resilience and maintain forest carbon.

### **Summary:**

MFS and many stakeholders continue to monitor drivers and components of change in Maine's forests, particularly forest insects and diseases, invasive species, and weather events driven by climate change. Market shifts and innovation constitute are critical drivers that hold both challenge and promise for the forest sector. Forest industry employment levels, especially among loggers, truckers, and mill/manufacturing workers, is strongly affected by difficult economic conditions (Crawley et. al. 2025) as well as by demographic shifts (Kingsley 2025), and severely challenge rural, forest-dependent communities and businesses statewide.

Maine's forests have enormous potential to continue to provide economic, social and ecological benefits for Maine's people long into the future. Strategies and opportunities to protect and enhance these benefits for the long term can be and are being developed through the collaborative efforts of all those with an interest in the future of the forest.

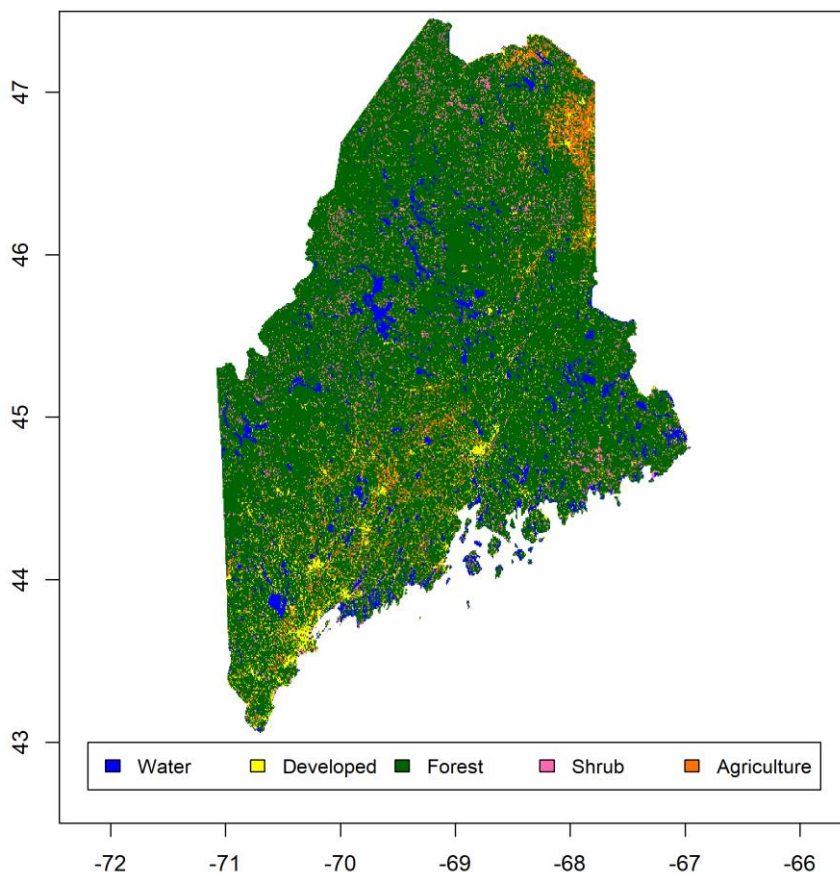
# Part I. Maine's Forest Condition

## Section 1. Forest cover

### 1a. Current Forest Area Statewide

Maine's land is predominantly forest land, and trees are the natural vegetation over the vast majority of Maine's landscape due to appropriate soils, largely of glacial, marine, and lacustrine origin, and a moist temperate climate suitable for a wide array of tree species (Figure 1.1).

Despite a slight decline in forested land area, Maine remains the most forested state in the nation, with over 88% of the land area forested. As of 2023, there are 17.44 million acres of forest land in Maine. Developed areas, agriculture, and non-forest natural vegetation, such as wetlands, comprise a much smaller proportion of the land area (Figure 1.2). An analysis of forest cover based on FIA plots shows a similar pattern of heavy forest cover (Table 1.1)

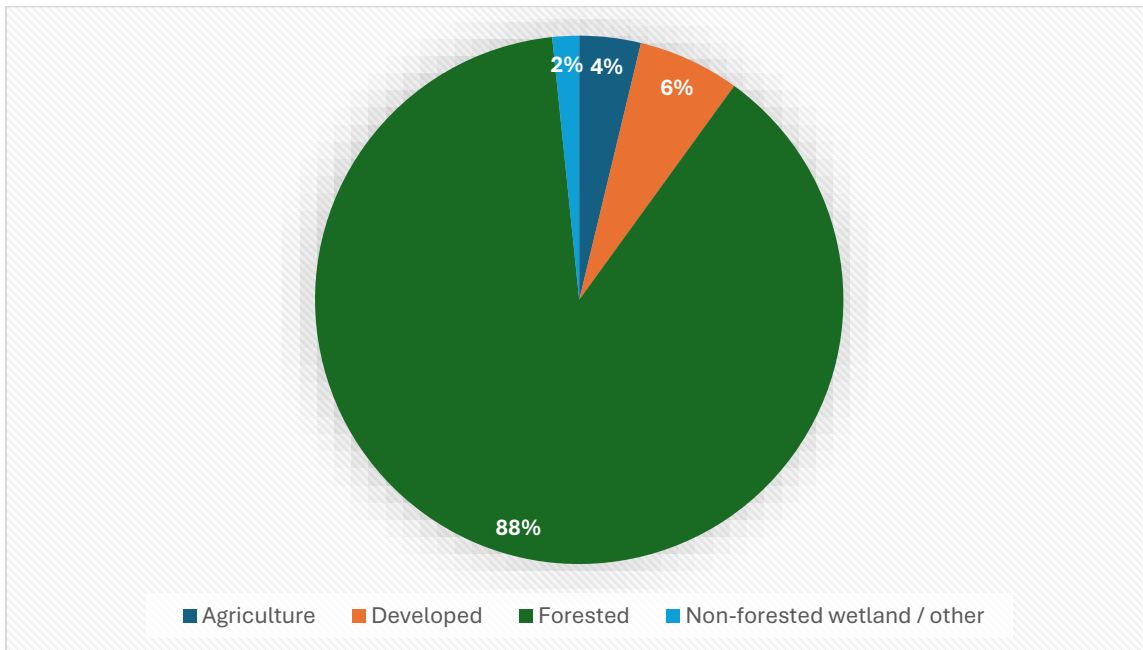


**Figure 1.1. National Land Cover Data (NLCD) Land cover types, Maine, 2023.** Axes indicate degrees of latitude and longitude (source: U.S. Geological Survey, NLCD, 2024).



**Maine land use categories:**

The following estimates of land category acreages were derived from FIA data:



Land Use Category	Area (thousand acres)	Representation (%)
Agriculture	741	3.8
Developed	1,228	6.2
Forested	17,444	88.4
Non-forested wetland/other	323	1.6
All Land	19,736	100

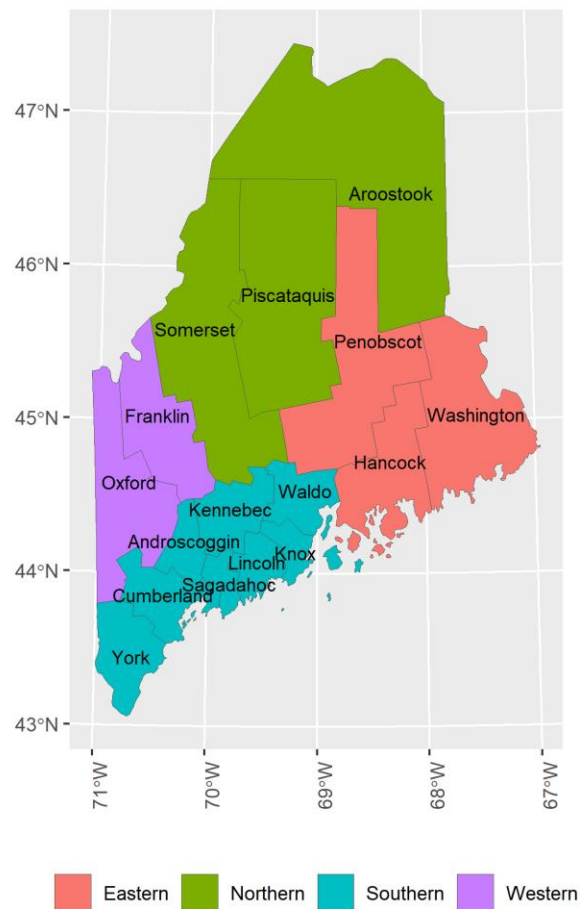
**Figure 1.2. Land use area (thousand acres) and representation (%), Maine, 2023** (source: USDA-FS-FIA 2025). Representation (%) was estimated as a percentage of all land. Estimates were based on a land only basis. Agriculture is largely cropland, but also other agricultural land, pasture, rangeland, and idle farmland. Developed includes cultural (i.e., business and residential), rights-of-way, and other developed lands. Non-forested wetland /other includes wetland and other (i.e., undeveloped beach, marsh, bog, snow, and ice; see Burrill 2024, PRESNFCD).

**Table 1.1 Land class area (thousand acres) and representation (%), Maine 2023.**

Representation (%) was estimated as a percentage on area of sampled land and water (source: USDA-FS-FIA 2025).

Land Class	Area (thousand acres)	Representation (%)
Accessible Forest	17,444	82.3
Non-forest	2,293	10.8
Non-census water	56	0.3
Census water	1,407	6.6
Area of Sampled Land and Water	21,200	100

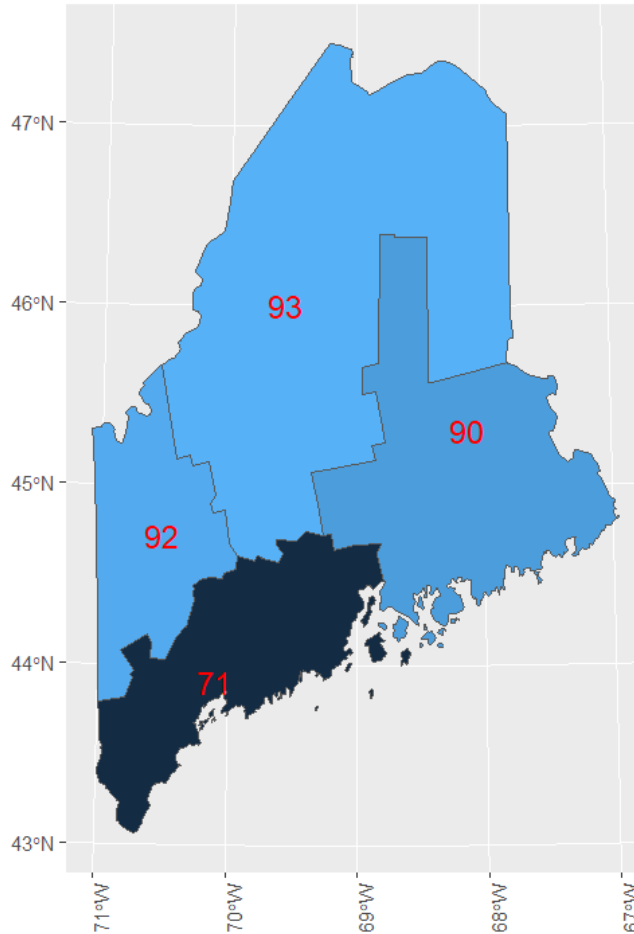
**Megaregions:** As part of the United States Department of Agriculture Forest Service (USDA FS), Forest Inventory and Analysis (FIA) program, Maine monitors its forests using roughly 3,500 sample plots. Data are collected on a rotating schedule from approximately 20 percent of these plots each year. The summary statistics presented here have been generated using FIA data. Megaregions are used because most Maine counties lack sufficient numbers of FIA plots to calculate precise forest statistics by county. At larger scales, megaregions, many forest statistics can be estimated with useful precision. Megaregions were also created to represent areas that are relatively homogeneous with respect to landowner type, dominant silvicultural treatments, forest types and ecology, and markets. Maine Forest Service reports some forest statistics for four megaregions (Figure 1.3) when it is useful for understanding regional differences in forest conditions, forest management, timber harvesting, and wood processing within Maine.



**Figure 1.3 Four megaregions, Maine, 2023** (source: USDA-FS-FIA 2025). Most Maine counties lack sufficient numbers of FIA plots to calculate precise forest statistics by county. Many forest statistics can be estimated with useful precision for larger areas, megaregions. Megaregions were selected to represent relatively homogeneous areas with respect to landowner type, dominant forest management strategies, forest types and ecology, and markets.

**Current forest area by megaregion:**

Although Maine’s forests dominate the landscape in all parts of the state, southern areas, both historically and in recent years, have experienced more development and conversion to agriculture than northern areas. Nonetheless, the southern megaregion remains 71% forested (due in large part to reversion of abandoned agricultural land to forest), while the other three megaregions are all at least 90% forested (Figure 1.4). The northern megaregion is by far the largest with over 8.5 million acres of forest land (Figure 1.4).



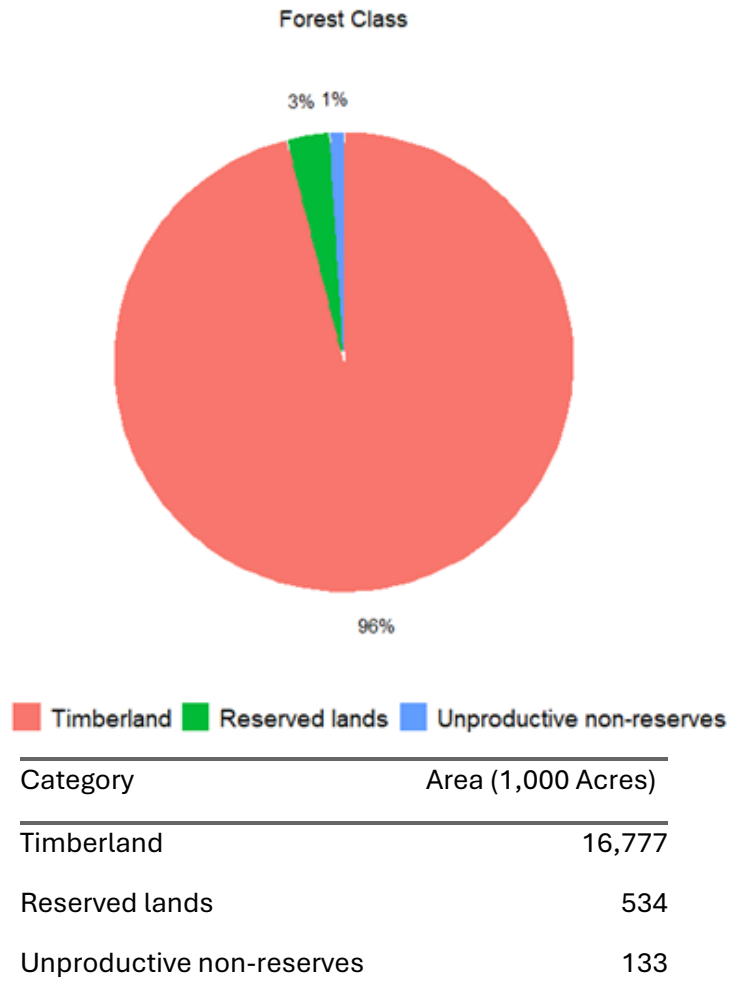
FIA Megaregion	Forest Land Area (thousand acres)	All Land Area (thousand acres)	Forest Land (%)
Eastern	4,331	4,821	90
Northern	8,622	9,313	93
Southern	2,261	3,187	71
Western	2,230	2,415	92

**Figure 1.4. Forest land area (acres) and representation (%) by megaregion, 2023.** Forest land cover (%) was estimated as a percentage of all land area, by megaregion (source: USDA-FS-FIA 2025).

**Current forest area by Forest class.**

Most of Maine’s forest land is also considered timberland, which includes any land not reserved from harvest (Figure 1.5). Approximately 3% of Maine’s forests are in permanent reserves, though many more acres are in some form of conservation or land protection where timber management is not explicitly excluded. Barely 1% of Maine’s forested area is considered unproductive non-reserved land, incapable of producing commercial forest products.

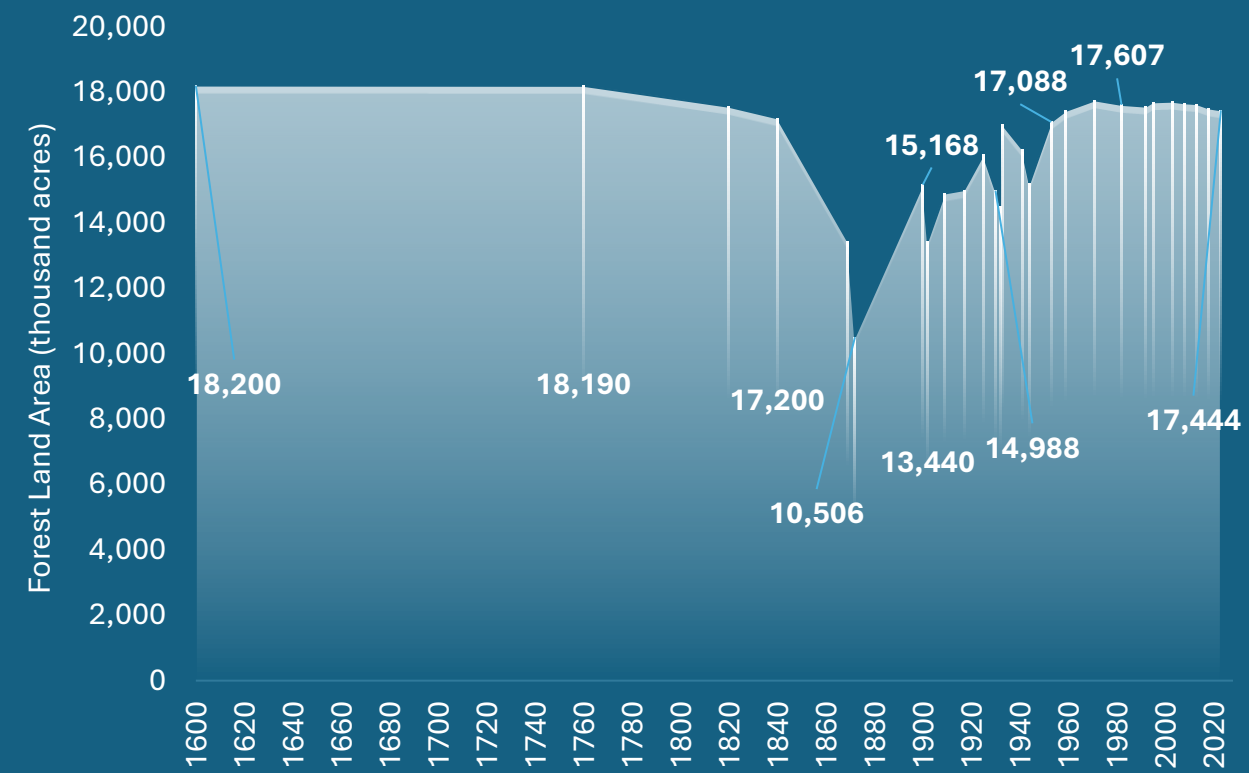
While “timberland” predominates with 96% of the forest area, not all acres may be available for timber harvest, based on landowner objectives, access, forest condition, or other constraints on harvesting. Other factors affecting actual timber harvest are terrain/physical operability, workforce availability, or markets for specific products/grades. In some instances, ownership objectives may shift from timber management and harvesting to seek new income streams (such as carbon markets), while in other cases, new owners may have different objectives (including non-timber objectives) than previous owners.



**Figure 1.5. Forest land area (acres) by forest class (timberland, reserved lands, and unproductive non-reserves, 2023 (source: USDA-FS-FIA 2025).**

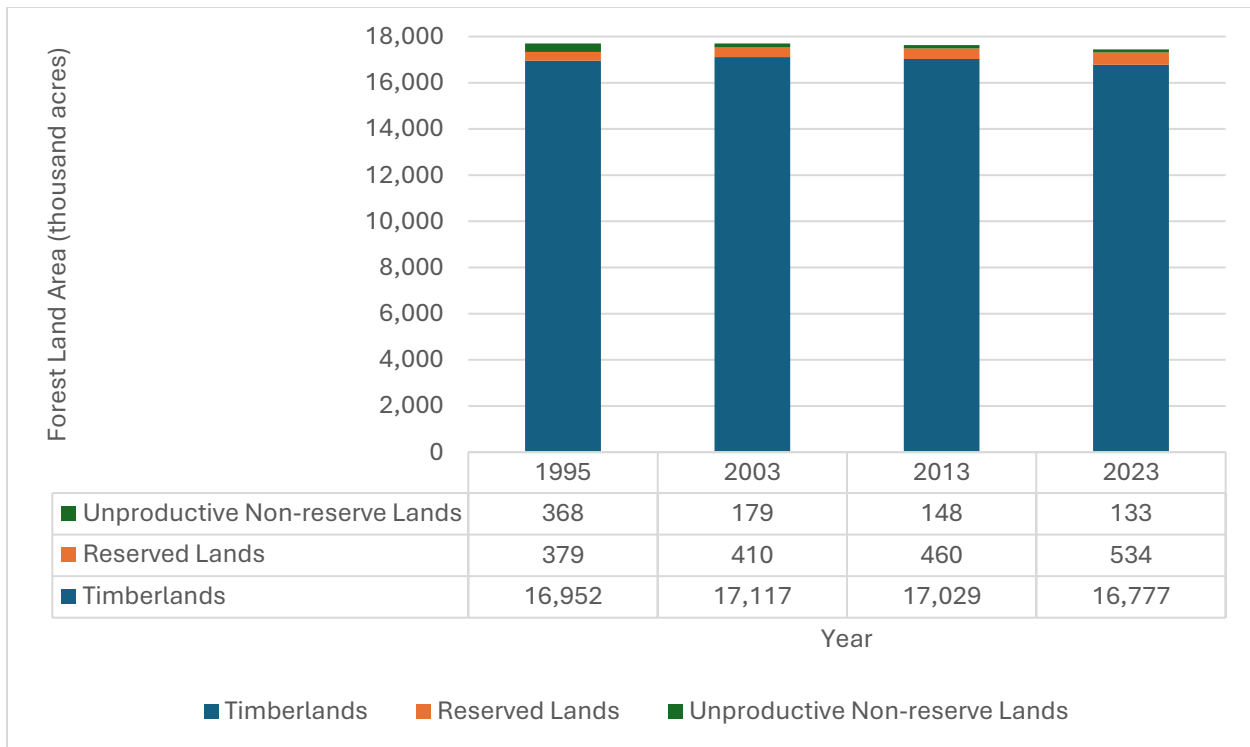
**1b. Forest Cover Trends**

Forest land area is estimated to have been approximately 18 million acres prior to European settlement but began to decline as forest was converted to farmland beginning in the 1600s and accelerating rapidly after U.S. independence (Figure 1.6). Forest area began to rebound after 1880 with a decline in agriculture and natural forest recovery, peaking at 17.7 million acres in 1997, and approaching pre-European settlement levels. As a result of these shifting patterns of land use, in some areas of the state the recovery of forests in the last 150 years obscures decades of agricultural, industrial, and intensive timber uses and the human settlements that accompanied them. More recently, forest land area has undergone a slight decline over the past 2 decades with conversion to other uses such as agriculture, residential and commercial development.



**Figure 1.6. Forest Land Area of Maine from 1600 to 2023** (sources: Forest and area estimates between 1600 and 1998: Irland 1998; forest land area estimates from 2003 to 2023: USDA-FS-FIA 2025).

The state’s forest land base has remained relatively stable over several decades in the second half of the 20<sup>th</sup> century. (Figure 1.6), as forest loss to conversion has been balanced by reversion to forest on abandoned agricultural lands. Though the trend is small, forest land, timberland, and other non-reserved land area have declined slightly since 2005 (Figure 1.7).



**Figure 1.7. Recent Forest Land Area (acres) Trends, by land class, 1995-2023.** Area of total forest land, timberland, reserved lands, and unproductive non-reserve lands in Maine for 1995, 2003, 2013, and 2023. (source: USDA-FS-FIA 2025).

FIA data were used to estimate net change in forest land acres by estimating forest conversion as well as reversion acres (e.g., likely through natural regeneration of abandoned agricultural lands) (Table 1.2). The rate of forest conversion was different among megaregions. Not surprisingly, southern and eastern megaregions show the greatest net change, likely because forest loss to housing and other development are greatest in southern coastal areas.

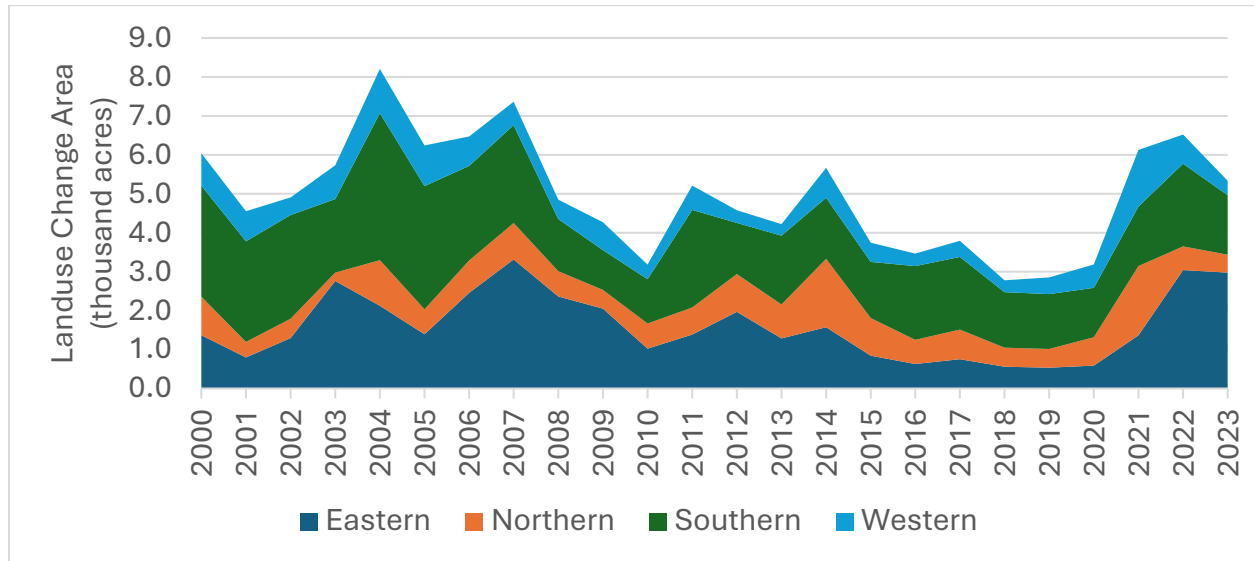
**Table 1.2. Total Forest Area Change, by Megaregion and statewide, from 2014 to 2023.** Conversion, reversion, forest area, total area, net change, and net change are expressed as a percentage of the total area by megaregion (source: USDA-FS-FIA 2025). Area acreage estimates are in 1,000 of acres.

Megaregion	Area (1,000 acres)					Net Change (%)
	Conversion	Reversion	Forest (2023)	Total (Land and Water) (2023)	Net Change	
Eastern	7.4	1.5	4330.6	5351.0	-5.9	-0.11
Northern	6.4	1.9	8621.9	9792.8	-4.5	-0.05
Southern	6.3	1.8	2261.4	3549.7	-4.5	-0.13
Western	1.0	1.3	2229.8	2506.3	0.3	0.01

Statewide	21.1	6.5	17,444.0	21,180.0	-14.6	-0.07
-----------	------	-----	----------	----------	-------	-------

MFS receives landowner reports of annual timber harvest activity that also note change of use from forest to other land uses (development, agriculture, etc.; MFS 2025a). They show a similar pattern of greatest forest loss in the southern and eastern megaregions (Figure 1.8, Table 1.3). However, these are not directly comparable to FIA estimates due to differences in definitions, reporting mechanisms and timeframes.

According to 2023 FIA data, in Maine approximately 21,000 acres were converted from forest land to other uses (diverted) and 6,500 acres are reverted to forest land annually, although many of these changes are impermanent (Woodall et al. 2022). The statewide FIA annual estimates are higher than MFS estimates of land use change based on timber harvest reports, which range from 3,000 to just over 6,000 acres per year between 2014 and 2023. Landowner reports to MFS may underestimate forest conversion, since not all landowners are required to report specific land use change acres, and land use changes which occur more than a year post-harvest may not be reported. Current data sources do not permit a more precise estimate, and annual numbers likely fluctuate significantly. However, it is likely that approximately 21,000 acres were converted from forest land to other uses (diverted), and 6,500 acres were the rate of conversion of forest land to other land uses is between 5,000 and 10,000 acres annually.



**Figure 1.8. Annual forest loss (acres) by megaregion, 2000-2023** (sources: MFS Silvicultural Activities Report, 2000-2023; MFS 2025a). “Forest loss” is synonymous with “land use change” as identified in MFS reports, where forests are cleared for other uses.

**Table 1.3. Average annual forest loss (acres) by megaregion, 2000-2023.** Forest loss acreage was averaged annually within five 4-year periods between 2000 and 2023 (sources: MFS Silvicultural Activities Report, 2000-2023; MFS 2025a).

Megaregion	2000-2003	2004-2008	2009-2013	2014-2018	2019-2023
Eastern	1.6	2.3	1.5	0.9	1.7

Northern	0.5	0.8	0.7	0.9	0.8
Southern	2.5	2.6	1.5	1.6	1.6
Western	0.7	0.8	0.5	0.5	0.7
Total	5.3	6.6	4.3	3.9	4.8

## Section 2. Forest ownership

In Maine, private ownership, which includes corporate, family, industrial, and other private lands represents 92% of Maine’s forest lands.

Ownership information for Maine is available from four sources including FIA, the USDA Forest Service’s National Woodland Ownership Survey, and the state’s ownership layers managed by MEGIS and Maine Revenue Service. In addition, MFS landowner report data include self-reported ownership types and are summarized in the MFS silvicultural report.

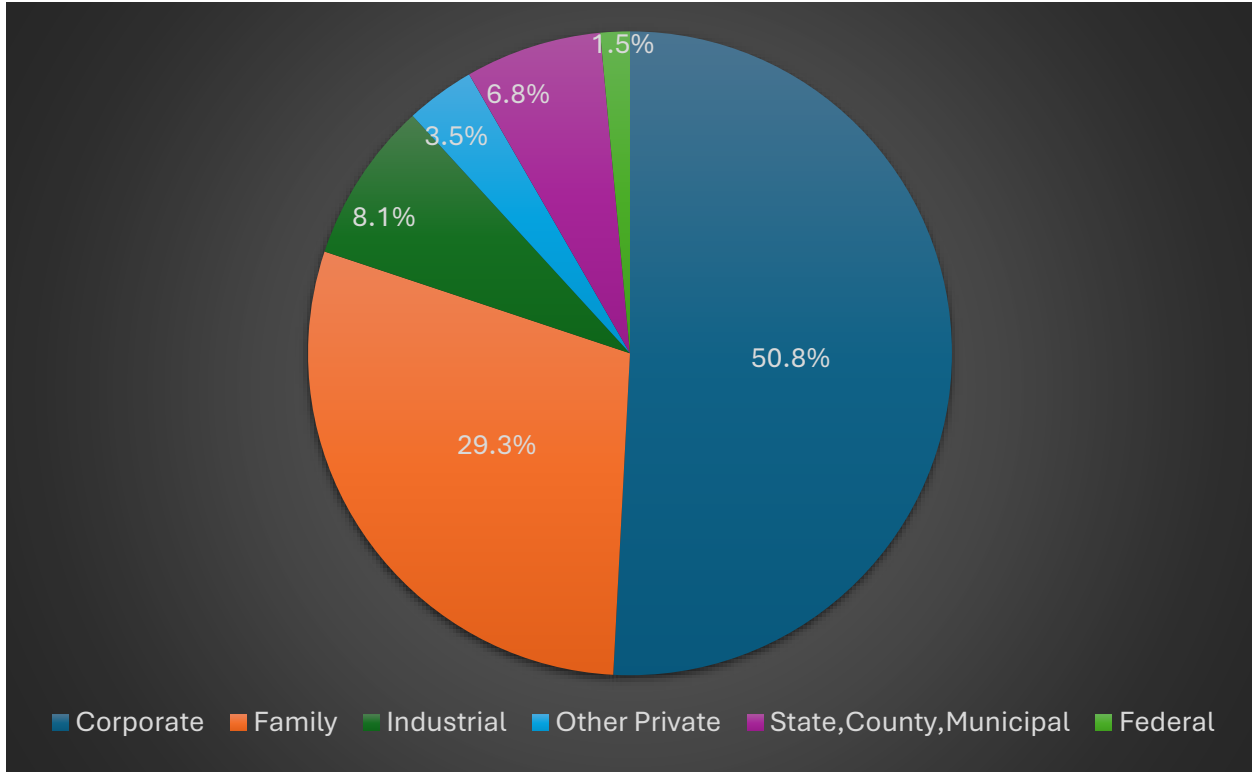
Acreage of forest ownership classes were estimated based on FIA data (Table 2.1, Figure 2.1). The publicly available FIADB data does not differentiate private ownership; however, more finely differentiated ownership acreage data are made available as part of a state agreement with the USDA Forest Service. Of the differentiated FIA classes, the corporate and family ownership classes are very well represented in Maine. Industrial lands are owned by landowners that also operates a primary wood-processing plant. “Other private lands” include NGOs, tribal lands, trusts, private universities, and some other miscellaneous private lands. For this report, unincorporated partnerships and the native American ownerships have relatively few owners and must be aggregated based on federal requirements to protect landowner identity.

**Table 2.1. Area and representation of two forest ownership groups and six forest owner classes, 2023** (source: USDA-FS-FIA 2025<sup>1</sup>).

Ownership Group	Ownership Class	Area (1,000 acres)	Representation (%)
Private	Corporate	8,867	50.8
Private	Family	5,109	29.3
Private	Industrial	1,410	8.1
Private	Other Private	606	3.5
<b>Private</b>	<b>Total</b>	<b>15,991</b>	<b>91.7</b>
Public	Federal	258	1.5

<sup>1</sup>The data on differentiated ownerships used in part of this publication/presentation was made possible, in part, by an Agreement from the United States Department of Agriculture’s Forest Service (FS). This publication/presentation may not necessarily express the views or opinions of the USDA Forest Service

Public	State, County, Municipal	1,194	6.8
<b>Public</b>	<b>Total</b>	<b>1,452</b>	<b>8.3</b>



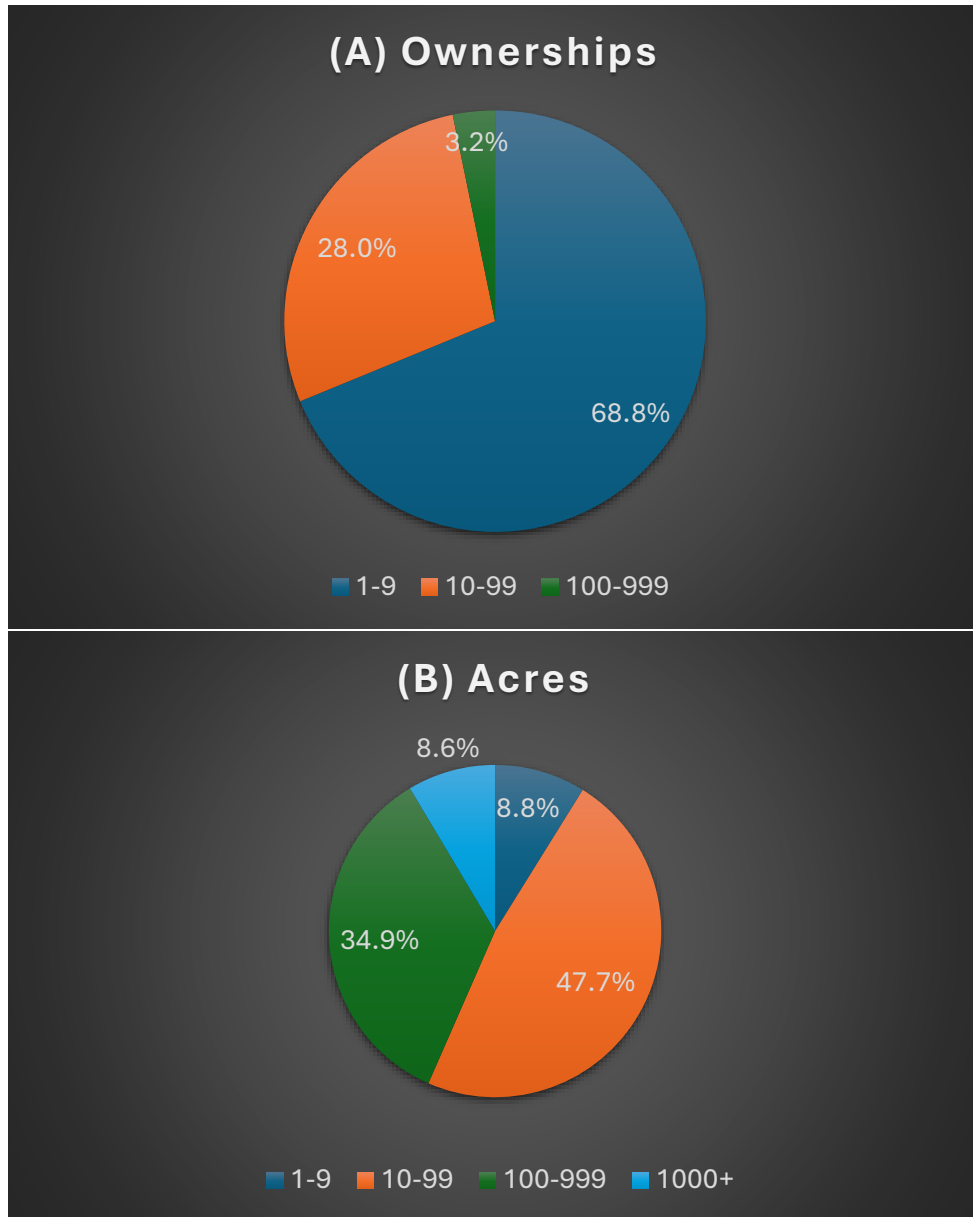
**Figure 2.1. Percentage of forestland occupied by six ownership classes, 2023** (source: USDA-FS-FIA 2025<sup>1</sup>).

## 2b. Size classes of family forest ownerships.

Family ownerships occupy a large percentage of Maine’s forest, with just under a third of all forests (Table 2.2). They dominate the landscape in the southern and central megaregions of the state but occur in all but the most thinly settled parts of the unorganized territories. Approximately 95,000 landowners have between 10 and 1000 acres; many more landowners own 1 to 9 acres, and in more populous towns and portions of the state, these ownerships contribute significantly to maintaining the forested landscape (Figure 2.2A, B). At the same time, smaller ownerships are less likely to apply management treatments for objectives such as forest products or forest health because economies of scale are harder to achieve given their small size. Other objectives, such as recreation, aesthetics, or human health and safety, may also face barriers to management treatments, as these treatments can also be financially prohibitive.

**Table 2.2: Number of family forest ownerships and acres by size class, 2023** (sources: Caputo and Butler 2026; USDA-FS-FIA In Press).

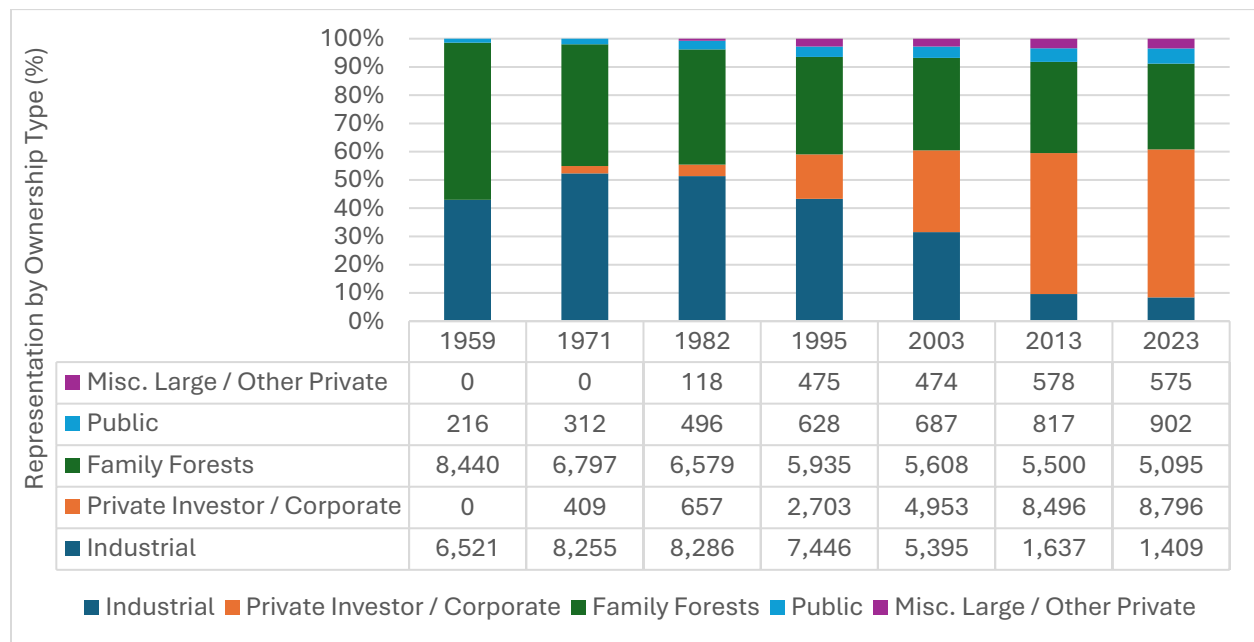
Acreage size class	Acres	Ownerships
1-9	462,000	209,000
10-99	2,491,000	85,000
100-999	1,820,000	9,800
1000-4999	317,000	<320
5000+	130,000	<30
Total	5,220,000	303,800



**Figure 2.2A, B. The percentage of (A) ownerships and (B) acres in each ownership size class for all family forest owners, 2023** (sources: Caputo and Butler 2026; USDA-FS In Press).

## 2c. Forest Ownership Trends

While most forest land in Maine remains in private ownership, the last 40+ years have seen a marked shift in forest ownership types, with forest products manufacturers legally separating ownership of their long-held forest lands from ownership of their mill operations (Figure 2.3). Many of these lands have been acquired by entities established to manage the lands as a stand-alone asset class, including timber management organizations (TIMOs), institutional investors, real estate investment owners, trusts, LLCs, and large logging contractors. Other lands have been acquired by high-net-worth individuals, non-governmental organizations (including conservation groups), and other groups. State-owned forest lands have increased slightly. County and municipal lands account for a small proportion of public lands in Maine.



**Figure 2.3. Long-term ownership type trends for timberlands, 1959-2023** (sources: Figure 2.6.1 from MFS 2010 and USDA-FS-FIA 2025').

## 2d. Landowner Participation in Maine’s Tree Growth Property Tax Program

Maine’s primary current-use program (property tax valuation based on land use) for forests is the Tree Growth Property Tax Program, which provides reduced valuations for productive forest land for owners who commit to long-term management for commercial forest products. The enrollment statewide of over 11 million acres indicates that two-thirds of Maine’s forests are committed to contributing to Maine’s forest economy and are likely to remain forested indefinitely (Table 2.3). Moreover, landowners across the state participate in the Tree Growth Property Tax Program, with nearly 20% of timberland in the southern megaregion enrolled.

**Table 2.3. Tree Growth Property Tax Program enrollment by megaregion, 2024/2025** (sources: Unorganized Territory acres enrollment: Maine Revenue Service 2025; Organized Town enrollment: MFS 2024; timberland acres for each megaregion: USDA-FS-FIA 2025).

<b>Megaregion</b>	<b>Classified OT Acreage</b>	<b>Classified UT Acreage</b>	<b>Total Tree Growth Acres</b>	<b>FIA Timberland Acres (2024)</b>	<b>Enrollment (%)</b>
Eastern	1,130,977	1,578,297	2,709,274	4,083,600	66
Northern	1,354,343	5,281,411	6,635,754	8,295,438	80
Southern	404,112	4,891	409,003	2,231,598	18
Western	731,105	719,212	1,450,317	2,140,715	68
<b>Statewide</b>	<b>3,620,537</b>	<b>7,583,810</b>	<b>11,204,347</b>	<b>16,751,352</b>	<b>67</b>

## Section 3. Forest composition and structure

Maine’s forests are influenced by geography, soils, past land uses and timber harvesting activities and other disturbances. As such, they are diverse in type, age, size, structure, and volume.

### 3a. Forest Types

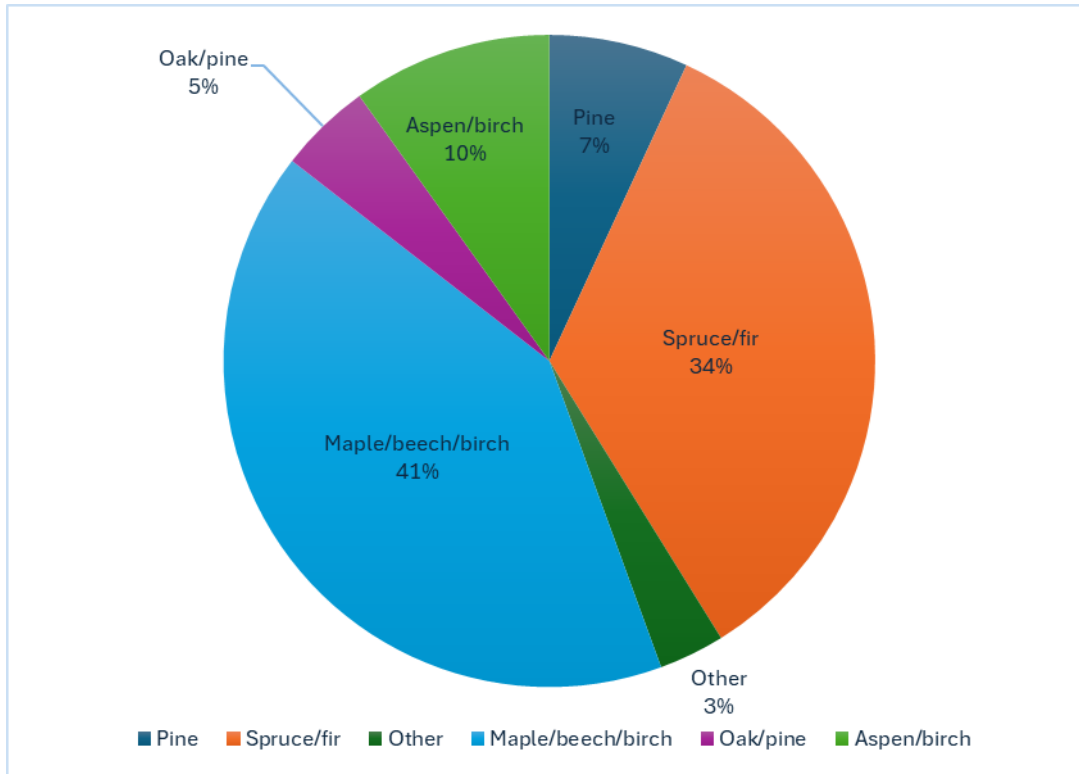
Forest type groups aggregate similar types based on species composition. The methodology and nomenclature are assigned by FIA based on national criteria but are adapted slightly for Maine by MFS.

Together, the maple/beech/birch group and the spruce/fir forest type groups constitute 75% of Maine’s forests (Figure 3.1, Table 3.1). Forest types vary in proportion in different parts of the state - white pine and oak forests are much more common in southern portions of the state, while spruce/fir forests are more dominant further north. In addition, Maine’s forests are more diverse than these broad type groups imply and include over 30 individual forest types identified in Maine using FIA methodology (Table 3.2). The spruce/fir forest type group alone includes seven individual forest types, based on relative proportions of the primary species.

The distribution and proportions of forest types have been relatively stable over the last several decades. The main exception was the reduction in spruce/fir forests between the 1982 and 1995 inventories, in the aftermath of the spruce budworm outbreak, which resulted in high mortality of balsam fir, white and red spruce. More recently, aspen/birch forests have declined somewhat in area as their characteristic shorter-lived, early successional forest species decline and are replaced by longer-lived species.

**Table 3.1. Areas (acres) and representation (%) of six major forest type groups, 2023** (source: USDA-FS-FIA 2023). For acres of major forest type group and forest type by megaregion see and year supplemental table (S3a).

Forest Type Group	Area (thousand acres)	Representation (%)
Maple/beech/birch	7,168	41
Spruce/fir	5,973	34
Aspen/birch	1,727	10
Pine	1,207	7
Oak/pine	799	5
Other	569	3
<b>Total</b>	<b>17,444</b>	<b>100</b>



**Figure 3.1. Representation (%) of Six Major Forest Type Groups, 2023.** Forest type groups are composed of forest types based with similar tree species composition. The FIA methodology and nomenclature were adapted for this figure: Maple/beech/birch, aspen/birch, and spruce/fir are as assigned by FIA. “Pine” is the abbreviated name for the FIA “White/red/jack pine group”, since white pine is by far the most abundant pine species in Maine. “Oak/pine” is the abbreviated name for oak/hickory and oak/pine because hickory forest types are very uncommon in Maine (USDA-FS-FIA 2025).

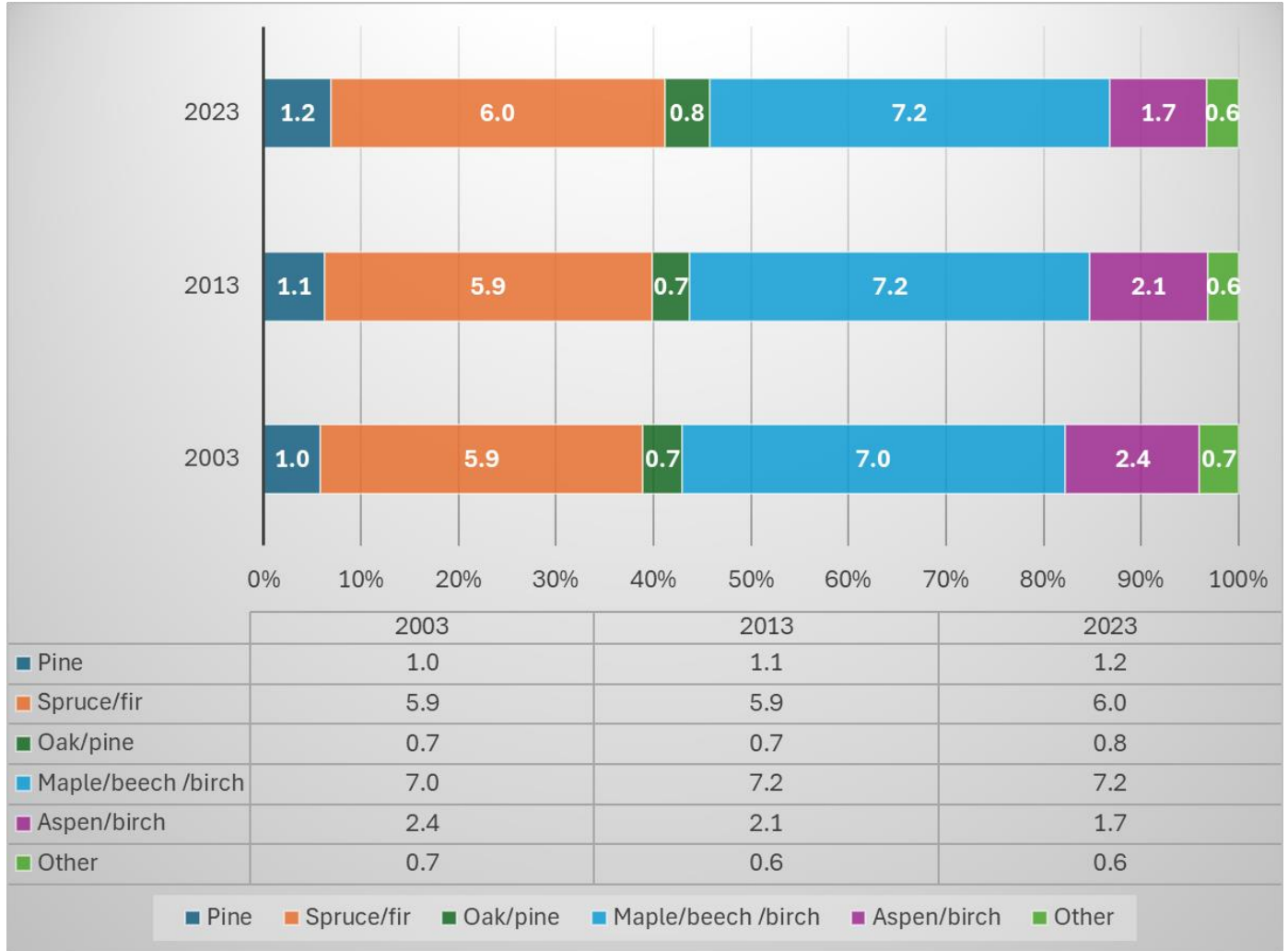
**Table 3.2: Estimated area (acres) of 37 forest types, 2023** (source: USDA-FS-FIA 2025). Forest type group and forest type follow USDA FS FIA methodology and nomenclature. Estimated acreage of more abundant forest types have smaller standard errors than less abundant forest types; in effect estimates of less common types are less precise and certain.

Forest Type Group	Forest Type	Estimated Area (acres)	Standard Error (%)
Maple/beech/birch group	Sugar maple/beech/yellow birch	6,127,367	2
Spruce/fir group	Balsam fir	2,164,835	5
Spruce/fir group	Red spruce/balsam fir	1,090,727	7
Spruce/fir group	Northern white-cedar	973,834	7
Spruce/fir group	Red spruce	928,518	7
Aspen/birch group	Aspen	784,899	8
Maple/beech/birch group	Red maple/upland	771,836	8
White/red/jack pine group	Eastern white pine	661,812	9
Aspen/birch group	Paper birch	591,583	10

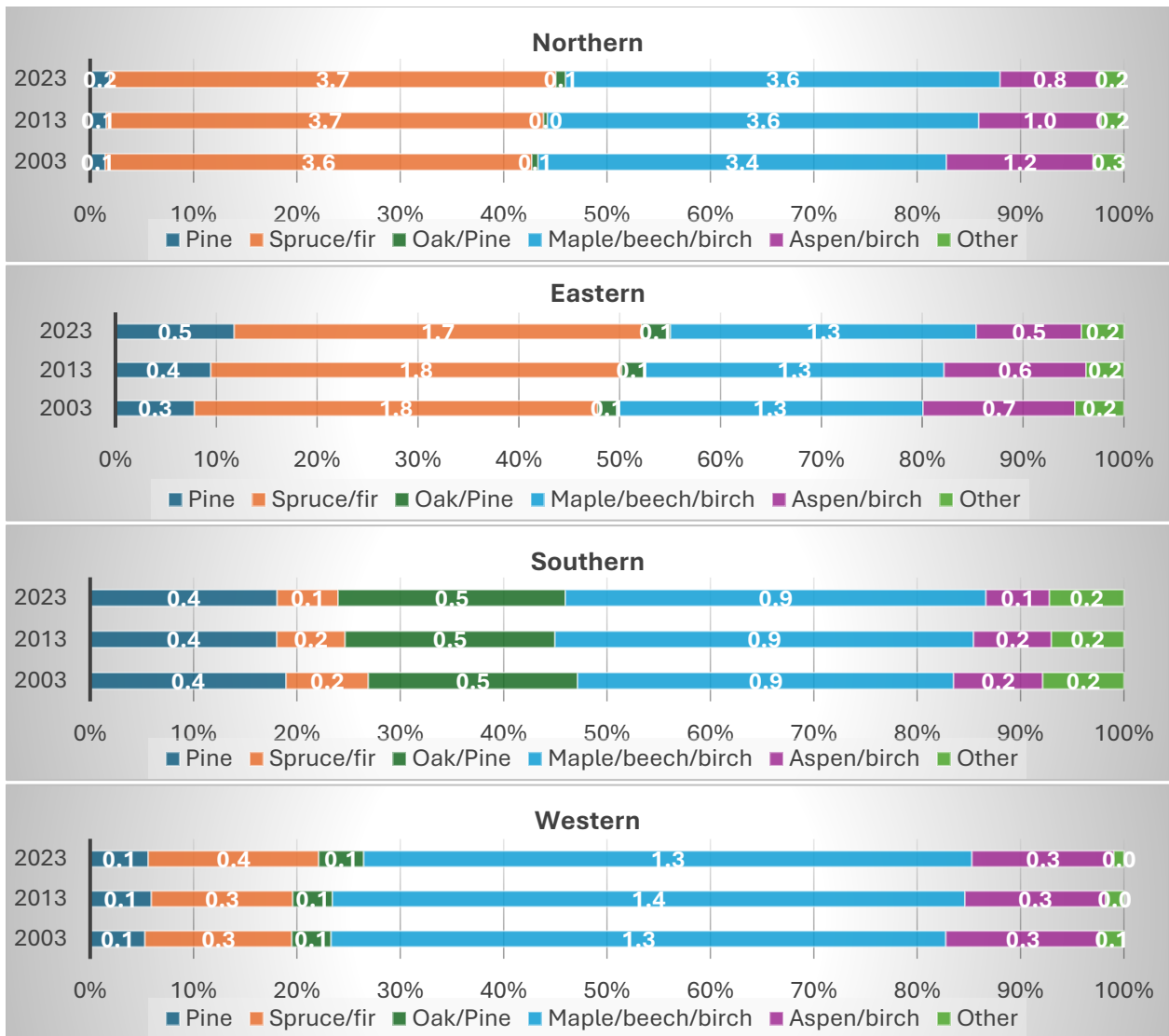
Spruce/fir group	Black spruce	559,833	10
Oak/pine group	Eastern white pine/northern red oak/white ash	371,170	12
White/red/jack pine group	Eastern hemlock	352,538	12
Oak/hickory group	Northern red oak	305,667	13
Maple/beech/birch group	Hard maple/basswood	268,559	14
Elm/ash/cottonwood group	Red maple/lowland	260,615	14
Aspen/birch group	Gray birch	191,992	16
Spruce/fir group	White spruce	164,034	17
White/red/jack pine group	Eastern white pine/eastern hemlock	134,896	20
Other hardwoods group	Other hardwoods	115,778	21
Elm/ash/cottonwood group	Black ash/American elm/red maple	99,921	22
Spruce/fir group	Tamarack	91,340	23
Aspen/birch group	Pin cherry	83,755	26
Aspen/birch group	Balsam poplar	75,269	26
White/red/jack pine group	Red pine	57,383	29
Oak/hickory group	White oak/red oak/hickory	52,152	29
Nonstocked	Nonstocked	25,554	39
Exotic softwoods group	Norway spruce	22,165	51
Oak/hickory group	Red maple/oak	21,718	48
Elm/ash/cottonwood group	Sugarberry/hackberry/elm/green ash	19,678	52
Oak/hickory group	Cherry/white ash/yellow poplar	17,843	55
Oak/hickory group	Mixed upland hardwoods	15,163	60
Oak/pine group	Other pine/hardwood	12,877	68
Exotic softwoods group	Introduced larch	11,262	70
Loblolly/shortleaf pine group	Pitch pine	6,827	96
Elm/ash/cottonwood group	Silver maple/American elm	4,391	100
Elm/ash/cottonwood group	Sycamore/pecan/American elm	3,141	98
Oak/hickory group	Elm/ash/black locust	2,732	75

### Forest type changes.

FIA data indicate slight changes in forest types over the past two decades (Figure 3.1). Major forest type groups are largely stable. Early successional types in the aspen/birch group have declined slightly statewide, especially in the northern and eastern megaregions (Figure 3.2).



**Figure 3.1. Forest type group area (million acres) and representation (%), 2023, 2013, and 2003** (source: USDA-FS-FIA 2025).

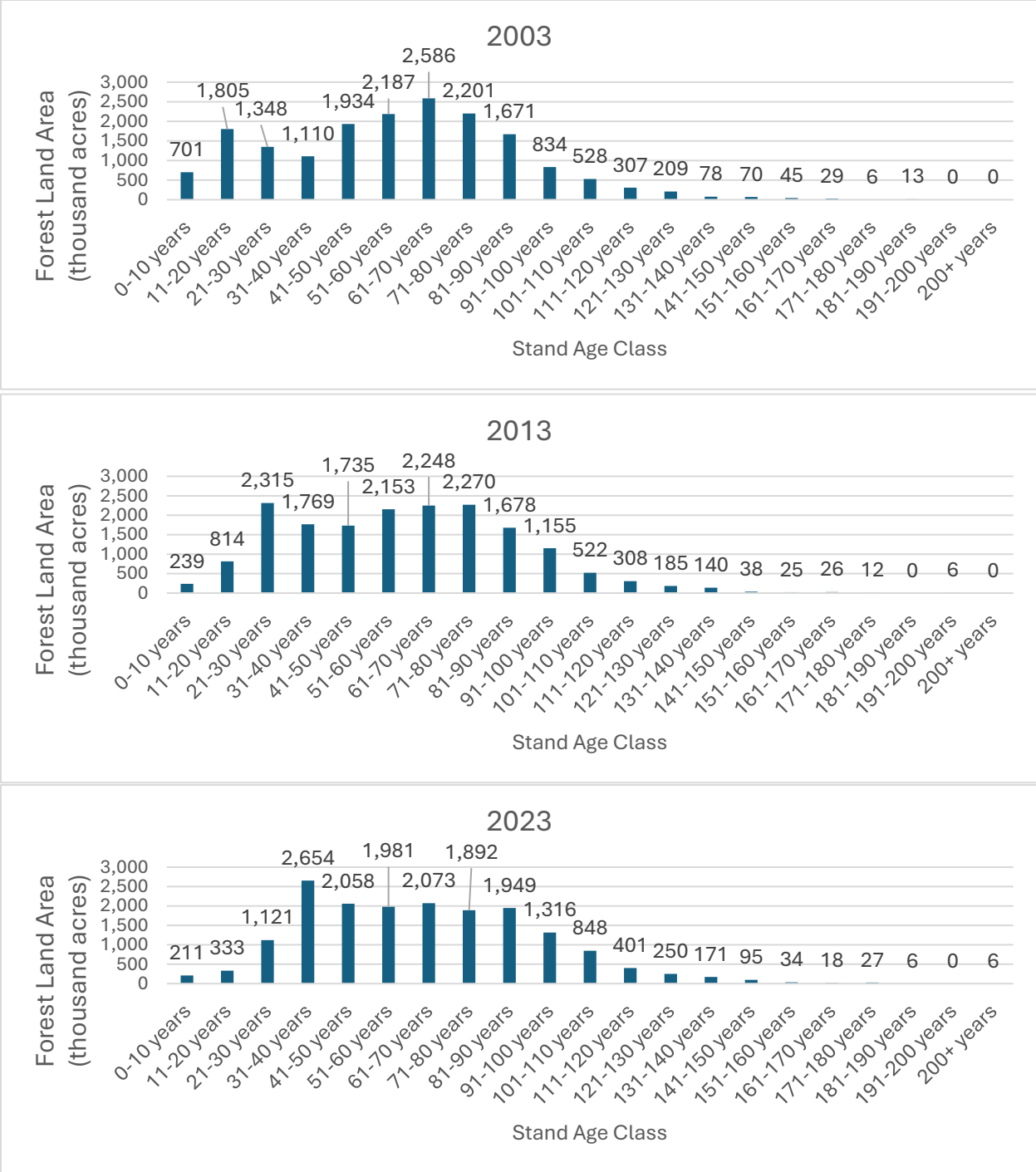


**Figure 3.2. Forest type group area (million acres) and representation (%) in four megaregions, 2023, 2013, and 2003 (USDA-FS-FIA 2025). Megaregions vary greatly in acres (acres).**

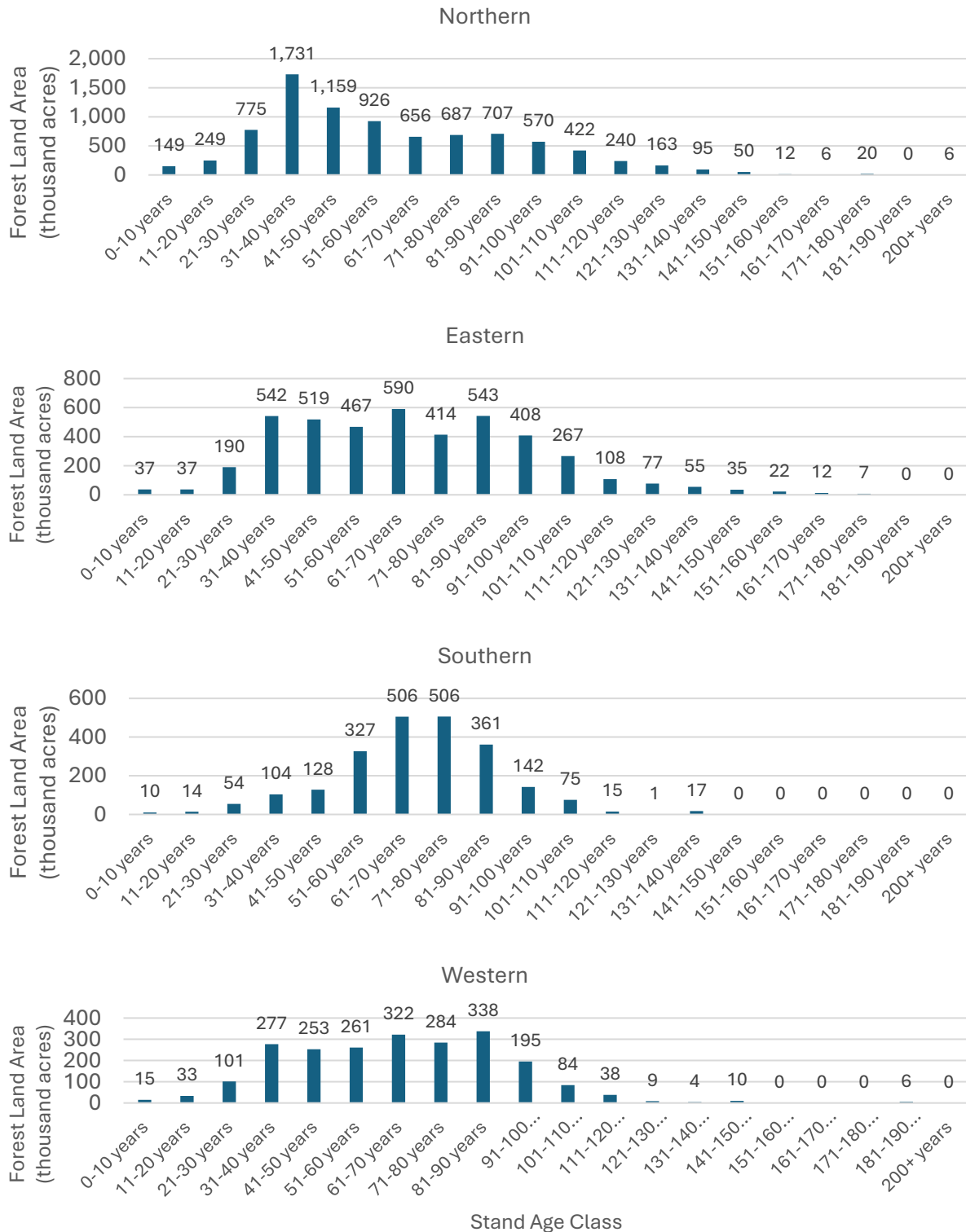
### **3b. Forest age class distributions**

Maine's forests range in age from newly regenerated seedling stands to stands over 150 years old (Figure 3.3). Over the last 3 inventory cycles, the distribution of age classes has remained relatively stable, with a slight decline in young stands less than 20 years old. However, forests older than 100 years continue to be much less common than younger forests. As noted in the 2020 State Forest Action Plan, these late-successional and old growth forests are perhaps the most vulnerable forest habitats in Maine, with old forests increasingly restricted to relatively small reserves, small patches, and areas inaccessible to logging operations. At the same time, old forest habitats are distinguished not only by old ( $\geq 120$  years) trees but also by other variables such as long-lived tree species, coarse woody debris, and canopy structure that is made complex by multiple layers and large limbs. Old forests are also often characterized by trees of large sizes, though many old forests may be composed of smaller, old trees, particularly of slow-growing species or on poor sites. The decadal shifts from young to mid-age classes are also evident and indicate a slight decline in early successional habitats.

The distribution of forest age classes varies slightly across the four megaregions (Figure 3.4). In the southern megaregion stands the current structure suggests a shift from younger to middle to older stands. The northern megaregion includes a large number of 30 to 50-year-old stands which likely reflect forest recovery from the last spruce budworm outbreak as well as silvicultural investment in planting in the same period. The northern and eastern megaregions have a slightly greater percentage of older (more than 110 years old) forest than the southern or western megaregions.



**Figure 3.3. Changes in Forest Age Class Distribution, 2003, 2013, and 2023** (source: USDA-FS-FIA 2025). The area (thousand acres) presented for each of 20 forest age classes.



**Figure 3.4. Regional Differences in Forest Age Distribution for four megaregions, 2023** (source: USDA-FS-FIA 2025). The area (thousand acres) is indicated for each of 20 forest age classes. Note: the y-axes of graphs for each megaregion are different.

### 3c. Forest Stand Size Classes

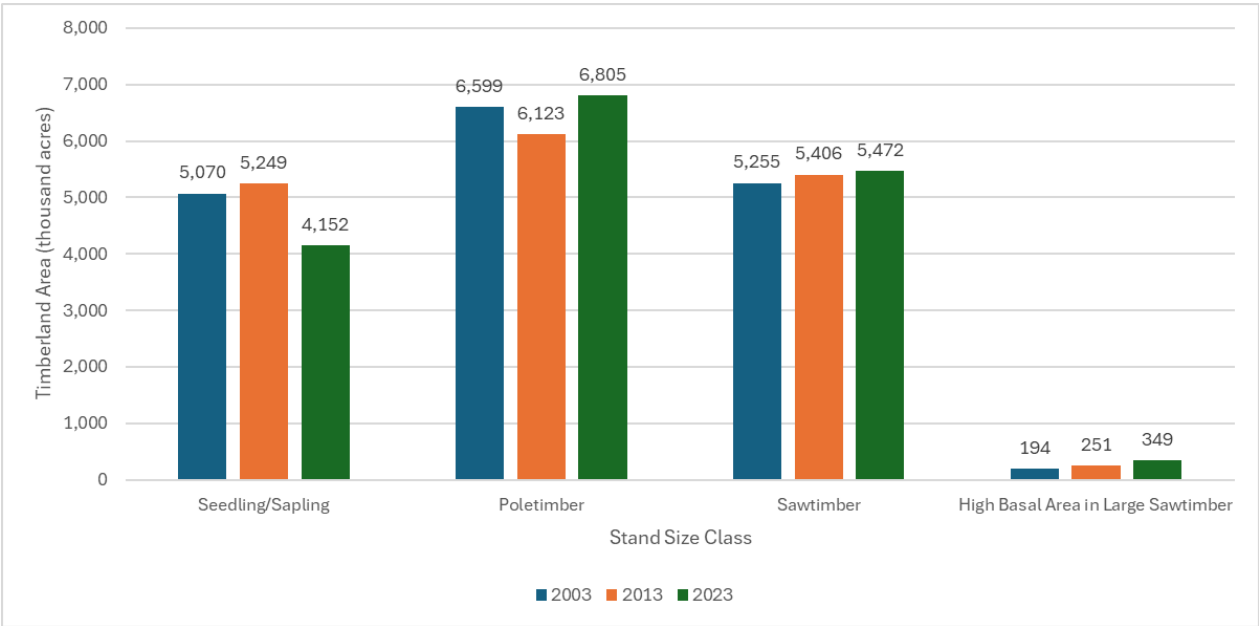
Forest stands frequently include trees of a wide range of diameters and can be assigned to a stand size class based on the prevailing tree sizes present.<sup>2</sup> Stand size class terms – seedlings, saplings, poletimber, sawtimber – reflect merchantability classes based primarily on diameters, but are also meaningful for describing forest stand structures that reflect key forest habitat elements and natural community condition.

Statewide, area in seedling/sapling-sized stands has declined slightly while area in poletimber and sawtimber increased slightly. These shifts parallel the increases in older age classes noted earlier (section 3b).

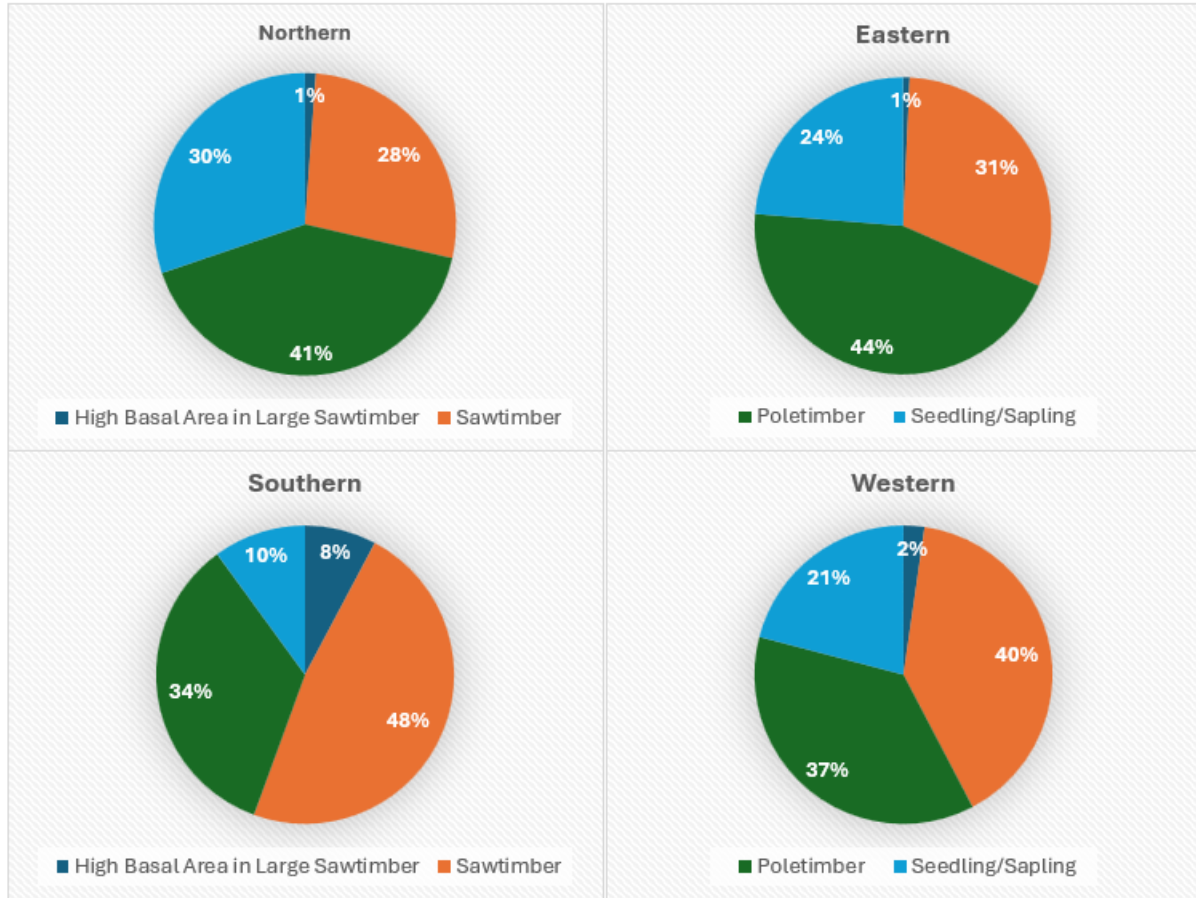
For this analysis, stands dominated by large sawtimber (trees > 16 inches in diameter) were separated and found to be uncommon, though these have also increased slightly in acreage. Note this describes the structure of the stands and does not mean that larger trees themselves are uncommon, since they may occur in stands of smaller overall size classes, though in lower numbers. In addition, size does not directly reflect age, since differences in growing conditions, structures, growth rates and species also influence the occurrence of larger stand size classes. For example, in the southern and western megaregions, the greater abundance of large white pine likely contributes to greater area of sawtimber stand size class. In addition, some “old” forest features and legacies may be found in smaller size class forest stands.

---

<sup>2</sup> Stand size classes assume FIA methodology except when the following criteria is met for the large saw class: over 50% of the basal area is in the large saw size class (over 16”); the condition on the plot has over 100 square feet of basal area; and the condition on the plot was initially classified as sawlog. The non-stocked class is a very small proportion of the land area and combined with the seedling/sapling stand size class (0.0%, 0.1%, 0.1%, and 0.4 % in the western, eastern, northern and southern megaregions, respectively. ) FIA stand-size classes: Seedling/sapling = dominated by trees less than 5.0 inches d.b.h./d.r.c.; Poletimber = dominated by trees 5.0 to 8.9 inches d.b.h./d.r.c. for softwoods and 5.0 to 10.9 inches d.b.h./d.r.c. for hardwoods; Sawtimber = dominated by trees greater than or equal to 9.0 inches d.b.h./d.r.c. for softwoods and 11.0 inches d.b.h./d.r.c. for hardwoods.



**Figure 3.5. Timberland area (percent) in four size classes, 2023** (source: USDA-FS-FIA 2025). The USDA FS FIA methodology was used to estimate area from plots in each size class except for the high basal area in large sawtimber size class. Plots that were (1) sawtimber class, (2) >50% of basal area in saw timber trees (>16 dbh), and (3) >100 square feet of basal area were assigned to the high basal area in large sawtimber size class.



**Figure 3.6. Timberland area (percent) in four size class, by megaregion, 2023** (source: USDA-FS-FIA 2025). The USDA FS FIA methodology was used to estimate area from plots in each size class except for the high basal area in large sawtimber size class. Plots that were (1) sawtimber class, (2) >50% of basal area in sawtimber trees (>16 dbh) and (3) >100 square feet of basal area were assigned to the high basal area in large sawtimber size class.

**Table 3.7. Timberland area (thousand acres) by size class and megaregion, 2023** (source: USDA-FS-FIA 2025). The USDA FS FIA methodology was used to estimate area from plots in each size class except for the high basal area in large sawtimber size class. Plots that were (1) sawtimber class, (2) >50% of basal area in saw timber trees (>16 dbh), and (3) >100 square feet of basal area were assigned to the high basal area in large sawtimber size class.

Megaregion	High Basal Area in Large Sawtimber	Sawtimber	Poletimber	Seedling/Sapling	Total
Eastern	30	1,262	1,826	969	4,087
Northern	97	2,277	3,419	2,508	8,300
Southern	174	1,071	770	225	2,240
Western	49	862	791	450	2,151
Total	349	5,472	6,805	4,152	16,777

## Section 4. Forest timber volume

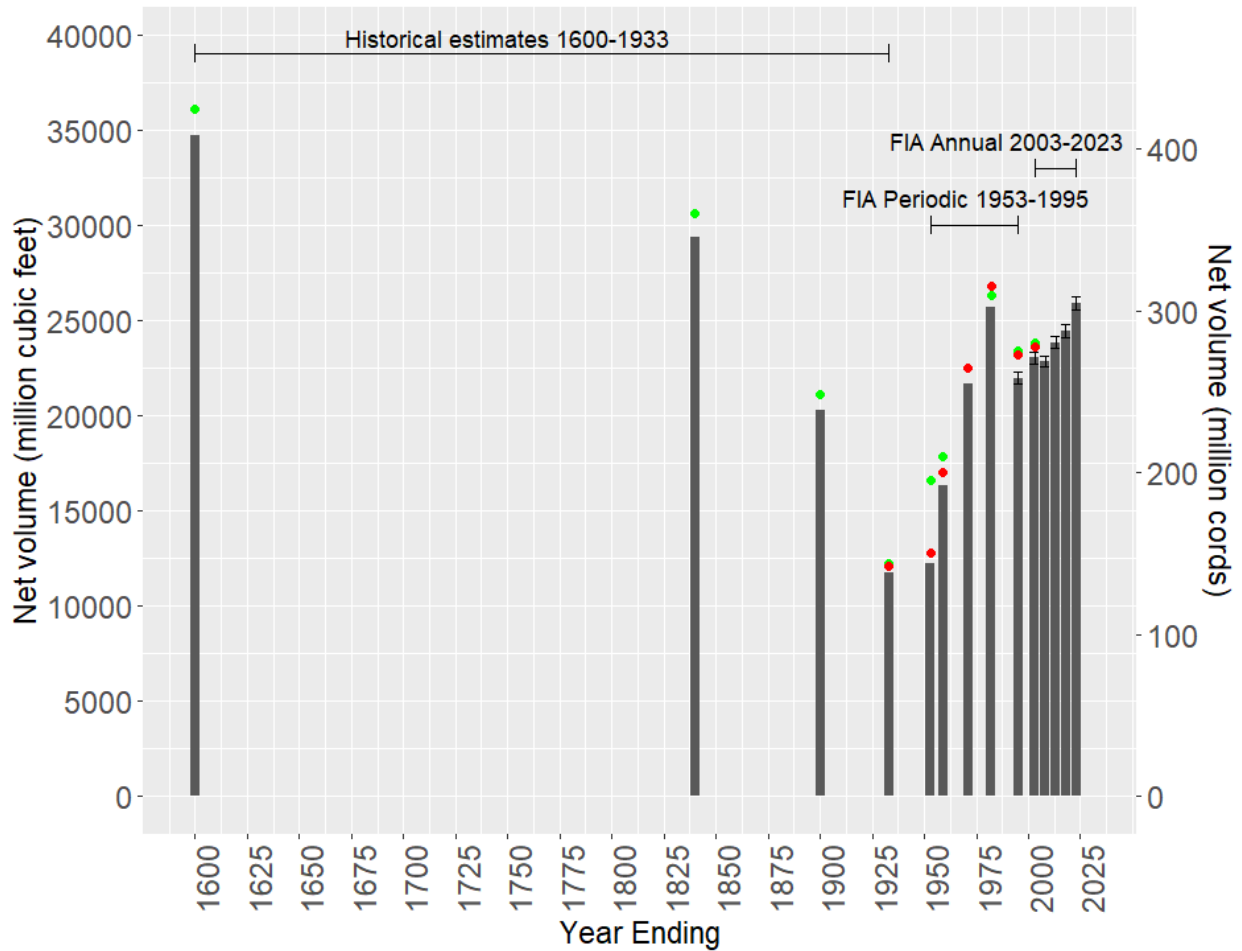
The volume estimates provided in this report use FIA-defined standards to identify specific tree quality and product classes, which may differ from local and regional merchantability standards. The FIA-defined standards including a link to the USDA-FS-FIA reference and other terms can be found in the glossary.

Maine forests continue to increase in total volume of trees (Figure 4.1). Although methodologies have changed slightly since a statewide inventory began in 1959, the total volume of trees has increased due to a number of factors over the past 100 years. From a low total volume in the aftermath of the 1910-1920 spruce budworm outbreak, large wildfires, and high number of acres in agriculture, forests have recovered. The primary reasons for the increase in total volume include reversion of farmland, positive growth rates of young to middle-aged forests, management interventions, and most recently, reduced total harvest.

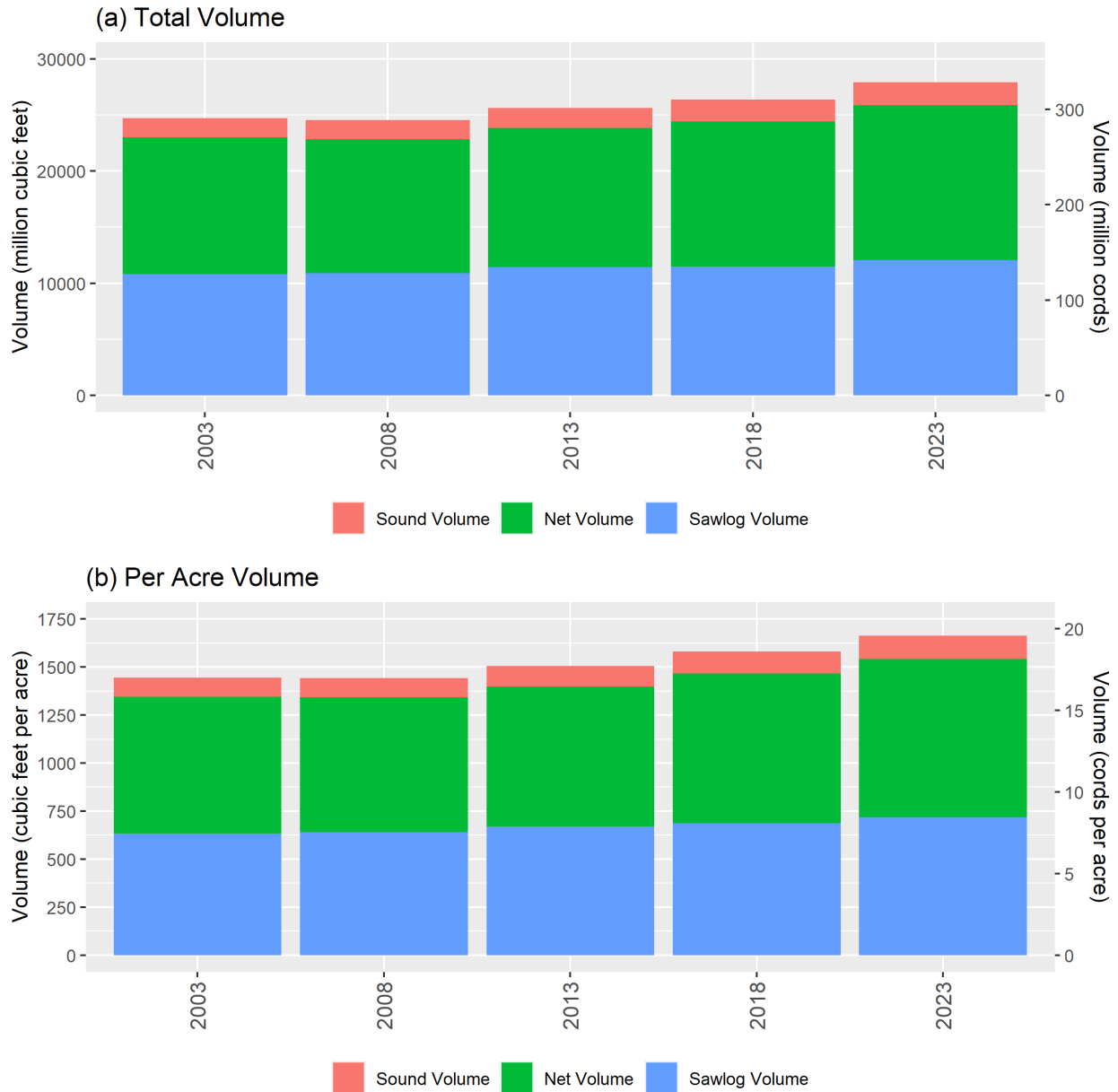
Volume over the last two decades shows a more mixed picture when broken out by species and product classes. Some species have seen decreases in sawlog and overall sound volume, such as sugar maple, beech and some other hardwoods. Other species, including white pine, red/soft maple, eastern hemlock, aspen, ash, and red oak, have increased in volume. Yellow birch has had decreasing sawtimber volume but increasing overall sound volume, Spruce and fir sawtimber volumes are mostly flat, though overall sound volume of fir is increasing.

Whether these changes in recent decades represent trends that will continue is uncertain and dependent on markets and resulting harvest levels as well as forest health, including insect, disease and weather events. Regeneration of forests is relatively assured, though both species composition and volume growth can be influenced by intensive management such as planting, competition control, pre-commercial thinning and other interventions. Management activities to modify stand conditions, such as commercial thinning in intermediate-sized stands, may also play a significant role, especially given the prevalence statewide of this condition. Various silvicultural thinning approaches can maintain or enhance growth rates and stem quality, control relative proportions of key species, and address forest health impacts. These same techniques can be applied to enhance future timber value and volume, but also to maintain resilience of stands in the face of climate change, enhance wildlife habitats, or influence aesthetic or recreational values. Markets for smaller diameter trees are essential for making such treatments financially viable.

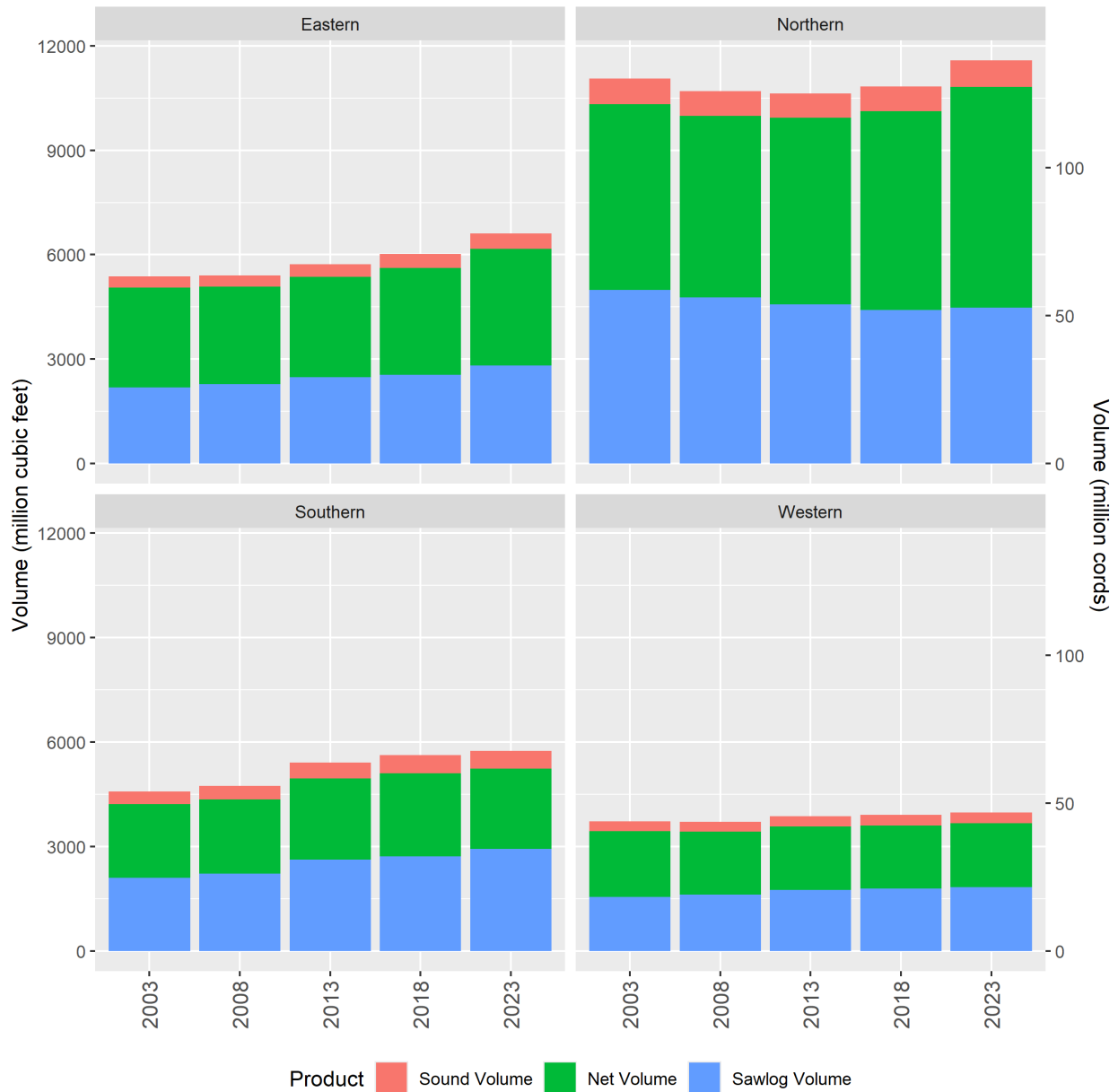
As with stand size class, there are significant differences in stand volume between megaregions, based on species, stand history, harvest levels, and forest health impacts.



**Figure 4.1. Historic Net Wood Volume estimates, 1600 to 2023** (sources: Net volume for years from 2003 to 2023 were estimated from USDA FS FIA data based on pulpwood-or-better quality trees on timberland (source: USDA-FS-FIA 2025). Net volume for year from 1600 to 1997 were estimated from the 2005 State of the Forest report (MDC MFS 2005). Years with red dots (1600 to 2000) were interpolated from Figure 11 of the report. Years with green dots (1928 to 2000) were interpolated from Figure 12). Standard error bars are only included forest wood volumes in the years with annual inventory data.



**Figure 4.2a, b. (a) Total volume (million cubic feet and million cords) and (b) volume (cubic feet and cords) per acre for all species, by FIA stem quality on timberlands, 2003, 2008, 2013, 2018, 2023 (source: USDA-FS-FIA 2025). The total volume is sawlog volume plus the portion of net volume, which includes sawlog volume. Sound volume is depicted as the sawlog volume plus the net volume that is not sawlog volume plus portion of the sound volume not accounted for by the sawlog or net volume. The right-hand axis is in cords using a conventional conversion factor of 85 cords per cubic feet. Definitions of FIA stem quality can be found in the glossary.**

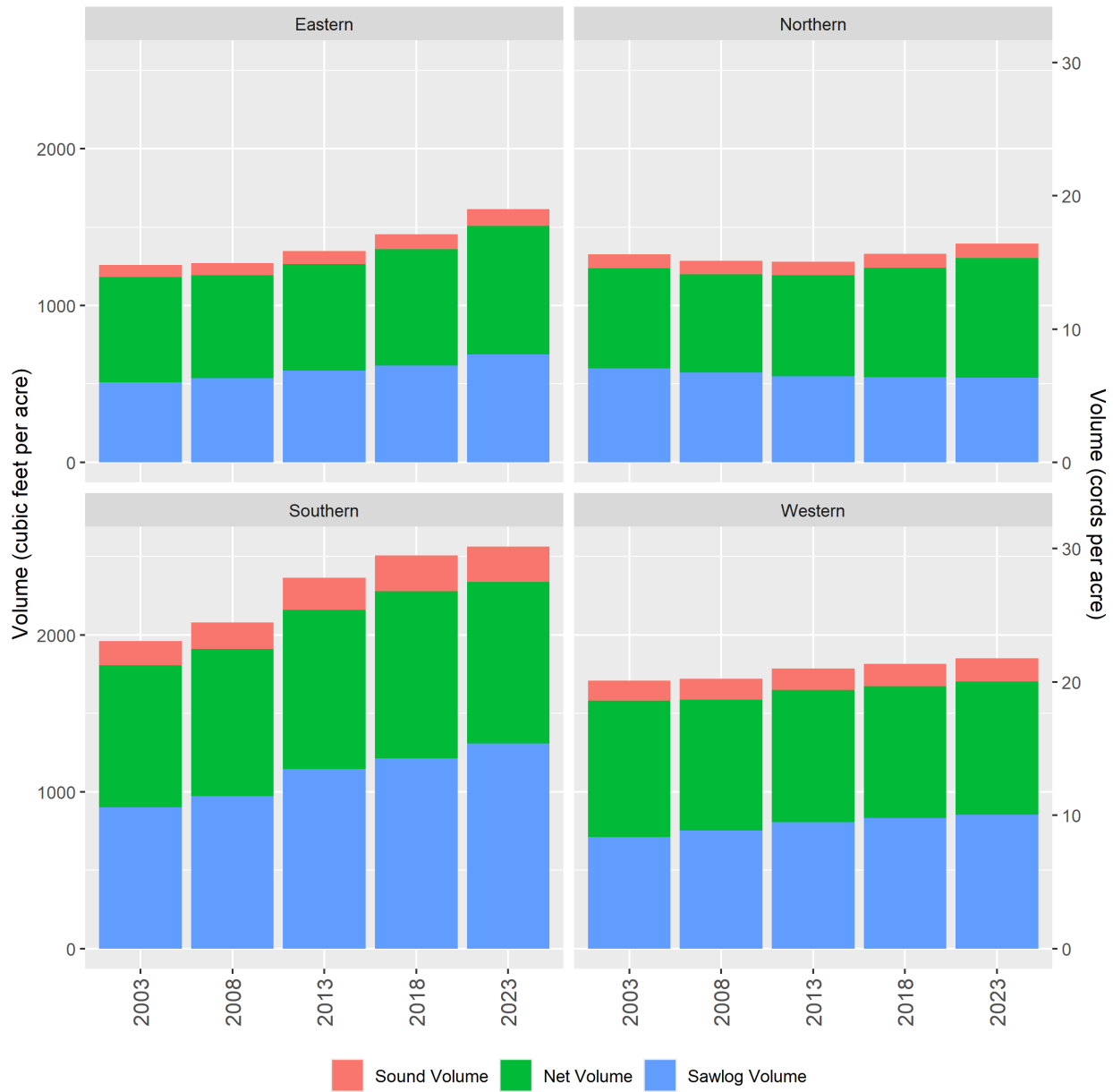


**Figure 4.3. Total volume for all species by megaregion, stem quality, and year on timberlands, 2003, 2008, 2013, 2018, 2023** (source: USDA-FS-FIA-2025). The total volume is sawlog volume plus the portion of net volume, which includes sawlog volume. Sound volume is depicted as the sawlog volume plus the net volume that is not sawlog volume plus portion of the sound volume not accounted for by the sawlog or net volume. The right-hand axis is in cords using a conventional conversion factor of 85 cords per cubic feet. Definitions of FIA stem quality can be found in the glossary.

**Table 4.1. Sound volume, net merchantable volume, and sawlog volume (million cubic feet) for all species by region (megaregion and statewide) for timberland, 2003, 2008, 2013, 2018,**

**2023** (source: USDA-FS-FIA-2025). FIA definitions of sound volume, net merchantable volume, and sawlog quality can be found in the glossary.

Megaregion	Year				
	2003	2008	2013	2018	2023
Sound Volume (million cubic feet)					
Northern	11,061	10,695	10,634	10,829	11,581
Eastern	5,368	5,401	5,720	6,013	6,602
Southern	4,579	4,739	5,412	5,619	5,743
Western	3,719	3,710	3,872	3,904	3,979
Statewide	24,728	24,545	25,639	26,365	27,905
Net Merchantable Volume (million cubic feet)					
Northern	10,317	9,987	9,933	10,115	10,822
Eastern	5,047	5,075	5,368	5,619	6,165
Southern	4,224	4,353	4,948	5,103	5,234
Western	3,439	3,425	3,574	3,597	3,661
Statewide	23,026	22,840	23,823	24,434	25,882
Sawlog Volume (million cubic feet)					
Northern	4,988	4,768	4,576	4,411	4,482
Eastern	2,184	2,282	2,479	2,552	2,812
Southern	2,106	2,219	2,623	2,718	2,927
Western	1,546	1,622	1,746	1,789	1,834
Statewide	10,823	10,890	11,425	11,471	12,055

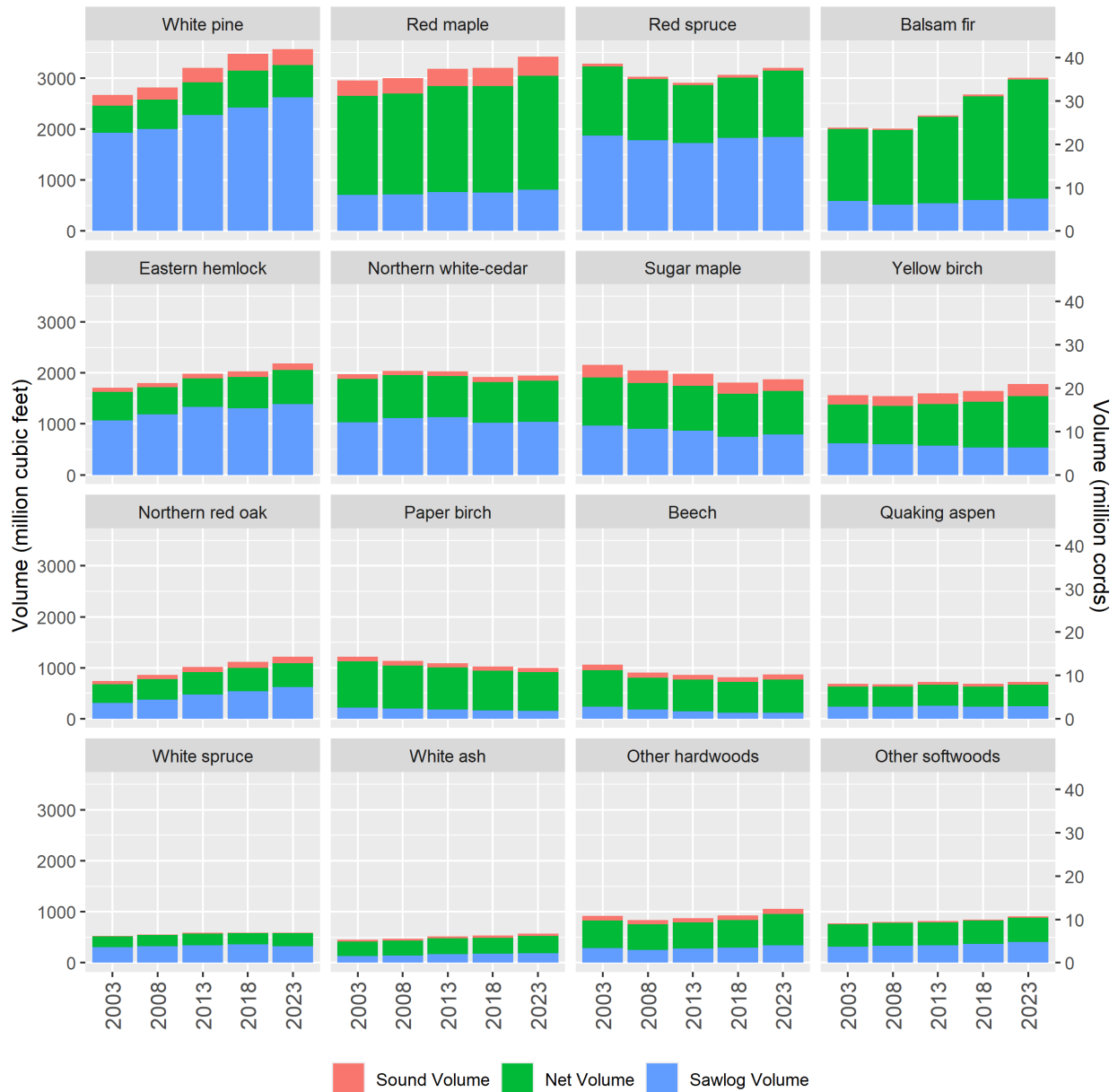


**Figure 4.4. Total volume (cubic feet or cords) per acre for all species by megaregion, stem quality, and year on timberlands (USDA-FS-FIA, 2025).** The right-hand axis is in cords using a conventional conversion factor of 85 cords per cubic feet. The total volume shown here is sound volume which includes net volume, which includes sawlog volume (i.e., the estimate of sound volume as shown here is the sawlog volume plus the remaining net volume plus the remaining sound volume). Please see the glossary for definitions for each volume classification.

**Table 4.2. Total volume (cubic feet per acre) for all species by megaregion (and statewide), stem quality, and year on timberlands, 2003, 2008, 2013, 2018, 2023 (source: USDA-FS-FIA 2025).**

FIA		2003	2008	2013	2018	2023
Megaregion						

Sound Volume (cubic feet per acre)					
Northern	1,327	1,284	1,278	1,329	1,395
Eastern	1,257	1,270	1,347	1,453	1,615
Southern	1,959	2,079	2,363	2,508	2,564
Western	1,710	1,719	1,786	1,816	1,850
Statewide	1,445	1,442	1,506	1,581	1,663
Net Merchantable Volume (cubic feet per acre)					
Northern	1,238	1,199	1,193	1,242	1,304
Eastern	1,182	1,193	1,264	1,358	1,508
Southern	1,808	1,910	2,161	2,278	2,336
Western	1,581	1,587	1,649	1,673	1,702
Statewide	1,345	1,342	1,399	1,465	1,543
Sawlog Volume (cubic feet per acre)					
Northern	599	572	550	542	540
Eastern	511	536	584	617	688
Southern	901	973	1,145	1,213	1,307
Western	711	751	806	832	853
Statewide	632	640	671	688	719

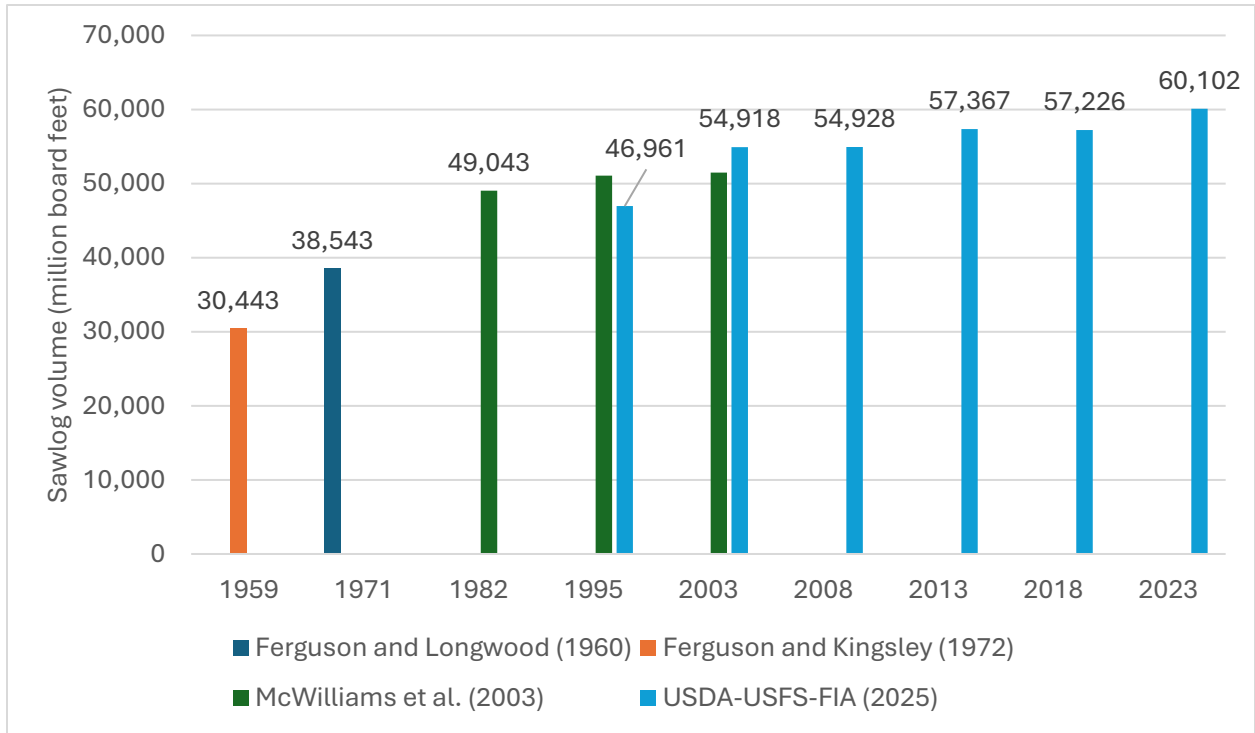


**Figure 4.5. Total volume by species group, stem quality, and year on timberlands, 2003, 2008, 2013, 2018, 2023** (source: USDA-FS-FIA 2025). The right-hand axis is in cords using a conventional conversion factor of 85 cords per cubic foot. The total volume shown here is sound volume which includes net volume, which includes sawlog volume (i.e., the estimate of sound volume as shown here is the sawlog volume plus the remaining net volume plus the remaining sound volume). Please see the glossary for definitions for each volume classification.

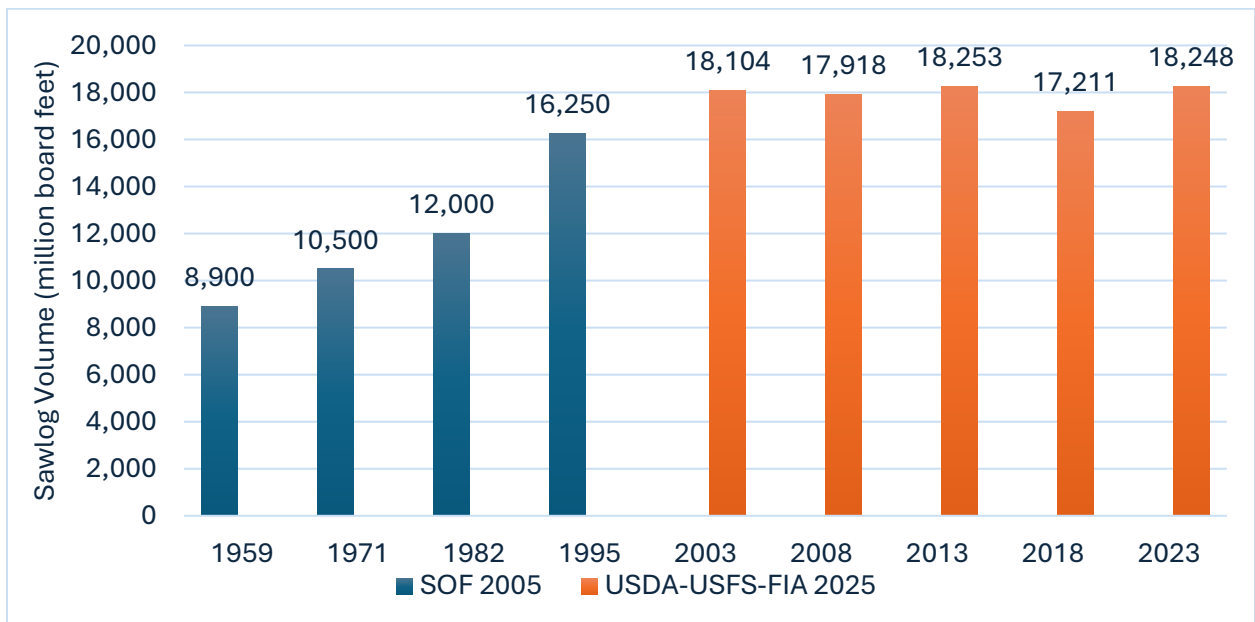
**Table 4.3. Volume by species, 2023 (million cubic feet** (source: USDA-FS-FIA 2026). *Sawlog Ratio is the sawlog volume: net volume, on a timberland basis.*

Species	Sound	Net	Sawlog	Sawlog Ratio
White pine	3,562	3,251	2,619	0.806
Red maple	3,421	3,042	805	0.265
Red spruce	3,198	3,145	1,844	0.586
Balsam fir	3,007	2,969	634	0.214
Eastern hemlock	2,181	2,059	1,386	0.673
Northern white-cedar	1,947	1,847	1,040	0.563
Sugar maple	1,875	1,645	792	0.481
Yellow birch	1,784	1,548	533	0.344
Northern red oak	1,218	1,086	627	0.577
Paper birch	994	917	155	0.169
Beech	873	772	123	0.159
Quaking aspen	723	666	244	0.366
White spruce	589	577	327	0.567
White ash	573	526	183	0.348
Other hardwoods	1,052	952	338	0.355
Other softwoods	909	880	403	0.458

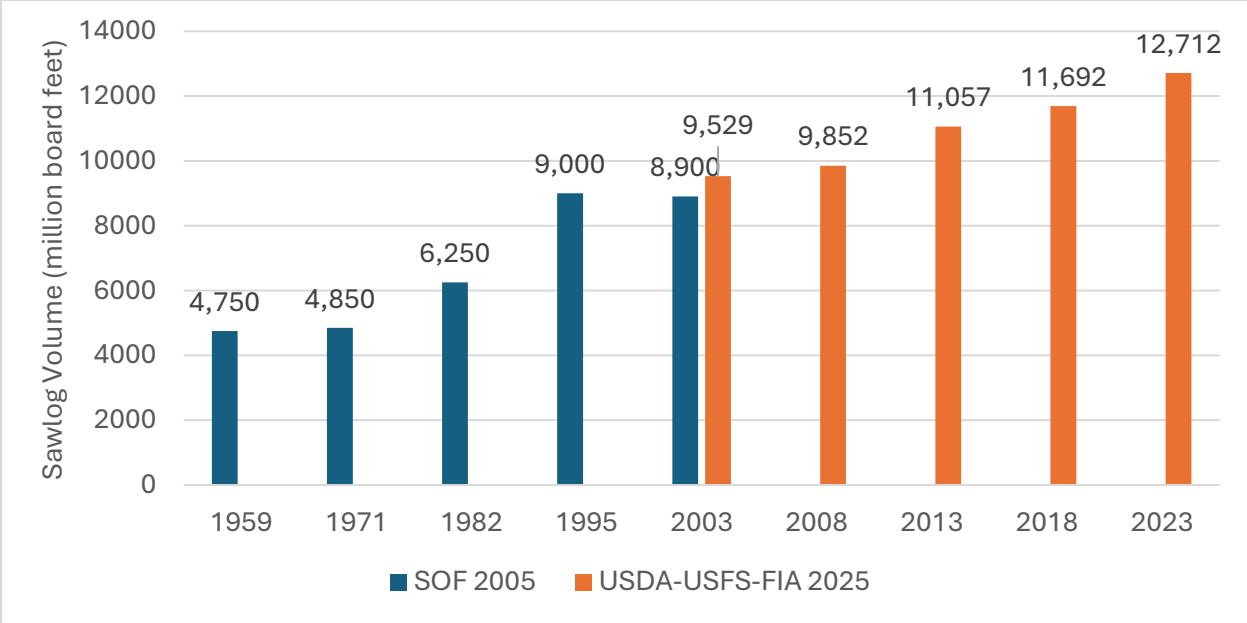
**Figure 4.6. Sawlog Volume for Major Species Groups and Individual Species (1959 to present)**



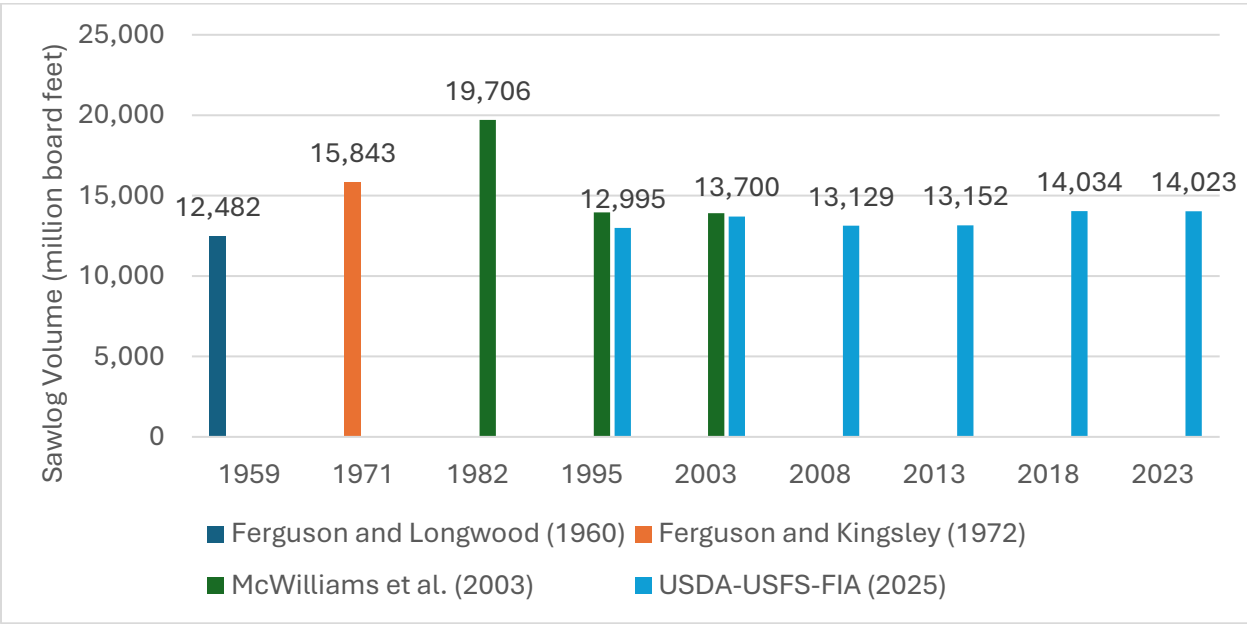
**Figure 4.7. All species sawlog wood volume (million board feet) for sawtimber trees for select years from 1959 to 2023 (source: USDA-FS-FIA 2025).**



**Figure 4.8. Mixed hardwood sawlog wood volume (million board feet, 1959-2023).**



**Figure 4.9. White pine sawlog wood volume** (million board ) for select years from 1959 to 2023 (sources: State of the Forest Report USDA-FS-FIA 2025).



**Figure 4.10. Spruce-fir sawlog wood volume (million board feet) for select years from 1959 to 2023** (sources: Ferguson and Longwood 1960, Ferguson and Kingsley 1972, McWilliams et al., 2003, USDA-FS-FIA 2025).

## Section 5. Forest growth, removals, and mortality

### 5.1 Statewide trends

Maine's diverse forests are dynamic, accumulating volume over time through stem growth and establishment of new seedlings and saplings and losing volume through natural mortality and harvest. Net forest growth is equal to gross growth minus mortality. Since 2013, Maine's growing stock net growth has ranged from 600 million to 700 million cubic feet annually in the last decade, significantly exceeding growth rates of the 1980s to the early 2000s (Figure 5.2).

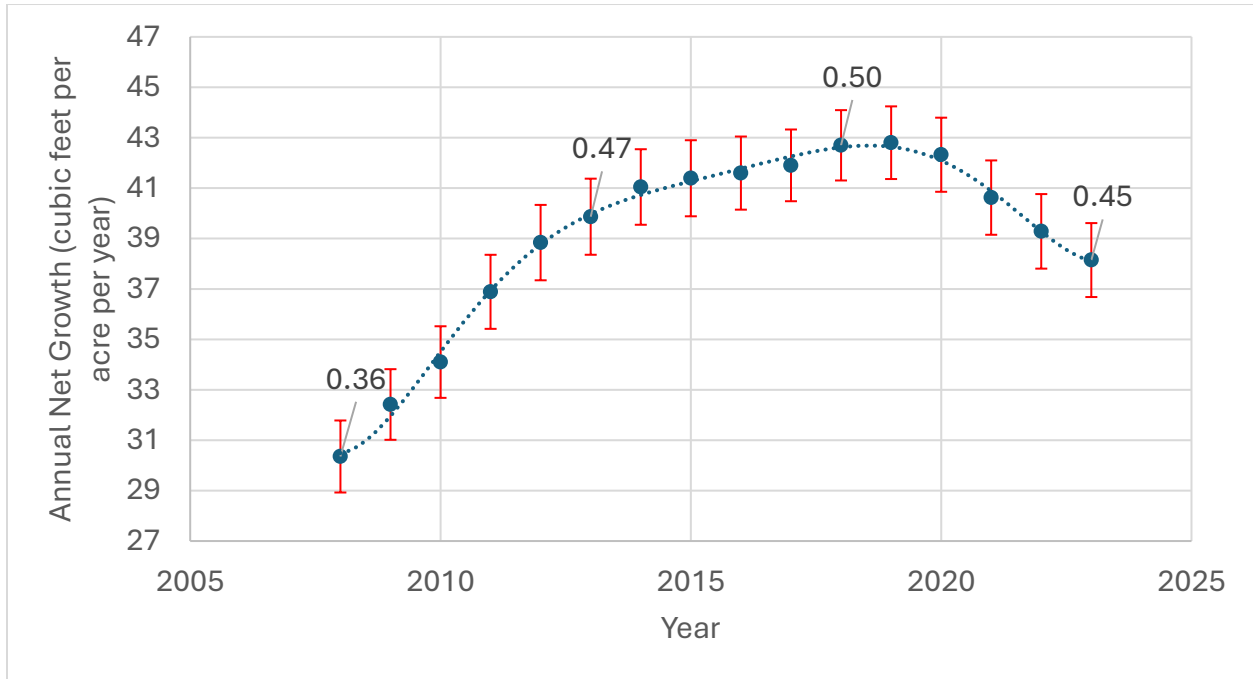
Statewide growth is perhaps mostly directly represented by comparing it to statewide removals. Throughout the last century, the growth-to-removals ratio has fluctuated markedly (Figure 5.1). The nadir in the mid-1990s was when growth was just under 80% of harvest, perhaps for the first time in decades, and clearly not sustainable. The spruce budworm outbreak of the 1970s and 1980s and the resulting mortality likely played a large role in this imbalance.

In part in response, the 2005 State of the Forest report recommended a minimum threshold of a 1:1 (=1.0) ratio of growth to harvest. That threshold was exceeded in 2008 and has remained above 1.0 ever since, reaching a statewide average of 1.55 in 2023. Statewide, growth has exceeded harvest removals across three volume classifications (sound volume, growing stock volume, and sawlog volume) since 2013 (Figure 5.3). The ratio also exceeds one in all megaregions, though the northern and western megaregions have stayed closer to 1.0, not rising as rapidly in the north, and declining slightly in the west (Figure 5.4). This is a marked contrast to the rapid increase in growth-to-harvest in the eastern megaregion and the relatively high (though somewhat reduced) ratio in the southern region. Both likely reflect lower harvest levels in these areas, particularly due to reductions in wood processing capacity in the southern half of the state.

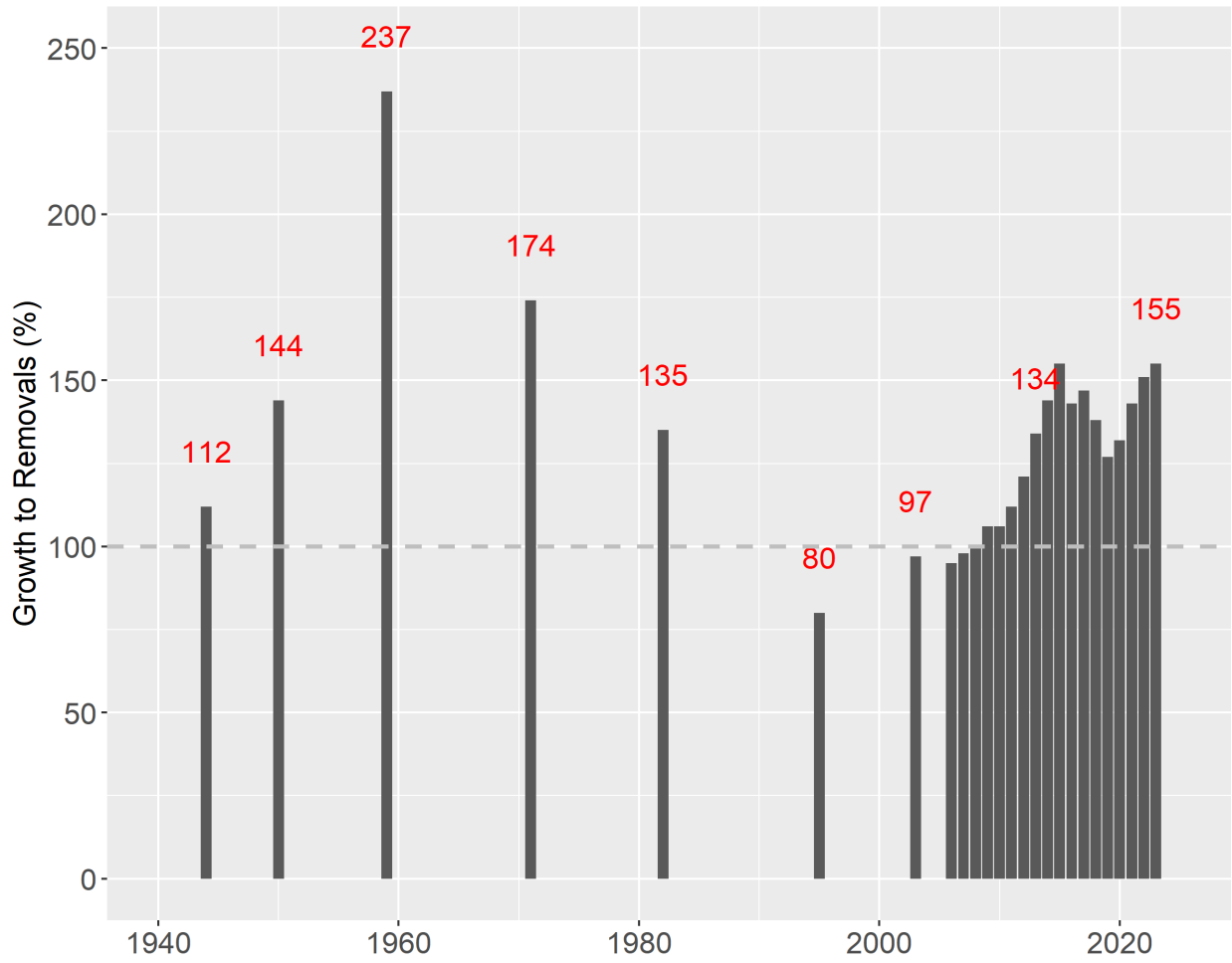
Mortality is regular part of all forest ecosystems – forest stands are dynamic, and a range of factors from insect and disease to weather impacts occur at multiple scales. Average annual mortality is relatively stable across the landscape, amounting to 15-20 cubic feet per acre (figure 5.5). Not surprisingly, shorter-lived but abundant tree species that are more susceptible to disease and insect predation constitute the largest proportions of mortality – especially balsam fir, aspen, birch, and soft/red maple (Figure 5.6). To a large extent, forest regeneration occurs naturally, with these same species among the most abundant and prolific (Figure 5.10). Current forest health concerns include multiple non-native pests and diseases, as well as native pests such as resurgent spruce budworm populations and weather damage related to climate change. These conditions are documented in much greater depth in the 2025 MFS Forest Health Conditions Report.

Timber supply projections suggest that growth can continue to exceed harvest, and inventories should continue to increase for the next two to four decades. A number of factors may disrupt the assumptions built into those projections, which modelled steady demand for wood products and stable harvests based on 2018 harvest levels, as well as stable forest health conditions. In fact, declines in harvest in response to wood markets, increases in spruce budworm activity, and insect, disease, and climate change impacts affecting forest health more generally, juxtaposed with intensive management efforts and forest carbon credit sales, have increased uncertainty about future wood supplies and sustainable harvest levels. New efforts to model timber supply (including those incorporating forest carbon) are being developed that may be able to project available timber

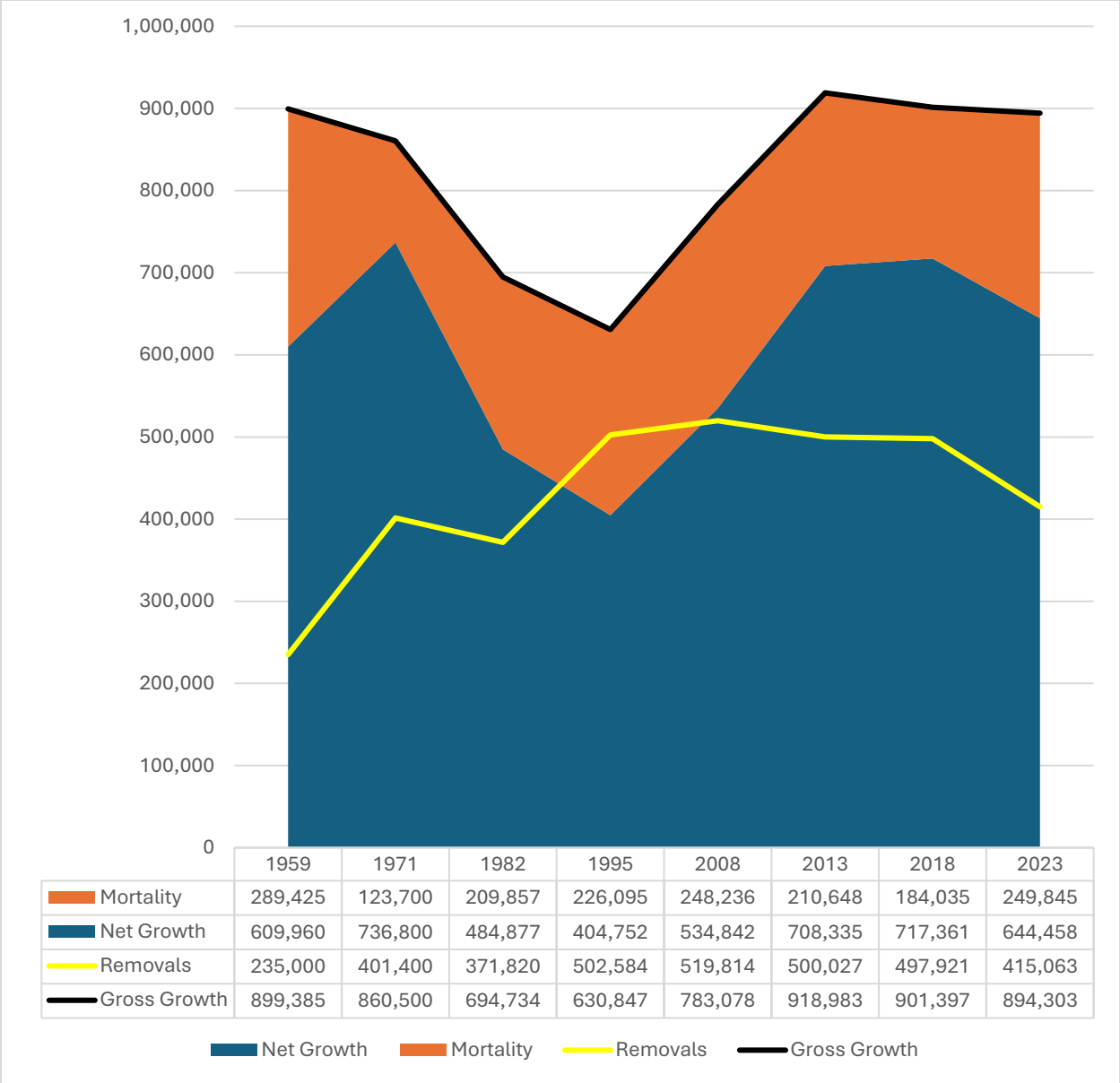
supplies in a range of scenarios, ideally incorporating factors including natural disturbance events as well as market shifts.



**Figure 5.1. Average Annual Net Growth (cubic feet per acre per year) on timberlands, 2008-2023** (source: USDA-FS-FIA 2026). Error bars represent 95% sampling error. Labels, at the end of each complete cycle are in cords/acre/year assuming a conversion of 85 cubic feet per cord.



**Figure 5.2. Long-term growing stock growth-to-removals (harvest and other) percentages for timberland for select years from 1944 to 2023** (source: USDA-FS-FIA 2025; additional periodic data sources are described in Part IV; Source Data).



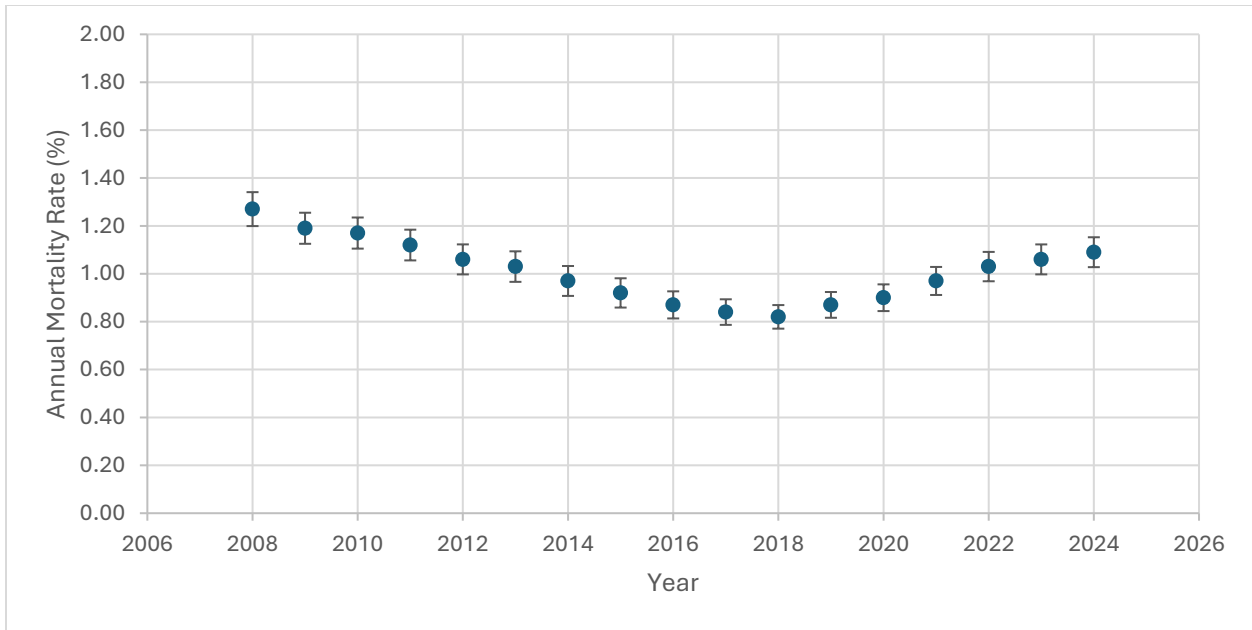
**Figure 5.3. Gross growth, net growth, harvest removals, and mortality, on growing stock trees (thousand cubic feet) for select years from 1959 to 2023 (source: USDA-FS-FIA 2025; additional periodic data sources are described in Part IV; Source Data).**



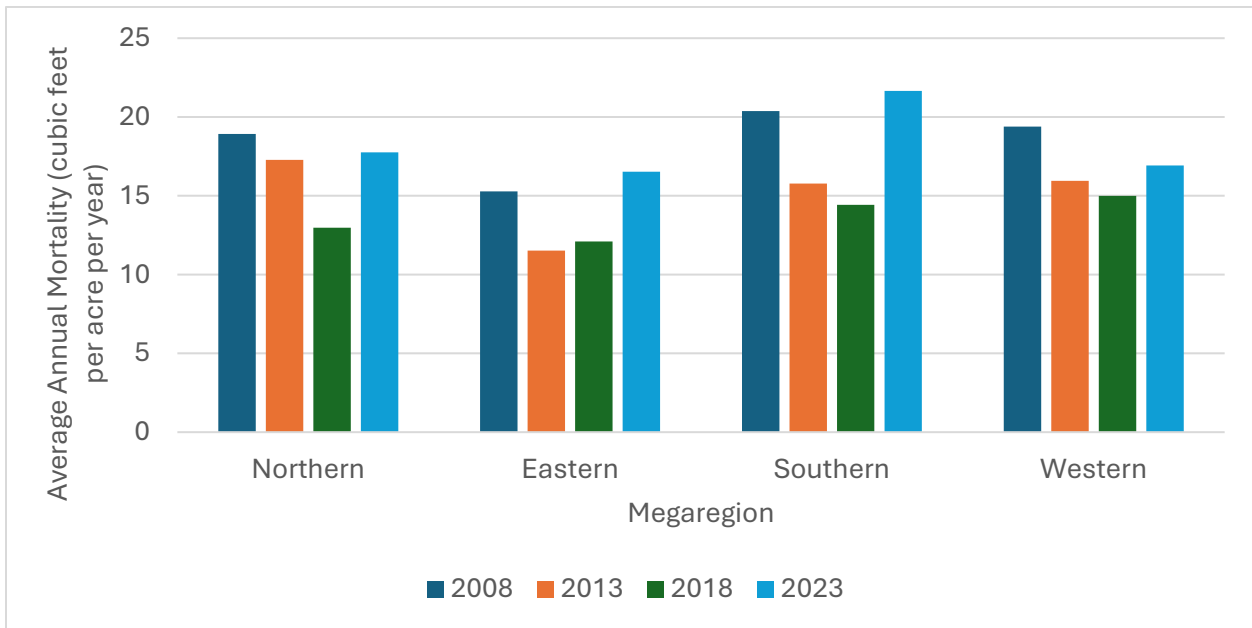
**Figure 5.4. Statewide growth to harvest removals percentages on timberlands for volume classifications, all sound volume (including growing stock), growing stock (which includes sawlog), and sawlog volume alone, for 2008, 2013, 2018, and 2023 (source: USDA- FS-FIA 2025).**



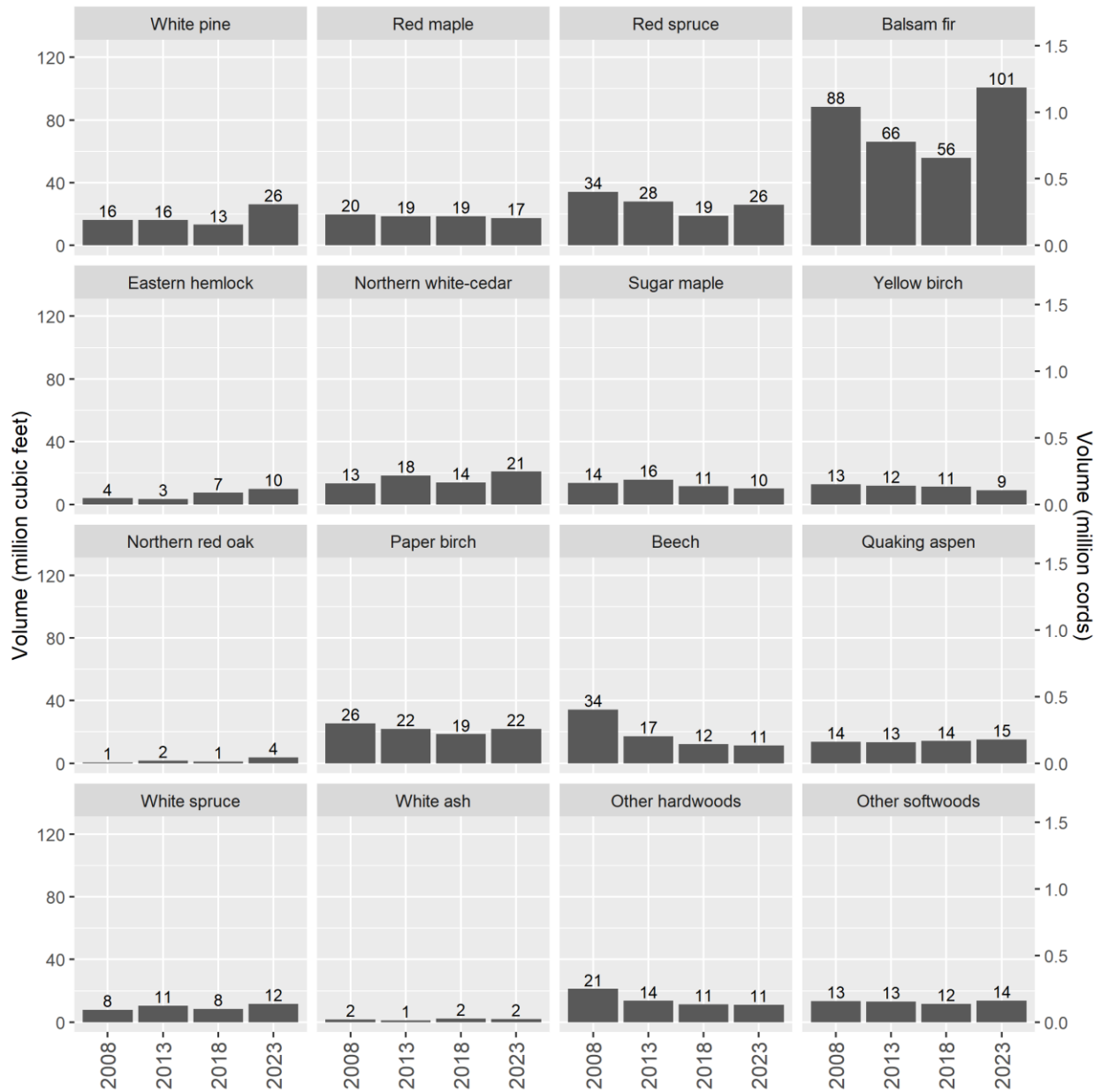
**Figure 5.5. Growth-to-harvest removal percentages on timberlands for all growing stock (which includes sawlog), and sawlog volume alone, and sound volume (including growing stock), by megaregion for 2008, 2013, 2018, and 2023 (USDA-FS-FIA 2025).**



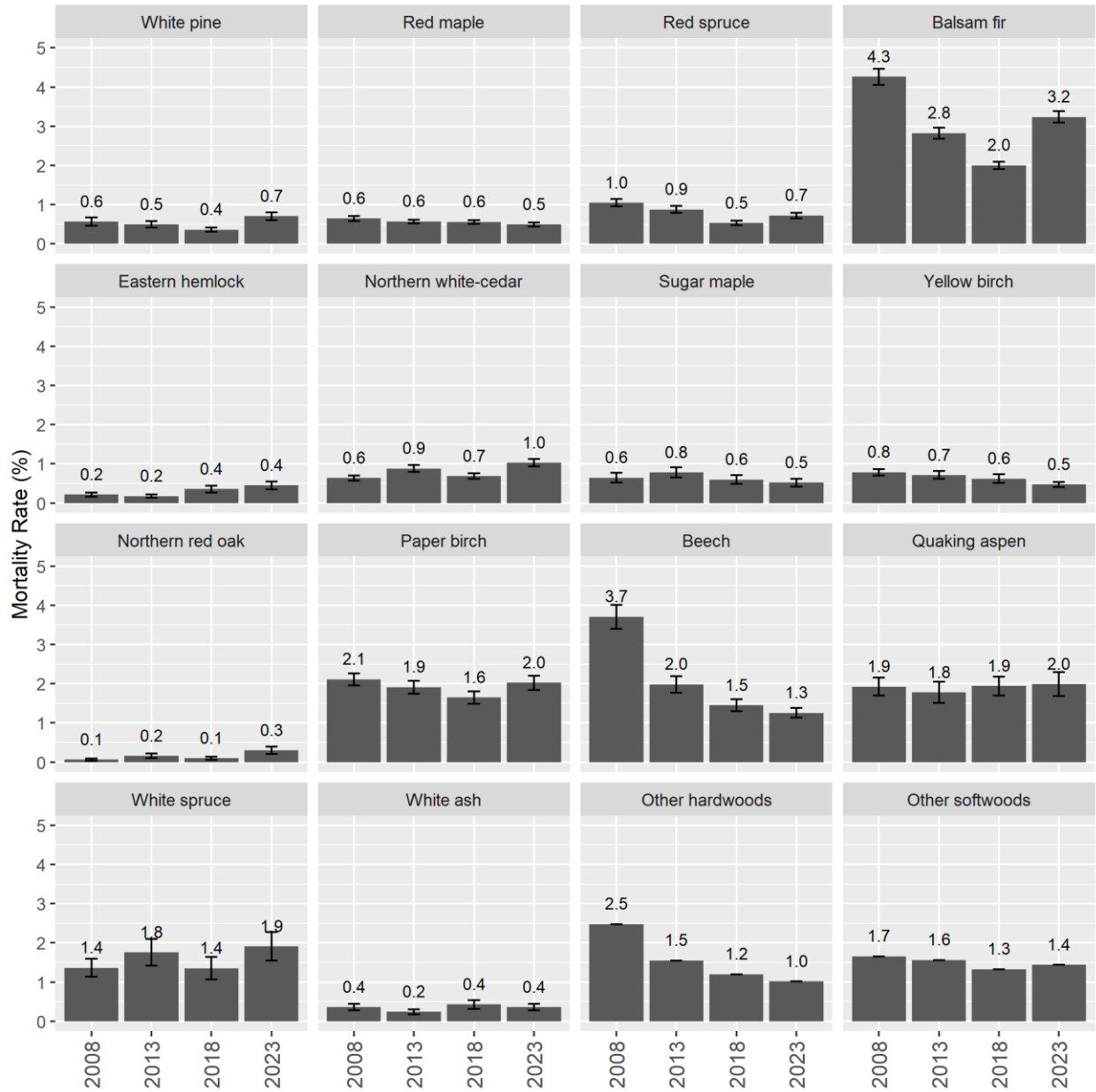
**Figure 5.6. Average annual mortality rates for sound bole wood volume on forest land (average annual mortality (cubic feet per year)/ time 2 volume (cubic feet)\*100%). Error bars represent 95% confidence intervals (source: USDA-FS-FIA 2025).**



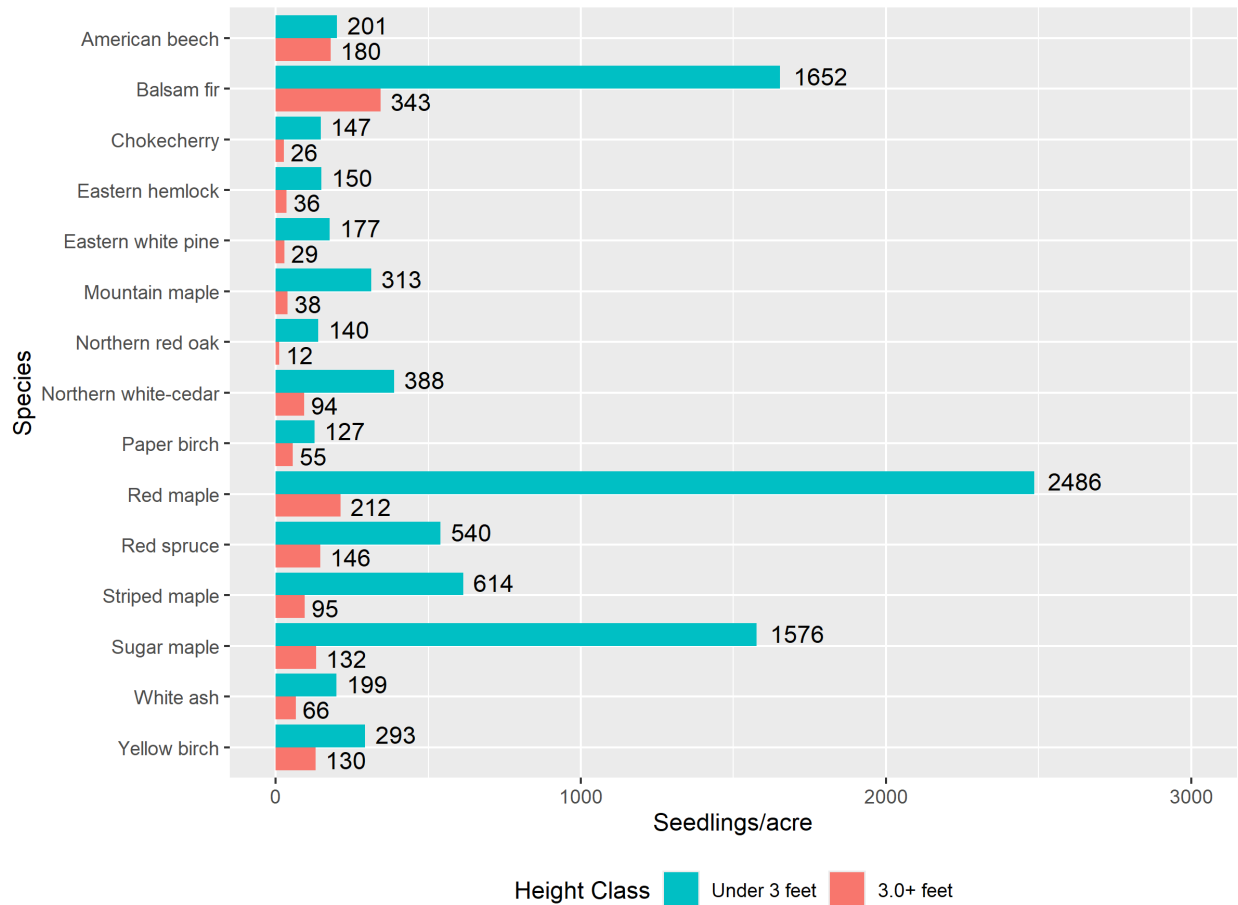
**Figure 5.7. Average annual mortality (cubic feet per acre per year) of sound bole wood volume on forest land by megaregion for 2008, 2013, 2018, and 2023 (source: USDA-FS-FIA 2025).**



**Figure 5.8. Average annual mortality of sound bole wood volume for 16 important commercial tree species on or species groups forest land for 2008, 2013, 2018, and 2023 (source: USDA-FS-FIA 2025).** The left-hand axis and labels are in units of million cubic feet, the right-hand axis is in units of million cords.



**Figure 5.9. Average annual mortality rate for sound bole wood volume for 16 important commercial tree species or species groups on forest land for 2008, 2013, 2018, and 2023** (source: USDA-FS-FIA 2025). The average annual mortality / time 2 inventory \*100). Estimates were based on plots that were forestland at the beginning and end of the remeasurement period. Error bars represent 68% confidence level.



**Figure 5.10. Number of tree seedlings per acre for the 15 most abundant tree species for two height classes on forest land, 2023** (sources: USDA-FS-FIADB 2025, Burrill est al. 2024). Tree seedlings are at least 2 inches tall and have a dbh that is less than a 1 inch.

## Section 6. Forest Harvest

The amount of timber harvesting occurring is derived from three data sources. First, Maine landowners are required by statute to report harvesting and related silvicultural activities (such as planting and precommercial thinning) annually. In addition, Maine’s wood processing facilities, from firewood sellers to sawmills to pulp and paper mills, are similarly required to report roundwood (unprocessed logs received) to the state. Data from individual landowners and mills are confidential by statute, but summary reports are generated annually by MFS. Finally, approximately 3500 permanent FIA plots are resampled every 5 years, revealing where harvest activity has occurred since the previous inventory, thus providing estimates of acreage and volumes harvested. These data sources result in slightly different estimates of annual harvesting.

Both timber harvest acres and volumes have declined, though acres have fallen more dramatically.

Total acres harvested for timber per year have declined by over 40% (from over 500,000 acres to just over 255,000 acres) from 2003 and 2023. These declines have occurred in all megaregions and

ownership types, although declines were smaller for some megaregions and ownership types. The northern megaregion is the largest in area and continues to have the most acres of harvest annually, despite a significant decline. Declines in harvesting are primarily a response to declining demand for wood products and related mill closures.

Harvest practices have also changed over the last two decades. Both partial harvesting and initial shelterwood harvests have declined, though final shelterwood harvests (which would include final overstory removal or OSR harvests) have fallen proportionally less, and clearcut acres have remained relatively steady at approximately 23,000 acres annually. Harvests undertaken to convert forest land to non-forest use (e.g., agriculture, residential development, commercial development, or utility development [e.g., solar fields]) are of a magnitude that is inconsequential at the statewide level, ranging from 3000 to 6000 acres annually, though such conversion may be impactful in terms of overall forest values at the local or community level.

5a. Harvest Area (statewide, by megaregion, by landowner type, and by harvest type)

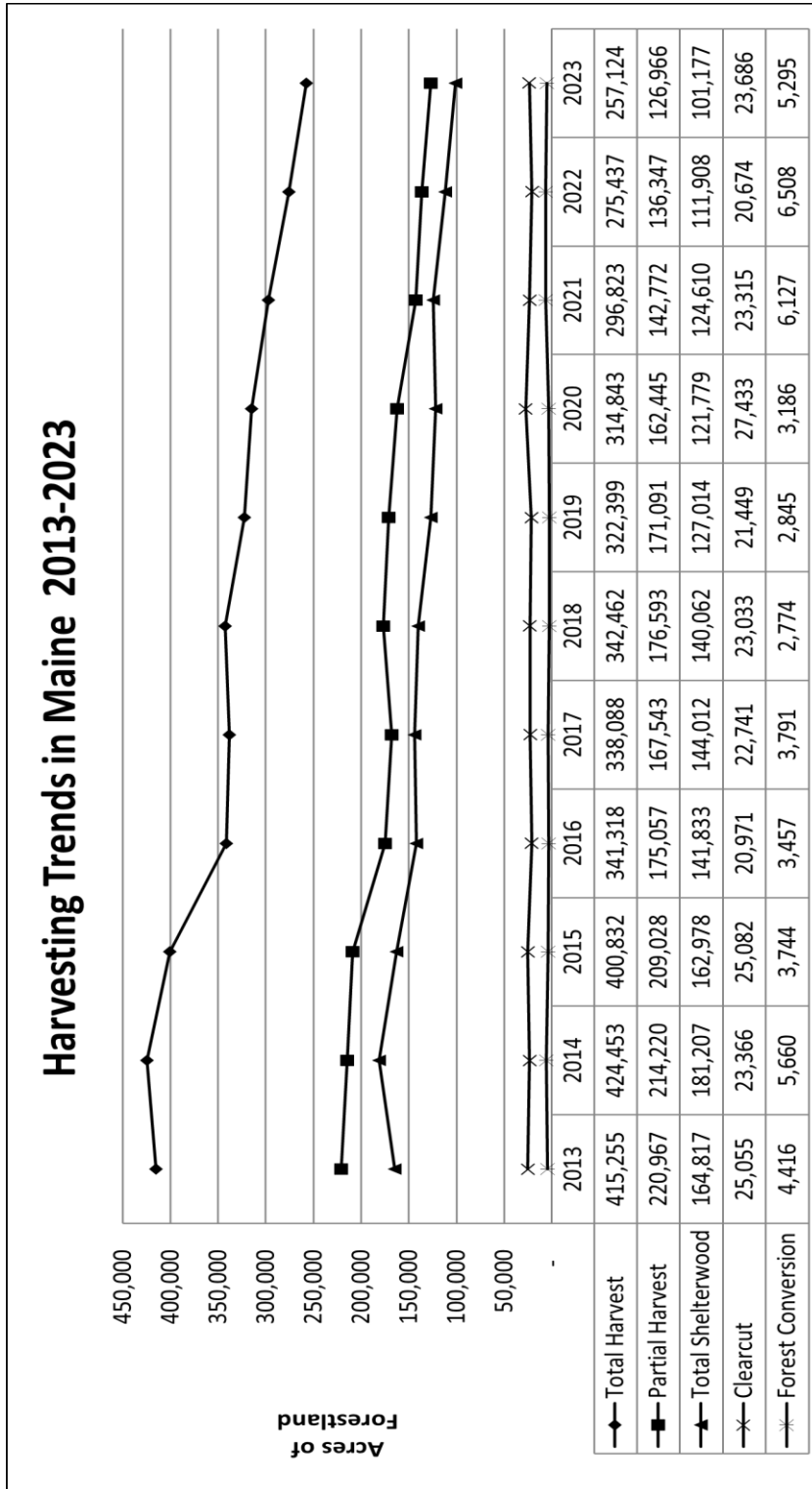
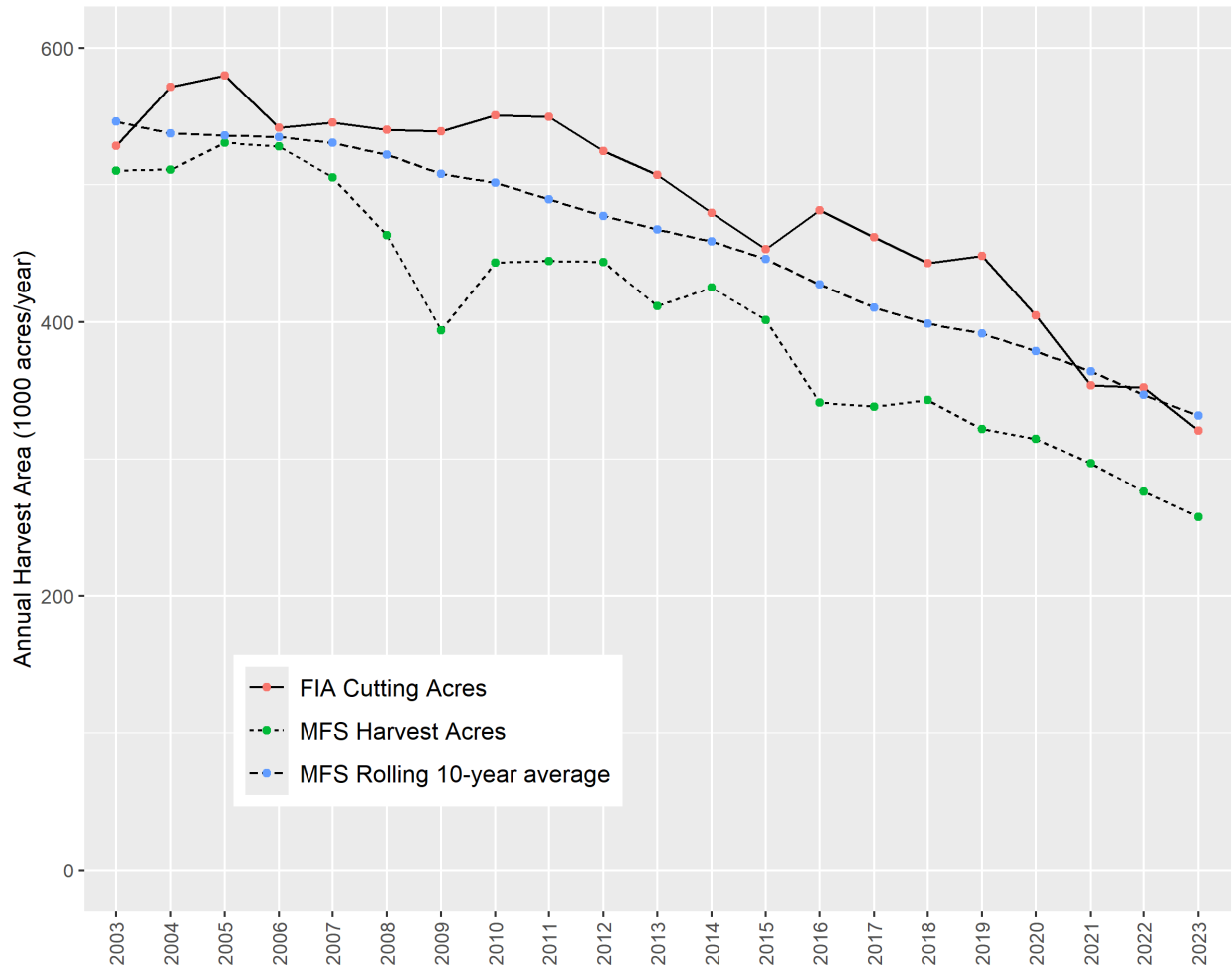


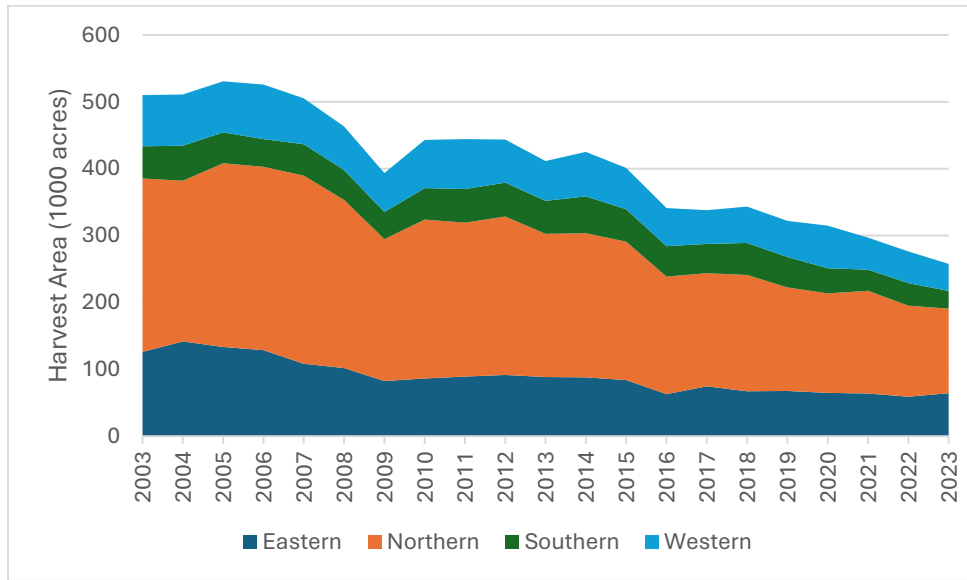
Figure 6.1. Harvested Acres, 2013-2023 (source: MFS Annual Landowner Reports of Timber harvesting, as reported in MFS 2023 Silvicultural Activities report).



**Figure 6.2. Annual harvest area (acres) using FIA and MFS data sources, 2003-2023** (sources: USDA-FS-FIA 2025, MFS 2023 Silvicultural Activities report). “Annual” harvest levels from FIA data in fact represent a periodic estimate of harvest levels, while MFS harvest data are reported annually. This accounts for some of the differences between these data sources. For comparison the graph also includes a 10-year lagged rolling average based on MFS annual landowner reports (e.g., 2023 is an average of MFS harvest acres between 2013 and 2023).

**Table 6.1. Average annual harvest area (1,000 acres) by megaregion and statewide for five 4-year time intervals from 2003 to 2023** (sources: MFS Silvicultural Activities Report, 2003-2023).

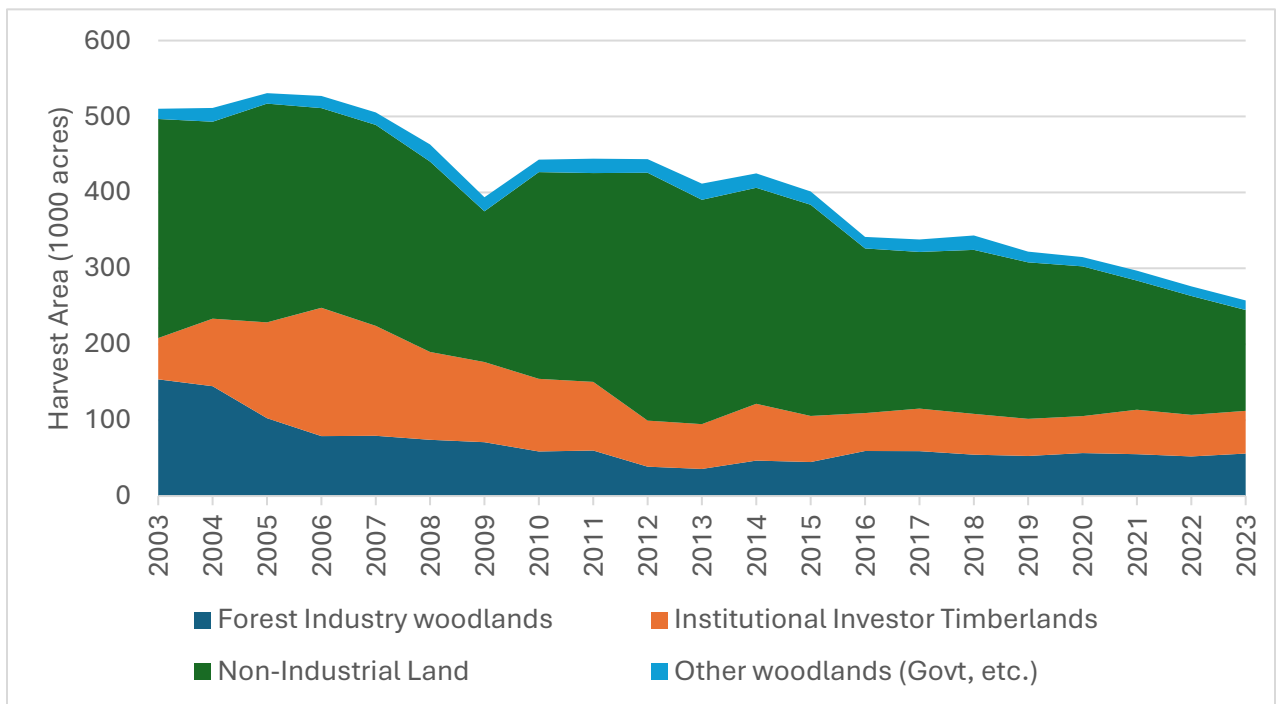
Megaregion	2003	2004-2008	2009-2013	2014-2018	2019-2023
Eastern	126	123	88	75	64
Northern	259	264	226	188	144
Southern	48	46	48	48	35
Western	77	74	66	58	51
Statewide	510	507	427	370	294



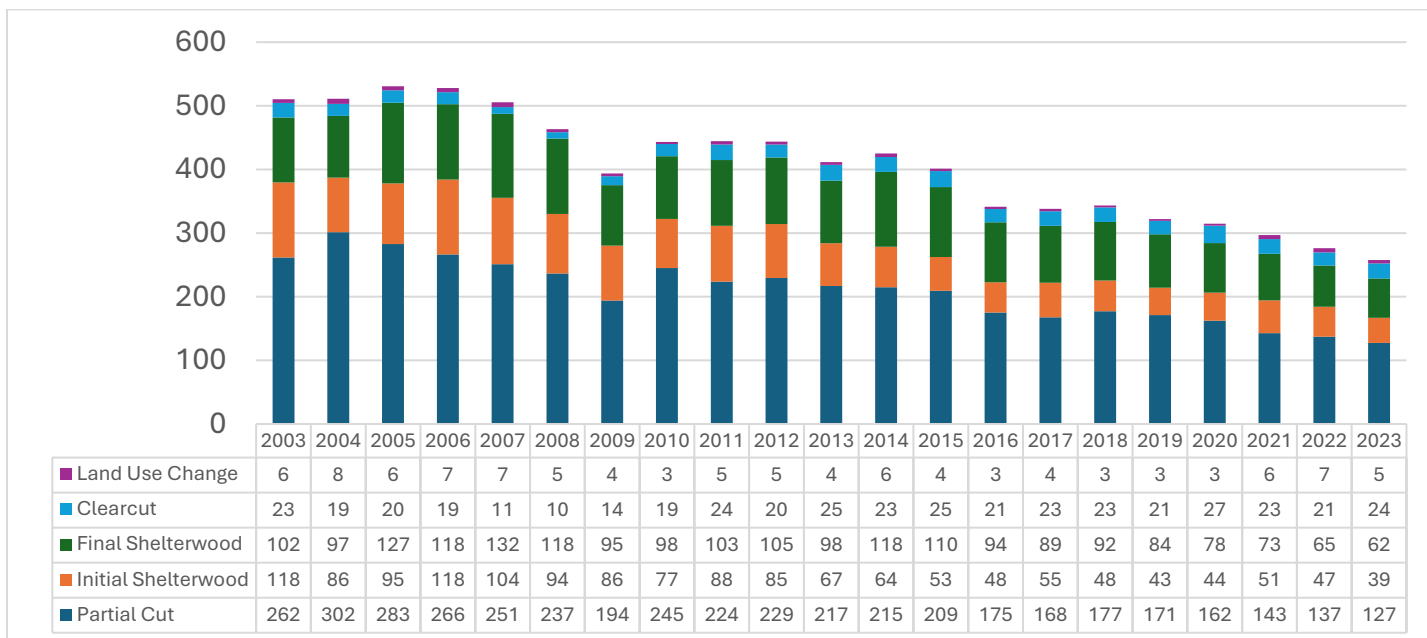
**Figure 6.3. Total harvest area (1,000 acres) by megaregion, 2003-2023** (source: MFS Silvicultural Activities Report, 2000-2023).

**Table 6.2. Average annual harvest area (1,000 acres) by ownership type for five 4-year intervals, 2003-2023** (source: MFS Silvicultural Activities Report, 2000-2023).

Ownership Type	2003	2004-2008	2009-2013	2014-2018	2019-2023
Forest Industry woodlands	154	96	53	53	55
Institutional Investor Timberlands	55	129	82	59	53
Non-Industrial Land	289	265	274	240	173
Other woodlands (Govt, etc.)	13	17	19	17	13
Statewide	510	508	427	370	294



**Figure 6.4. Total harvested acres annually (1,000 acres) by ownership type** (source: MFS Landowner Reports of timber harvesting, 2003-2023. Non-industrial land refers to land owned by large and small landowners.



**Figure 6.5. Total acres treated by five silvicultural harvest treatments and land use change, 2003-2023** (source: MFS annual landowner report data, 2003-2023).

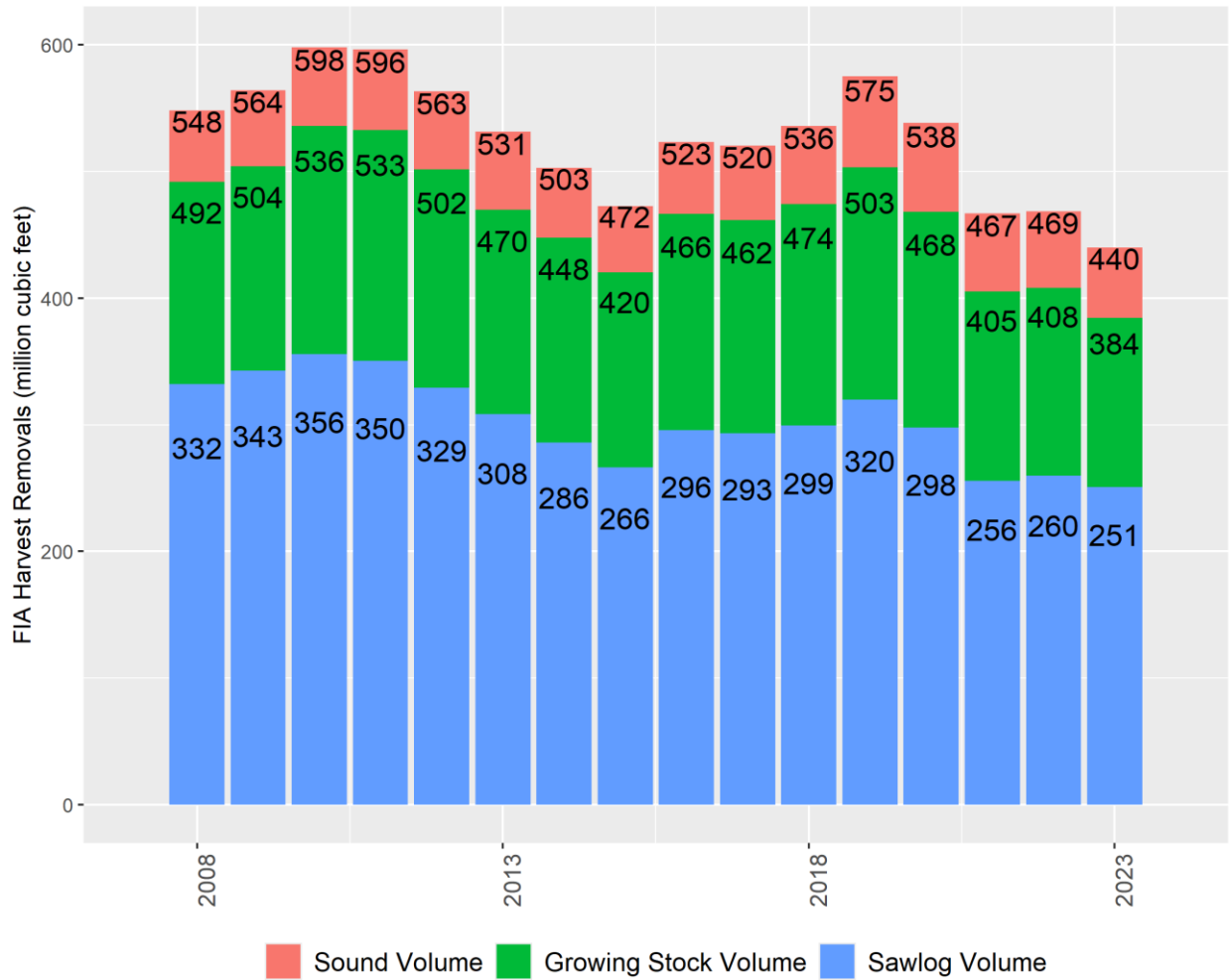
## 6b. Harvest volume

Timber volumes harvested have also declined overall, as well as harvest acres. Depending on data source, volumes are reported/calculated as cubic feet, board feet, green tons, or other units, suggesting caution when making comparisons. In addition, FIA data on removals include harvest removals only i.e. trees that have been cut, measured at the stump, while MFS Wood Processor report data include what is reported by the mill, concentration yard, or wood transporter. Some harvest volume captured in FIA data may not make it to the mill (e.g. left in the woods or landing, breakage, utilization), and some trees may not be merchandized at the mill as FIA would estimate. Finally, additional “removals” in FIA occur when forest land acres are converted to different land uses, or timberlands transition into reserves- these removals are not included here.

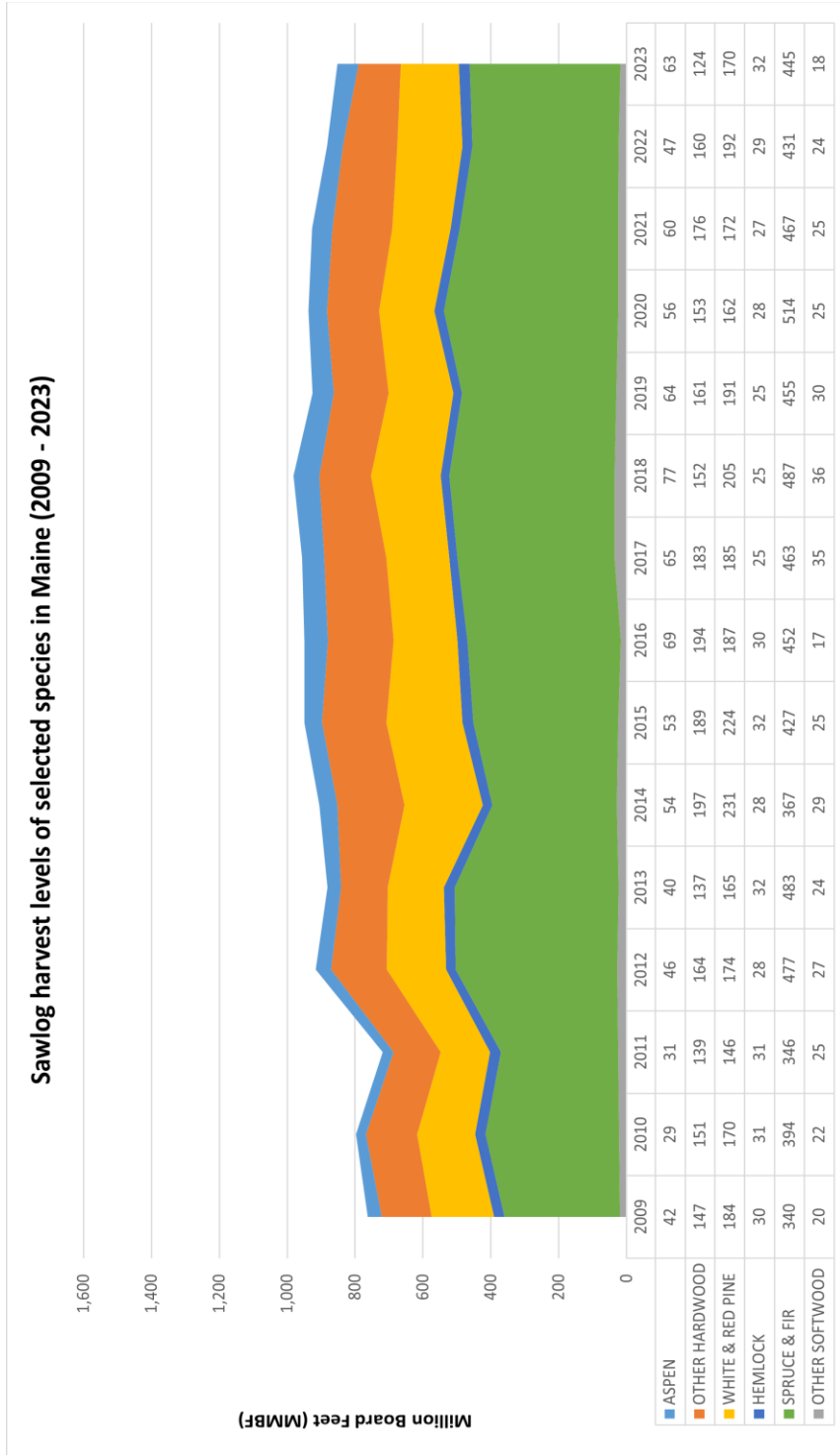
Total sound bole wood harvest volume has decreased from roughly 550 million cubic feet annually in 2005 to just under 450 million cubic feet, based on estimates from FIA data.

While sawlog harvest volume has increased slightly since 2009 (especially spruce-fir sawlogs), overall pulpwood harvests have declined by 39%. The relative proportions of species harvested remain relatively constant, with other hardwoods (excluding aspen), spruce & fir, and white pine making up most of the volume. Slight increases in other softwoods likely reflect increased harvest of northern white cedar, while declines in hemlock reflect reduced markets for this species.

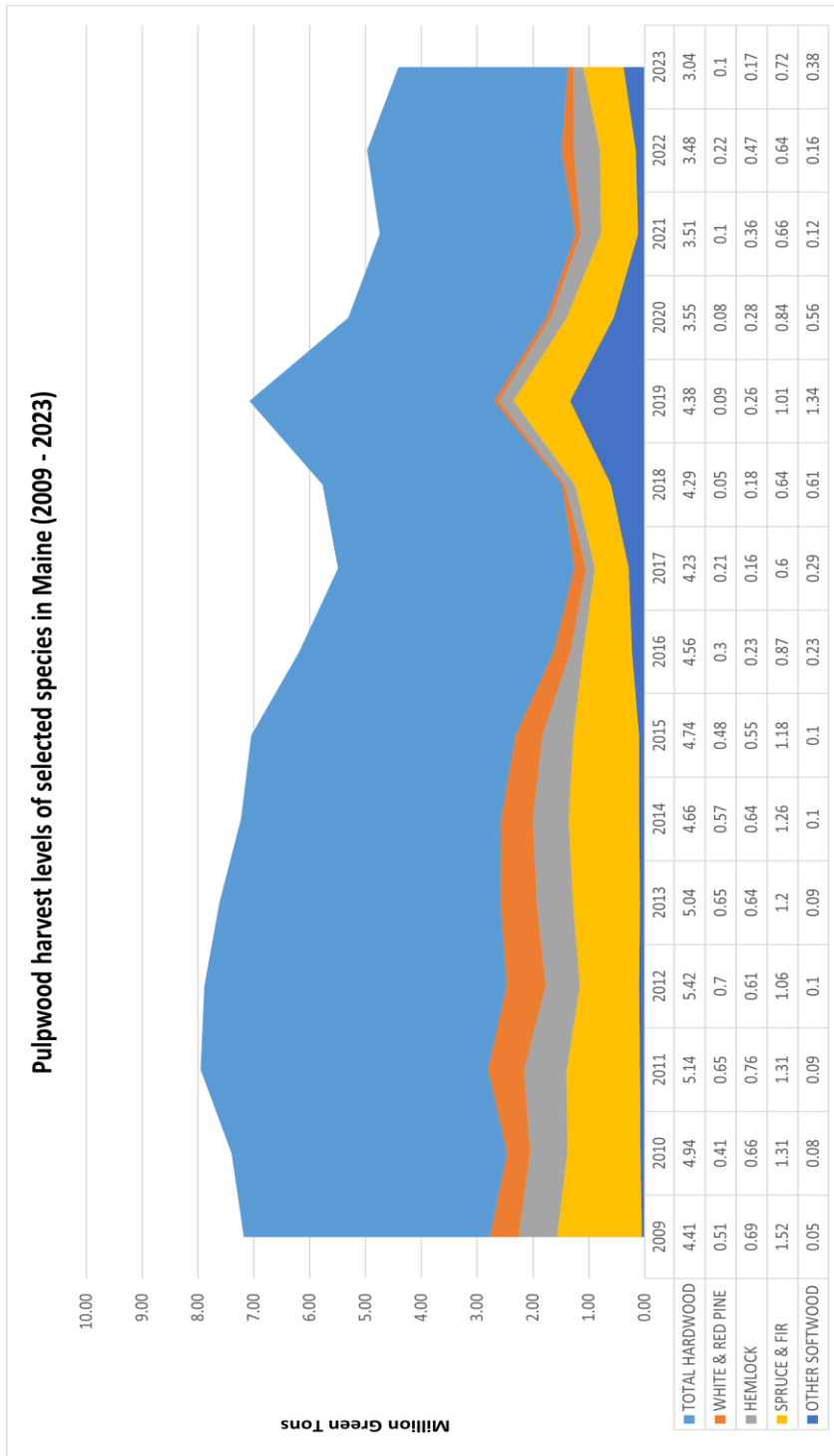
Based on FIA data, statewide harvest removals per forested acre have declined from 31.6 cubic feet per forested acre to 29.5 cubic feet per forested acre. Removal rates have declined in the eastern and northern megaregions, reflecting lower overall harvest activity levels. By contrast, removal rates have increased markedly in western and southern megaregions, suggesting that harvest activity and intensity have increased across these megaregions. Northern forests still generate more wood in total than other megaregions simply because there are far more total acres in the northern megaregion.



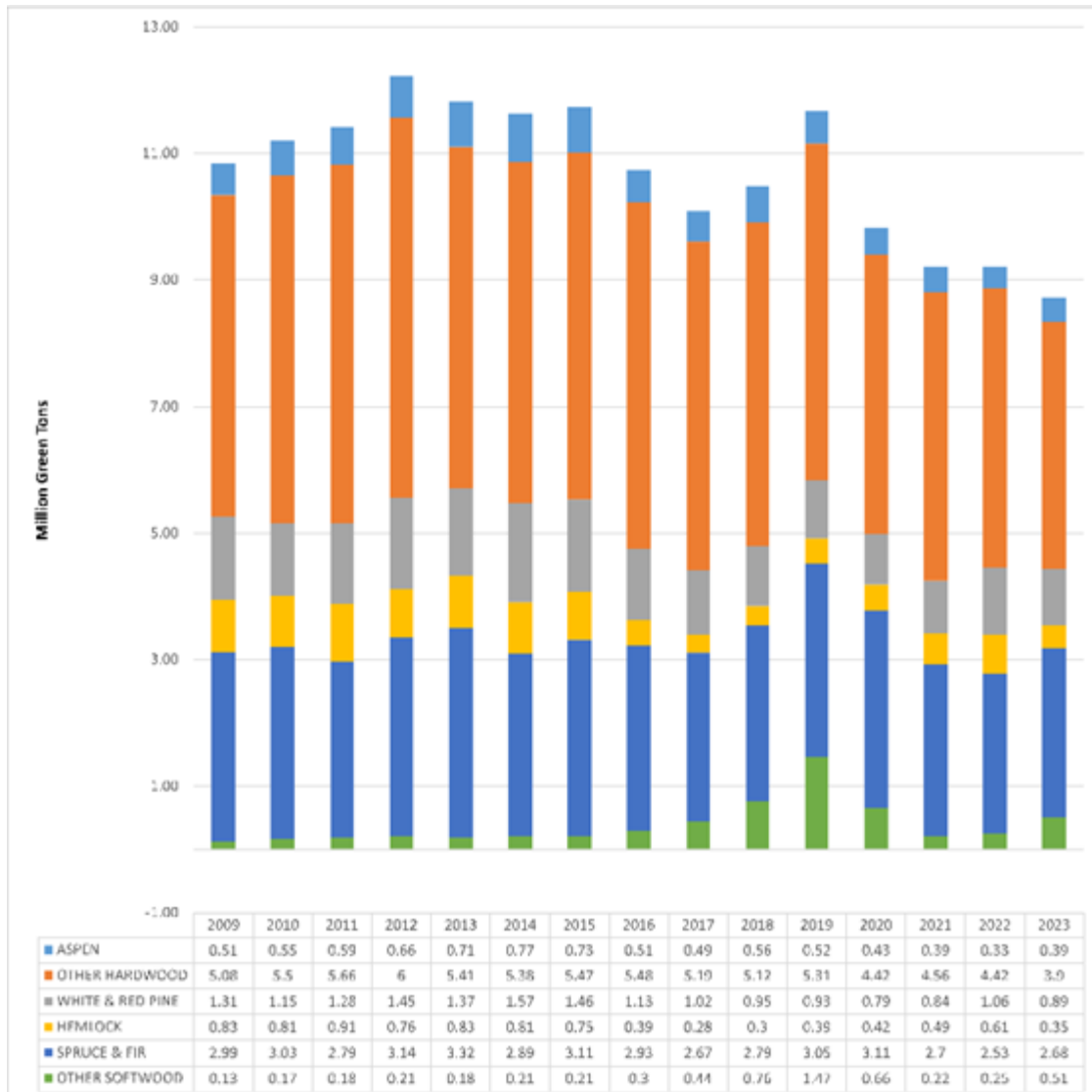
**Figure 6.6. Sawlog, growing stock, and sound harvest volume on timberlands, 2008-2023** (source: USDA-FS-FIA 2026). Total volume is the sound volume, which includes growing stock volume, which includes sawlog volume. Labels here show the total volume for each volume class, while bars show residual growing stock volume after accounting for sawlog volume and residual sound volume after accounting for growing stock volume.



**Figure 6.7: Annual sawlog harvest volumes, in board feet, 2009-2023** (source: MFS Annual Wood Processor report data, 2009-2023).



**Figure 6.8. Annual pulpwood harvest volumes, in green tons, 2009-2023** (source: MFS Annual Wood Processor report data, 2009-2023).

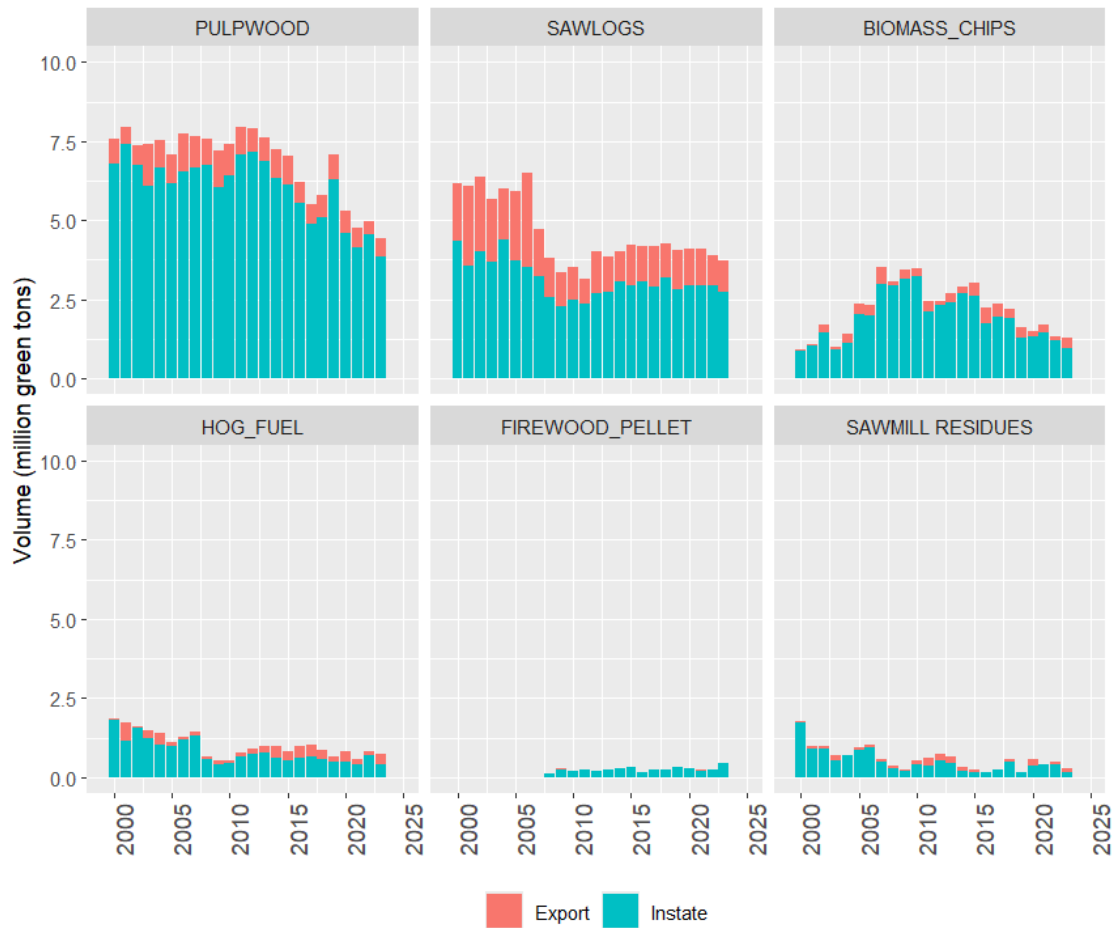


**Figure 6.9. Annual harvest (million green tons) of commercially important species, 2009-2023** (source: MFS Annual Wood Processor reports including total reported sawlog, pulpwood, and firewood volumes, 2009-2023).

Megaregion	2008	2013	2018	2023
Northern	36.9	34.2	34.2	25.0
Eastern	30.1	26.5	22.7	18.9
Southern	20.5	25.9	34.8	32.1
Western	32.1	36.3	40.4	39.6
<b>Statewide</b>	<b>32.4</b>	<b>31.5</b>	<b>32.2</b>	<b>26.3</b>

**Table 6.3. Average harvest removal volume (in cubic feet) per timberland acre by megaregion and statewide for terminal years 2008, 2013, 2018, 2023** (source: USDA-FS-FIA 2025)

## 6d. Products Harvested



**Figure 6.10. Wood harvest estimates by product, 2000-2023** (source: USDA-FS-FIA 2026). These harvest volumes include both wood that remained instate for processing, and roundwood that was exported out of state without processing (MFS 2025b). Roundwood is defined as raw logs used to produce sawlogs, pulpwood, biomass, and firewood/pellets. Hog fuel and sawmill residues as reported here are secondary products and are not included in harvested wood. Compare with estimates of processed wood below.

## Section 7. Wood processing

Wood primary processing is a critical component of Maine's forest economy. Data for the amount of roundwood processed in Maine rely on annual reports to the MFS by mills and manufacturers who process roundwood, including sawmills, pulp and paper mills, and other facilities.

The total amount of wood processed in Maine is the net of total wood harvested, minus roundwood exported without processing, plus roundwood imported into Maine (Figure 7.1). Roundwood is most frequently exported to other states and Canada. Trends in harvested wood, exported wood, processed wood (in Maine), imported wood, and total processed wood declined from 2009 to 2023. In all years, total processed wood exceeded harvested wood, making Maine a net importer of wood to make up the difference between harvest and processing.

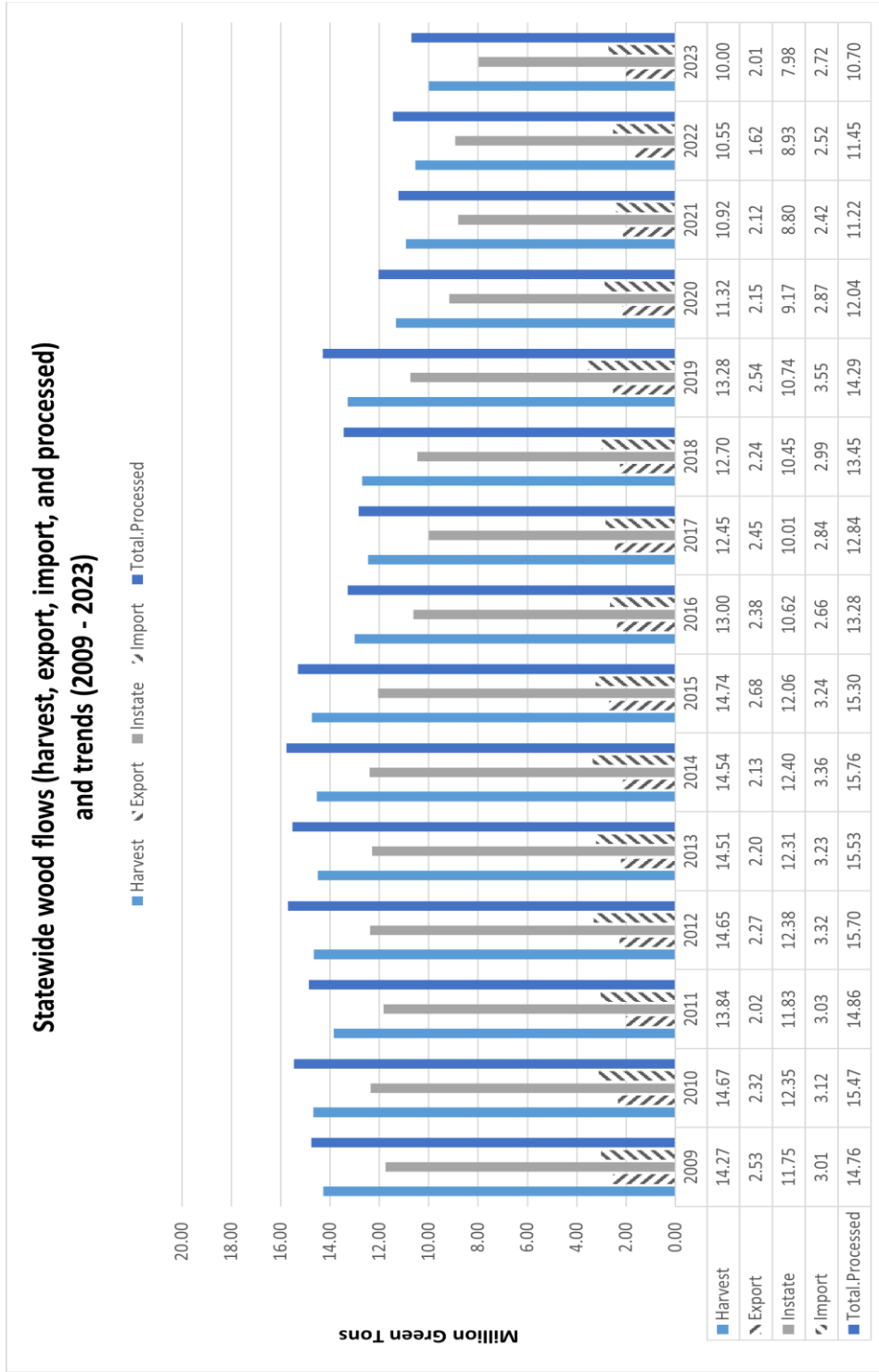
In 2023, a reported 882,601,000 board feet of sawlogs were processed in Maine, approximately three-quarters of this volume was softwood (roughly 60% of which was spruce-fir, and 40% white pine; Table 7.1). This volume is equivalent to 3,842,155 green tons. Notably, when compared to 2009 (2.25 million board feet, or 2.25 million board feet), this volume represents a 48% increase in sawlogs processed, including a near tripling of sawlog imports. However, these volumes are still lower than pre-2009 levels.

In 2023, over one third of the hardwood sawlog volume, and slightly less than one quarter of the softwood sawlog volume was imported (Table 7.1). These proportions varied considerably by species. Notably, yellow birch, sugar maple, and spruce-fir sawlogs were disproportionately exported from Maine without processing, while nearly 2/5 of the white pine sawlogs processed were imported. Pine logs were equal to one-third of the hardwood sawlog volume, and slightly less than one-quarter of the softwood sawlog volume. They resulted in Maine being a net importer of logs despite exports of yellow birch, sugar maple, and spruce-fir logs (Figure 7.2)

Also in 2023, 5,265,746 green tons of pulpwood were processed, a decline of 34% since 2009 (Table 7.1). Of this total 3,999,289 green tons were hardwood and 1,266,457 were softwood. Because wood processed is often reported as mixed loads of softwood or hardwood, data for individual species are not available.

Of the total pulpwood processed, a reported 1,423,253 green tons were imported from outside Maine (Figure 7.2). A further 1,150,481 green tons of biomass chips (used as fuel) were processed, and most of this wood originated in Maine. The reported volume of firewood processed of 188,150 cords nearly doubled since 2009, though prior under-reporting is likely a factor in this increase. In addition, the 2023 number may still be an undercount since only the largest firewood suppliers regularly report.

Trends in the annual processing of wood in Maine generally mirror trends in annual harvest of Maine wood as markets have shifted, expanded and contracted. Pulpwood processing has declined significantly since 2009 as pulp mills have closed, while sawlog processed volumes rebounded slightly around 2015. Since then, harvest levels have increased slightly while imports have increased very significantly in order to make up gaps in wood supply.



**Figure 7.1. Statewide Wood flows (harvest, export, import, and processed) for sawlogs, pulpwood, biomass chips, firewood/pellets, and total wood, 2009 – 2023** (source: MFS Annual Wood Processor Reports, 2009 to 2023).

**Table 7.1. Comparison of wood harvest, export, import, and processed in Maine, 2009 and 2023** (source: MFS Wood processor reports 2009 and 2023).

<b>Maine Wood Harvested/Processed, 2009 &amp; 2023</b>		<b>2009</b>	<b>2023</b>	<b>% change</b>
<b>Sawlogs</b> <i>(in MBF)</i>	Maine wood harvested & processed instate	531768	637164	19.8
	Maine wood harvested & exported	244033	252708	3.6
	Total Maine Harvest	775801	889872	14.7
	Wood imported from outside Maine	62777	245437	291.0
	<b>Total Wood Processed in Maine</b>	<b>594545</b>	<b>882601</b>	<b>48.4</b>
<b>Pulpwood</b> <i>(in green tons)</i>	Maine wood harvested & processed instate	6056014	3842493	-36.6
	Maine wood harvested & exported	1131958	568755	-49.8
	Total Maine Harvest	7187972	4411248	-38.6
	Wood imported from outside Maine	1934200	1423253	-26.4
	<b>Total Wood Processed in Maine</b>	<b>7990214</b>	<b>5265746</b>	<b>-34.1</b>
<b>Biomass chips</b> <i>(in green tons)</i>	Maine wood harvested & processed instate	3141650	943797	-70.0
	Maine wood harvested & exported	276807	333867	20.6
	Total Maine Harvest	3418457	1277664	-62.6
	Wood imported from outside Maine	800425	206684	-74.2
	<b>Total Wood Processed in Maine</b>	<b>3942075</b>	<b>1150481</b>	<b>-70.8</b>
<b>Firewood/pellets</b> <i>(in cords)</i>	Maine wood harvested & processed instate	98604	180711	83.3
	Maine wood harvested & exported	3313	592	-82.1
	Total Maine Harvest	101917	181304	77.9
	Wood imported from outside Maine	0	7439	<i>(null)</i>
	<b>Total Wood Processed in Maine</b>	<b>98604</b>	<b>188150</b>	<b>90.8</b>
<b>Total wood</b> <i>(in green tons)</i>	Maine wood harvested & processed instate	11780938	7983714	-32.2
	Maine wood harvested & exported	2495391	2012895	-19.3
	Total Maine Harvest	14276329	9996609	-30.0
	Wood imported from outside Maine	3006414	2721225	-9.5
	<b>Total Wood Processed in Maine</b>	<b>14787352</b>	<b>10704939</b>	<b>-27.6</b>

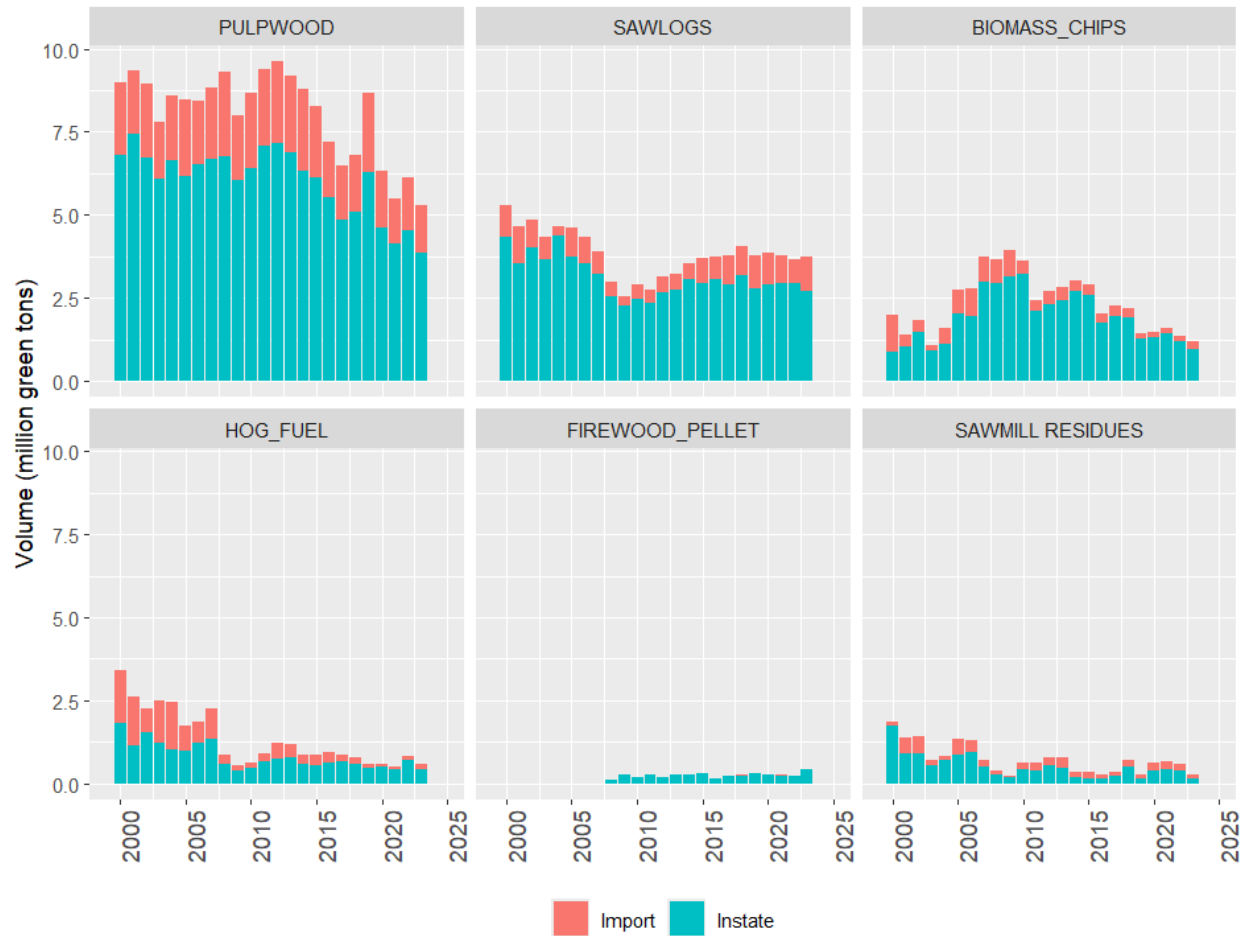


Figure 7.2. Processed wood estimates pulpwood, sawlogs, biomass chips, hog fuel, firewood/pellets, and sawmill residues, 2000-2023 (source: MFS 2025b). These totals include wood that was harvested and processed in Maine and wood that was imported to Maine and processed in Maine.

## Section 8. Forest Carbon

Maine's forests act as significant carbon sinks, using photosynthesis to take up CO<sub>2</sub> from the atmosphere and store it as carbon in trees, deadwood, soil, and other vegetation (Daigneault et al., 2020). Maine's forests, whether publicly or privately-owned, working forests or reserves, help mitigate climate change by storing carbon and sequestering additional carbon (Maine Department of Environmental Protection 2024). Maine's large areas of managed forest land help maintain fast growing and carbon-absorbing mid-age forests while providing economic benefits through sustainable timber harvesting for forest products. Forest carbon sequestration in Maine is considerable (Table 8.1). Maine's forests sequester the equivalent of 91% of Maine's Scope 1 and Scope 2 emissions (Maine Department of Environmental Protection 2024) and may play a role in Maine's strategy of achieving Net Zero emissions by 2045. Older, lightly managed forests and forest reserves store large amounts of carbon. Maintaining healthy, diverse forests allows for high levels of carbon sequestration and potentially maximizes long-term carbon storage capacity.

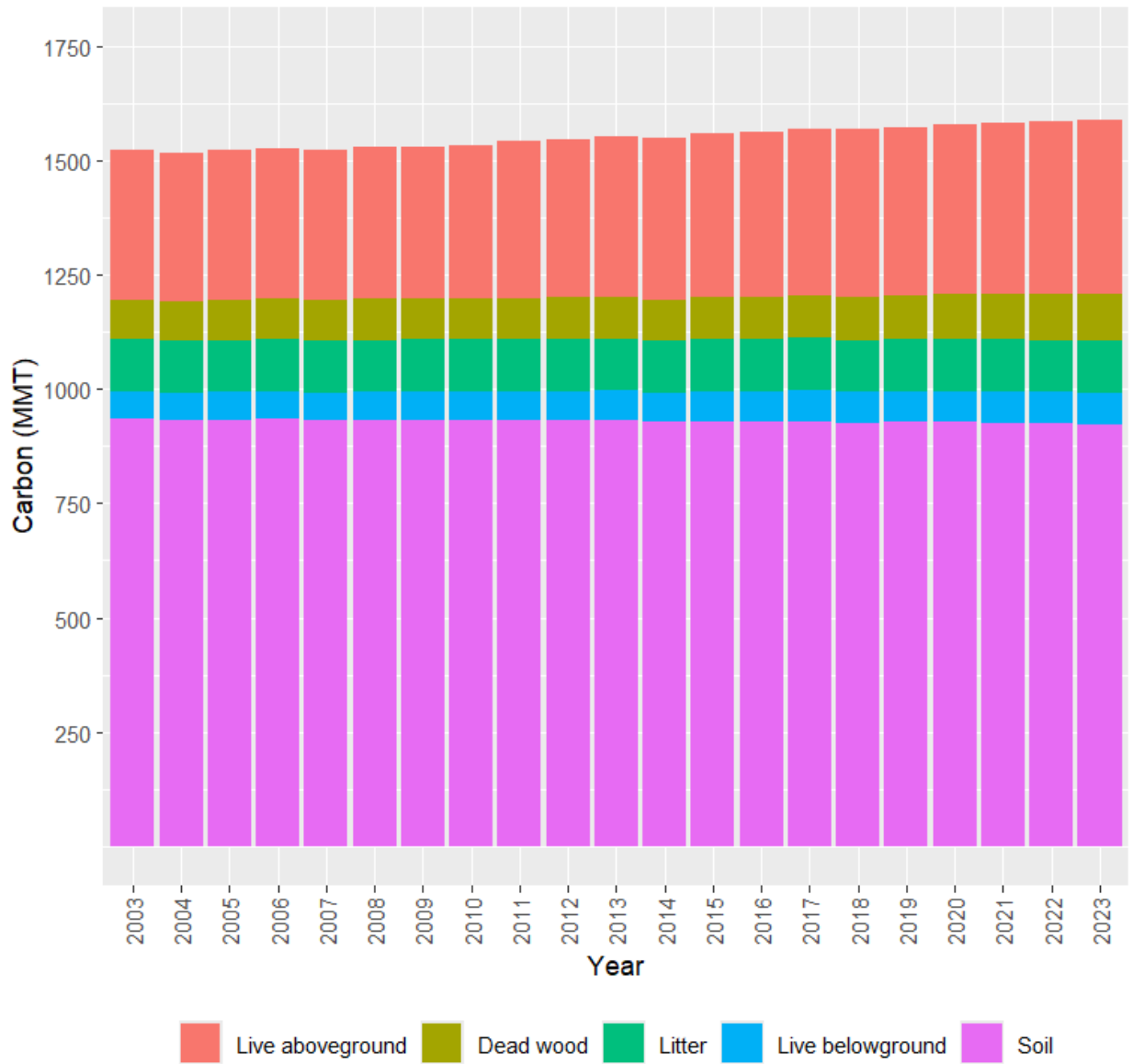
Forest carbon occurs in different pools or portions of forest stands – live aboveground (primarily trunks and branches of trees and other plants), live below ground (roots of living plants and living soil organisms), deadwood (standing or fallen), forest litter, and soil (Daigneault et al., 2020). Estimates of these pools indicate how each pool contributes to important functions of both storage of carbon and its sequestration.

The greatest proportion of forest carbon is stored in soil, and the carbon stocks in this pool are relatively stable (Figure 8.1.). Carbon estimates based on forest inventories over time indicate that overall Maine's forests have slowly stored additional carbon in recent decades, particularly in the live aboveground pool, which also reflects increases of Maine's standing timber inventory. Modest net increases in forest carbon may continue unless tree mortality increases significantly due to unusual pest outbreaks, very large increases in timber harvesting occur, or forest aging greatly reduces carbon sequestration.

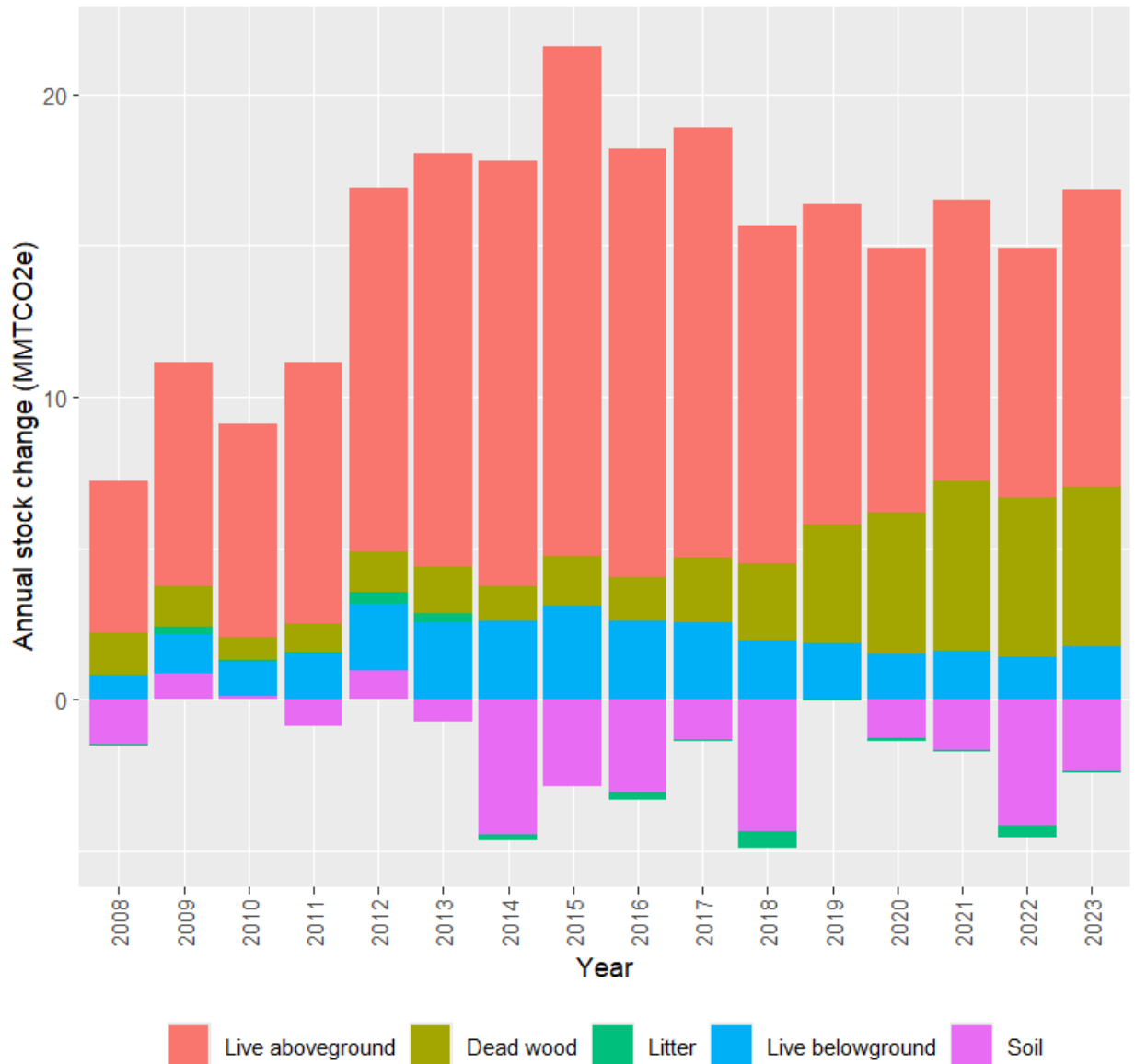
Annual net change of forest carbon primarily occurred in the live-above-ground carbon pool (e.g., mostly growth/mortality of standing timber), with moderate changes in live-below-ground and deadwood carbon pool (Figure 8.2). The live-above-ground pool (mostly living trees) drives much of forest carbon dynamics, sequestering the most carbon in Maine's forests of all pools. Natural mortality of trees may be resulting in small net increases of deadwood storage. While the overall soil carbon pool is relatively stable, small annual pulses in soil carbon loss may occur through forest loss (conversion) to other land uses that cause soil carbon to break down and release carbon dioxide into the atmosphere.

**Table 8.1. Total forest carbon (MMT) on forest lands and annual carbon stock changes (MMTCO2e)** (source: USDA-FS-FIA 2026). Carbon stock changes are calculated cycle to cycle. For instance the 2023 carbon stock changes use terminal year 2023 as time 2 and terminal year 2018 as time 1. The estimates are differenced, annualized and converted from carbon to carbon dioxide equivalents using the conversion of  $*44/12$ ;  $(1,588-1,569)/5*(44/12) = 14.42$ . These estimation methods are in alignment with Hayes et al. 2024.

Year	C Store (MMTC)	Annual Carbon Stock Change (MMTCO2e)
2003	1,523	-
2004	1,517	-
2005	1,523	-
2006	1,528	-
2007	1,524	-
2008	1,530	5.68
2009	1,532	11.17
2010	1,535	9.09
2011	1,542	10.28
2012	1,547	16.93
2013	1,554	17.30
2014	1,550	13.14
2015	1,561	18.68
2016	1,563	14.91
2017	1,571	17.51
2018	1,569	10.80
2019	1,572	16.32
2020	1,579	13.53
2021	1,583	14.81
2022	1,586	10.39
2023	1,588	14.42



**Figure 8.1. Carbon stocks for five forest carbon pools (in million metric tons, MMT), 2003-2023**  
 (source: USDA-FS-FIA 2025).



**Figure 8.2. Net Annual Change in Carbon stocks (in million metric tons of carbon equivalents, MMTCO<sub>2</sub>e) for five forest carbon pools, 2003-2023** (source: USDA-FS-FIA 2025). Positive estimates reflect carbon sinks while negative estimates reflect carbon sources. Estimates are calculated across land use change categories as such the net change in the soil carbon stock are mostly due to net loss in forest area.

## Glossary:

For additional terms, a glossary of standard terminology for Forest Inventory and Analysis (FIA) is available: [Forest Inventory and Analysis Glossary - Standard Terminology](#). For convenience some terms used in this report are defined below.

**Diversion:** The conversion of forest land to non-forest and water uses, also referred to as gross forest loss

**Forest land:** Land at least 10-percent canopy cover by trees of any size, including land that formerly had such tree cover and that will be naturally or artificially regenerated. Forest land includes transition zones, such as areas between heavily forested and non-forested lands that are at least 10-percent canopy cover with trees and forest areas adjacent to urban and built-up lands. Also included are pinyon-juniper and chaparral areas in the West and afforested areas. The minimum area for classification of forest land is 1 acre and 120 feet wide measured stem-to-stem from the outer-most edge. Unimproved roads and trails, streams, and clearings in forest areas are classified as forest if less than 120 feet wide.

**Forest type:** A classification of forest land based upon and named for the tree species that forms the plurality of live-tree stocking. A forest-type classification for a field location indicates the predominant live-tree species cover for the field location; hardwoods and softwoods are first grouped to determine predominant group, and forest type is selected from the predominant group.

**Forest type group:** A combination of forest types that share closely associated species or site requirement

**Growing stock tree:** All live trees of commercial species that meet minimum merchantability standards. In general, these trees have at least one solid 8-foot section, are reasonably free of form defect on the merchantable bole, and at least 34 percent or more of the volume is merchantable.

**Growing stock volume:** The cubic-foot volume of sound wood in growing stock trees at least 5.0 inches d.b.h. from a 1.0-foot stump to a minimum 4.0-inch top d.o.b. to the central stem.

**Net volume:** The gross volume in cubic feet less deductions for rot, roughness, and poor form. Volume is computed for the central stem from a 1-foot stump to a minimum 4.0-inch top diameter outside bark, or to the point where the central stem breaks into limbs.

**Ownership Class:** A descriptor for the type of ownership – in this report, this generally refers to where either the FIA plot condition was located or the landowner reporting for the MFS silvicultural activities report.

- *Corporate* (FIADB): Incorporated ownerships including LLCs, TIMOS, REITS, and other incorporated ownerships.
- *Family Forest Ownership* (NWOS; FIADB): The term family ownership is shorthand for the FIA ownership category defined as “Individual and family, including trusts, estates, and

family partnerships” (Burrill et al. 2024). Combining the two definitions (family and forest land), a family forest ownership is a family, individual, trust, estate, or family partnerships that owns at least 1 acre of land with tree cover of at least 10 percent, and the land is not used for other purposes, such as lawn, that would impede natural processes (from Butler et al. 2018).

- *Federal* (FIADB): National Forest, National Grassland, National Park Service, Bureau of Land Management, Fish and Wildlife Service, Departments of Defense/Energy, Other Federal. In Maine these included: White Mountain National Forest, Acadia National Park, and Katahdin Woods and Waters.
- *Forest Industry Woodlands* (MFS) Woodlands owned by a forest products industry; usually most of the wood harvested is used by that industry.
- *Industrial* (FIADB): A landowner that owns and operates a primary wood-processing plant. A primary wood-processing plant is a commercial operation that originates the primary processing of wood on a regular and continuing basis. Examples include pulp or paper mill, sawmill, panel board mill, post or pole mill.
- *Institutional Investor Timberlands* (MFS) Woodlands owned by organizations, including Timberland Investment Management Organizations (TIMOs) and Real Estate Investment Trusts (REITs) that hold timberland assets as fiduciaries for the benefit of others.
- *Misc. Large* (MFS 2010): A term borrowed from the 2010 Forest Action Plan. Presumed (likely) to be synonymous with other private from FIADB.
- *Non-industrial Land* (MFS): Woodlands privately owned but NOT by a forest industry. These include private individuals and other non-forest product industries (corporate that are not IITs or industry and other private).
- *Other Private*: This includes non-governmental conservation/natural resources organization, unincorporated local partnerships / associations /clubs, and native American ownerships.
- *Other Woodlands* (Gov’t etc.; MFS): Woodlands owned by other entities not listed above -- including local, state, federal, or tribal governments.
- *Private Investor* (MFS 2010): A term borrowed from the 2010 Forest Action Plan. Presumed (likely) to be synonymous with Corporate (FIADB).
- *Private* (FIADB): Corporate, family, other private combined.
- *Public* (FIADB): Federal, State, County, Municipal (FIADB).
- *State, County, Municipal* (FIADB): Including water authorities. In Maine, state ownership is dominated by the Bureau of Parks and Lands, Baxter State Park, and Maine Department of Inland Fisheries and Wildlife.

**Removals:** The volume of trees removed from the inventory by harvesting or other cultural operations (such as timber-stand improvement), by land clearing, or by changes in land use (such as a wilderness designation).

**Reserved land:** Land that is withdrawn by law(s) prohibiting the management of the land for the production of wood products.

**Reversion:** The conversion of non-forest land and water to forest; also known as gross forest gain.

**Sawlog Volume:**

VOLBFNET Net board-foot wood volume in the sawlog portion of a sawtimber tree. The net board-foot (International ¼-inch Rule) volume of wood in the central stem of a timber species tree of sawtimber size (9.0 inches d.b.h. minimum for softwoods, 11.0 inches d.b.h. minimum for hardwoods), from a 1-foot stump to a minimum top diameter (7.0 inches for softwoods, 9.0 inches for hardwoods), or to where the central stem breaks into limbs all of which are less than the minimum top diameter. This is a per tree value and must be multiplied by TPA\_UNADJ to obtain per unit area information. This attribute is blank (null) for softwood trees with DIA.

VOLCSNET Net cubic-foot wood volume in the sawlog portion of a sawtimber tree. The net cubic-foot volume of wood in the central stem of a timber species tree of sawtimber size (9.0 inches d.b.h. minimum for softwoods, 11.0 inches d.b.h. minimum for hardwoods), from a 1-foot stump to a minimum top diameter, (7.0 inches for softwoods, 9.0 inches for hardwoods) or to where the central stem breaks into limbs, all of which are less than the minimum top diameter. This is a per tree value and must be multiplied by TPA\_UNADJ to obtain per acre information. This attribute is blank (null) for softwood trees with DIA

Sound volume: The sound cubic-foot volume of wood in the central stem of timber species (trees where diameter is measured at breast height [d.b.h.]  $\geq 5.0$  inches d.b.h., from a 1-foot stump to a minimum 4-inch top diameter, or to where the central stem breaks into limbs all of which are  $< 4.0$  inches in diameter. Calculated for live and standing dead trees. Does not include rotten and missing cull (volume loss due to rotten and missing cull defect has been deducted).

(see Burrill et al. 2024, VOLCFSND)

Timberland: Forest land that is producing or is capable of producing crops of industrial wood and not withdrawn from timber utilization by statute or administrative regulation. (Note: Areas qualifying as timberland are capable of producing at least 20 cubic feet per acre per year of industrial wood in natural stands. Currently inaccessible and inoperable areas are included.)

Unproductive land: Land whose inherent capacity to grow crops of industrial wood is low (less than 20 cubic feet per acre per year).

## Part II. Maine Criteria and Indicators of Forest Sustainability

Seven Criteria for Forest Sustainability were identified in statute in 1997 (M.R.S Title 12, Subchapter 4-A, Forest Resource Assessment Program (see especially section 8876-A)). The legislation requires the Maine Forest Service to report on the state of the State's Forests, including consideration of these criteria, indicators and benchmarks of sustainability.

The first State of the Forest Report in 2005 identified the seven criteria and eighteen associated indicators and benchmarks to serve as a yardstick for making progress on forest sustainability. However, neither benchmarks for all indicators, nor data sources or monitoring programs for all benchmarks have been developed. As a result, a number of indicators and benchmarks lack the data necessary to be assessed. Several benchmarks established goals to be achieved in the 2000s which have not been revisited. State of the Forest Reports in 2010 and 2020 adapted the statutory framework and merged some criteria with requirements of the federally mandated State Forest Action Plan, while also incorporating Montreal Process criteria and indicators (Montreal Process 2015).

This report addresses the original seven criteria and also adds a criterion to regarding the contribution of Maine's forests to global carbon cycles.

### Criterion 1. Soil Productivity

**Goal:** Maintain proper soil structure, texture, organic matter, and adequate nutrient levels for forest growth.

Soil productivity is the soil's capacity to support tree growth for timber resources and a healthy forest to sustain other forest benefits (O'Neill et. al. 2005). It is determined by factors such as the soil physical structure and texture, nutrient availability and other chemical properties, organic matter, and soil biota community. Forest management activities and timber harvesting can potentially affect soil productivity and properties, including soil structure and nutrient cycling. Climate change may affect soil erosion and nutrient loss by increasing extreme rainfall events that erode soils and leach soil nutrients (Swanson et al., 2028).

When this criterion was proposed in 2001, it was anticipated that data from the recently established Forest Health Monitoring (FHM) Program of the US Forest Service Forest Inventory Assessment (FIA) Program could be used to monitor soil productivity indicators. In 2005, the MFS recognized that the small number of FIA/FHM soil plots was inadequate for analysis at a scale smaller than the state and then the US Forest Service discontinued the FHM soil sampling program. An effort by the MFS to develop an alternative soil monitoring program for Indicators 1.1 and 1.2 (see below) was unsuccessful. If resources allow, a more intensive monitoring program could further evaluate the identified indicators of soil productivity.

**Indicator 1.1: Harvested area with soil disturbance (removal of organic matter, exposure of mineral soil, soil erosion, compaction, destruction of soil horizons, or alteration of internal soil hydrology) that alters soil physical properties and degrades soil productivity.**

**Status and trends of this indicator:** FIA and MFS monitoring data suggest that timber harvesting operations may have a modest impact on the physical properties of soil at the stand- and landscape-level.

The FIA Program sampled forest soil in Maine from 2001-2023. With very low sample sizes (soils sample on about 40 plots per year), this effort detected low occurrence of soil compaction: 96% of sampled locations had no or very low levels of soil compaction (0 to 5%) and 90% with no compaction. It also detected very little bare soil: 44.6% of sites had no bare soil, 42.4% of sites had <1.0% bare soil, and only 1% of sites had >25% bare soil. However, trends cannot be detected with these data due to small sample sizes each year. A 1988 study found that timber harvesting in the Northeast may expose mineral soil on <3% of the harvest area, and skid roads may typically cover <18% of the area (Martin 1988). Lightly used skid trails may recover soil functions like soil bulk density (one measure of soil compaction) within a decade (DeArmond et. al. 2021).

Maine Forest Service, in collaboration with the USDA Forest Service, developed a monitoring program of Best Management Practices (BMPs) to protect water quality in timber harvest operations. The program has been implemented on roughly 70 to 100 sample sites annually, since 2001. This program is focused on sedimentation of water bodies from skid trails and haul roads, with an emphasis on stream crossings. The program consistently finds that >80% of sample sites had no sediment entering a water body (Maine Department of Agriculture, Conservation, and Forestry and Maine Forest Service 2024). Where sediment does enter a water body, 95% of the detected sedimentation events resulted from the stream crossing itself or trail/road approaches to the stream crossing – not from other areas of the harvest. While focused on water quality, this finding suggests that soil erosion impacts on soil productivity may be limited.

**Rationale for this indicator:** Measuring harvested areas with soil disturbance in Maine forests is critical because soil damage may directly impact long-term forest productivity and carbon storage (Nave et al., 2024). Soil disturbance may reduce organic matter, thereby reducing nutrient availability and water retention capacity. Compaction and erosion diminish soil structure, limiting root growth and tree regeneration (Puhlick and Fernandez; 2020 Cambi et al., 2015). Soil compaction on more heavily used skid roads may take several decades or longer to recover and affect vegetation, including tree seedling growth. These sites may not recover from soil disturbance if future harvests use the same areas for roads (DeArmond et al., 2021). In addition, significant changes in harvesting equipment and methods in recent decades may be altering logging impacts on soil properties, seedling responses, and tree growth. For example, intensive silvicultural practices such as mechanical site preparation may require additional research regarding their extent and potential soil impact. Harvest impacts are likely variable. Impacts vary by soil type, particularly depth, texture and drainage, as well as tree species, geography, and local climate, making it difficult to compare small or modest impacts to soil by logging operations. Additional research would help inform this indicator.

## Indicator 1.2: Harvested area with significant change in soil chemistry that degrades soil productivity.

**Status and trends for this indicator:** Maine lacks a soil monitoring program for scientifically tracking forest soil chemistry. In 1999, the MFS recommended implementation of a forest soil monitoring system to collect data on a range of soil chemistry parameters when it proposed this indicator. However, no program has been developed to identify the most appropriate soil chemistry indicators or conduct systematic soil chemistry monitoring.

A number of studies suggest that timber harvesting can affect nutrient availability and organic matter of soils (Crawford et al., 2021). Harvesting for biomass or on well-drained or shallow soils may deplete nutrients after repeated harvests on the same site. Although many U.S. studies have suggested that timber harvesting reduces levels of soil carbon and organic matter, a recent extensive analysis for the northeastern U.S. suggests that harvesting may not affect soil carbon levels, or impacts may be slight or restricted to where equipment impacts are high (Nave et. al. 2024).

Overall, short-term impacts of harvesting on soil productivity may be modest or restricted to high-impact areas. However, scientists are increasingly focusing on understanding of long-term plus cumulative impacts of harvesting on soil productivity. Also, climate change may reduce soil productivity of harvested forests more than non-harvested forests. (Valipour et. al. 2021). Warming temperatures may amplify potential declines in soil carbon and greater rainfall may increase leaching of nutrients mobilized by soil disturbance due to harvesting.

A larger soil sampling program could provide better data if it sampled areas lacking forest harvesting (e.g., ecological reserves), as well as high and low impact areas of harvest sites. As noted, comprehensive long-term data are not available.

**Rationale for this indicator:** Soil chemistry has an essential role in determining forest regeneration and productivity (Liu 2025). Its key attributes include nutrient availability (nitrogen, phosphorus, potassium, etc.), pH, and organic matter content. These properties influence tree growth, health, and overall forest ecosystem function. Harvesting may reduce chemical properties by removal of wood, soil disturbance and erosion, or changes in their flux which may lead to leaching (Puhlick and Fernandez 2023). Maintaining healthy soil chemistry is crucial for sustainable forest management and maximizing timber production and other ecosystem services.

## Criterion 2. Water Quality, Wetlands, and Riparian Zones:

**Goal:** Maintain, or where necessary, restore the chemical, physical, and biological integrity of aquatic systems in forested areas.

Forests play a critical role in maintaining the chemical, physical, and biological integrity of aquatic systems in Maine (Wilkerson et al., 2010). They help ensure clean drinking water, maintain the

health of aquatic ecosystems, fish, and wildlife. Forested areas around streams, lakes, and wetlands (riparian areas) filter pollutants and sediments that could otherwise contaminate downstream water sources and while also maintaining critical habitat for fish, amphibians, and countless other species. Logging operations can affect aquatic systems by disrupting stream flow patterns at stream crossings, exposing mineral soil and increasing erosion of sediment into waterbodies (Cristan et al., 2016). By maintaining aquatic systems, forests can continue to provide clean water, support biodiversity, and maintain the ecological processes that benefit both wildlife and human communities. Although the 2005 State of the Forest Report identified indicators for this criterion, no comprehensive program exists for collecting data to support the indicators established.

### Indicator 2.1: Percent of water bodies in forest areas (e.g., stream kilometer, lake hectares) in which the aquatic life is as naturally occurs.

**Status and trends of this indicator:** Maine does not have a water body monitoring program for scientifically tracking aquatic life. In 1999, the MFS recommended implementation of an in-stream water quality monitoring system to collect data on a range of parameters when it proposed this indicator. However, no ongoing monitoring program has been established, nor has subsequent research produced adequate data for this indicator in forested areas.

Maine’s Department of Environmental Protection (DEP) uses a water classification system to establish water quality attainment goals for water bodies across Maine. DEP classifies streams and rivers as AA or A as a proxy for aquatic life being “as naturally occurs”, and in 2025 conducted an analysis of small stream watersheds averaging 19,600 acres (HU12 watersheds). This analysis found that 94.2% of rivers and streams in forested watersheds are classified as AA or A.<sup>3</sup> By contrast, watersheds with less than less than 65% forest cover contain only 22.4% class AA or A water bodies. These results are based on water quality attainment classes, which are assigned based on regularly monitored water quality parameters at a limited number of sites at lower reaches of the watersheds, and therefore serve as a proxy indicator. Elsewhere, water quality parameters in heavily forested (>80% forest) watersheds can be naturally variable making it challenging to establish a range of natural variation that excludes streams with modest regulatory impairment (Neufeld et al., 2025). Most watersheds with >70% forest cover will not show impairment, likely falling within the range of natural variation (Locke 2024). However, the long history in Maine of stream alterations for water power and to facilitate log drives complicates analyses of “as naturally occurs”. In addition, the density of stream crossings by roads may have greater impact on water quality than area in timber harvesting (Erdozain et al., 2022). Impacts may be variable in how they persist in time and space. For example, sedimentation from logging operations may accumulate downstream while harvest impacts such as stream water warming may dissipate downstream. Stream warming due to canopy removal likely also decreases rapidly over time with revegetation of riparian forests.

**Rationale for this indicator:** Strong correlations are often found among forest cover, high water quality, and high habitat value for aquatic organisms (Cole et al., 2010). Maine’s iconic wild brook

---

<sup>3</sup> pers comm., 2025, Meagan Sims, [Becky Schaffner](#) ME DEP.

trout habitats are closely associated with the high-water quality and cool temperatures of forested streams and rivers. Logging operations can disrupt stream flow patterns and reduce water quality of aquatic systems through erosion into waterbodies (Cristan et al., 2016). By supporting aquatic systems, forests can continue to provide clean water, support biodiversity, and maintain the ecological processes that benefit both wildlife and human communities.

## Indicator 2.2: Percent of harvested acres on which Best Management Practices for the protection of water quality are utilized effectively.

**Benchmark 2.2:** The percentage of harvested acres on which Best Management Practices for the protection of water quality are utilized effectively will increase from 47 percent in 1995 to 75 percent by 2005.

**Status and trends for this indicator:** MFS implemented a statewide system to monitor the use and effectiveness of water quality BMPs on timber harvesting operations in 2002. The 2023-2024 report found that water quality BMPs were used effectively on 70% of harvested sites where surface water was present which is consistent with recent years (Maine Department of Agriculture, Conservation, and Forestry and Maine Forest Service 2024).

The same report found that soil did not reach the water body or bankfull channel of water bodies on 84% of sites overall, and 72% of sites with a crossing structure. These results indicate that progress in achieving this indicator has been made since the benchmark was established and is close to achieving the benchmark set in 2005. The 2023-2024 report also recommended continued training and resources to ensure that these gains are maintained and increased.

**Rationale for this indicator:** This indicator directly measures logging operations' effective use of water quality protection practices. It assumes that forest management operations can effectively use Best Management Practices (BMPs) along with other practices to minimize the adverse impacts of forest management on water quality. BMPs include techniques like maintaining buffer zones along streams, using proper road construction methods, and controlling erosion to prevent sediment and pollutants from entering waterways. A higher percentage indicates high levels of stewardship and voluntary compliance in the forestry sector, showing that logging operations are effectively minimizing their impact on water resources (Warrington et al., 2017, Wilkerson et al., 2010).

## Indicator 2.3: Percent of water bodies in forest areas (e.g. stream kilometers, lake hectares) with significant variation from the historic range of variability found in relatively undisturbed watersheds in pH, dissolved oxygen, levels of chemicals (electrical conductivity, sedimentation, nutrients or temperature change).

The MFS recommended implementation of a water body water quality monitoring system to collect data on a range of parameters when it proposed this indicator in 1999. Subsequent research has

not provided adequate comprehensive data for this indicator in forested areas. No systematic water body sampling program has been developed to address the suite of parameters in the indicator, nor to establish the historic range of variability, at a landscape level. Chemical properties of undisturbed water bodies can vary widely

#### Indicator 2.4: Percent of mapped, perennial first and larger order stream kilometers with acceptable levels of large woody material and snags with riparian zones.

This indicator measures how many of Maine’s permanent streams have enough fallen trees and dead wood along their banks, which is crucial for healthy stream and river ecosystems. No statewide data exist to quantify this indicator. Large woody material creates pools where fish can hide, spawn, and rest, traps leaves and other organic matter, and slows down water flow to reduce erosion and flooding downstream. When streams lack this natural wood material, fish populations may decline, water quality may drop, and riparian ecosystem may become less stable and resilient to environmental changes.

Maine Forest Service’s “Chop and Drop” program, established in 2012, sets standards and provides training to create additional woody structure in streams, while also removing the need for permits to conduct these habitat improvement practices. A small number of landowners have adopted this or similar stream restoration practices. In addition, timber harvesting rules in shoreland areas limit timber harvesting in riparian areas and help ensure that riparian forests continue to contribute woody and organic material to streams.

#### Indicator 2.5: Percent of stream kilometers in forested watersheds in which stream flow and timing has significantly deviated from the historic range of variability found in relatively undisturbed watersheds.

**Status and trends of this indicator:** Maine has a very limited statewide stream flow monitoring program maintained by the USGS, which is insufficient for assessing this indicator and is at risk of being discontinued. No additional streamflow monitoring system has been developed.

Subsequent research has not provided adequate data for this indicator in forested areas statewide, and individual watershed studies have provided conflicting results. MFS’s water resources program is aimed at Best Management Practices (BMPs) education and outreach, especially proper installation of stream crossings, BMP use and effectiveness monitoring, fish passage, woody debris in streams and related riparian habitats.

**Rationale for this indicator:** Many Maine streams have been impacted by 4 centuries of land use change and physical alteration of streams, which included bulldozing and dynamiting streams for log driving. Importantly, the impacts of climate change and extreme weather events greatly complicate the understanding of the “historic range of variability” of streamflow.

Several studies have evaluated streamflow impacts from forest management (Hornbeck et al., 1993). Some studies point to streamflow impacts from heavy cutting in small watersheds that greatly reduces tree cover, as well as relatively rapid recovery of streamflow in relatively few years

as forests revegetate (Campbell et al., 2021). At the same time, variables such as soils, terrain, vegetation type, and the application of buffers influence the range and intensity of impacts (Locke 2024).

### Criterion 3. Timber Supply and Quality

**Goal:** To ensure that Maine’s future timber supply is of sufficient quantity and quality to support a diverse and economically healthy forest manufacturing sector.

Maine's timber supply and quality are fundamental to sustaining the state's forest economy and rural communities across the state (Kingsley et al., 2004). The forest products industry represents a cornerstone of economic activity in many rural communities, supporting thousands of jobs in logging, sawmills, paper manufacturing, and wood product facilities across the state.

Adequate timber supply ensures mills and processors can operate at full capacity, maintaining employment and generating tax revenue for towns and the state. When supply becomes constrained, mills face reduced production, increased costs, and potential closure, directly affecting mill workers and communities. The impacts can extend beyond forest industry jobs to sectors like trucking, equipment sales, and professional services. Timber supply generally refers to the growth of forests, but it also presumes adequate logging and trucking capacity, which may be locally limited or affected by trucking distance to mills, or otherwise constrained. Future capacity is currently challenged by market forces as discussed elsewhere in this report.

Timber quality is equally critical because different products require specific wood characteristics. High-quality sawlogs support value-added manufacturing of dimensional lumber and specialty products that command premium prices. Lower-quality material feeds pulp and biomass facilities. Importantly, markets for low grade wood make early silvicultural interventions financially viable. These can include activities such as thinning younger stands to improve growth rates, species composition, and stem quality, or to address forest health issues. A diverse quality of wood enables a balanced forest products sector where different mill types coexist and provide feedstocks for other mills, creating market outlets for all timber grades and supporting comprehensive forest management.

Maintaining a robust timber supply and quality protects Maine's forest industry competitiveness, preserves the working forest landscape, sustains rural employment, and ensures that landowners have the economic incentive to keep forests as forests rather than converting them to other land uses including development.

### Indicator 3.1: Ratio of projected growth and harvest, as determined by modeling current management practices and trends in forest development.

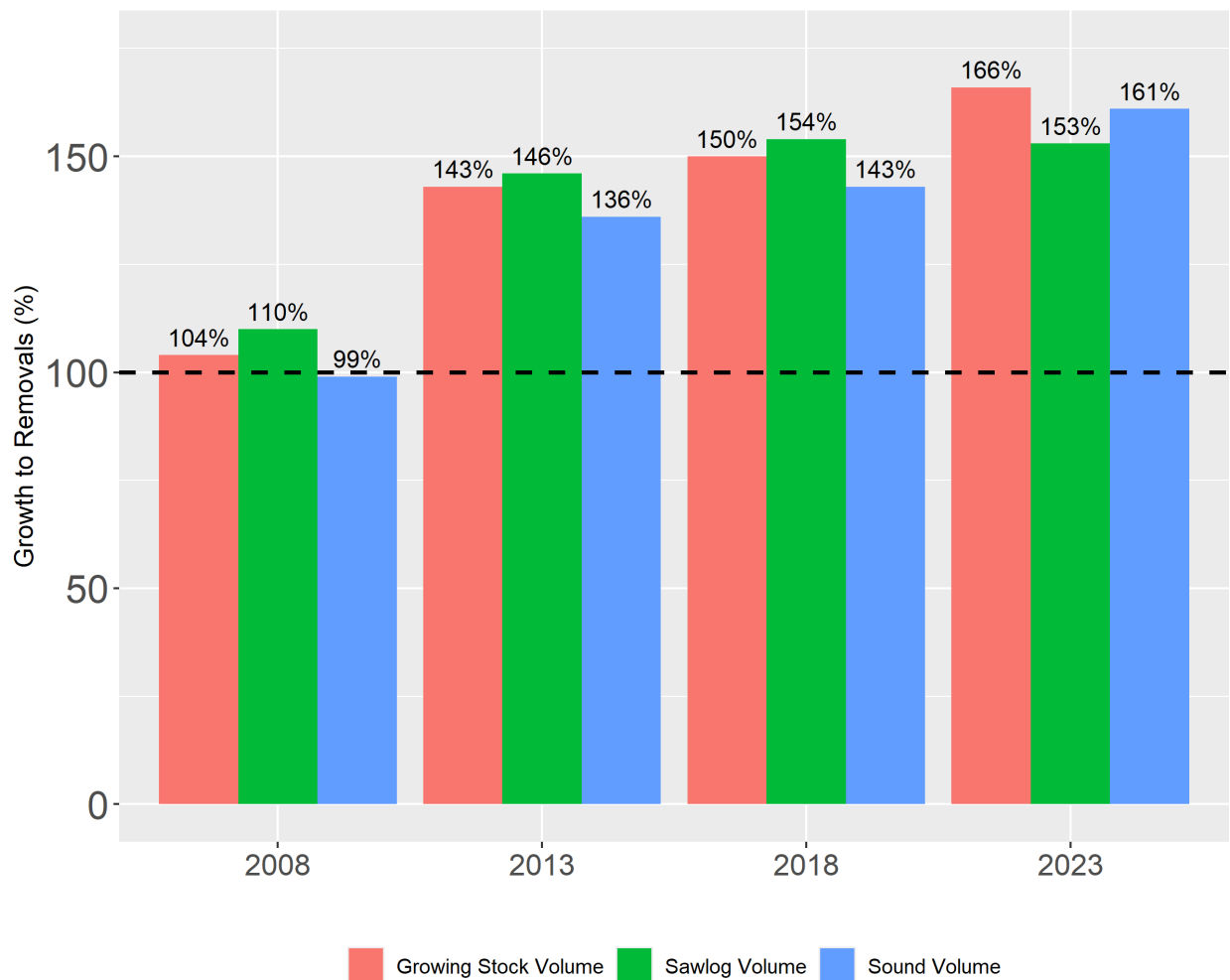
**Benchmark 3.1.1:** The ratio of projected growth to harvest for the statewide resource will show improvement from the ratio of 86% as identified in the 1998 Timber Supply Outlook by 2005.

**Benchmark 3.1.2:** The ratio of projected growth and harvest for major geographic and ownership divisions will show improvement from current projected levels by 2005.

**Benchmark 3.1.3:** The ratio of projected growth and harvest for distinct categories of tree species and quality will show improvement from current projected levels by 2005.

#### Status and trends for this indicator:

**Overall ratio of growth to harvest:** At the time of the 2005 State of the Forest report (2005) the most current reported growth to harvest percentage was 86% as identified in the 1998 Timber Supply Outlook (Figure C3.1a). Since then, growth to harvest ratios have increased notably, exceeding 100% across all megaregions.



**Figure C3.1a: Statewide growth to harvest removals percentages for volume classifications, all sound volume (including growing stock), growing stock (which includes sawlog), and sawlog volume alone, 2008, 2013, 2018, 2023 (source: USDA-FS-FIA 2025).**

Statewide net growth to harvest removal ratios for sound volume have risen significantly to 1.66 since the benchmark was established. (The ratio growth to harvest and other removals is 1.56.) This improvement is likely attributable to several factors, including continued recovery of forests from spruce budworm outbreak of the 1970s and 1980s, whose impacts were still apparent at the time of the 1998 report. Other factors likely include silvicultural investments by several landowners, relatively high growth rates of younger to middle-aged stands which dominate Maine's forests, and, more recently, a decline in overall harvest levels.

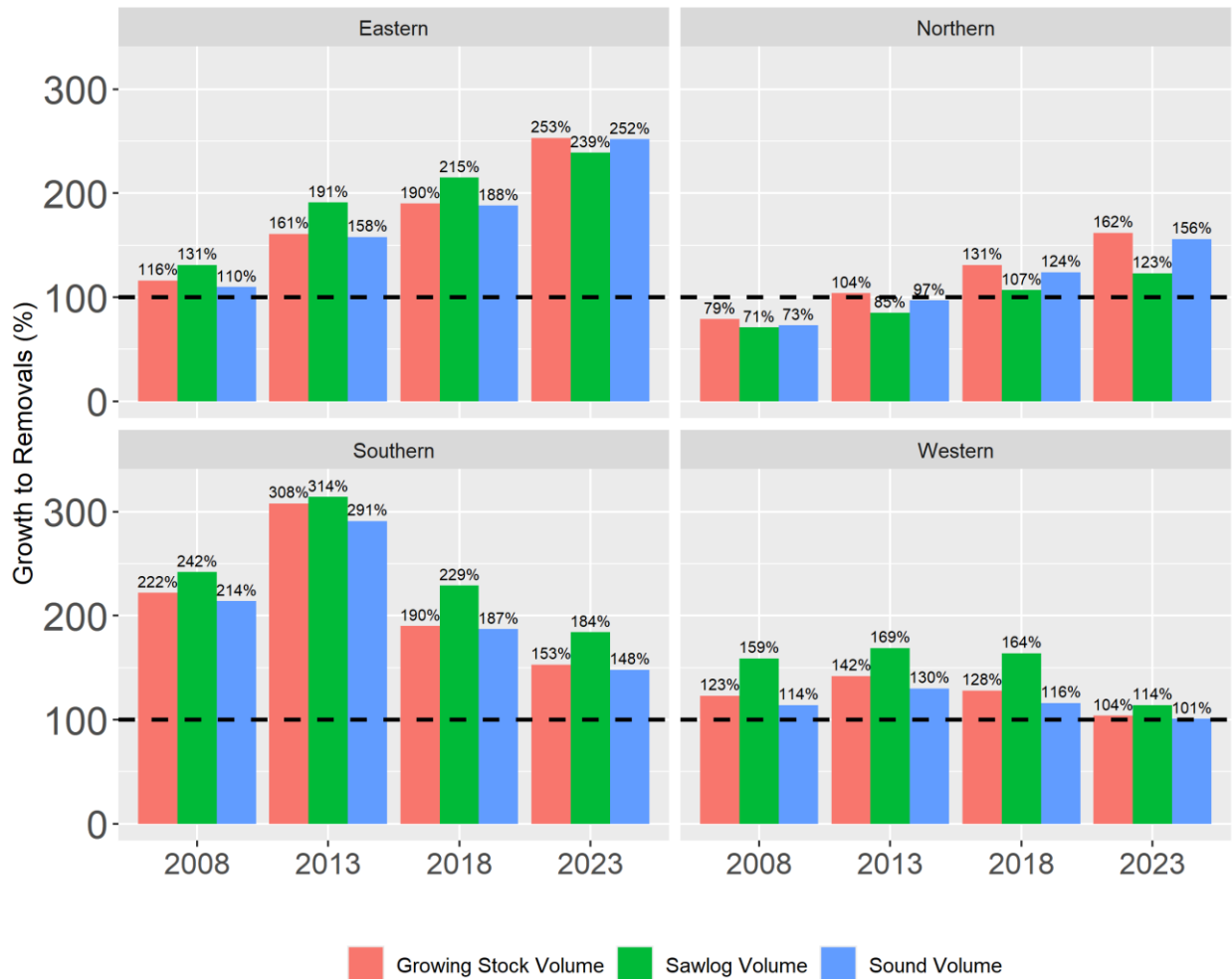
An internal MFS analysis in 2023 found that, assuming recent harvest levels, based on the 2018 inventory cycle, growth to harvest ratios were projected to remain above 1.0 for the next 40 years. While the model only went out 40 years, it is likely that growth would continue to exceed harvest through 50 years. Growth exceeded harvest for most species except for a few species such as sugar maple and yellow birch. While standing timber inventory was projected to increase, the analysis did not establish whether and to what degree harvest levels could increase above then-current levels, assuming that other removals, i.e. land use conversion and conversion to reserves, remained stable.

Since the modeling exercise, harvest levels in Maine have dropped, resulting in even higher growth to removals ratios. At the same time, other factors influencing wood supply have become less predictable, particularly disturbances such as forest health impacts from native insects such as spruce budworm, exotic species such as emerald ash borer, beech leaf disease, and hemlock woolly adelgid, and climate impacts including drought, frost and storm damage. Alternative forest uses including management for carbon and other ecosystem services may also affect the number of acres available for timber management and harvest. Given reduced harvests and uncertainty when markets will rebound, it seems likely that overall harvest levels can continue or expand in the next several years.

At the same time, modelling these factors along with uncertain markets for wood products, new technologies, forest conversion, creation of new forest reserves, and carbon markets will prove even more challenging going forward. As resources allow, MFS timber supply projections will remain a priority.

The trends in the ratio of growth to harvest varied across megaregions and ownerships: While growth to removal ratios remain above 1 across all areas of the state, the trends differed slightly among megaregions (Figure C3.1b). The eastern megaregion shows the greatest increase in this ratio, which may have resulted in part from reduced harvesting, while the northern megaregion showed slow but consistent increases. In contrast, the southern megaregion saw reductions in growth to harvest, which may result in part from stagnating growth as dense stands mature, as well as increased harvest activity, including terminal harvests (conversion to non-forest land uses). The western megaregion shows a slow decline in growth to harvest but remains slightly above 1, perhaps resulting from increased harvests of mature stands.

This analysis does not include an assessment of growth to harvest ratios for ownership classes. Maine’s forest has seen considerable fragmentation and diversification of ownerships in the last 20-40 years, with many new owners whose classification using existing categories is somewhat arbitrary, as well ongoing separation of woodlands from mill ownerships. As such, harvesting based on ownership classification is made more difficult and potentially misleading, with large potential errors, especially if ownerships are mis-classified or comprise the majority of acres in one class, or the number of FIA plots in a particular class is low. Improving ownership classification is an ongoing effort.



**Figure C3.1b. Growth-to-removal percentages on timberlands by megaregion for growing stock, sawlogs, and sound volumes, 2008, 2013, 2018, 2023** (source: USDA-FS-FIA 2025).

**Table C3.1a: Growth-to-removals ratios based on growing stock trees by megaregion and statewide for major species group, for 1995, 2003, 2008, and 2023** (source: USDA-FS-FIA 2025).

	Hardwoods	Softwoods	All Species
--	-----------	-----------	-------------

Megaregion	1995	2003	2008	2023	1995	2003	2008	2023	1995	2003	2008	2023
	Northern	1.29	0.74	0.62	1.66	0.17	0.85	0.91	1.59	0.42	0.80	0.79
Eastern	1.99	0.85	0.84	2.58	1.10	1.02	1.36	2.51	1.35	0.94	1.16	2.53
Southern	1.98	1.49	3.43	2.11	1.15	1.36	1.55	1.03	1.46	1.43	2.22	1.53
Western	1.04	1.42	1.12	1.02	0.64	0.87	1.38	1.05	0.98	1.11	1.23	1.04
Statewide	1.50	1.00	0.94	1.72	0.51	0.96	1.13	1.62	0.81	0.97	1.04	1.66

Ratio of growth and harvest for different tree species and tree quality: All species except paper birch show positive growth to harvest ratios from 2008 to 2023, across all product categories (Table C3.1b). The shifts in individual species are highly variable, reflecting the variability in markets and harvest removals in response.

**Table C3.1b. Growth-to-removals ratios for 13 key commercial tree species, for 1995, 2003, 2008, and 2023** (source: USDA-FS-FIA 2025).

Species	Live Sound volume			Growing stock volume				Sawlog volume			
	2003	2008	2023	1995	2003	2008	2023	1995	2003	2008	2023
American beech	-0.15	-0.03	1.33	2.21	-0.46	0.18	1.29	0.97	0.38	-0.04	1.25
Aspen	0.61	0.84	1.37	0.99	0.55	0.95	1.52	1.58	0.18	0.89	1.21
Balsam fir	0.61	1.03	2.08	-0.07	0.53	1.09	2.09	-0.06	0.38	0.39	1.25
Eastern hemlock		1.65	1.83			1.72	1.92			1.80	2.02
Eastern white pine	1.52	1.87	1.36	1.14	1.49	1.81	1.35	1.14	1.40	1.89	1.39
Northern red oak	1.96	5.71	2.15	2.41	2.13	5.69	2.10	1.92	1.36	8.09	2.73
Northern white cedar	-0.03	1.29	0.95	1.42	0.65	1.43	2.02	1.10	0.19	1.77	2.40
Paper birch	0.79	0.19	0.70	0.91	0.69	0.33	0.76	0.92	0.88	0.28	0.97
Red maple	1.23	1.32	1.98	1.93	1.09	1.38	2.02	1.67	1.27	1.45	2.00
Red spruce	0.96	0.61	1.36	0.34	0.64	0.62	1.35	0.59	0.42	0.74	1.12
Sugar maple	1.53	0.65	1.22	2.05	1.82	0.66	1.36	1.38	1.55	0.65	1.51
White ash		1.93	1.62			2.05	1.61			2.08	1.44
Yellow birch	1.25	0.90	1.91	1.41	1.31	0.94	1.92	0.99	1.23	0.84	1.21

**Rationale for this indicator:** Maine monitors the growth-to-harvest ratio to ensure forest sustainability and long-term health. This metric indicates the long-term sustainability of wood supply and forest health, whether timber harvesting rates exceed natural regeneration, identify risk of over harvesting forest, and supports the future viability of the forest products industry (McCaskill et al., 2011). By tracking this ratio, forest managers can maintain productive woodlands for future economic use, preserve wildlife habitat, protect ecosystem services, and

balance commercial timber interests with conservation goals for Maine's 17 million forested acres.

### Indicator 3.2: Acres by forest type and landowner category that are suitable for management and harvest.

Benchmark 3.2.1: The number of forest acres available for management and harvest will support projected harvest and growth.

Process Benchmark 3.2.1: MFS will document the number of acres by forest type and landowner category where forest management or timber harvesting are limited by regulation, easement, or other restrictions.

**Status and trends for this indicator:** MFS does not have a consistent program or methodology to determine the number of forest acres where forest management or timber harvesting are limited by regulation, easement, or other restrictions. Such constraints can vary widely in the degree of impact on management and planning, whether silvicultural options are constrained at all, and what benefits may accrue from such restrictions.

Statewide timber harvest regulations potentially affect virtually all acres of timberland, e.g., clearcutting standards which regulate (but do not prohibit) the size, arrangement, and regeneration of clearcuts. Other state regulations affect a more limited area, e.g., in the case of comparatively narrow buffers on water bodies. Liquidation harvesting rules affect a narrow set of activities and includes several exemptions. Local regulations on forest management occur in a number of municipalities across the state but likely vary widely in their impact. Current use property tax programs which set requirements for enrolled acres, especially Maine's Tree Growth Property Tax program, require a degree of accountability from landowners through program standards, and provide incentives to manage for specific objectives. These programs set a low level of constraints and requirements on forest management. Publicly or privately held conservation easements, which involve millions of acres of Maine land, may completely prohibit timber harvesting or have little to no impact beyond state regulations. Notably, approximately 85% of conserved land in Maine is managed as working forests.

Maine's forests currently support significant harvest through robust growth rates. Going forward the most lasting impact of restrictions on future management may result if constraints on harvesting become significant enough to encourage the conversion of forest to non-forest uses, such as agriculture, commercial or residential use, or utilities such as solar arrays, powerlines, or wind turbines. MFS estimates that forest conversion involves 5,000 to 10,000 acres of forest land per year which are converted to other land uses, primarily development. While such conversion rates may not be significant from a statewide perspective, they may have greater impact on local or regional forest-based economies, wildlife habitat and connectivity, and other values.

Most recently, MFS is implementing a reporting requirement for landowners who enroll in forest carbon programs, which are typically established to generate transferable carbon credits. In some cases, such enrollments may result in a reduction in harvest. Tracking these trends in acres

enrolled will not identify such reductions in detail but should provide better insight into the level of adoption of such programs by landowners of all sizes. MFS makes ongoing efforts to identify data sources and methods to assess this benchmark.

**Rationale for this indicator:** Monitoring forest acres by type and ownership and limitations on timber harvesting helps Maine understand harvest capacity and inform policy decisions. Different forest types (hardwood, softwood, mixed) have varying growth rates and commercial values, while ownership categories (industrial, private, public) face different management constraints and harvest likelihood. This data enables accurate timber supply forecasting, targeted outreach to landowners, sustainable forest planning, and assessment of economic opportunities across Maine's diverse forest landscape.

### Indicator 3.3: Amount of tree mortality occurring that could otherwise be used through the application of sound silvicultural practices.

Benchmark 3.3.1: Forest landowners and managers will implement practices to reduce measurable tree mortality by 20 percent by 2009.

**Status and trends of this indicator:** Harvestable volume across ownerships and landscapes is highly variable and influenced by access, markets, stand volume, available harvest operators and equipment, as well as past harvest history. Silvicultural interventions may be able to capture some mortality on some ownerships, especially where thinning of dense stands may capture merchantable wood from trees that are being out-competed (often referred to as the stem exclusion phase of stand development). In other stands likely mortality from disease, insect or weather-related damage, affecting part or all trees in a stand, can be captured as merchantable volume through partial harvesting or regeneration of the entire stand. However, such interventions may not always be financially and operationally feasible, or silviculturally appropriate, and may also have implications for other values such as wildlife habitat.

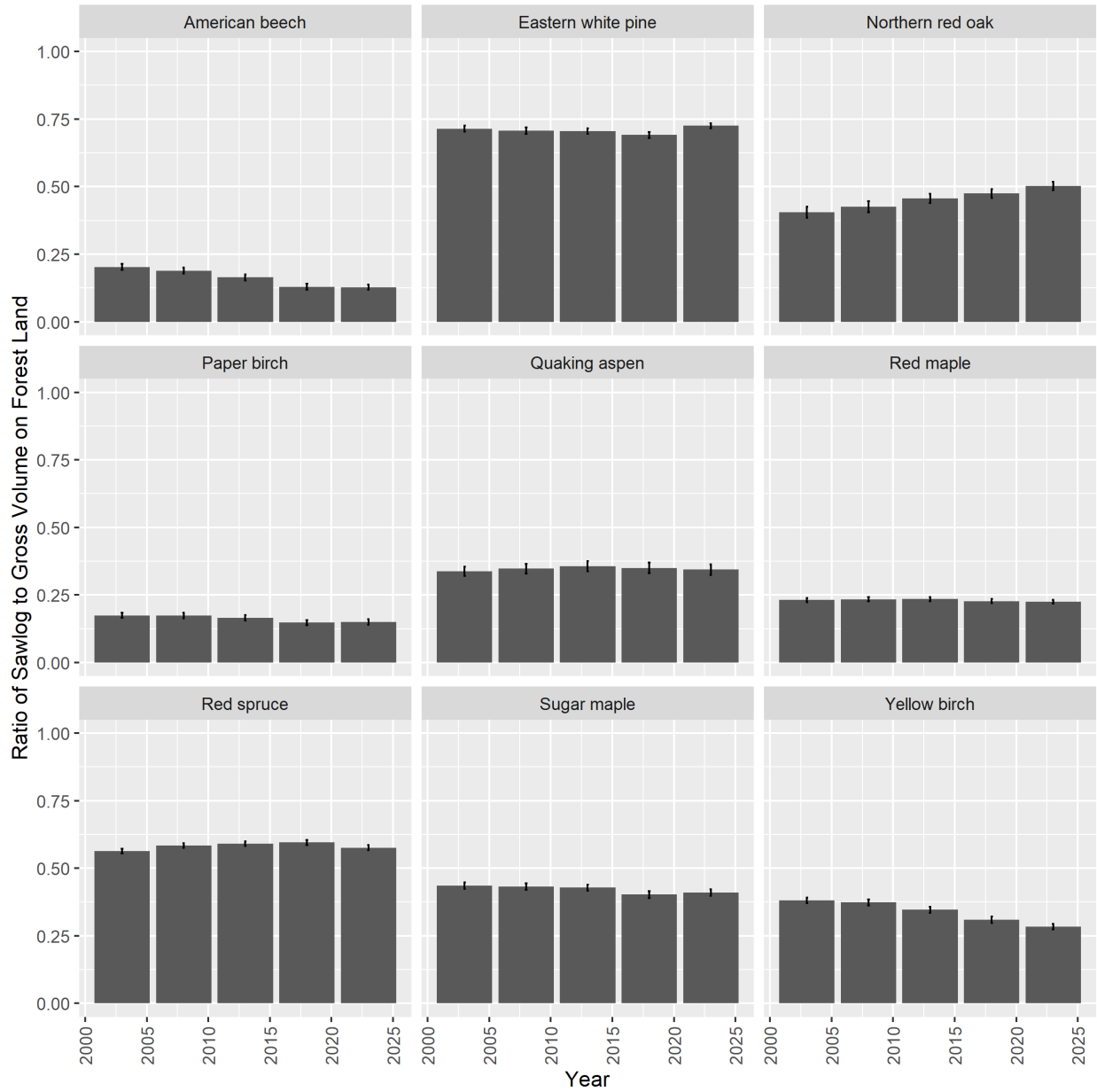
As a result, estimating the degree to which mortality can be captured is very difficult to assess and continues to run into data limitations for a statewide or regional analysis. Better modelling of forest health conditions and events, and statewide projections of forest growth and harvest that incorporate primary components of change may begin to address this indicator.

**Rationale for this indicator:** Capturing tree mortality through harvesting is a worthwhile and common objective both at a statewide policy level and for individual landowners. At the same time, overall trends in tree mortality are variable and due to forest stand dynamics, forest health, and weather events, which are often beyond the control of, or entirely unpredictable for, forest managers. Similarly, the amount of tree mortality that is available for harvest is difficult or impossible to estimate other than on a harvest-by-harvest basis. Anticipated mortality due to stand conditions or forest health impacts may be harvestable under some circumstances, though some mortality contributes snags and down woody debris which are important elements of habitat. All of these factors limit the ability of forest landowners and managers to implement practices to reduce measurable tree mortality.

Indicator 3.4: The ratio of sawlog and veneer volume to total volume for red spruce, white pine, red maple, sugar maple, yellow birch, white birch, beech, aspen, and northern red oak.

Benchmark 3.4.1: Increase the quality of trees growing in the Maine forest. All harvest of commercial forest products should be guided by silvicultural principles that promote long-term productivity of the forest, and high-quality growth. As a result, the ratios of sawtimber volume to total volume for important species will increase 10 percent by 2009.

**Status and trends of this indicator:** An assessment of the ratio of sawlog volume to gross volume below provides mixed results and considerable variability among species over the last two decades (Figure C3.4a). Most species examined had steady or slightly decreasing sawlog to total volume ratios. Only one, red oak, increased its ratio by roughly 10%.



**Figure C3.4a: Ratio of sawlog volume to gross merchantable volume for the nine most commercially important tree species in Maine for 2000, 2005, 2010, 2015, 2025 (source: USDA-FS-FIA 2026).**

**Rationale for this indicator:** Improved timber quality is expected to improve access to markets and landowners' returns as well as to strengthen local and rural wood products economies. Improving stand quality via silvicultural treatments is a goal of many ownerships but requires a long-term commitment to forest management. Such silvicultural measures are most suitable for the higher-value species.

## Criterion 4. Aesthetic impacts of timber harvesting

**Goal:** Manage the visual impacts of timber harvesting to convey a strong stewardship ethic.

The aesthetics of forested settings are a matter of individual preference (Ribe et al., 2022). The aesthetic impressions of a timber harvest can vary widely among people with different opinions about forest management. Maine's forest management is highly visible on accessible private lands. Post-harvest aesthetics—slash piles, damaged trees, rutting, geometric edges—shape public perceptions and concerns. Good stewardship practices minimize visual impacts, and measures addressing these issues are widely identified and applied across forestlands.

**Indicator 4.1: Number of forest landowners and the acreage managed by forest landowners certified as managed in compliance with the applicable objectives and criteria pertaining to aesthetics.**

Benchmark 4.1: The number of forest landowners and the acreage managed by forest landowners certified as managed in compliance with the applicable objectives and criteria pertaining to aesthetics will continue to increase.

**Status and trends of this indicator:** The number of forested acres enrolled in forest certification continues to climb, albeit slowly. Existing forest and logging (sometimes referred to as “point of harvest”) certification programs (Sustainable Forestry Initiative (SFI), Forest Stewardship Council (FSC), and Master Logger Certification® (MLCP)) have criteria and objectives for managing aesthetics. To be certified, landowners, land managers, and loggers must address aesthetic requirements in their harvest planning and implementation. Practices to address aesthetic concerns must be applied with consideration of individual site conditions, and forest landowners can consider the goal of minimizing negative visual impacts in multiple ways when making management decisions.

Over 50% of Maine timberland acres are enrolled in a program that has requirements regarding attention to aesthetics of harvested areas. In addition, certified loggers are involved in a substantial proportion of logging activity in Maine. The Sustainable Forestry Initiative's Maine State Implementation Committee (ME SIC) maintains a hotline to receive complaints about timber harvesting in the state. In the last three years, the Sustainable Forestry Initiative's State Implementation Committee did not receive any complaints regarding aesthetic issues in timber harvests in Maine (P. Johnson, pers. comm.). Similarly, Maine's Outcome-Based Forestry program, under which the MFS monitors the activities of participating landowners, consistently has

not identified significant issues related to aesthetics. MFS-issued permits for harvesting in some areas, such as high mountain areas, require that applicants consider visual impacts.

**Rationale for this indicator:** Minimizing the negative, short-term aesthetic impacts of timber harvesting is an important step in communicating a strong stewardship ethic to the public. This indicator addresses the challenge posed by differences in individual preference by employing as a proxy the efforts of landowners, managers, and harvesters to address timber harvesting aesthetics, by having a system of policies in place to guide harvesting operations and minimize negative visual impacts.

## Criterion 5. Biodiversity

**Goal:** Maintain healthy, well-distributed populations of native flora and fauna and a complete and balanced array of different types of ecosystems

Biodiversity is the variety of life on earth, ranging from genes, species, and ecosystems, and includes the interrelationships and ecological processes necessary to support them (Hunter and Gibbs 2006). Its enormity makes it challenging to monitor. The handful of indicators and benchmarks presented here attempt to monitor key elements of forests and their biodiversity at a statewide level, though the complexity of forest systems means exact benchmark levels for achieving optimal biodiversity may never be precisely known for all ecological communities and contexts.

Five of the six (Indicators 5.1 to 5.4 and 5.6) Biodiversity indicators focus on forest structural elements, forest types, and landscape components that support a variety of forest biodiversity, including forest species in Maine and are not monitored by other agencies. Indicator 5.5 measures the loss of forest habitat through conversion. Indicators under other criteria addressing soils, water quality, timber supply, and forest carbon also have implications for biodiversity.

Maine Forest Service participates with many other entities in Maine's Department of Inland Fisheries and Wildlife (IFW), including in its development of the State's 5-year Wildlife Action Plan, which addresses comprehensively the status of terrestrial and aquatic wildlife species in Maine (Maine Department of Inland Fisheries and Wildlife 2026). IFW's Beginning with Habitat program also monitors and provides public information on wildlife habitats in Maine. The Maine Natural Areas Program in the Department of Agriculture, Conservation and Forestry is also responsible for researching and tracking the conservation status of Maine's natural communities, including forest plants. These programs have different roles in the conservation of forest species and forest biodiversity in Maine.

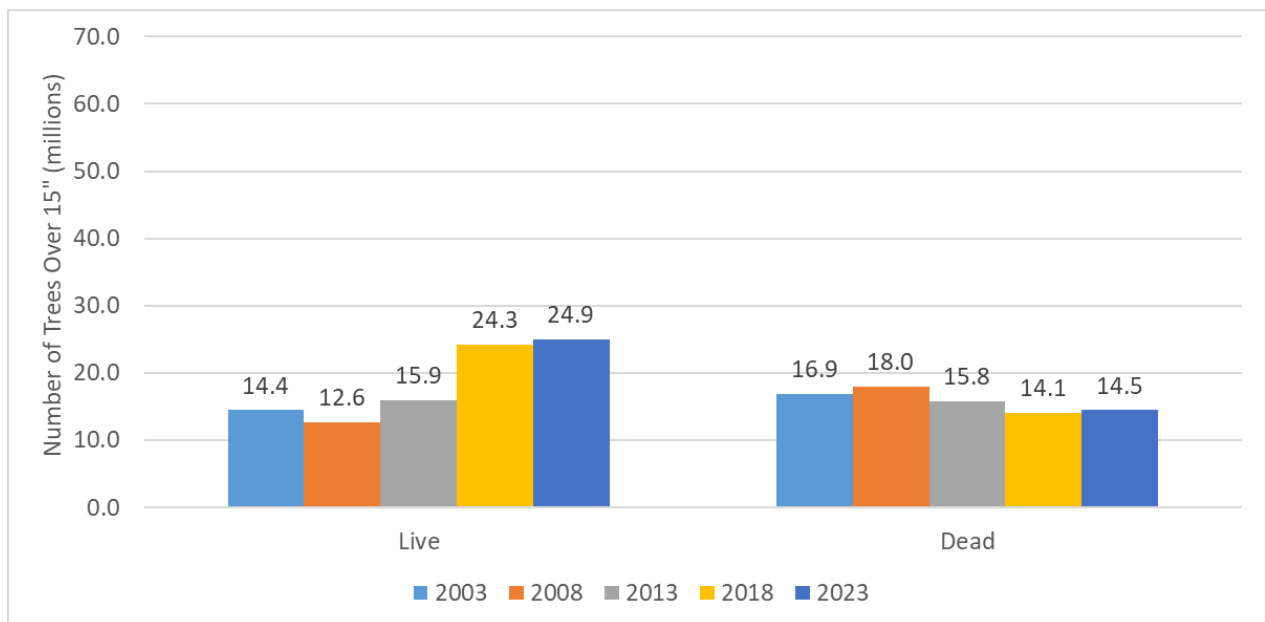
### Indicator 5.1: Number and distribution of large diameter trees, snags, and down logs ( $\geq 15.0$ in DBH)

The 2005 benchmarks established total and per acre goals for live rough and rotten trees, standing dead trees, and large down dead trees. The 2005 benchmarks for this indicator are consolidated here. The 2005 analysis was based on forestland acres, while includes inoperable land. This

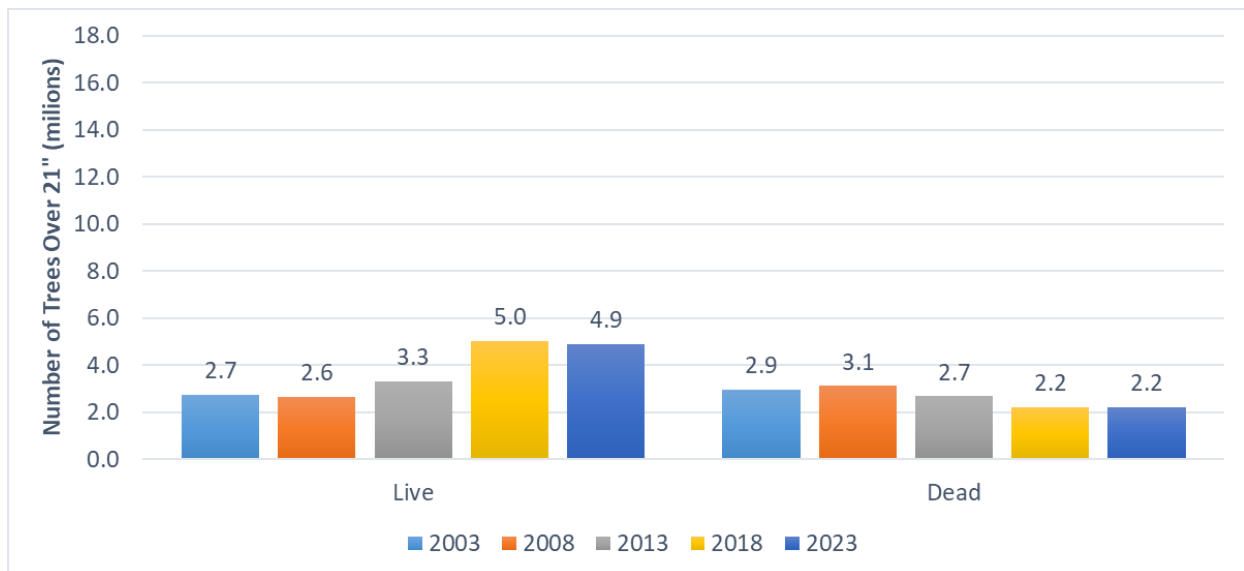
analysis is restricted all timberland acres as these are acres where human activities may affect this indicator.

Benchmarks 5.1.1, 5.1.2, 5.1.3: The number of 1) rough and rotten, large diameter trees, 2) large diameter dead trees and snags, and 3) large diameter, down dead trees in Maine’s timberland should increase gradually over time to at least 68 million (4 stems per acre) (for each category), well distributed on the landscape. At least 17 million of these trees (1 stem per acre) should be  $\geq 21.0$  in DBH.

**Status and trends for this indicator:** Between 2003 to 2023, large rough and rotten trees  $\geq 15$ ” show the most dramatic change, remaining relatively stable around 12-14 million trees until about 2012, then increasing sharply to reach over 27 million trees (Figure C5.1a), though rough and rotten trees  $\geq 21$ ” have increased less rapidly to roughly 5 million trees (Figure C5.1b). The number of standing dead  $\geq 15$ ” remained relatively flat throughout the entire period, hovering around 14-17 million with minimal variation and showing no clear upward or downward trend. Data for dead and down trees are inadequate to establish statewide numbers. While these trends show modest improvement, they still fall below the benchmarks set in 2005.



**Figure C5.1a** Number of rough and rotten live and dead trees 15 inches and over (millions) on timberland, in Maine, for 2003, 2008, 2013, and 2023 (USDA-FS-FIA 2025). The benchmark target was 68 million trees in 2005.



**Figure C5.1b Number of rough and rotten dead trees 21 inches and over (millions) on timberland, 2003, 2008, 2013, 2018, 2023** (source: USDA-FS-FIA 2025). The benchmark target was 17 million trees in 2005.

**Rationale for this indicator:** The numbers and distribution of large ( $\geq 15.0$  in DBH) and very large ( $\geq 21.0$  in DBH) “rough and rotten” trees and large ( $\geq 15.0$  in DBH) dead trees are primary elements of forest structure and as such serve as key microhabitats for select plant and animal species, while contributing to key ecological processes (such as regeneration of some tree species). Large diameter trees provide important substrates for certain lichen, moss, liverwort, and invertebrate species that are uncommon or rare in the northeast, foraging substrates for many forest birds, and nesting platforms by forest raptor species (Lindenmayer et al., 2013). Dead down trees are considered important germination sites for species such as red spruce. Large snags are necessary substrates for nesting or roosting cavities used by some rare saproxylic beetles, endangered bat species, large-bodied bird species like wood duck, common golden eye, merganser species, and barred owl, and by mustelids and raccoons (Löfroth et al., 2023, Barry et al., 2018, Dollin et al., 2008, Wiglet et al., 2007).

These three features also contribute to nutrient and carbon cycling, can affect forest hydrology and microclimates (Russell et al., 2014). They are typically not favored in commercially managed forests and so are at-risk to declining in number across the forested areas of Maine. The decline in these three forest elements has been linked to the decline of rare invertebrates, lichens, mosses, liverworts, fungi, and bird species in Europe where forest management has occurred for longer than in Maine (Löfroth et al., 2023; Koivula and Vanha-Majamaa 2020; Gustafsson et al., 2010).

## Indicator 5.2: Functional, connected riparian forests

**Status and trends of this indicator:** No benchmark has been developed for this indicator at this time due to the challenges of identifying, compiling and collating current, readily available, statewide riparian GIS data to accurately identify measure “functional, connected riparian forests”.

**Rationale for this indicator:** Riparian ecosystems provide habitats, ecological processes, and important structural inputs to terrestrial and aquatic systems (Ramey and Richardson 2017). They are areas used by a large number of species. Their key functions include wildlife habitat; buffering aquatic and wetland habitats and species from disturbance; protecting water quality; exchanging energy between aquatic and terrestrial ecosystems; and providing organic matter, nutrients, and structure to aquatic ecosystems.

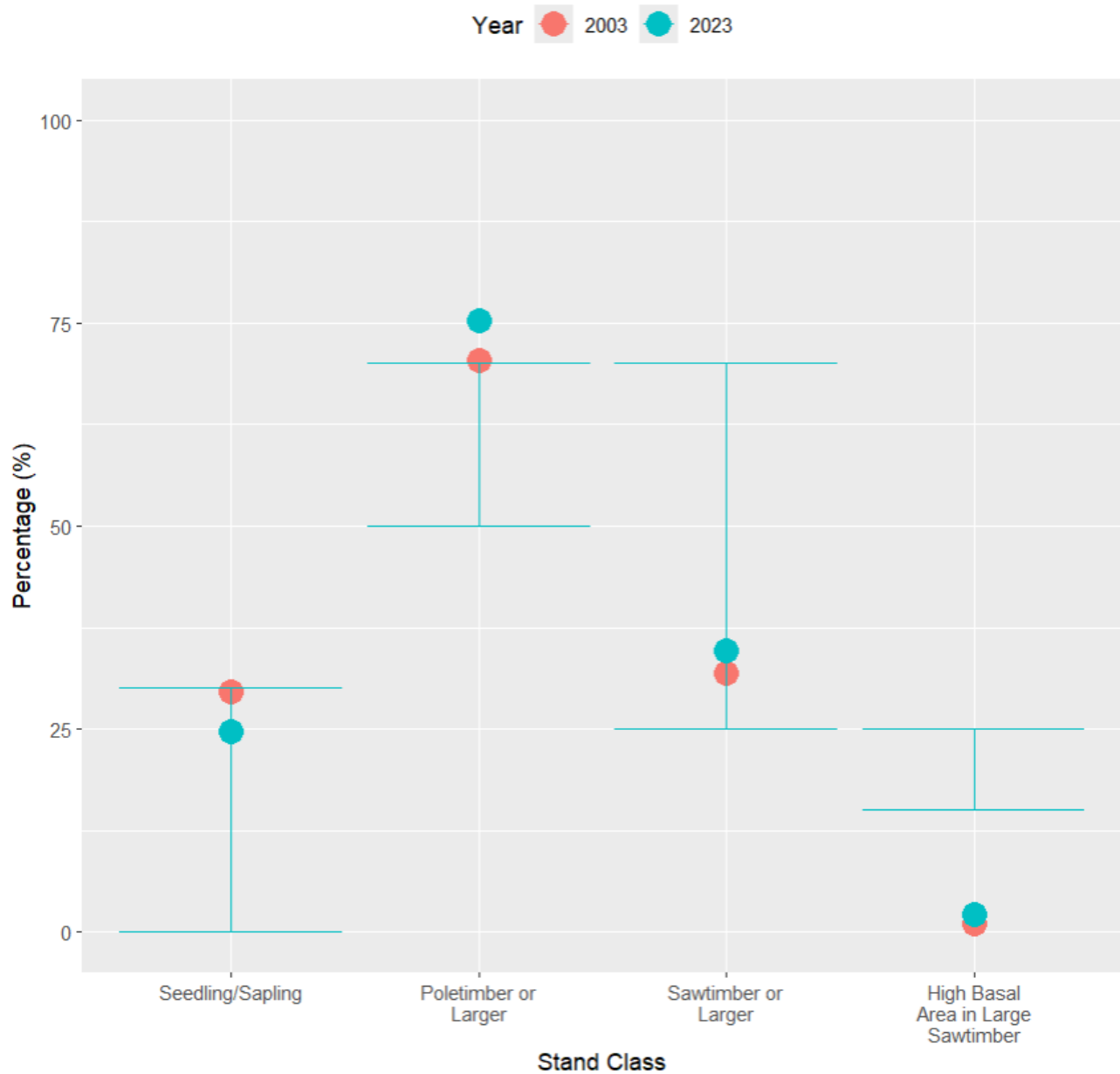
## Indicator 5.3: Forest Stand Structure

Benchmark 5.3.1. Maine’s forests should be managed to attain an ideal structural distribution (well distributed across the state and among forest types).

**Status and trends of this indicator:** The stand structure of Maine’s forests (Figure C5.3a) has changed slightly since 2003. The percentage forest in 2023 for poletimber or larger and high basal area in large sawtimber stand classes were outside their respective proposed idealized stand structure ranges. The percentage of forest for seedling/sapling and sawtimber or larger stand classes have stayed with in respective idealized stand structure ranges and are closer to the center of their ranges. The percentage of forest in high basal area in large sawtimber remains less than a fifth of the idealized stand structure range.

Few stand classes change in relative abundance for the key forest type groups (Table C5.3b). For spruce/fir, the Seedling/sapling class shrank in area while the Poletimber and Larger class grew proportionally larger in area. Maple/beech/birch stand classes changed little. Pine stand classes changed with increases in the Sawtimber and Larger class and the High Basal Area in Large Sawtimber class, a nearly 70% increase in the latter.

Stand class changes between 2003 and 2023 were more apparent in the four megaregions (Table C5.3c). The eastern megaregion saw a shift from smaller stand classes to larger stand classes. The northern megaregion saw the Poletimber and Larger class increase in area while the Seedling/sapling and Sawtimber and Larger classes became smaller. The Southern region saw a decline in Seedling/sapling area and increase in the three larger stand classes. The Western megaregion saw a small decline in smaller stand classes and moderate increases in the larger stand classes.



**Figure C5.3 Idealized forest stand structure (proposed ranges shown using bars) and statewide timberland structure for 2003 and 2023** (source: USDA-FS-FIA 2025). Idealized stand structure follows the MFS SOF Report (2005). The idealized stand structure and suggested ranges (depicted by bars) depicted here were based on idealized stand structures proposed by DeGraaf (1992) and further refined by the Maine Council on Sustainable Forest Management (1996) and the MFS Criterion 5 Biodiversity technical working group (2000-2005).

	<b>Forest Stand Class (percent of forest type group by year)</b>							
Major Forest Type Group	Seedling/sapling		Poletimber or larger		Sawtimber or larger		High Basal Area in Large Sawtimber	
	2003	2023	2003	2023	2003	2023	2003	2023
Spruce/fir	39.2	30.1	60.8	69.9	30.7	28.2	0.3	0.4
Maple/beech/birch	18.4	21.2	81.6	78.8	36.0	35.3	1.1	1.6
<b>Pine</b>	<b>4.7</b>	<b>3.6</b>	<b>95.3</b>	<b>96.4</b>	<b>71.0</b>	<b>83.3</b>	<b>7.7</b>	<b>12.8</b>

**Table C5.3b: Stand structure for key forest types (spruce/fir, maple/beech/birch, and pine) using DeGraaf classification (source: USDA-FS-FIA 2025).**

	<b>Forest Stand Class (percent of megaregion for year)</b>							
Megaregion	Seedling/sapling		Poletimber or larger		Sawtimber or larger		High Basal Area in Large Sawtimber	
	2003	2023	2003	2023	2003	2023	2003	2023
Northern	34.4	30.2	65.6	69.8	34.1	28.6	1.0	1.2
Eastern	34.5	23.7	65.5	76.3	23.9	31.6	0.6	0.7
Southern	16.3	10.0	83.7	90.0	37.0	55.6	2.2	7.8
Western	16.3	20.9	83.7	79.1	33.2	42.3	1.5	2.3

**Table C5.3c: Stand structure for key by megaregion using DeGraaf classification (source: USDA-FS-FIA 2025).**

**Rationale for this indicator:** An idealized statewide stand structure metric helps assess whether diverse age classes and structures occur across regions and forest types (DeGraaf 1992). An idealized statewide stand structure metric helps address resilience, biodiversity, ecosystem services, and sustainable forest management questions statewide. Maine's forest biodiversity depends on sound management of working forests, as public ecological reserves alone cannot protect all biodiversity due to limitations in size, connectivity, and location. Stand structure serves as a proxy for the full range of forest habitats supporting biodiversity, since forest dynamics create

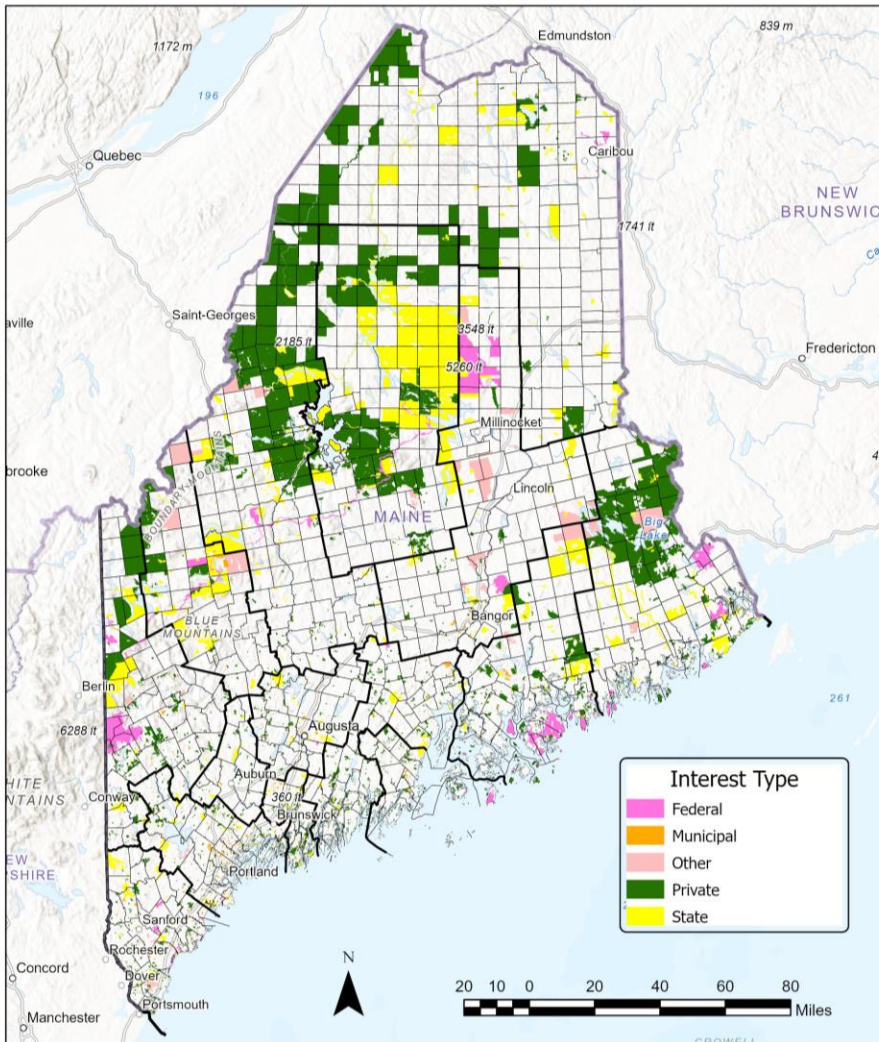
a mosaic of forest conditions from both natural disturbance events and anthropogenic disturbances, especially harvesting.

In 2005, MFS developed an idealized statewide stand structure metric based on work by Degraaf et. al. (1992), the Maine Council on Sustainable Forest Management (1996), and technical stakeholder groups. This metric established a desired range of the percentages of forest land acres by 4 stand size classes. In so doing it recognized that while the percentages could fluctuate over time, the long-term development of forests in all size (and age) classes depended on management that ensures adequate acres of early, middle, and late successional forests over time and across the landscape while maintaining a range of habitats and most of Maine's wildlife and plant species.

Large sawtimber stands (trees over 15 inches DBH) serve as proxies for late-successional forests, providing structural complexity and heterogeneity that support uncommon species, high-value timber, watershed protection, recreation, and management benchmarks. Sawtimber includes softwoods at least 9.0 inches DBH and hardwoods at least 11.0 inches DBH and are productive for timber. Poletimber comprises trees 5.0 inches or larger but smaller than sawtimber.

Seedling/sapling stands are a proxy for early successional habitats critical for endangered species like Canadian lynx and declining bird populations. Achieving idealized structures requires both allowing mature stands to age into late-successional conditions and using active management to accelerate development of late-successional characteristics.

## Indicator 5.4: Size, distribution, and representation of protected areas



**Figure C5.4: Map of federal, municipal, other (including tribal), private (mostly land conservation organizations), and state conservation lands in Maine (source: ME Revenue Service 2026).**

The sustainability criteria and indicators established in 2005 included benchmarks addressing the total area and distribution of conserved forests in Maine.

Benchmark 5.4.1: There should be at least two protected examples of each forest type within the state by 2013.

Benchmark 5.4.2: In each of seven ecological regions, the proportion of protected forest types should increase to at least half of the types that naturally occur in each region by 2013.

Benchmark 5.4.3: The total acreage of landowners who voluntarily protect special or unique habitats and who are certified as well managed should increase to at least 7.5 million acres by 2005.

**Status and Trends of this Indicator:**

**Table C5.4: Area of forest habitats (habitat macro-groups) and proportions conserved in Maine, 2025** (source: Maine Inland Fish and Wildlife 2026).

Forest habitats	Area in Maine (Acres)	Percent of State	Percent Conserved
Acadian-Northern Appalachian Forest	14,574,829	73.9%	24.4%
Laurentian-Acadian Flooded & Swamp Forest	1,787,282	9.1%	23.1%
Appalachian Oak - Pine Forest & Woodland	343,125	1.7%	11.3%
Central Hardwood Swamp Forest	83,024	0.4%	13.9%
North Atlantic Coastal Forest & Woodland	17,943	0.1%	31.4%
Coastal Plain Evergreen Hardwood - Conifer Swamp	12,256	0.1%	13.0%
Total Land Area	19,730,290		22.1%

Forest type protection: Approximately 4.8% of Maine’s land area is reserve management land (Schlawin et al., 2021). Many common forest types have one example with some level of protection in Maine. However, conservation of all major forest habitats (habitat macro-groups) exceeds at least 11% of their total acreage across the state (Table C5.4).

Coverage of forest type conservation in each ecological region: Fewer than 2 high-quality examples of most forest types are protected within reserve management lands in each ecoregion (Schlawin et al., 2021). Forest types found at low to moderate elevations are under- represented in protected lands in most ecological regions.

Acreage of landowners who voluntarily protect special or unique habitats and are certified: The two forest certification programs active in Maine require conservation of special and unique areas: the Sustainable Forestry Initiative (SFI; Sustainable Forestry Initiative 2022) and Forest Stewardship Council (FSC, Forest Stewardship Council 2026). The 2005 target for acreage of landowners who voluntarily protect special or unique habitats and are certified was 7.5 million acres of Maine’s timberland. In 2026, this acreage was estimated to be about 9.5 million acres well exceeding this target (Sustainable Forestry Initiative 2026; Forest Stewardship Council International 2026). No further data describe the extent or nature of such conservation areas.

**Rationale for this indicator:**

These benchmarks were developed to describe the extent of conserved forest across the state. A key aspect of any land conservation strategy is to distribute conservation areas across the state and different forest types to ensure conservation of the richness of biodiversity in Maine (Maine Ecological Reserves Scientific Advisory Committee 2009). The area of “conserved” or “protected” land based on public fee ownership, private conservation ownership, and publicly and privately held conservation easements, has increased markedly in the last 2 decades. At the same time, the management of conserved lands in Maine can range from no intervention to intensive timber management, which indicates that the level of biological conservation may vary depending on landowner biodiversity objectives.

Forest type protection: Protected areas conserve biodiversity. Ensuring multiple protected examples of each forest type provides insurance against catastrophic loss and maintains genetic diversity.

Coverage of forest type conservation in each region: Regional representation protects unique assemblages across Maine's different landscapes. It reduces overall risk to natural communities and species from loss from exposure to a single limited catastrophic event (e.g., hurricane, disease), maintains genetic diversity, and allows species to evolutionarily respond to changing natural conditions.

Acreage of landowners who voluntarily protect of special or unique habitats and are certified: Voluntary habitat protection through certification helps incentivize conservation stewardship on private lands, which comprise most of Maine's forests. This helps create a conservation network beyond public reserves while supporting sustainable forest management and conservation goals statewide.

The Sustainable Forestry Initiative (SFI) certification standard requires participating landowners to have a program to map and conserve *Forests with Exceptional Conservation Value*, old-growth forests, and ecologically important sites (Sustainable Forestry Initiative 2022). Forest Stewardship Council (USA) standard requires appropriate management of “rare ecological communities (including plant communities)” and “other habitats, ecosystems ...of management concern” aimed at conserving the environmental values at risk (Forest Stewardship Council 2026). This includes managing to maintain or enhance and monitor High Conservation Value Ecosystems and Habitats, including “rare, threatened or endangered ecosystems, habitats, or refugia.”

## Indicator 5.5: Conversion, parcelization, and roading of forest land

Benchmark 5.5.1: Maine’s forest land area should remain relatively stable at or near 17 million acres.

Benchmark 5.5.2: At least half of Maine’s forest lands should remain in parcels of 5,000 acres or larger.

Benchmark 5.5.3: The percentage of Maine’s forests that lie within 1,000 feet of a class 1, 2, or 3 road should stabilize at less than 35%.

**Status and trends for this indicator:**

**Forest land area stable at or near 17 million acres:** As noted in Part 1 of this report, Maine’s forest land area continues to exceed 17 million acres and meets this benchmark. Despite a slight decline in forested land area, Maine remains the most forested state in the nation, with over 88% of the land area forested. As of 2023, there are 17.44 million acres of forest land in Maine well above the level established in Benchmark 5.5.1. (Preliminary data from 2024 indicate a slight further decline in forest land acres.) Statewide FIA estimates are that approximately 20,000 acres converted and 10,000 acres reverted annually, though many of these changes are not permanent (Woodall et al. 2022). FIA net change estimates of 10,000 acres per year are slightly higher than MFS estimates of land use change based on timber harvest reports, which range from 3,000-6,000 acres per year.<sup>2</sup> However, it seems likely that the rate of conversion of forest land to other land uses lies somewhere between 5,000 and 10,000 acres annually, with disproportionate acres converted in southern portions of the state where development is more likely.

**Half of forest lands in parcels of 5,000 acres or larger:** MFS has not acquired or analyzed statewide parcel data to make a determination of this benchmark. The average parcel size of lands in the organized towns enrolled in Tree Growth Tax Law program declined by 38% (annualized 1.6% per year) from 265 acres to 165 acres from 1980 to 2003 and may be continuing to decline to the present (Maine Department of Conservation, Maine Forest Service 2005).

Year	Over 1000 feet	Within 1000 feet	Total	Percent of Forest Acres within 1000 feet (%)
2003	10,005,990	7,699,675	17,705,665	43.5
2008	9,870,164	7,785,871	17,656,035	44.1
2013	9,975,549	7,660,532	17,636,080	43.4
2018	9,696,799	7,806,106	17,502,904	44.6
2023	9,254,301	8,189,361	17,443,663	46.9

**Table C5.5: Area over 1,000 feet (acres) and within 1,000 feet (acres and percentage) of Improved Roads, 2003, 2008, 2013, 2018, 2023** (source: USDA-FS-FIA 2025).

**Percentage of forests within 1,000 feet of a road:** The percentage of forests within 1,000 feet of a road was stable from 2003 to 2013 and has slowly increased to 46.9% from 2018 to 2023 (Table C5.5). This was estimated using FIA data which measures the horizontal, straight-line distance from the center of each forested FIA plot to the nearest maintained or improved road, which is used to determined average distance of forested areas from roads. This may be a road of any width that is maintained as indicated by pavement, gravel, grading, ditching, and/or other improvements and includes roads other than class 1, 2, and 3 roads. The difference between the benchmark of 35%

and the 2023 level of 46.9% may reflect differences road definitions were applied in understanding road standards. This statistic has exceeded the benchmark of 35% in every year.

#### **Rationale for this indicator:**

Forest conversion, fragmentation, and road proliferation threaten ecological integrity, wildlife connectivity, and forest-dependent economies. Together, these Benchmarks can be used to assess cumulative landscape-level changes that reduce habitat quality and connectivity between forest patches, and threaten species requiring large, contiguous forest areas. They track Maine's forest and risk of fragmentation that could affect biodiversity and sustainable forest management. Maintenance of an intact, unfragmented forest landscape is a primary indicator that there are land resources available for maintaining biodiversity, the forest economy, and other valued forest benefits.

Forest land area stable at or near 17 million acres: Maintaining 17 million forested acres ensures conservation of forest biodiversity (Thompson et al., 2013) and timber supply (Drummond and Loveland 2010).

Half of forest lands in parcels of 5,000 acres or larger: Blocks of forest in large parcels support wide-ranging species, enable landscape-scale management, and maintain forest resilience (Woollard et al, 2024). Forest conversion to non-forest uses permanently removes habitat and ecosystem functions. Parcelization into smaller ownerships can result in less opportunity or financial viability to manage for a range of objectives including biodiversity (Mölder et al., 2021). Parcelization especially dividing large forest tracts into smaller ownerships—often leads to fragmented management, increased development pressure, and disrupted wildlife corridors. Small parcel size appears to correlate strongly with reduced landowner engagement in active forest management and conservation (Ma et al., 2012; Butler et al., 2021; Hatcher et al., 2013; Vickery et al., 2009; Kitteridge and Grogan 2005).

Percentage of forests within 1,000 feet of a road: Road construction fragments habitats, creates barriers to animal movement, increases edge effects that favor generalist species over forest specialists, facilitates invasive species spread, and can alter hydrology (Zhou et al., 2026, Forman and Alexander 1998). Proximity to roads is also a limiting factor for wildlife species that require undisturbed forest interior habitats and can create barriers or hazards to movement of some species. The development of forest roads increased markedly beginning in the 1960s with the decline for river driving as a primary means of transporting wood long distances. The greatest period of road expansion likely occurred between 1975 and 1995, though new road construction still occurs in managed forests. Increased road density has allowed management activities to occur on additional acres and provided additional access for public recreation.

### **Indicator 5.6: Degree to which forest management is consonant with natural forest dynamics**

No benchmark has been developed for this indicator at this time due to the lack of current, readily available, statewide data that quantifies the area in forest management that is consonant with

natural forest dynamics. The following discussion is presented to inform public discussion about the topic.

The degree of alignment of current forest management strategies with natural disturbance regimes is not straightforward to evaluate and continues to be the subject of considerable research and debate. In theory, forest management that is consonant with natural forest dynamics creates patterns similar to those created by natural forest disturbances, such as wind, insects, disease, and occasionally wildfire. Natural disturbances in some northeastern forests were found to create canopy gaps averaging approximately 2 acres (Desrochers et al., 2025), while other studies have estimated substantially smaller average gap sizes (Seymour et al. 2002). Some silvicultural approaches vary the intensity, timing, and spatial patterns of timber harvesting in an effort to mimic natural disturbances and create diverse age classes and forest structures that support a wide array of biodiversity, while also producing timber. By contrast, some forms of commercial harvesting result in homogenization and simplification of forests and landscapes, resulting in potential losses of forest biodiversity. However, even intensive forest harvesting may retain significant amounts of forest structure.

Total timber harvest acres per year have declined by over roughly 50% (from over 511,070 acres to just over 257,124 acres) from 2003 to 2023 (see Figure 5a). These declines have occurred unevenly across megaregions and ownership types. Harvest practices have also undergone significant changes over the last two decades. Both partial harvesting and initial shelterwood (include final overstory removal or OSR harvests) harvest acres per year have declined (by 49% and 46% respectively). Clearcut acres per year have remained relatively steady at around 24,000 acres each year.

The current harvest footprint covers approximately 1.5% of the state's forest land area each year which may be less than the canopy disturbance of natural forest (~2%) in the region (Desrochers et al, 2025, Louis et al., 2025). Of the annual harvest footprint in 2023, approximately 49% of the acres are harvested by a partial harvest method (either individual trees or groups of trees). The remainder is harvested using either the shelterwood (42%) or clear-cut (9%) methods. Some of these acres receive additional intensive treatments, such as competition control through herbicides, mechanical site preparation, planting, and precommercial thinning. The timberland area that is managed under silvicultural regimes which approximate the effects of a major or catastrophic disturbance on forest succession (effectively reset to zero every 50-70 years) exceeds 5%. The "return interval" and patch size of land managed under clearcutting and intensive forestry does not match that of the natural forest, while "partial harvests" may vary widely in their similarity to natural disturbances (Seymour et al, 2002). Nevertheless, the annual total acreage in intensive silviculture is small, and 2023 herbicide use on approximately 16,000 acres, planting of 7,000 acres, and precommercial thinning of 15,000 acres, are all less than reported in 2003. In addition, intensive management of forests can substantially increase the volume, value, and harvest interval, such that total harvest acres can be substantially lower to derive the same amount of wood products than would be possible with more extensive management.

## Indicator 5.7: Availability of Hard Mast for Wildlife

This indicator is added in 2026 in recognition of the changing characteristics, especially species composition, resulting from novel insects and diseases, compounded by climate change.

Species	Megaregion	1995	2003	2008	2013	2018	2023
American beech	Eastern	404	362	352	372	384	377
American beech	Northern	1,340	969	777	616	551	556
American beech	Southern	216	223	246	268	261	288
American beech	Western	393	332	349	323	337	330
northern red oak	Eastern	130	160	171	178	188	206
northern red oak	Northern	48	39	44	44	43	72
northern red oak	Southern	681	754	827	895	925	978
northern red oak	Western	268	233	279	338	342	327
white oak	Eastern	0	4	4	4	5	5
white oak	Southern	47	61	63	54	65	70
white oak	Western	14	12	5	4	17	17

**Table C5.7: Average number of forestland acres (1000s) with at least one mast tree species over 10" in diameter, by species, for six inventory cycles indicated by cycle terminal year (source: USDA-FS-FIA 2025).**

**Status and trends for this indicator:** The major hard mast tree species in Maine are American beech, Northern red oak, and white oak (Table C5.7), though black oak, bur oak, shagbark hickory, and swamp white oak are lesser hard mast tree species found mostly in southern areas. American chestnut, once an important mast species in parts of Maine, has been nearly eliminated from the landscape due to chestnut blight.

The acreage with at least one mast-producing (>10" DBH) tree of three major mast producing species changed in the four megaregions of the state (Table C5.7). From 1995 to 2023, the acreage of plots with at least one mast-producing (>10" DBH) American beech tree moderately increased in the southern megaregion, but declined slightly in the western and eastern megaregions, while the decline was greatest in the northern megaregion. The acreage with at least one mast-producing (>10" DBH) northern red oak tree increased moderately in all megaregions. White oaks, which are nutritionally superior to red oaks, appeared to increase as well though data are very limited.

The net gain in acreage with at least one mast producing oak tree did not offset the loss in net loss in acreage with at least one mast producing American beech tree: the state-wide American beech

loss was 315,000 acres greater than oak acres gained. In the northern megaregion, the American beech acreage loss was 708,000 acres greater than the oak acres gained. This may indicate an overall shift in hard mast production from American beech to oak species and a net reduction in mast producing acres in Maine. The nutritional value of beech mast vs. red oak mast is likely as significant a factor in overall food value of these acreages.

**Rationale for this indicator:** Hard mast, including acorns from oaks and nuts from beech trees, provides critical high-energy food for wildlife during fall and winter months when other foods are scarce (Jakubas et al., 2005; Kulge et al., 2025). Wildlife species including black bears, white-tailed deer, wild turkeys, and numerous smaller mammals and birds depend on hard mast to build up fat reserves before winter and overall survival. Other predator species including raptors rely on small birds and mammals as prey. Mast production varies annually, and abundant mast years significantly influence wildlife population dynamics, reproductive success, and winter survival rates across multiple species.

## Criterion 6. Public Accountability of Forest Owners and Managers

**Goal:** To broaden the practice of sustainable forestry and build public confidence by establishing and maintaining reasonable accountability measures.

Public accountability ensures Maine's forests are managed responsibly for current and future generations. It helps assure a forest that benefits rural economies, local communities, and way of life vital for many Mainers. Accountability can be demonstrated by highlighting how decision-making about forest management is made by trained professionals with oversight from third-party certifying programs.

Professional management of Maine's forest occurs in planning at different levels and harvesting and can be readily monitored. Licensed foresters apply professional judgement to planning and harvesting decisions which can lead to improved forest health and productivity. Forest certification programs use third-party verification help assure landowners are applying sustainable forest planning and management practices that maintain or enhance timber production and other forest benefits. Logger training and certification help assure that workers understand, plan and implement harvest operations in accordance with best management practices, protect water quality and soil integrity, maintain other forest values, and apply ethical business practices. Maine Forest Stewardship Program guidelines provide science-based standards for foresters of small woodland owners.

Together, the selected indicators metrics reveal how widely voluntary stewardship systems are widely applied. They can help build public trust in the forestry industry and activities of forest landowners, document progress toward sustainability goals, and identify gaps requiring additional improvements or programs. This approach balances private property rights with public interest in healthy, productive forests that sustain Maine's economy, ecology, and communities.

## Indicator 6.1: Percentage and number of acres harvested where management planning, harvest layout, silvicultural prescription, and harvest operations are conducted under the direct supervision of a Licensed Forester (LF)

Benchmark 6.1.1: The percentage of acres harvested annually under the direct supervision of a Licensed Forester will increase from 74 percent (372,579 acres) in 1997 to 85 percent (estimated 429,000 acres) by 2005.

Benchmark 6.1.2: The percentage and number of acres harvested annually on small ownerships (under 1,000 acres) under the direct supervision of a Licensed Forester will increase from 38 percent (60,330 acres) in 1997 to 50 percent (estimated 80,000 acres) by 2005.

### **Status and Trends of the indicator:**

Total acres harvested annually under direct supervision of a Licensed Forester: Across all harvest acres, 79% of harvested acres had a Licensed Forester involved in 2023 (Maine Forest Service 2025), which is higher than previous reports but slightly less than the benchmark established for 2005 of 85%. In 2023, Licensed Foresters supervised harvesting on 202,622 acres, as compared to 210,622 acres in 2022. These acreages are substantially lower than in past years, reflecting the roughly 38% overall decline in harvested acres over the last ~10 years.

Traditionally, forester supervision is highest on industrial and investor-owned woodlands, where foresters are employed or contracted to oversee management of these lands where timber management is a primary objective.

Acres harvested annually on small ownerships under direct supervision of a Licensed Forester: By contrast, smaller ownerships ( $\leq 1000$  acres) most often are often at risk to being harvested without any involvement, or only minimal involvement, of a Licensed Forester. In 2023, 41.4% of harvested acres on land in small ownerships were implemented with the involvement of a Licensed Forester (Maine Forest Service 2025). This is less than the benchmark goal of 50% of harvested acres set for 2005. The degree of involvement and specific services of the forester in terms of planning, silviculture, and operational layout and supervision are not reported in these data and likely variable.

Historically, this statistic has not exceeded 25-35%. MFS education and assistance to woodland owners stresses the importance and long-term value of working with both a Licensed Forester and a skilled, professional logger to plan and execute timber harvesting with the highest assurance of positive outcomes, including long-term stewardship of forest resources.

**Rationale for this indicator:** This indicator measures professional oversight in forest management and helps assess adherence to professional standards on harvests (Godar et al., 2022). Licensed Foresters possess certified expertise in sustainable practices, legal compliance, and resource stewardship. Tracking their involvement reveals whether harvesting occurs under qualified supervision, helping protect public interests in water quality, wildlife habitat, and long-term forest health. Higher percentages indicate greater professional accountability, while lower rates may signal need for strengthened landowner education.

## Indicator 6.2: Number of acres (or number of landowners) under management certified by valid, independent, third-party certifiers of sustainable forest management

Benchmark 6.2.1: The number of acres (or number of landowners) under management certified by valid, independent, third-party certifiers of sustainable forest management will increase significantly from the current level.

**Status and trends for this indicator:** Certification programs have affected the management of about one-half of Maine’s forests for the last two decades. The greatest increases in certification enrollment occurred between 1995 and 2001. In 2005, Governor Baldacci set a target of enrolling 10 million acres of Maine’s timberland in forest certification, which has almost been achieved in 2026, with estimated certified acreage of 9.5 million acres (Sustainable Forestry Initiative 2026; Forest Stewardship Council International 2026).

**Rationale of this indicator:** Forest certification programs use independent third-party auditors to verify responsible management practices (Wolff and Schweinle 2022). These voluntary, market-driven systems offer flexible alternatives to rigid regulations, adapting to landowner goals and evolving science. Requirements are regularly updated based on stakeholder input. Supply chain demands, sustainability claims, and public concerns drive landowner enrollment, promoting accountability without mandating specific practices.

Maine landowners currently participate in two certification programs: the Sustainable Forestry Initiative (SFI) which was established by the U.S. forest products sector to address sustainable forestry management concerns in North America; Forest Stewardship Certification (FSC) which was developed by the environmental community primarily in response to concerns about unsustainable logging practices in tropical countries. Both certification programs operate internationally but has regional standards, including in the U.S., and are administered by independent non-profit organizations governed by diverse stakeholders.

Landowners in Maine no longer use two other certification programs. The American Tree Farm System (ATFS), established in the 1950s, operated a certification program for approximately a decade in furtherance of its long-standing program foster forest stewardship by landowners of small parcels. Its certification program was discontinued by the Maine Tree Farm Committee so that it could re-focus on its core recognition and technical assistance program. The International Organization for Standardization (ISO), an independent global standard-setting program, has used its ISO 14001 standard to evaluate landowners’ environmental management systems, but it was used by few Maine landowners.

### Indicator 6.3: Percent and number of timber harvesters who have received training and certification from the Certified Logging Professional Program (CLP) or an equivalent training system

Benchmark 6.3.1: The percentage of timber harvesters who received training and certification from the Certified Logging Professional Program or an equivalent training system will increase from an estimated 58 percent in 1997 to 90 percent by 2005.

**Status and trend of this indicator:** The last three decades have seen significant growth in the development of professional standards, training, and verification in timber harvesting and trucking. The Certified Logging Professional (CLP) program is a second-party training and verification program, established by the Sustainable Forestry Initiative (SFI) in the 1990s, but now operated by Maine TREE Foundation, and has trained thousands of loggers over the years in safe operations, best management practices, and other aspects of forest management. In 2025, CLP had 669 loggers who operated in Maine and were certified, and 314 logging companies with at least one CLP operator (Certified Logging Professionals 2026).

The Professional Logging Contractors of Maine (now the Professional Logging Contractors of the Northeast) formed around 2000 as a membership organization for loggers. PLC established the Master Logger Certification Program, a point-of-harvest training and certification program following the SmartLogging standard, with third party verification. (The certificate holder is The Trust to Protect Northeast Forest land under the PLC umbrella.) Eighty-nine logging/trucking contractors in Maine belong to the certified group of Master Loggers. Many of these are large contractors but some are smaller firms or sole proprietorships. Although exact numbers are not available, Maine has an estimated 1,800 Logging Equipment Operators (NAICS code 1133) in 2022 (Kingsley 2024) and about 412 logging companies (Bailey and Crawley. 2021). The total number of logging companies enrolled in one or both programs is 361 companies (A. Whitman, pers. obs.), or potentially about 79% of logging companies. While no direct data are available, it is likely that loggers who have engaged in a training or certification program conduct a high proportion of the harvested acres in Maine.

**Rationale for this indicator:** Trained and certified logging professionals are expected to apply best management practices that protect water quality, soil productivity, and wildlife habitat during harvest operations (Brooke et al., 2007). Training is intended to ensure loggers understand sustainable techniques, minimize environmental impacts, comply with forestry standards, and maintain long-term forest health. Participation certification systems as well as training indicate the forest industry's commitment to professionalism and environmental stewardship, directly linking harvest practices to forest ecosystem sustainability and public trust in Maine's forestry operations.

## Indicator 6.4: Total acres of non-industrial forest land with management plans meeting Maine Forest Stewardship Program guidelines

Benchmark 6.4.1: The number of acres of non-industrial forest land with management plans meeting Forest Stewardship Program guidelines will increase from a cumulative total of 1,777 parcels and 162,664 acres in 1997 to 4,000 parcels and 400,000 acres by 2005.

**Status and trends of this indicator:** In the 10-year period from 2015 to 2025, MFS supported 1216 landowners and 101,672 acres of current Forest Stewardship/Forest Management Plans. Future funding is uncertain as federal priorities and agencies are in flux as of 2025. USDA NRCS's programs, with substantially higher levels of funding and cost-share rates, especially in recent years, supported 39,638, 46,768, and 99,845 acres of Forest management plans, in the last 3 years (respectively). At least 288,022 acres of Maine's forests have active Forest Management Plans that follow the USDA Forest Stewardship Program guidelines. In 2005, the Forest Stewardship Program had enrolled 605,646 acres of nonindustrial forest land, which was driven by the impacts of the 1998 Ice Storm.

Maine Forest Service has long aligned its landowner education and assistance program, known as "Be Woods Wise" with the USDA Forest Service's Forest Stewardship Program, established around 1990. The Forest Stewardship Program Guidelines help ensure landowners have a forest management plan that thoroughly considers a range of landowner goals and management objectives and include information necessary for good stewardship.

**Rationale for this indicator:** Maine's Forest Stewardship Program Guidelines ensure comprehensive management plans addressing diverse landowner objectives and promoting good forest stewardship. Aligned with USDA NRCS standards for Forest Management Plans since 1990, these plan guidelines help ensure landowners balance multiple goals effectively.

Financial incentives through Maine Forest Service's WoodsWise Program and USDA's Natural Resources Conservation Service encourage plan adoption via cost-sharing. However, participation fluctuates based on available funding, cost-share rates, and landowner awareness. Since landowners bear partial costs and funding varies unpredictably, many face barriers to participation. Most plans are written for a ten-year period and can be renewed with additional assistance.

Tracking acres under these plans helps identify forest lands under high-quality management. It reveals program effectiveness while identifying obstacles to broader adoption, informing policy adjustments that are likely needed to increase professional forest stewardship across Maine's non-industrial forestlands.

## Criterion 7. Traditional recreation

**Goal:** Public policies that encourage private landowners to continue to provide traditional forest recreation opportunities.

Maine's tradition of public access to private lands for recreation has important cultural and economic benefits, and provides the wide variety of recreational activities, from hunting and fishing, hiking and canoeing, backcountry camping, as well as motorized activities such as snowmobiling and all-terrain vehicles (Maine Department of Inland Fisheries & Wildlife and the Department of Agriculture, Conservation, and Forestry 2026). Most of these occur in or are enhanced by a forested setting. A recent report identifies that such uses are shifting with more motorized uses in larger recreational vehicles and higher user numbers in all seasons, while private owners frequently bear the costs of such use or misuse. Finally, the report emphasizes that public access to private land is a privilege, not a right, with responsibilities required of all users.

Conservation lands with public access are least available near urban and underserved populations in southern Maine (Schlawin et al., 2021). The indicators and benchmarks for this criterion do not consider the unique public access issues for areas near cities and in southern Maine where public access is more limited.

Most larger ownerships with private road systems have some form of public use, but may require that all users meet certain conditions to use their roads (such as the permit system used by North Maine Woods, Inc.). Smaller owners may post their land or require written permission, and some may have little awareness of occasional or even more regular public use. Issues of public access and user responsibilities are currently under discussion as outdoor recreation pursuits become more varied and user pressure increases.

### Indicator 7.1: Acreage of Maine forest land open to responsible public recreation.

Benchmark 7.1.1: The number of acres open to responsible public recreation will not significantly decrease from the current level.

Benchmark 7.1.2: The amount of Maine conservation land intended for public use will increase from 1.06 million acres in 2000 to 1.28 million acres by 2005 (Adopted from Maine Economic Growth Council, Goals for Growth 2004).

#### **Status and trends of this indicator:**

Acres open to responsible public recreation: The number of acres of forested land available for public use is extremely difficult to establish, because relevant data is held by many different agencies and organizations. The number of acres open to the public is estimated to be at least 10.8 million acres of the nearly 18 million acres of forest land in Maine: 1.3 million acres of local, state, and federal land (Maine Land Trust Network 2025). 2.9 million acres held by land trusts (Maine Land Trust Network 2025), 3.1 million acres of small woodland owners allowing recreational

access (Caputo and Butler 2026), and 3.5 million acres held by large landowners in the North Maine Woods (North Maine Woods, Inc. 2026). This does not include other lands held by large commercial landowners who have open access which might amount to another 1 million acres.

The amount of Maine conservation land intended for public use: As of 2023, Maine land trusts provide more than 2.9 million acres of publicly accessible land (Maine Land Trust Network 2025). State and federal conservation lands included about 1.3 million acres in 2016 (Maine Department of Inland Fisheries and Wildlife 2019). The total conservation land in Maine intended for public access, 4.2 million acres, now exceeds the 2005 target of 1.28 million acres. At the same user interest has increased significantly.

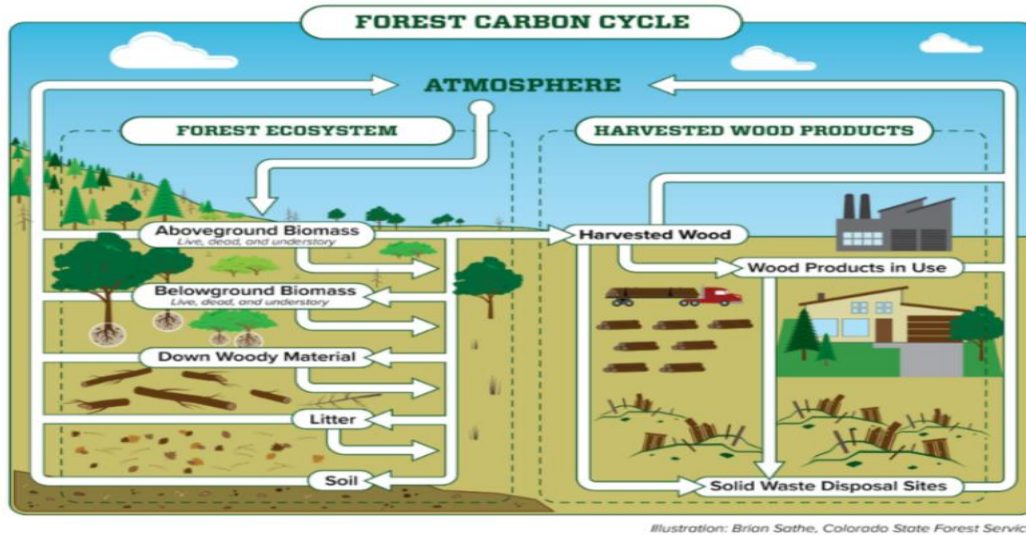
**Rationale for this indicator:** Tracking acreage open for responsible recreational can be used to help determine whether policies are successfully encouraging private landowners to maintain access. Since most Maine forests are privately owned, public access for responsible recreation depends on landowner cooperation. Monitoring access trends identifies when recreational strategies may need to be adjusted, including outreach and education programs aimed at recreational users and landowners, tax incentives, or other measures that encourage private landowners to permit public use while respecting their property rights and concerns.

## Criterion 8. Forest carbon

**Goal:** Maintain or enhance the positive contributions of Maine’s forests and forest products to global carbon balance and offsetting Maine’s emissions.

This sustainability criterion, added in 2023 is based on Criterion 8 of the Montreal Process criteria and indicators and addresses the role of forests in climate change mitigation (Montreal Process 2015). Forests are major terrestrial carbon sinks that help offset CO<sub>2</sub> emissions from the use of fossil fuels. In Maine, forests play a significant role in balancing state-wide greenhouse gas fluxes, making forest carbon sequestration and storage critical benefits (Maine Department of Environmental Protection 2024). Emerging voluntary markets for forest carbon also create economic opportunities through forest carbon credits for landowners (Baral et al., 2025).

Carbon stocks in forests include above ground biomass, belowground biomass, dead and decaying organic matter and soil carbon (Simmon et al, 1996). Carbon is also stored in wood products. Forests draw CO<sub>2</sub> from the atmosphere, through photosynthesis and eventually return CO<sub>2</sub> to the atmosphere through respiration and the decay of organic matter. Although most of the carbon in forests fixed by trees and other plants during photosynthesis is stored long-term, trees use a portion of photosynthate for maintenance respiration and other energy-requiring processes and emit some CO<sub>2</sub>. When trees die, they deposit litter and dead branches onto the forest floor and microorganisms break down this organic material, a process called decomposition. Decomposition releases carbon back into the atmosphere as CO<sub>2</sub>, a process called respiration. Some carbon from the decomposed material remains in the soil, contributing to the soil carbon pool. The exchange of CO<sub>2</sub> between terrestrial ecosystems including forests and the atmosphere is large; about one-seventh of the total atmospheric CO<sub>2</sub> that passes into vegetation each year.

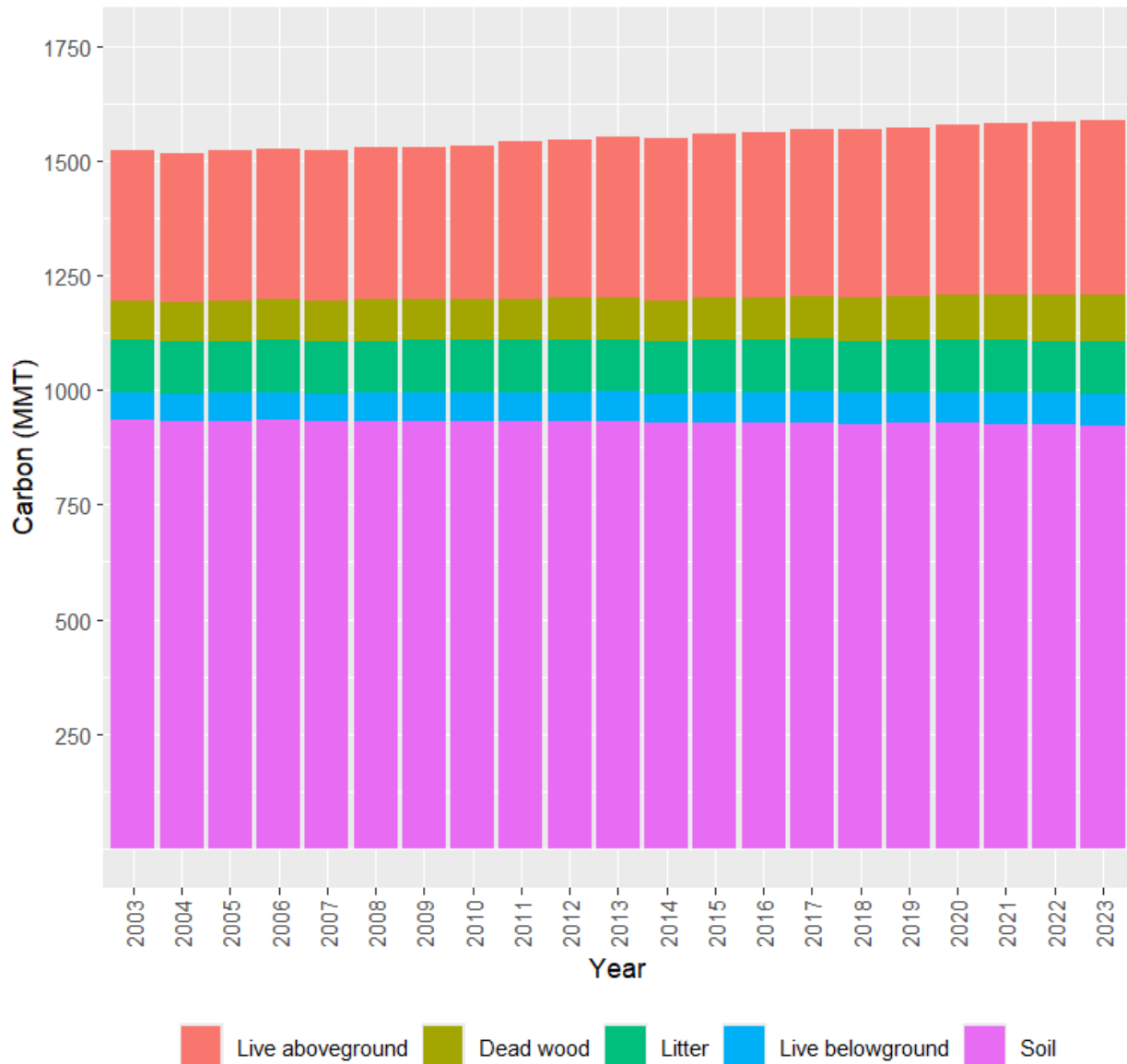


**Figure C8: The forest carbon cycle and key pathways show how carbon moves within and between forest ecosystems, harvested wood products, and the atmosphere (figure is from Vorster et al., 2024). The forest ecosystem includes aboveground biomass pools, belowground biomass pools, down woody material, litter, and soil. Each forest pool has a pathway to return carbon to the atmosphere. Carbon stored in aboveground biomass pool can be transferred to harvested wood pool, where it follows its own trajectory of wood products in use, solid waste disposal sites, and return to the atmosphere.**

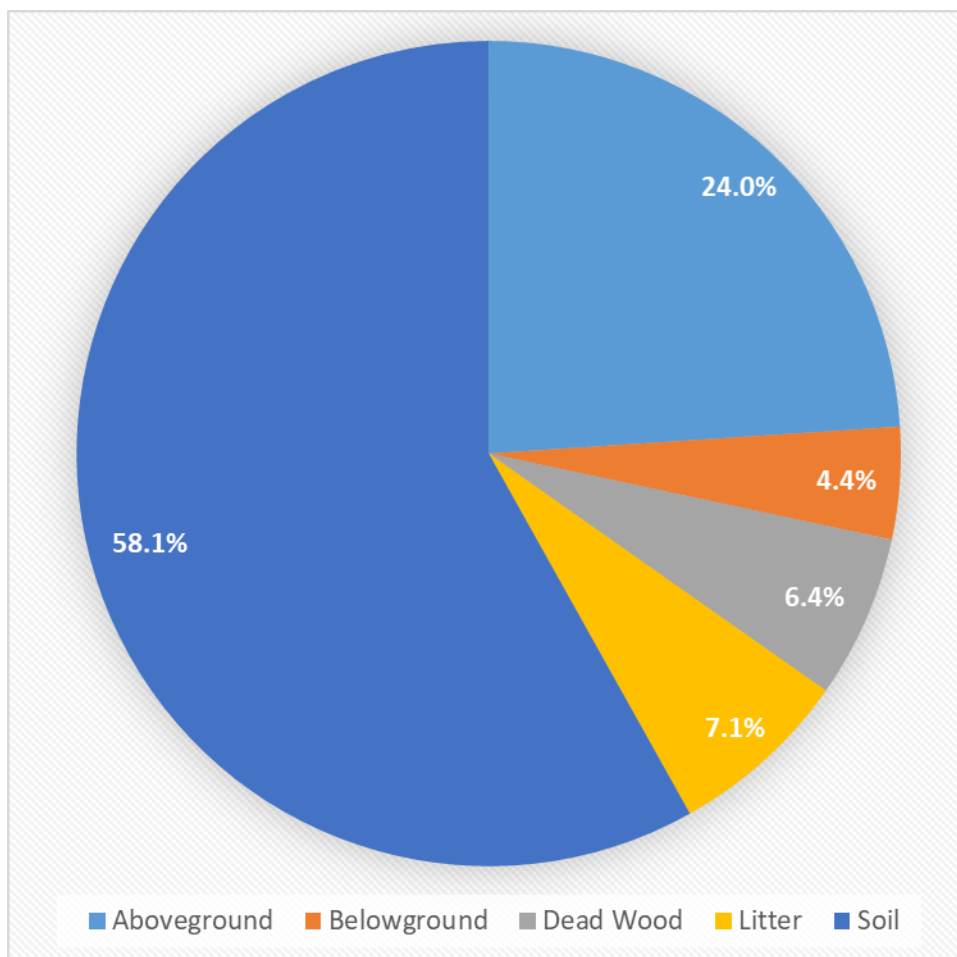
Forests can mitigate GHG emissions from human activities and thereby help mitigate global climate change (Simmons et al., 1996). Climate change is affecting the productivity and health of Maine’s forests, their forest carbon stocks and fluxes (Davis et al., 2026), and the prevalence of forest fires, disease and insect outbreaks, and storm damage (Maine Climate Council 2021). Forest management practices also affect carbon sequestration, storage, and CO<sub>2</sub> fluxes (Gunn and Buchholz 2018).

Permanent deforestation through conversion of forests to other land uses has a major negative impact on forest carbon (Dangal et al., 2014). By contrast, long-term forest management activities that maintain and enhance the carbon stored in forests and forest products over the medium to long term can make a positive contribution to mitigating atmospheric carbon dioxide levels (Ameray et al., 2021). Forest products such as mass timber and other building materials, packaging, bioplastics, or other products have the added benefit of displacing the use of more carbon-intensive materials such as concrete, steel, aluminum, and oil (Sathre and O’Connor 2010). In addition, biomass from forests can displace non-renewable fossil fuels and readily reduce greenhouse gas emissions when used for heating, combined heat and power generation, and bioenergy with carbon capture.

Indicator 8.1: Carbon Storage in Forest Pools and Fluxes, 2000-2023, and Proportions in 2023).



**Figure C8.1. Annual trends in forest carbon stocks in different pools, 2003 to 2023** (source: USDA-FS-FIA 2025). There are five major pools of carbon in the forest of Maine: the aboveground biomass (ABG) pool, the belowground biomass (BGB) pool, the dead wood pool, the litter pool, and soil organic carbon pool. In most forests, the soil organic carbon pools are the largest soil carbon pool.



**Figure C8.2. Carbon representation (%) by major carbon pool on forest lands in Maine, 2023** (USDA-FS-FIA 2025).

**Status and Trends for this Indicator:**

Forest carbon pools: Forest soils comprise over 58% of carbon stored in forests, while the live-aboveground (ABG) pool accounts for 24% of carbon stocks in Maine’s forests (Figure C8.1). Other pools account for less of forest carbon stocks depending on the forest type. Conservation of forest carbon typically focuses on keeping forests as forests because the greatest loss of forest carbon occurs when forest is converted to other land uses and soil carbon decomposes and is released as CO<sub>2</sub>.

Forest carbon fluxes: The greatest proportion of forest carbon is stored in soil, and the carbon stocks in this pool are relatively stable (Figure C8.2). Carbon estimates based on forest inventories over time indicate that overall Maine’s forests have slowly stored additional carbon in recent decades, particularly in the live aboveground pool, which also reflects increases of Maine’s standing timber inventory. Modest net increases in forest carbon are likely to continue in the near term unless tree mortality or removals increase sharply.

**Rationale of this indicator:** Monitoring trends in forest carbon pools and fluxes in Maine’s forests is essential for understanding forests' role in climate change mitigation (Simmons et al., 1996).

Maine's forests are a significant carbon sink that absorbs and stores atmospheric CO<sub>2</sub> (Maine Department of Environmental Protection 2024). Tracking these carbon pools helps quantify how much carbon is sequestered in trees, soil, and vegetation over time.

This monitoring informs landowners about the potential for forest carbon markets and balancing timber harvesting objectives with mitigation objectives. Past trends in forest carbon fluxes create a baseline for understanding how forest disturbances like harvesting, diseases, insects, and climate change might affect the mitigation capacity of Maine’s forests, which is information that may help landowners achieve forest certification requirements. Accurate carbon accounting is also important for meeting statutory requirements in Maine for reporting on state GHG inventory and developing strategies to enhance forest carbon storage as Maine pursues climate action plans, quantifying forest carbon stocks provides baseline data to measure progress (Maine Department of Environmental Protection 2024).

**Indicator 8.2: Carbon Stocks in Different Forest Pools by FIA forest type group.**

Forest Type Group	Live Above-ground	Live Below-ground	Dead Wood	Litter	Soil	Total Carbon	Forest Land Area	Carbon Density
	Representation (%) of each carbon pool within each forest type group					mmtc	million acres	tonnes/acre
Maple/beech/birch	23.8	4.4	5.6	7.2	59.0	650.6	7.2	90.8
Spruce/fir	22.6	4.0	7.5	7.3	58.7	541.0	6.0	90.6
Aspen/birch	22.4	4.0	6.3	8.3	59.0	148.2	1.7	85.8
Pine	31.2	6.1	6.6	6.7	49.4	121.8	1.2	100.9
Oak/pine*	30.3	5.6	6.6	5.0	52.4	81.4	0.8	101.9
Other**	17.4	3.1	4.7	6.0	68.8	45.3	0.6	79.6
Total	24.0	4.4	6.4	7.1	58.1	1,588.3	17.4	91.1

**Table C8.2: Carbon storage in five forest pools in six major forest types on forest lands, 2023** (source: USDA-FS-FIA 2025). \* Oak/pine combines the oak/pine and oak/hickory groups. \*\*Other includes elm/ash/cottonwood, non-stocked, other hardwoods, exotic softwoods, and the loblolly (pitch) pine group.

**Status and trends of this indicator:** In response to *Maine Won't Wait*, the state of Maine’s climate action plan, MFS is developing methods and tools to quantify sequestration of carbon by forests. Among the five major pools of carbon in the forest of Maine, the live above-ground pool sequesters more CO<sub>2</sub> than the other forest pools (Table C8.2). Recent analyses of state-wide carbon sequestration show that net uptake of carbon (i.e., negative CO<sub>2</sub> emissions) by the forest has been the largest contributor in Maine for sequestering carbon from the atmosphere, accounting for -94.6%, -126.8%, and -137.9% of gross GHG emissions over the past three inventory periods, respectively.

**Rationale for this indicator:** Carbon stocks may vary across different FIA forest type groups in Maine due to differences intrinsic to the carbon dynamics of each type group, the typical age of that type group, and the acreage in each type group (Woodall et al., 2011). Variation in their stocks

reveals differences in the capacity of different forest types to store carbon and their relative importance to state-level carbon stocks. Hardwood forests, softwood stands, and mixed types have distinct carbon storage capacities in their biomass, deadwood, litter, and soil pools. It also helps predict how changing forest composition—due to harvesting, natural succession, or climate impacts— might affect Maine's overall carbon storage capacity.

## Part III. Maine Forest Service Programs and Emerging Issues

### Maine Forest Service (Bureau of Forestry, DACF)

- **Patty Cormier, Bureau Director**

Maine Forest Service (MFS) is a Bureau within the state Department of Agriculture, Conservation, and Forestry. MFS has statewide responsibilities for issues and services to the public involving forest protection and health, forest management activities and practices, and forest policy matters. Key program functions include forest inventory, analysis, and reporting; forest fire protection and suppression; forest insect and disease monitoring and mitigation; forestry education and training; the development and implementation of forest policy; and enforcement of forest laws and forest practice regulations.

The **Forest Health and Monitoring Division** (FHM) serves and benefits all Maine people by promoting healthy forests that support Maine's forest-dependent economies and ecosystems. The Division provides technical advice and assistance to community members, municipalities, and forest landowners and managers on recognizing and managing insects, diseases, and abiotic factors that cause significant damage to the state's forest, shade, and ornamental tree resources to promote the overall health of the forest resource and to maintain a statewide forest health monitoring system. The 118<sup>th</sup> Legislature expanded the Division's responsibilities to include conducting an annualized inventory of Maine's forest resources on a five-year cycle. The 2020 *Maine State Forest Action Plan* identifies as one of the key goals "to maintain the health and resiliency of Maine's forests in the face of threats from biotic and abiotic agents." Forest health remains a key issue requiring sustained programs and activities.

The **Forest Policy and Management Division** (FPM) provides technical assistance, financial assistance, forest management information, and educational services to the public, woodland owners, loggers, foresters, forest products processors and marketers, municipalities, community groups, students, teachers, and many others. FPM receives and responds to inquiries and requests about all matters concerning forests, trees, woodlands and wood products. Programs delivered by FPM (particularly technical and financial assistance) lay the foundation for the state's forest economy, including the forest products industry itself, as well as forest-based recreation and tourism, while protecting wildlife habitat, drinking water supplies, scenic resources, and other values. FPM conducts assessments and provides multiple reports about forest conditions, forest management practices, wood processing, nontimber forest products, secondary manufacturing, energy resources, and the broader forest economy for decision makers. FPM also enforces regulatory requirements for timber harvesting under the Forest Practices Act, relating to clearcutting, forest regeneration, liquidation harvesting, protection of water resources, and other related land use practices.

The **Forest Protection Division** (FP) protects public and private forest lands and high-value property from damaging wildfires and enforces state natural resource laws. FP is responsible for wildfire control in the state and plays an active role in all-hazard incident response. In addition to

wildfire suppression, FP prepares and maintains facilities, staffing, and equipment, necessary to detect and prevent wildland fires, and enforces wildland fire laws. FP also conducts a comprehensive education and prevention program, along with focused wildland fire training for all of Maine's fire service. It enforces the Forest Practices Act; the forestry standards of the LUPC; timber theft and timber trespass laws; as well as laws and regulations relating to recreational vehicles, Christmas trees, wild blueberries, logging equipment theft and vandalism, damage to forest roads, litter, and BPL rules and regulations. FP has assisted with enforcing water quality laws related to timber harvesting on behalf of the Department of Environmental Protection (DEP) and the LUPC.

### **Maine Forest Service Program areas**

Program activities and accomplishments of MFS are reported in multiple formats and annual reports. Program areas include:

**Forest Health and Monitoring:** FHM has two major program areas: Insect and Disease Management (IDM) and Forest Inventory (FIA).

IDM's work includes monitoring and research on a myriad of native and non-native insect and disease conditions and abiotic stressors, working with a wide variety of partners and engaging with and educating varied audiences.

- IDM reports comprehensively on all its work in the Annual Forest and Shade Tree Insect and Disease Conditions for Maine. Insect and Disease Conditions reports are produced throughout the growing season. These reports are available by subscription and can also be found on the MFS website.
- IDM and other divisions/agencies have collaborated with multiple partners to form the Spruce Budworm Taskforce to address the recent buildup of spruce budworm populations. Most recently, these activities have included the 2025 Early Intervention Strategy, a large-scale treatment program to manage budworm populations, coordinated by commercial forest landowners and managers. These activities build upon a 2016 risk assessment and strategic response recommendations to address the impending budworm situation. A dedicated spruce budworm page has been upgraded and can be viewed at [www.maine.gov/sbw](http://www.maine.gov/sbw).
- IDM provides information, conducts monitoring, and pursues Integrated Pest Management programs for multiple pest and disease species such as hemlock woolly adelgid. In collaboration with land trusts, municipalities, other private and public agencies, and individuals, IDM offers intensive education on biological control and targeted insecticide applications.

The FIA program conducts measurements on the national Forest Inventory plot network delivering quality data on-time for analysis and use by decision makers and scientists.

**Forest Policy and Management:** FPM programs encourage and support forest stewardship and management by woodland owners, foresters, and loggers, urban and community forestry by municipalities and community groups, forest practices regulation and enforcement, water resources, and forest resources assessment and reporting. Education, information, field assistance, and financial incentives are throughlines for all FPM work. Primary efforts/programs include:

- Stewardship Education and Technical Assistance: FPM's mandates to provide education and technical services for woodland owners, as well as private consulting foresters, loggers, and other service providers, fall largely under the outreach and assistance program

known as WoodsWise. A core feature of this assistance is a free site visit or “walk and talk” by an FPM District Forester, available to woodland owners as well as loggers, foresters, nonprofit organizations, and other entities. Workshops, displays, presentations, and informational materials are another key component, often in partnership with other agencies or organizations. WoodsWise also offers financial incentives to woodland owners for forest management planning, invasive species planning and control, and other activities, in keeping with the federal Forest Stewardship Program. As a result of significant new funding from the USDA Forest Service, an enhanced incentives program, “WoodsWise Resilience” to support forest resilience and carbon stewardship practices by woodland owners is launching in 2026.

- **Urban and Community Forestry:** FPM’s UCF program, known as Project Canopy, provides technical services, information, and grants relating to urban and community trees and forests to municipalities, community organizations, land trusts, licensed arborists, utilities, and others. Project Canopy has established a strong partnership with Maine Conservation Corps, establishing a Community Tree Stewards program to provide additional capacity to communities and local organizations.
- **Conservation Education:** FPM provides direct education and resources regarding trees and forests to children and youth. FPM foresters conduct programs for teachers and students from kindergarten to university, in collaboration with multiple partners, through many venues. These efforts are provided to the entire spectrum of the education system, from the children, teachers, parents to administrators, summer programs, nonprofits, as well as high school vocational programs, college students, interns and others.
- **Forest Resource Assessment Program:** FPM compiles required forest assessment reports from landowners and wood processors and publishes annual summaries of harvesting activities, wood utilization, and related information. In addition, ongoing analyses of forest conditions, often based on MFS Forest Inventory and Analysis data, are released in multiple formats such as the 5-year State of the Forest Report. FPM and other MFS staff regularly collaborate with researchers from University of Maine, the USDA Forest Service, and others.
- **Water Resources:** Recognizing the critical linkages between forests and water resources such as clean drinking water and aquatic habitat, FPM leads or participates in numerous educational efforts, field monitoring and reporting. The core of this program is the development Best Management Practices to protect water quality (BMPs), which involves the state BMP manual for forest management and timber harvesting activities, as well as numerous associated education and training resources. MFS released a supplement to the BMP manual on adapting to extreme weather events in 2026. FPM’s Water Resources program also offers financial incentives, such as the Direct Link Loan program and the Temporary Skidder Bridge Assistance program, to support harvesters and others, to promote the protection of Maine’s water resources. FPM also works with Maine’s Department of Inland Fisheries and Wildlife to implement the “Chop and Drop” stream habitat enhancement program, and with other groups focused on stream habitat.
- **Natural Resource Regulation:** FPM maintains a state-mandated Forest Operations Notification system as an essential basis for awareness, reporting, and regulatory oversight of timber harvesting activities. Regulations primarily address clearcutting and regeneration requirements, constraints on liquidation harvesting, and protection of water quality and shoreland areas during timber harvesting. FPM prioritizes education, field assistance, and pre-regulatory mitigation to encourage regulatory compliance, and reviews permits and

operations plans. Where necessary, investigations can lead to enforcement actions, which may result in Administrative Settlement Agreements. Maine forest regulations are unique in that the Outcome-Based Forestry program allows member landowners the flexibility to manage their land based on agreed-upon outcomes, versus descriptive regulations. FPM maintains, monitors, and reports on this program, which provides regulatory flexibility for four large participating forest ownerships covering roughly 1.7 million acres, in exchange for assurance that measures of sustainability are maintained.

- Forest Policy: FPM monitors policy proposals, legislation, and emerging issues, and engages with multiple partners to pursue or respond to policies that impact the entire forest community.
- Climate & Forest Carbon: Virtually all FPM programs and policy efforts incorporate considerations related to climate/carbon. With the addition of a staff climate and forest carbon specialist, all FPM programs, outreach efforts, education, and policy considerations are carefully monitored and incorporate the latest climate science.

**Forest Protection:** Through its partnership with the US Forest Service (USFS) and the Northeast Forest Fire Compact, FP provides crews, engines, and incident management personnel across the country each year. The last few years have proven to be record-breaking in terms of the intensity and complexity of wildfires. These efforts not only provide key capacity assistance but, more importantly, enable Forest Rangers to expand their training and experiences, thereby establishing qualification-building standards that enhance Maine's fire preparedness and readiness. Other key efforts include:

- The Volunteer Fire Assistance Program provides approximately \$200,000 annually to small volunteer fire departments to acquire wildland firefighting equipment. FP also screens for and acquires federal excess fire engines and other excess equipment that is made available directly to these small towns at no charge.
- FP has continued to revitalize MFS's aviation program to ensure it meets the demands of its core mission of wildland fire suppression. Currently, MFS operates and services 3 UH-1H Huey helicopters and 3 Bell 407 helicopters, along with 2 Cessna 206 fixed-wing aircraft. These aircraft also support other MFS missions, including aerial surveys for insect and disease damage and the survey of Maine's forests for the Forest Practices Act. Additional support for other state agencies includes search and rescue missions for the Maine Warden Service and Maine State Police, and access to remote equipment by the Office of Technology.
- FP provides Community Wildfire Preparedness programming to landowners and communities that have extensive wildland urban interface problems. Continued efforts encourage wildfire risk reduction activities through the support of Firewise communities, the development of Community Wildfire Protection Plans, mechanical fuel reduction activities such as chipping and masticating, and prescribed burning. The development of partnerships and encouragement of risk communication between Maine's fire service, landowners, community leaders, and other non-governmental organizations is critical for successful preparedness strategies.
- FP is playing a leading role with respect to prescribed burning in Maine. Through its membership with the Maine Prescribed Burn Council and partnerships with landowners, FP has identified prescribed burning as a tool that is being used for wildfire risk reduction, as well as enabling wildfire resiliency through fire adaptive communities. These practices are making a difference in land management objectives across the State.

FP maintains an extensive training program to ensure Maine’s fire service, landowners, and contractors have appropriate wildland fire response training to ensure efficient wildfire suppression and safety. Each year, Forest Rangers conduct incident management training, basic wildland training, S130/S190, and advanced NWCG courses to approximately 300 people. These trainings are regional and include classroom instruction, field practicals, and tabletop exercises. The Maine Forest Service employs Town Wardens in each municipality to conduct local fire programming, ensuring full accountability and coordination.

## Priorities and Emerging Issues

Maine Forest Service has long sought to identify and address critical issues affecting the forests of Maine, and the many values and resources it represents to Maine communities. Solution building can be challenging as many of these issues are complex, uncertain, and inter-related, and resources are limited.

**Maintaining the forest land base:** Evolving woodland ownership trends are universally recognized as having significant implications across the land base, involving all ownership types from large ownerships in northern Maine to individual woodlots in southern Maine. Not only does Maine remain the most forested state in the country, with over 88% of the land in forest (as of 2023), but forests still cover >60% of the southernmost counties. Forest conversion to developed uses, parcelization, fragmentation, and generational transfer are primary factors in the challenge to “keep forests as forests.” These factors are driven in part by demographics of ownerships, development pressures, and other land transfers, including of larger parcels. Future forest benefits will rely on limited conversion and continued management that includes forest products, recreational access, and protection of habitats and related resources.

MFS is challenged to track and report forest ownership changes and trends in a consistent, comprehensive way. Data sources including property tax information, Tree Growth Tax Program participation, real estate transfers, and conservation transactions, are somewhat fragmented, inconsistently available, and/or require extensive quality control. Some new data sources have become available, however. As a primary example, as an initial measure to better understand evolving woodland ownership objectives, MFS was tasked by the 132<sup>nd</sup> Maine Legislature to begin tracking landowner participation in forest carbon programs for the emerging forest carbon credit market. Initial summary results should begin to be available in late 2026.

More fundamentally, Maine Forest Service is charged with providing education, outreach, and technical assistance to landowners of all sizes. MFS’s 12 district foresters and program staff provide essential support for landowners and private foresters. MFS helps these entities understand, grow and manage forests according to long-term, science-based forestry principles, for a variety of objectives. Timber income is often a lower priority for some owners, but harvesting can be an important silvicultural tool to manage forests to address other goals such as addressing forest health issues or managing wildlife habitat. Landowners, particularly of smaller properties,

are challenged by lack of awareness and access to forestry information. Nonetheless landowners commonly do make the decision to harvest timber, supporting the local and regional economies, Roughly 30-40% of smaller landowners employ the services of a licensed forester when planning and implementing harvests.

Maintaining landowner support and assistance programs for woodland owners are critical to maintaining a working forest land base. MFS is also expanding its financial incentives program through federal grants, which will enable landowners to implement noncommercial silvicultural measures to improve the resilience of their woodlands, and ongoing sources of support are key to maintaining these investments at a landscape scale.

All ownerships benefit from continuing education for foresters, loggers, and other natural resource professionals, which is an ongoing collaboration among MFS, the University of Maine, multiple nonprofit organizations and forest industry, and helps maintain awareness and application of the latest developments in forest research and practice.

**Forest condition and structure:** The long-term sustainability of Maine's forests depends on management responses to current conditions, including the current composition and structure of the forests. Historically, a diversity of forest types and age/size-classes has yielded a continuous wood supply that has supported a robust Maine's forest products industry, future wood supply, while maintaining a diverse, resilient forest.

The most positive indicators of long-term sustainability of Maine's forests include continued diversity of species and forest types, maintenance of forest cover, and a robust statewide growth to removals ratio exceeding 1.5 statewide. While some of that condition is the result of reduced harvest rates in recent years, it also points to a range of age classes and structures, from young to middle-aged stands, that are in a period of significant growth. Several conditions at the regional or state level suggest areas of focus to maintain or improve long-term sustainability.

Ownerships where timber harvesting is not the primary ownership objective are more common in southern Maine. In part due to passive management, there has been a shift to middle-aged forests that would benefit from thinning and similar silvicultural interventions to maintain productivity and enhance timber quality and species composition. Increasingly, these same forests would also benefit from silvicultural interventions to address emerging forest health issues and make these forests more resilient. The high proportions of such stands coupled with reduced markets for low-grade wood make these long-term management investments cost-prohibitive where in past years they could be accomplished with a net positive financial outcome.

At the same time, in some instances timber harvesting occurs, especially in southern regions, that has primarily short-term objectives or lacks long-term stewardship considerations. Such harvests prolong the time until, and reduce potential value of, the next harvest. Where such practices are widespread, they can also degrade forests, reducing growth rates and timber quality, and impinging on forest regeneration and resilience. These harvest patterns create challenges for traditional wood procurement systems and threaten the future viability of local, forest-based industries.

Another challenge is maintaining and improving the proportion of sawtimber across the landscape. While specifications for these higher-value products have evolved, enhancing higher grades typically requires longer periods of growth and investment. Such management can also help ensure that future harvesting is financially viable and not overly reliant on lower grade wood. The resulting more mature forests also provide important habitat and recreational benefits, across all forest types. Considerations as retaining snags and coarse woody debris and maintaining complex structures can also be incorporated into harvest planning. Older forests resulting from past high-grading, however, may provide fewer long-term benefits as well as fewer management options. Some landowners are exploring carbon markets as a way to fund timber stand improvement and for delaying harvesting to grow high-quality large sawtimber.

MFS continues to articulate the benefits of active forest management to landowners and ensure that the silvicultural expertise, harvesting infrastructure and full range of markets (including for low grade wood) are available to allow them to meet their objectives and manage for the long term. Increasingly, foresters are addressing climate change impacts in forest management to develop resilience of forest stands to changing conditions, which can include drought, more frequent and severe storms, and increased forest health threats from insects and diseases. MFS has participated actively in discussions and efforts by the Maine Climate Council and its many partners to develop knowledge and resources to implement climate-friendly forest practices.

Active management also requires attention to the full spectrum of habitats and other ecological values, and MFS has been involved in the development of the State's Wildlife Action Plan (Maine Department of Inland Fisheries and Wildlife, 2026). MFS also recognizes the growing attention to keeping late-successional and old-growth forests (LSOG) well-represented on the landscape. Forests over 100 years old are increasingly recognized as having both high importance for biodiversity and high relative timber value. The Department of Agriculture, Conservation and Forestry, led by MFS, has been charged by the 132<sup>nd</sup> Maine legislature with developing strategies to conserve and maintain LSOG forests as an enduring component of Maine's forests.

**Forest Products Markets:** The forest products sector of Maine's economy remains vital to the state's overall economic health. A recent report found that the sector in 2024 contributed \$8.3 billion in economic output (including multipliers), 29,000 jobs, and \$2.1 billion in labor income. (Crawley et. al. 2025).

At the same time, the past five years have seen significant disruptions to wood markets, ranging widely from mill closures, COVID and its attendant shifts in consumer demand, severe weather events and patterns, federal policy, and international affairs. These factors have resulted in substantial volatility in Maine sawlog markets and reduced markets for pulp-grade wood. The report cited above found that the wood product manufacturing component increased from 23% to 39% of the overall forest sector's output, with a 45% increase in sales. In the same period the paper manufacturing component shrank from 67% to 46%, with a 41% decrease in sales. These shifts are likely a reflection of both investments in solid wood products manufacturing (especially sawmills) and paper and pulp mill closures.

While the forest products sector remains a vital component of Maine's economy particularly in rural communities, negative factors affecting markets have impacted forest management opportunities and diminished the economic health of Maine's wood harvesting/trucking businesses. In addition, these same factors make projections of future forest products markets difficult. The most recent report (November 2025) of the Maine's Consensus Economic Forecasting Commission left most forecasts of economic indicators unchanged, but highlighted significant economic uncertainty resulting from multiple factors, among them moderate but stubborn inflation, weak consumer confidence, federal tariff policy, geopolitical tension, and voids in economic data (resulting from the 2025 federal government shutdown). These same factors impact business decisions about making investments across sectors that affect wood products markets.

Global demand for wood products remains strong, and Maine wood products firms have responded with investments in capacity and the development of innovative products. Maine's research community led by the University of Maine conducts cutting edge efforts to identify and commercialize new uses for structural wood and wood fiber. MFS continues to receive inquiries from potential industrial investors who are attracted to Maine's well-documented sustainable wood supply and positive forest growth rates. However, no major new markets for pulp-grade wood have been established. Other innovations in wood use, from wood fiber insulation and packaging, to biofuels, to mass timber, while promising, have been challenging to bring to scale in Maine. MFS continues to work with Maine's forest industry, the state's Department of Economic and Community Development, the Maine Technology Institute, the University of Maine, and others to address these and related economic development issues.

**Workforce retention and development:** The forest management, timber harvesting, trucking and wood processing professions and trades are similarly challenged by the extended decline in the forest products markets. Timber harvesting contractors and truckers are among the businesses most vulnerable to market swings, with short and longer-term reductions in wood purchases and price reductions, at the same time that costs for fuel, equipment, and other inputs have risen. Smaller independent harvesters and truckers are more vulnerable than larger contractors. A recent report noted that the number of individuals employed in logging declined from 3,900 to just over 3,000 between 2017 and 2021 (Professional Logging Contractors of the Northeast, 2026).

Additional pressures on the logging sector since 2021 have likely resulted in further declines, and by some estimates, 30-40% of the logging capacity has been lost to retirement or other trades in the last several years (Bailey and Crawley 2024). MFS data show approximately 1800 harvesters, from sole proprietorships to large contractors, have submitted Forest Operations Notifications in the past 3 years.

Rural population declines also contribute workforce issues in logging, forest management, and in manufacturing. In addition, the availability of foreign workers who perform precommercial thinning, planting and other essential forest management activities has been affected by immigration policy. Absent a significant improvement in the financial outlook based on strong markets, these essential workforce components, and the people, skills and equipment required will be difficult to maintain and replace in the foreseeable future.

Employers in the wood products industry are becoming increasingly creative in efforts to retain and acquire workers. These range from workforce housing and childcare to high school and post-high school training and apprenticeship programs for forest and mill workers. Similarly, university forestry programs have been adapting to attract students and prepare them for a broad suite of possible career pathways. Across the industry, the University of Maine, other agencies and organizations, forest products, professional and trade associations have been increasing efforts to engage, train, and mentor new employees. Professional licensing and private certifications provide some degree of focus and recognition for establishing training programs in all aspects of forestry. However, limits to financial support and collaboration across the various skills and professions remain ongoing barriers to expanding these efforts.

**Real-time forest inventory, assessment, and analyses:** Maine Forest Service develops information about forest conditions based heavily on its Forest Inventory and Analysis (FIA) program, conducted in partnership with the USDA Forest Service program of the same name. MFS also responds periodically to requests for spatially-specific information regarding forest extent and condition to enable timely, informed management decisions by private landowners and industry. These analyses provide information that has been used to evaluate the potential for expanding existing facilities and for attracting new wood-using industries into Maine, as well as to evaluate the impacts of ownership changes, forest health, and extreme weather. These data are of critical importance in generating periodic reports assessing the current levels and trends of Maine's forest resources, which are used to provide a sound basis for policy discussions and a foundation for modeling potential future forest conditions.

MFS also is mandated to require reports from forest owners and wood processors, and to collate, analyze, and report summary data for the industry and the wider public. Primary data sets involved timber harvesting and other silvicultural activities as reported by landowners, roundwood processing by Maine's primary wood processing facilities, and imports/exports of roundwood. Beyond FIA, maintaining and expanding these and other data acquisition capacities are of critical ongoing importance. In addition, new technologies such as LiDAR and other forms of remote sensing are quickly becoming industry standard and critical to the entire state's forest community. Maintaining data sets, providing timely analyses and reports, and at the same time improving data quality and acquiring new technologies and analytic tools remain a significant challenge.

Improving analytical and predictive capability tools extends even more broadly into predictive modelling. Timber supply projections have always been among MFS's responsibilities. However, the current state of flux in timber markets, coupled with changes in areas such as growth rates, forest structure, species abundance, wood availability, and threats from historical and new forest pests, has made many previous predictions of future forest conditions, wood supplies, and regulatory costs obsolete. MFS's Forest Resource Assessment Program strives to provide insights into these conditions to provide a base level of information for economic and policy decisions. At the same time, new tools and approaches are needed as MFS is increasingly charged with addressing questions of biodiversity and habitat, forest carbon, and components of forest change driven by climate influences and policy initiatives. The MFS continues to work with the University of Maine and the forest industry to enhance its capacities in the use of analytical tools, advanced modeling, and projections.

**Forest health, native and exotic pests:** Forest health conditions and impacts for many species and forest types have long been a core area of focus for MFS. These issues today are compounded by erratic weather, shifting seasons, intensification of damage from native pests due to changes in forest composition and seasonal temperatures, and continued emergence of novel insect and disease threats. Together, these threats are profoundly altering Maine's forest communities.

The emerald ash borer, hemlock woolly adelgid, and beech leaf disease are among introduced species having a significant impact on forest health in Maine now and represent part of the current wave in an ongoing invasion of novel threats. Support for regulations that prevent and contain invasions and continued education to encourage behavioral changes that limit introductions and spread of these species are critical to forest health.

Native species are poised to cause significant damage to Maine's forests. Although their outbreaks are part of natural processes in the forest, they occur in an environment altered by management, climate change, and the introduction of non-native species. Promising interventions exist for spruce budworm and have been initiated by forest managers, and coordination of monitoring and early intervention strategies with ongoing research has been facilitated by multiple partners in Maine's Spruce Budworm Task Force.

Forest health and insect and disease damage levels are influenced by changes in precipitation patterns, growing season length, and minimum winter temperatures. Changes in weather due to climate change will likely exacerbate these damage levels, though some changes in weather may create less suitable conditions for some pests and diseases in some years. Longer growing seasons are expected to increase the reproductive success of native *Dendroctonus* beetles, such as the spruce beetle, as has been seen in the eastern larch beetle, potentially leading to unprecedented damage by these and related species. The invasive spongy moth and browntail moth can experience population increases when dry conditions prevail during late spring and early summer, resulting in increased forest damage. Warm late-summer temperatures enable browntail moth caterpillars to feed and grow more rapidly, entering winter in a more robust state, which improves their overwinter survival and causes population growth. However, these same warm temperatures speed up metabolism in unfed but diapausing spruce budworm larvae, resulting in poorer survival of this species over winter. Warmer winter temperatures increase the survival of species such as hemlock woolly adelgid and other insects that originated in more temperate climates, leading to increased damage in the forest. Flooding and windthrow are among the abiotic conditions that have increased in recent years, with an atmosphere containing more energy.

Recently, landowners have been enticed to undertake mass cultivation of Chaga, a non-timber forest product that grows as a result of infection by a native fungal pathogen, in native birch species. The pathogen causes extensive rot and staining in infected trees, and leads to production of a sterile conk that is reported to have human health benefits when taken in various forms. There is little information available about how much forest land has been enrolled in the practice, but media reported in early 2025 that 9000 acres had been established by one company in about three years. With a promise of large financial gains, landowners have entered into long-term agreements for mass cultivation of this pathogen, with little understanding of the impacts to forest ecology and productivity that this practice could bring about.

Invasive plant species, including woody shrubs, vines, tree species and herbaceous plants, threaten the regeneration of native trees and other flora. Many foresters and other observers have noted expanded ranges, intrusion into new stands, and increasing densities. Along with other impacts, agents which cause significant mortality of trees also increase wildfire risk due to higher fuel loads. Some implications for human health are also related to density of disease-bearing ticks found in forests with higher presence of some invasive plants.

The Bureau's ability to detect and combat the full spectrum of pests must be improved to address the mounting threats to forests. Landowners and managers should be engaged and provided with resources to promote greater forest stewardship that limits forest damage and fosters more resilient forests.

**Wildfire response capacity:** The capacity of MFS and its partners around the state to respond effectively to wildfires is increasingly challenged. Three primary factors are affecting Maine's wildfire response capacity – changing weather patterns linked to climate change, declining wildfire control services in rural areas, and aging facilities and equipment. Changing weather patterns, especially periods of extended drought, along with forest conditions affecting the presence and abundance of forest fuels, have increasingly highlighted the importance of wildfire readiness and response. MFS and its partners have a high rate of success in keeping both the number and size of wildfires small. However, the Maine Forest Service and local fire service in Maine continue to see declining capacity for suppression response. With a declining volunteer force come challenges with effective initial attack operations. Recruitment efforts are ongoing, but they may not result in meeting the full need, resulting in the use of outside resources from a regional or national effort. The continued need for updated equipment and aircraft has an impact on budgets across Maine, all the while we are seeing more aggressive trends of fire weather and behavior. It will be important in the coming years to continue fostering important collaboration between agencies while supporting key infrastructure improvements to ensure an effective response for Maine.

Continued investment in fire control capacity is needed, as aging MFS facilities are increasingly a reality. Most facilities are now between 50 and 75 years old. A combination of sales, acquisitions, and construction will be needed to develop the most cost-effective and functional organization possible. At the same time, MFS relies on municipal fire departments to provide critical local resources to respond quickly to wildfire. These departments, too, are facing aging members and a decline in volunteers. Within its own ranks, MFS continues to work hard to recruit and train new rangers with the right skills to maintain or expand its presence across the state, though vacancy rates remain stubbornly high. MFS continues to work with communities across the state to address both local (often volunteer) fire suppression capacities, and wildland-urban interface issues through education and active management of fuels in proximity to structures.

Among MFS's most successful efforts is its aviation program, which provides among the most robust aerial forest monitoring, wilderness rescue, and fire suppression capabilities in the eastern U.S. Maintaining this program, developed through more than 20 years of hard work, is an MFS priority.

There is a trend of increased wildfire occurrence over the last 5 years, including wildfire seasons starting in February and ending in November. The 5-year average is 681 wildfires annually burning 387 acres. This shows an increase over the previous 10-year period. Maine has a high incidence rate of human-caused wildfires. Ninety-five percent of Maine's wildfires over the last 5 years have a human element to them. FP must continue to educate all about the proper use of open burning and use of fire in the State of Maine, including support of systems in place such as the online open burning and fire danger rating systems. With changing weather patterns becoming evident, it is critical to provide trustworthy fire weather and prediction services and messaging to the public and stakeholders to allow for appropriate preparedness across Maine.

**Forest monitoring and regulations:** MFS has a significant mandate to both monitor and regulate forest activities to protect critical resources and ensure long-term sustainability of forest resources. These responsibilities encompass timber harvesting standards and regulations relating to clearcutting, liquidation harvesting, and shoreland areas, as well as forest health quarantines addressing a variety of insect and disease threats. Other regulations require Forest Operations Notifications and reporting of forestry and wood processing activities, and most recently, forest carbon program enrollment reporting.

Opportunities remain to ease the burden of regulations. MFS has shifted the harvest notification system online to reduce costs and provide better customer service, and improvements are ongoing. Similarly, reporting requirements are moving to online and mobile systems. These systems may take on increasing importance with advancing technology. MFS still offers alternative reporting methods to individuals with limited access to technology or internet access. At the same time, MFS is also working to build awareness within the regulated community of woodland owners, harvesters, foresters, and municipalities to improve compliance.

Outcome-Based Forestry (OBF) is a key element offering planning and operational flexibility to forest managers. The Bureau has established and renewed OBF agreements with several landowners to report and monitor forest conditions and activities on these ownerships. Oversight of required sustainability criteria occurs with the assistance of an independent expert panel and field-based monitoring by MFS personnel, while landowners can adapt harvest plans based primarily on stand conditions and operational need. OBF has been an effective collaboration for streamlining regulatory constraints on forest management while maintaining or enhancing non-timber resources.

Customer-agency relationships, especially pertaining to the regulated community of woodland owners, harvesters, truckers, foresters and manufacturers, are an essential component of MFS's monitoring and regulatory efforts. In collaboration with other departments, agencies, and partners, MFS prioritizes education, training, and early intervention over direct enforcement action wherever possible. This long-standing approach relies on adequate staff to conduct these activities in an equitable and consistent manner across the state. Expanding this effort is reliant on maintaining MFS capacity and coordinating with other entities to meet shifting needs and demographics of key audiences.

**Forest Conservation:** Forest conservation efforts seek to protect the many values forests in Maine represent, and continue to face multiple overlapping challenges. The importance of different key issues can vary regionally, making conservation a complex endeavor. Key issues include:

- Habitat losses result from forest conversion and subdivision that fragment large areas of forest, especially in southern Maine, threatening wide-ranging species like Blandings' turtle by reducing connectivity.
- Forest structure imbalances may result from silvicultural treatments that may simplify forest structure. The optimal forest age for forest products is declining, and this can result in simplifying the complex forest structures on which many species depend, especially species associated with multi-aged stands, snags and wildlife trees, or late-successional forests with large trees.
- Climate change amplifies existing threats while shifting suitable habitats northward faster than forest communities, including commercially important tree species, can migrate. Particularly boreal species and associated forest habitats may be at risk. MFS provides landowner outreach and education on climate-friendly forestry, which may alleviate some, but not all, such threats.
- Invasive, non-native plants, insects, and diseases are rapidly expanding, threatening forest health, ecosystems, and wood production capacity, especially in southern Maine. The MFS works with the Maine Natural Areas Program and offers a landowner cost-share program to help control invasive plant species, as well as assistance to municipalities and community forests. MFS's FHM program also monitors invasive pests and diseases, provides landowner education, and develops control practices.
- Watersheds and water quality are impacted by sedimentation, erosion, shoreline disturbance, and spills during timber harvest activities. Implementation of MFS's Best Management Practices by loggers and foresters can effectively address these issues. Conservation efforts and management interventions are improving stream connectivity with improved road/trail crossings, and in-stream structure through placement of woody material.
- Recreational access to private forests supports Maine's \$3 billion recreation economy and 41,000 jobs. With 92% private ownership, working forest easements maintain public access for hunting, fishing, hiking, and snowmobiling. Forests in southern Maine face the greatest challenges to public access.

Conservation of Maine's working forests aims to balance forest health, recreation, carbon storage, watershed protection, and biodiversity with timber production supporting a wide range of industries.

**Climate Change:** Climate change profoundly affects Maine Forest Service's work—by influencing forest health, harvest operations, infrastructure, by drought, fire risk, wood markets, c the Maine Forest Service's work by influencing forest health, harvest operations, infrastructure, cs, species resilience, wildlife habitat, and recreation (Maine Climate Council - Science and Technical Subcommittee 2024). Climate models predict 2-3°C warming, with major forest changes apparent

by 2040 and some already visible. Assessing, preparing for and mitigating these risks is an immediate challenge.

Temperature and Precipitation: Maine's winters have shortened and summers lengthened by two weeks compared to a century ago, with winters warming fastest. The growing season has extended 16 days since 1950. Reduced snowpack increases root kill, while frequent winter thaws and spring frosts damage buds, stress trees, and cause dieback. Annual precipitation will likely increase, especially in winter, with intense downpours of 2 inches or more becoming more common. Severe droughts are also likely as higher summer temperatures increase evaporation. Temperature swings and other changing weather patterns will disrupt logging and trucking operations, reduce maple syrup production, and cause subtle but increasing tree mortality across species and age classes.

Extreme Weather: Tropical cyclones and nor'easters may become more frequent, causing extensive wind damage. Intense downpours will flood logging operations, forest roads, and rural infrastructure. Wildfire risk will increase slightly as temperatures rise and droughts reduce soil moisture, though regional variations depend on climate, fuel availability, and human activity. The MFS provides training to help loggers apply BMPs to mitigate extreme weather, though these impose additional costs on landowners and loggers. MFS's FP Division manages the control wildfires and prepares landowners for changing wildfire risk.

Species Range Shifts: Iconic species, including balsam fir, red spruce, and northern white cedar, will shift northward. Northern red oak and white pine will expand their ranges. Boreal wildlife species are likely to decline, with boreal chickadees already decreasing.

Amplification of Invasives, Pests, and Disease Threats: Warmer winters reduce pest mortality. Hemlock woolly adelgid and pine bark beetle will expand northward. Warmer, wetter springs increase fungal diseases, while droughts reduce tree resilience. Invasive plants will thrive as southern species survive northward. The MFS's FHM Division monitors forest pests and diseases and demonstrates the application of control practices for landowners.

Forest Carbon: Achieving carbon goals may require maintaining vigorous mid-aged forests and carbon-storing old forests. The MFS helps landowners understand opportunities and risks of enrolling forests in offset programs.

Transitional risks of shifting markets: The benefits of emerging forest carbon markets are uncertain: a modest market may provide necessary landowners' revenue during wood market downturns and lead to long-term management without affecting wood supply for mills. The response of global markets and demand for wood products are uncertain but projected to increase, in part because of climate change. These global and regional developments are likely to create opportunities for innovation and new markets.

MFS will continue to communicate about climate change and work with partners to determine how commercial forestry and conservation can help achieve climate goals for all segments of the forestry community.

## **Summary**

Maine Forest Service's responsibilities address the broad spectrum of conditions and benefits across the state's most dominant landscape feature – its vast and iconic forests. From Kittery to Fort Kent, Maine's landscape is dominated by forests, affording wildlife habitats, ecosystem services such as drinking water, recreational opportunities, and economic activity based in forest products, that affect virtually every Maine citizen. Despite its abundance and pervasiveness, Maine's forests are a resource that should not be taken for granted.

Currently there are multiple transitions occurring, with climate change and forest health issues, shifting forest products markets, disadvantaged rural economies and forest-based communities, and Maine's changing demographics. These changes are all playing out in Maine but have a national and international context. Perpetuating forest benefits and minimizing risks is a collective effort of government, forest industry, and other forest-based interests.

Maine's policy approach is to apply equitably the basic available policy instruments of education, information, monitoring, analysis, incentives and disincentives. This report does not propose specific recommendations to address the many emerging issues and opportunities. More broadly, the challenges confronting Maine's forests and their many benefits should not be underestimated, and require continued support for existing programs as well as new initiatives, including capacity to implement them. MFS seeks to pursue our mission and support other efforts to create a stable, adequately resourced policy environment, balancing the spectrum of interests for the long term while addressing critical issues.

Strategies to address individual issues often require a multi-disciplinary approach, and invariably broader contexts, new information and fresh perspectives are important to acquire and consider. MFS will continue to seek broad input on the above and other issues, in a collaborative manner with the many members of Maine's forest community.

## **Overall goals for Maine's Forests as outlined in the 2020 Forest Action Plan**

The 2020 Maine State Forest Action Plan (SFAP) outlined strategies for achieving 9 goals for Maine's Forests. With this State of the Forest report, these goals remain in force. MFS anticipates that the 2030 State of the Forest Report will be integrated with an updated State Forest Action Plan as required by USDA Forest Service.

The nine Maine goals are:

- 1) Maintaining the most diverse, robust and economically beneficial forest products industry possible and the jobs that this industry provides.
- 2) Maintaining a stable or increasing flow of wood fiber consistent with sustainable forest management principles.
- 3) Sustaining local economies
- 4) Safeguarding critical natural resources, particularly water resources;
- 5) Protecting biodiversity, conserving and enhancing key fish and wildlife habitats;

- 6) Maintaining or enhancing existing public access for the full spectrum of existing recreational uses;
- 7) Preserving special places, e.g. old growth forests, areas with special recreational or cultural values, unique or exemplary natural features, and other similar features;
- 8) Contributing to meeting Maine's energy needs by reducing our dependence on fossil fuels and high energy costs, and;
- 9) Maintaining and increasing carbon storage, contributing to reducing levels of atmospheric greenhouse gases, and facilitating the adaptation of forest systems to a changing climate.

These goals were further addressed in the 2020 SFAP by identifying multiple long-term strategies to address threats to forest resources, within 11 goals/themes:

1. Support a diverse, robust forest economy
2. Support active management of the forest land base
3. Address climate change and its impacts on Maine's
4. Maintain the capacity of the MFS as an institution to serve the citizens of Maine
5. Maintain the health and resiliency of Maine's forests in the face of threats from biotic and abiotic agents
6. Promote Outcome Based Forestry and streamline the regulatory framework
7. Predict future forest conditions and wood supplies
8. Conserve forests for clean drinking water supplies and healthy fisheries
9. Conserve forest biodiversity
10. Maintain healthy trees and woodlands in urban and community areas
11. Address ongoing erosion of federal support for Cooperative Forestry programs

## Part IV. Supplemental Materials

### Source Data

This report, especially Part 1 on Maine's Forest Conditions relies heavily on several sources of data.

1. Maine's Forest Inventory & Analysis (FIA) data are the most critical and in-depth data source currently available to describe and assess forest conditions statewide.

Forest measurements on sample plots are collected annually by the Maine Forest Service crews and processed by the United States Department of Agriculture Forest Service (USDA FS) Forest Inventory and Analysis Program (USDA FS FIA). There are over 3,500 plots statewide, with 1/5 of the plots visited annually (i.e., each plot is visited every 5 years). This rolling annual inventory has been on-going since 1999. Before that, USDA FS surveyed a smaller subset of plots in Maine periodically with inventories in 1959 (Ferguson and Longwood 1960), 1971 (Ferguson and Kingsley 1972), 1982 (Powell and Dickson 1984), and 1995 (Griffith and Alerich 1996). An additional survey 1944 (Sewall, 1944) pre-dates the USDA FS survey.

The FIA data are the best source of data for estimating a wide range of variables in our forest (Burrill et al. 2024). (Some data come from EVALIDator, while for other analyses the raw data are used.) There are published methods for calculating population-level or per acre estimates of volume, carbon across 5 major pools, forest area, growth, mortality, harvest, and etc. (Pugh et al. 2018). At the time that this analysis was conducted, the most recent inventory available was 2023, which allowed for 25 years of data since the annual inventory began in 1999 or five full cycles for comparison ending in 2003, 2008, 2013, 2018, and the most recent full cycle in 2023.

In 2022 FIA updated the equations that it uses to estimate biomass on standing trees to help improve national consistency (Westfall et al. 2024). As such volume estimates in Maine dropped slightly while biomass estimates increased considerably. Since these equations were applied across the entire annual database 1999-present, comparisons between cycles within the annual data are consistent.

For several figures, we incorporate data as far back as 1959 or 1944, and a couple even back to 1600. We note, however, that plot designs, characterizations of stocking, forest type and stand size, land area estimation methods, volume equations and other estimation methods are not consistent between the periodic and annual data. Many of the summaries in this report between 2003 and 2023 rely solely on the annual FIA data and estimates are consistent with FIA population estimates (Westfall et. al., 2022; Bechtold et al. 2005) that were produced using the EVALIDator tool (USDA FS 2025).

2. Maine Forest Service statutes require that landowners report information to the state about their harvest and other silvicultural activities. This landowner report, an annual survey of thousands of landowners that results in two annual reports:
  - a. The MFS Silvicultural report which summarizes the number of acres harvested by landowner size class and ownership type.
  - b. The MFS Stumpage report which summarizes average stumpage prices by product, species, and region or county.

Landowner report data are an invaluable resource to summarize harvesting and forest management activities across the state and for diverse ownerships. Data acquisition and quality control for the thousands of reports received is an ongoing challenge.

3. Maine Forest Service bases its annual Wood Processor Report on another required survey of the activities of wood processing facilities, exporters, and importers, to estimate the amount of wood harvested by county, exported from Maine, imported to Maine and processed in Maine.

MFS relies on numerous other data sources and summaries, reports and program materials that help inform and address forest issues:

4. GIS data managed by MEGIS and MRS which includes layers that describe ownership, conservation status, roads, riparian areas, etc.
5. Tax data provided annually by MRS describing the number of acres and ownerships enrolled in the tree growth tax law program.
6. National Land Cover Database (NLCD). Is a federally available product with 30 x 30m resolution classifications of land cover including developed, forested land, and agricultural lands. It is

useful to remember that in Maine, shrublands and sometimes other classes are actually regenerating forests, so depending on your definition there may be more or less forested acres in Maine.

7. Economic data from state agencies and independent analyses.
8. The State Wildlife Action Plan (Maine Department of Inland Fisheries and Wildlife 2026);
9. Reports on conservation lands (see especially Schlawin et al. 2021)
10. Maine's Natural Areas Program data and related reports on ecological reserves (Puhlick and Weiskittel 2021; Kuehne et al. 2018; Maine Natural Areas Program, 2018)
11. The State Comprehensive Outdoor Recreation Plan (Maine Bureau of Parks and Lands, 2019);
12. Tenth Biennial Report on Progress toward Greenhouse Gas Reduction Goals (Maine Department of Environmental Protection, 2024)
13. Scientific Assessment of Climate Change and Its Effects in Maine - 2024 Update (Scientific and Technical Subcommittee, Maine Climate Council);
14. Forest Opportunity Roadmap/Maine.

## Maine Statutes – Forest Resource Assessment Program

Maine’s State of the Forest Report is a required component of the Forest Resource Assessment Program, as established in statute in 1997. Current statutes read are provided:

Title 12 M.R.S. §8876. Forest Resource Assessment Program. There is established in the Bureau of Forestry a Forest Resource Assessment Program. The of the Forest Resource Assessment Program is to systematically and continually assess the ability of the State’s forests to provide sustainable forest resources and socioeconomic benefits for the people of this State. The Director of the Bureau of Forestry, referred to in this subchapter as “the director,” shall implement this program to: [PL 1997, c. 720, §9 (AMD); PL 2011, c. 657, Pt. W, §7 (REV); PL 2013, c. 405, Pt. A, §23 (REV).]

1. Current status. Assess the current status of forest resources, using standards of forest sustainability developed in accordance with section 8876A; [PL 1997, c. 720, §9 (AMD).]
2. Future demand. Project future demand for forest resources based on a common economic forecast developed by the Consensus Economic Forecasting Commission and on other appropriate economic projections; [PL 2021, c. 293, Pt. A, §21 (RPR).]
3. Trends. Identify trends in resource utilization and forecast supply available to meet the projected demands; and [PL 1997, c. 720, §9 (AMD).]
4. Potential shortfalls. Identify potential shortfalls in forest resources and the management and policy actions necessary in the public and private sector to avoid shortfalls. [PL 1997, c. 720, §9 (AMD).]
5. Recommendations. [PL 1997, c. 720, §9 (RP).] The director shall coordinate the efforts of this program fully with ongoing bureau and federal forestry program planning efforts and with the efforts of the Maine Economic Growth Council to develop a long-term plan for the State’s economy pursuant to Title 10, section 929B. [PL 1997, c. 720, §9 (AMD); PL 2011, c. 657, Pt. W, §7 (REV); PL 2013, c. 405, Pt. A, §23 (REV).]

§8876-A. Forest sustainability The director shall establish a process to assess forest sustainability. In developing this process, the director shall build on the principles of sustainability developed by the Northern Forest Lands Council established by Congress in 1990 and the criteria developed by the Maine Council on Sustainable Forest Management pursuant to Executive Order #11 dated April 25, 1995. [PL 1997, c. 720, §10 (NEW).]

1. Standards. Standards must be established to assess each of the criteria listed in this subsection by January 1st of the year indicated. The following standards must be specific, measurable and understandable by both forest managers and the general public: A. Soil productivity by 2001; [PL 1997, c. 720, §10 (NEW).] B. Water quality, wetlands and riparian zones by 1999; [PL 1997, c. 720, §10 (NEW).] C. Timber supply and quality by 1999; [PL 1997, c. 720, §10 (NEW).] D. Aesthetic impacts of timber harvesting by 2003; [PL 1997, c. 720, §10 (NEW).] E. Biological diversity by 2002; [PL 1997, c. 720, §10 (NEW).] F. Public accountability of forest owners and managers by 1999; and [PL 1997, c. 720, §10 (NEW).] G. Traditional recreation by 2003. [PL 1997, c. 720, §10 (NEW).] [PL 1997, c. 720, §10 (NEW).]
2. Process. The director shall identify individuals with scientific background and practical experience in each of the criteria areas listed in subsection 1 and convene technical working groups. In the development of standards pursuant to subsection 1, the director and working groups shall assess current status and trends, the desired objectives and actions

to reach the objectives. Each working group shall identify a range of alternative standards and recommend a set of standards based on a comprehensive review of available information and an assessment of the economic impacts of implementing the standards. The director shall coordinate the efforts of each working group and provide an opportunity for public comment on the recommended standards prior to final adoption. [PL 1997, c. 720, §10 (NEW).]

3. Report. The director shall report to the joint standing committee of the Legislature having jurisdiction over forestry matters with a recommendation for each set of standards and an articulated goal for each criterion by the date specified in subsection 1. At the time of the report, the director shall indicate the recommended timetable for revisiting the particular criterion and standards. [PL 1997, c. 720, §10 (NEW).]
4. Monitoring. As each set of standards is adopted, the director shall develop a system to monitor statewide progress in achieving those standards and begin monitoring. Standards and monitoring systems must be in place for all criteria by July 1, 2004. [PL 1997, c. 720, §10 (NEW).]

#### SECTION HISTORY PL 1997, c. 720, §§10,11 (NEW).

§8877-A. Determination of supply and demand for timber resources. The director shall use a variety of methods, including those specified in this section, to assess the status of timber resources, project future demand for these resources and forecast the supply available to meet the projected demands. [PL 1997, c. 720, §11 (NEW).]

1. Forest inventory. The director, in cooperation with the United States Forest Service, shall conduct a forest inventory and analysis program. The inventory must be based on plot data collected annually in a manner that provides for the entire State to be inventoried on a cycle of not more than 5 years. Plot data must be collected and compiled to provide for analysis by ownership class and geographic region. The director shall provide for collection of supplemental plot data when needed to assess the impact of catastrophic events on the State's forests or significant changes in harvesting levels or methods. [PL 1997, c. 720, §11 (NEW).]
2. Remote sensing data. The director shall review data collected using remote sensing technology to determine the area of forest types and gross changes in forest types. [PL 1997, c. 720, §11 (NEW).]
3. Timber supply modeling. The director shall coordinate efforts to project future timber supply using forest models based on growth, harvest and other dynamic factors affecting the forest. The models must allow for statewide projections and projections for geographic regions and landowner classes. [PL 1997, c. 720, §11 (NEW).] SECTION HISTORY PL 1997, c. 720, §11 (NEW).

§8879. Report on the state of the State's forests The director shall publish a report on the state of the State's forests every 5 years. The director must submit a copy of the report to the joint standing committee of the Legislature having jurisdiction over forestry matters by January 1st every 5 years beginning January 1, 2016. [PL 2011, c. 532, §2 (AMD).]

1. Content. The report must describe the condition of the State's forests based on historical information and information collected and analyzed by the bureau for the 5-year period.

The report must provide an assessment at the state level of progress in achieving the standards developed pursuant to section 8876A, including an assessment of designated outcome-based forestry projects authorized under section 8003, subsection 3, paragraph Q, including a recommendation to continue, change or discontinue the outcome-based forestry projects. The director shall also provide observations on differences in achieving standards by landowner class. The report must summarize importing and exporting of forest products for foreign and interstate activities. The director shall obtain public input during the preparation of the report through appropriate methods. [PL 2013, c. 542, §7 (AMD).]

1-A. Report on changes in ownership of forest land. Using information received under Title 36, section 581G, the director shall monitor changes in ownership of parcels of forest land that are 1,000 acres or greater in area within the municipalities of the State and classified under the Maine Tree Growth Tax Law. Using information received under Title 36, sections 581F and 581G, the director shall monitor the number of parcels classified under the Maine Tree Growth Tax Law and the distribution of parcels by size. The report must include information on the number of parcels, classified by size categories, for the organized and unorganized territories of the State. The information must be presented in a manner that facilitates comparison from year to year. In assessing changes in forest land ownership, the director shall also consider information reported pursuant to Title 36, sections 305 and 2728. The director shall provide a summary of changes in ownership of forest land in the report. [PL 2011, c. 532, §2 (AMD).]

2. Recommendations. The report must include recommendations for state and private actions designed to address the needs identified in the assessment. A. State action recommendations must be defined in terms of necessary policies, programs, staff and budgetary requirements to achieve specific goals. [PL 1997, c. 720, §13 (NEW).] B. Recommendations for actions on privately held forest lands may be developed separately for large, industrial ownerships and small, nonindustrial ownerships. These recommendations must be defined in terms of actions needed to achieve specific goals. [PL 1997, c. 720, §13 (NEW).] [PL 1997, c. 720, §13 (NEW).]

SECTION HISTORY PL 1997, c. 720, §13 (NEW). PL 2001, c. 339, §7 (AMD). PL 2001, c. 564, §2 (AMD). PL 2005, c. 683, §A15 (AMD). PL 2011, c. 532, §2 (AMD). PL 2011, c. 657, Pt. W, §7 (REV). PL 2013, c. 405, Pt. A, §23 (REV). PL 2013, c. 542, §7 (AMD).

§8886. Reports The director shall produce the following reports. [PL 1989, c. 555, §12 (NEW); PL 1989, c.600, Pt. B, §11 (AFF).]

1. Harvesting practices. Utilizing a sample of forest landowner reports and any other appropriate survey methods, the director shall tabulate an annual survey of the methods of harvesting and the harvest practices employed. The information on harvesting must include, but is not limited to, the silvicultural prescriptions employed, the estimated acreage of various harvest methods, including clearcutting, the extent of whole-tree harvesting of both solid and chipped wood, the number of clear-cuts over 75 acres in size, the total acres planted and the total acres precommercially thinned. [PL 2011, c. 532, §11 (AMD).]

2. Annual price reports. The bureau shall publish, annually, a report on prices as specified below. These reports must be reported by zones as determined by the director and must include a statewide average of all zones.

A. The reports must include stumpage prices paid for forest tree species of the State as reported pursuant to section 8885. Prices for other forest products may be collected using acceptable survey techniques. [PL 1997, c. 720, §18 (AMD).]

B. [PL 2005, c. 133, §5 (RP).] [PL 2005, c. 133, §5 (AMD); PL 2011, c. 657, Pt. W, §7 (REV); PL 2013, c. 405, Pt. A, §23 (REV).]

SECTION HISTORY PL 1989, c. 555, §12 (NEW). PL 1989, c. 600, §B11 (AMD). PL 1997, c. 720, §18 (AMD). PL 2005, c. 133, §5 (AMD). PL 2011, c. 532, §11 (AMD). PL 2011, c. 657, Pt. W, §7 (REV). PL 2013, c. 405, Pt. A, §23 (REV).

## Literature Cited

Ameray, A., Bergeron, Y., Valeria, O., Montoro Girona, M. and Cavard, X., 2021. Forest carbon management: A review of silvicultural practices and management strategies across boreal, temperate and tropical forests. *Current Forestry Reports*, 7(4), pp.245-266.

Bailey, M. 2025 Economic Update. Consensus Economic Forecasting Commission, Maine Department of Administrative and Financial Services. Augusta, Maine

Bailey, M. and A. Crawley. 2021. Economic Contributions of Logging and Trucking in Maine: A Study of the Impact of Professional Logging & Trucking in Maine. Professional Logging Contractors of Maine, Augusta, ME

Baral, S., Lamichhane, S. and Koirala, A., 2025. Current status of improved forest management carbon offset projects in the US voluntary market. *Forest Policy and Economics*, 178, p.103567.

Barry, A.M., Hagar, J.C. and Rivers, J.W., 2018. Use of created snags by cavity-nesting birds across 25 years. *The Journal of Wildlife Management*, 82(7), pp.1376-1384.

Bechtold, W.A. and Patterson, P.L., 2005. The enhanced forest inventory and analysis program—national sampling design and estimation procedures (No. 80). USDA Forest Service, Southern Research Station.

Brooke K. Haworth, Charles R. Blinn, David T. Chura, Assessment of Logger Education Programs and Programming across the United States, *Journal of Forestry*, Volume 105, Issue 7, October 2007, Pages 358–363, <https://doi.org/10.1093/jof/105.7.358>

Burrill, Elizabeth A.; DiTommaso, Andrea M.; Turner, Jeffery A.; Pugh, Scott A.; Christensen, Glenn; Kralicek, Karin M.; Perry, Carol J.; Lepine, Lucie C.; Walker, David M.; Conkling, Barbara L. 2024. The Forest Inventory and Analysis Database, FIADB user guides, volume: database description (version 9.4), nationwide forest inventory (NFI). U.S. Department of Agriculture, Forest Service. 1016 p. [Online]. Available at web address: <https://research.fs.usda.gov/understory/forest-inventory-and-analysis-database-user-guide-nfi>

Butler, B.J., Caputo, J., Robillard, A.L., Sass, E.M. and Sutherland, C., 2021. One size does not fit all: Relationships between size of family forest holdings and owner attitudes and behaviors. *Journal of Forestry*, 119(1), pp.28-44.

Butler, B.J., Butler, S.M., Caputo, J., Dias, J., Robillard, A. and Sass, E.M., 2021. Family forest ownerships of the United States, 2018: Results from the USDA Forest Service, national woodland owner survey. *Gen. Tech. Rep. NRS-199. Madison, WI: US Department of Agriculture, Forest Service, Northern Research Station. 52 p.[plus 4 appendixes], 199.*

Cambi M, Certini G, Neri F, Marchi E. 2015 The impact of heavy traffic on forest soils: a review. *Forest Ecology and Management*. 338:124–138.

Campbell, J.L., Rustad, L.E., Bailey, S.W., Bernhardt, E.S., Driscoll, C.T., Green, M.B., Groffman, P.M., Lovett, G.M., McDowell, W.H., McGuire, K.J. and Rosi, E.J., 2021. Watershed studies at the Hubbard Brook Experimental Forest: Building on a long legacy of research with new approaches and sources of data. *Hydrological Processes*, 35(1), p.e14016.

Caputo, J. and B. Butler. 2026. National Woodland Owner Survey Dashboard (NWOS-DASH) version 1.0. Accessed 2026-01-27. [Workbook: NWOS\\_DASH](#)

Certified Logging Professionals. 2026. Certified Logging Professional Database. Augusta ME (accessed online on 1/21/2026 at: <https://www.clploggers.org/about-5>).

Coles, J.F., Cuffney, T.F., McMahon, G. and Rosiu, C.J., 2010. Judging a brook by its cover: the relation between ecological condition of a stream and urban land cover in New England. *Northeastern Naturalist*, 17(1), pp.29-48.

Crawford, Leslee J.; Heinse, Robert; Kimsey, Mark J.; Page-Dumroese, Deborah S. 2021. Soil sustainability and harvest operations: A review. *Gen. Tech. Rep. RMRS-GTR-421. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 39 p.* <https://doi.org/10.2737/RMRS-GTR-421>.

Crawley, A., Hunt, E., Damicis, J., Conroy, T., Hallowell, A., Hammond, D., O'Neil, S., Slate, J., Stedman, M., Brooks, J., Daigneault, A., Fife, C. 2025. 2024 Statewide Economic Contribution of Maine's Forest Products Sector. Maine Forest Products Council, Augusta, Maine.

Cristan, R., Aust, W.M., Bolding, M.C., Barrett, S.M., Munsell, J.F. and Schilling, E., 2016. Effectiveness of forestry best management practices in the United States: Literature review. *Forest Ecology and Management*, 360, pp.133-151.

Daigneault, A., Simons-Legaard, E., Birthisel, S., Carroll, J., Fernandez, I. and Weiskittel, A., 2020. Maine forestry and agriculture natural climate solutions mitigation potential. Interim report. Orono (ME): University of Maine Center for Research on Sustainable Forests.

Dangal, S.R., Felzer, B.S. and Hurteau, M.D., 2014. Effects of agriculture and timber harvest on carbon sequestration in the eastern US forests. *Journal of Geophysical Research: Biogeosciences*, 119(1), pp.35-54.

Davis, E.C., Sohngen, B. and Lewis, D.J., 2026. How much of the forest sink is passive? Case of the United States. *Proceedings of the National Academy of Sciences*, 123(4), p.e2513588123.

Dollin, P.E., Majka, C.G. and Duinker, P.N., 2008. Saproxylic beetle (Coleoptera) communities and forest management practices in coniferous stands in southwestern Nova Scotia, Canada. *ZooKeys*, 2, pp.291-336.

DeArmond, D., Ferraz, J.B. and Higuchi, N., 2021. Natural recovery of skid trails: a review. *Canadian Journal of Forest Research*, 51(7), pp.948-961.

Drummond, M.A. and Loveland, T.R., 2010. Land-use pressure and a transition to forest-cover loss in the eastern United States. *BioScience*, 60(4), pp.286-298.

[Erdozain, M., Kidd, K.A., Negrazis, L., Capell, S.S., Kreutzweiser, D.P., Gray, M.A. and Emilson, E.J., 2022. Understanding the effects of forest management on streams and rivers: A synthesis of research conducted in New Brunswick \(Canada\) 2014–2018. \*The Forestry Chronicle\*, 98\(1\), pp.77-88.](#)

Ferguson, R.H. and Longwood, F.R., 1960. The timber resources of Maine. A report on the forest survey made by the US Forest Service. *Upper Darby, PA: US Department of Agriculture, Forest Service, Northeastern Forest Experiment Station*. 75 p.

Ferguson, R.H. and Kingsley, N.P., 1972. *The timber resources of Maine* (Vol. 26). Northeastern Forest Experiment Station.

Forest Stewardship Council (FSC) International. 2026a. FSC® Search: Up-to-date certification and licensing information. FSC® International, Bonn, Germany (accessed on 1/21/2026 at: <https://search.fsc.org/en/>).

Forest Stewardship Council (FSC) International. 2026b. FSC Forest Stewardship Standard for the Conterminous United States of America. FSC-STD-USA-02-2026 EN. Forest Stewardship Council International, Bonn, Germany.

FOR/Maine 2018. Forest Opportunity Roadmap/Maine. FOR/Maine.

Forman, R.T. and Alexander, L.E., 1998. Roads and their major ecological effects. *Annual review of ecology and systematics*, 29(1), pp.207-231.

Frank, J., 2024, October. Recent Estimates and Future Projections of Maine's Timber Volume, Forest Carbon Stocks, and Sequestration Rates: 2003–2048. In *Analysis (FIA 2022) Science Stakeholder Meeting*.

Godar Chhetri, S., Boston, K. and Pelkki, M., 2025. Do Consulting Foresters in States Requiring Licensing Manage Forestlands Similarly to those in States without Licensing?. *Journal of Forestry*, pp.1-19.

Gunn, J.S. and Buchholz, T., 2018. Forest sector greenhouse gas emissions sensitivity to changes in forest management in Maine (USA). *Forestry: An International Journal of Forest Research*, 91(4), pp.526-538.

Gustafsson L, Kouki J, Sverdrup-Thygeson A (2010) Tree retention as a conservation measure in clear-cut forests of northern Europe: a review of ecological consequences. *Scand J For Res* 25:295–308

- Griffith, Douglas M.; Alerich, Carol L. 1996. Forest Statistics for Maine, 1995. Resour. Bull. NE-135. Radnor, PA; U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station. 134 p.
- Hatcher, J. E., Straka, T. J., & Greene, J. L. (2013). The Size of Forest Holding/Parcelization Problem in Forestry: A Literature Review. *Resources*, 2(2), 39-57. <https://doi.org/10.3390/resources2020039>
- Hayes, D., Brewer, A., Daigneault, A., Enterline, C., Fernandez, I., Frank, J., Johnson, B., Knapp, S., Legaard, K., Price, N., Puryear, K., Simons-Legaard, E., Stevens, A., Wei, X., Weiskittel, A. (2024). The State of Maine's Carbon Budget (Version 2, 2017 - 2021). <https://crsf.umaine.edu/forest-climate-change-initiative/carbon-budget/>.
- Hornbeck, J.W., Adams, M.B., Corbett, E.S., Verry, E.S. and Lynch, J.A., 1993. Long-term impacts of forest treatments on water yield: a summary for northeastern USA. *Journal of Hydrology*, 150(2-4), pp.323-344.
- Hubbart, J.A., Link, T.E., Gravelle, J.A. and Elliot, W.J., 2007. Timber harvest impacts on water yield in the continental/maritime hydroclimatic region of the United States. *Forest Science*, 53(2), pp.169-180.
- Hunter Jr, M.L. and Gibbs, J.P., 2006. *Fundamentals of conservation biology*. John Wiley & Sons.
- Ireland, L. 1998. Maine's forest area, 1600-1995: review of available estimates. University of Maine, Maine Agricultural and Forest Experiment Station, Misc. Publ. 736. University of Maine: Orono, ME. 12 pp.
- Jakubas, Walter J., Craig R. McLaughlin, Paul G. Jensen, and Stacy A. McNulty. 2005. "Alternate year beechnut production and its influence on bear and marten populations." In In: Evans, Celia A., Lucas, Jennifer A. and Twery, Mark J., eds. Beech Bark Disease: Proceedings of the Beech Bark Disease Symposium; 2004 June 16-18; Saranac Lake, NY. Gen. Tech. Rep. NE-331. Newtown Square, PA: US. Department of Agriculture, Forest Service, Northeastern Research Station: 79-87.
- Kasson, M.T. and Livingston, W.H., 2012. Relationships among beech bark disease, climate, radial growth response and mortality of American beech in northern Maine, USA. *Forest Pathology*, 42(3), pp.199-212.
- Kingsley, E. 2024. Maine Logging Wages Trending Upward, Employment Down. Forest Resources Association, Washington, D.C. (accessed online on 1/21/2026 at: [https://forestresources.org/2024/01/25/maine-loggers-are-earning-more/#\\_edn2](https://forestresources.org/2024/01/25/maine-loggers-are-earning-more/#_edn2))
- Kingsley, E. 2025. Disruptive Forces Impacting the Forest Industry. Presentation to Forest Resources Association, Northeast Region Forest Forum. October 2, 2025. Brewer, ME.
- Kingsley, E., Levesque, C. and Petersen, C., 2004. The Northern Forest of Maine, New Hampshire, Vermont and New York: A look at the land, economies and communities 1994-2004. *Draft (Review of work of the Northern Forest Lands Council): Northeast State Foresters Association*.
- Kittredge, D. and K. Grogan. 2005. Parcelization of forests and timber harvest. 16<sup>th</sup> Annual Harvard Forest Symposium (abstract). Harvard Forest, Harvard University, Petersham, MA (accessed online on 2/25/2026 at:

[https://harvardforest2.fas.harvard.edu/asp/hf/php/symposium/symposium\\_abstract\\_view.php?id=36](https://harvardforest2.fas.harvard.edu/asp/hf/php/symposium/symposium_abstract_view.php?id=36)).

Kluge, N.P., Sartini, C.E., Sedinger, B.S., Barringer, B.C., Hygnstrom, S.E., Tri, A.N., Denryter, K.A., Carpenter, C.P., Olfenbittel, C. and Carrollo, E.M., 2025. Harvest management and mast abundance affect black bear harvest demographics in the United States. *The Journal of Wildlife Management*, 89(3), p.e22710.

Koivula, M. and Vanha-Majamaa, I., 2020. Experimental evidence on biodiversity impacts of variable retention forestry, prescribed burning, and deadwood manipulation in Fennoscandia. *Ecological Processes*, 9(1), p.11.

Kuehne C, Puhlick JJ, and Weiskittel AR 2018. Ecological reserves in Maine: Initial results of long-term monitoring. General Technical Report. Maine Natural Areas Program, , Department of Agriculture, Conservation, and Forestry. Augusta, ME. 62 p.

Lindenmayer, D.B., Laurance, W.F., Franklin, J.F., Likens, G.E., Banks, S.C., Blanchard, W., Gibbons, P., Ikin, K., Blair, D., McBurney, L. and Manning, A.D., 2014. New policies for old trees: averting a global crisis in a keystone ecological structure. *Conservation Letters*, 7(1), pp.61-69.

Liu, J., 2025. Progress in research on the effects of environmental factors on natural forest regeneration. *Frontiers in Forests and Global Change*, 8, p.1525461.

Locke, K.A., 2024. Modelling relationships between land use and water quality using statistical methods: A critical and applied review. *Journal of Environmental Management*, 362, p.121290.

Löfroth, T., Birkemoe, T., Shorohova, E., Dynesius, M., Fenton, N.J., Drapeau, P. and Tremblay, J.A., 2023. Deadwood biodiversity. In *Boreal forests in the face of climate change: Sustainable management* (pp. 167-189). Cham: Springer International Publishing.

Ma, Z., Butler, B.J., Kittredge, D.B. and Catanzaro, P., 2012. Factors associated with landowner involvement in forest conservation programs in the US: Implications for policy design and outreach. *Land use policy*, 29(1), pp.53-61.

Maine Bureau of Parks and Lands. 2019. Maine State Comprehensive Outdoor Recreation Plan, 2020-2024. Maine Bureau of Parks and Lands, Department of Agriculture, Conservation, and Forestry. Augusta, ME.

Maine Climate Council; Governor's Office of Policy Innovation and the Future; Fernandez, Ivan; Dickson, Stephen; Arnold, Susie; Rose, Cassandra; Jackson, Troy; Black, Russell; Grohski, Nicole; Collamore, Amanda; Bacon, Linda; Beal, Brian; Birkel, Sean; Contosta, Alix; Cross, Amanda; Daigneault, Adam; DeMaynadier, Phillips; Elias, Susan; Hodgkins, Glenn; Kelley, Joe; Koehler, Glen; Lincoln, Rebecca; Lombard, Pamela; Lyon, Brandfield; Price, Nicole; Rubin, Jonathan; Salisbury, Joseph; Slovinsky, Peter; Soucy, Alyssa; Steneck, Robert; Stockwell, Sally; Wahle, Richard; Weiskittel, Aaron; and Wilson, Carl, "Maine Won't Wait One-Year Progress Report, 2021" (2021). General University of Maine Publications. 2272.

[https://digitalcommons.library.umaine.edu/univ\\_publications/2272](https://digitalcommons.library.umaine.edu/univ_publications/2272)

Maine Department of Agriculture, Conservation, and Forestry and Maine Forest Service. 2024. *Maine Forestry Best Management Practices (BMP) Use and Effectiveness—Data Summary 2022-2023*. Maine Forest Service, Augusta, ME.

Maine Department of Conservation, Maine Forest Service. 2005 (MDC MFS 2005). The 2005 Biennial Report on the State of the Forest and Progress Report on Sustainability Standards. Report to the Joint Standing Committee of the 122nd Legislature on Agriculture, Conservation and Forestry. Maine Department of Conservation: Augusta. 124 pp

Maine Department of Environmental Protection. 2024. Tenth Biennial Report on Progress toward Greenhouse Gas Reduction Goals. Report to the Joint Standing Committee on Environment and Natural Resources, Maine 131st Legislature, Second Session. Bureau of Air Quality, Maine Department of Environmental Protection, Augusta, ME.

Maine Department of Inland Fisheries and Wildlife. 2026. Maine's Wildlife Action Plan – 2025. Maine Department of Inland Fisheries and Wildlife, Maine Department of Agriculture, Conservation and Forestry, and the Department of Marine Resources, Augusta, ME.

Maine Department of Inland Fisheries & Wildlife and the Department of Agriculture, Conservation, and Forestry. 2026. Report Back on Resolve S.P. 538 - L.D. 1308, Directing the Department of Inland Fisheries and Wildlife and the Department of Agriculture, Conservation and Forestry to Examine Issues Related to Public Access to Privately Owned Lands. Report to the 2nd Session of the 132nd Joint Standing Committee on Inland Fisheries & Wildlife. Maine Department of Inland Fisheries & Wildlife and the Department of Agriculture, Conservation, and Forestry, Augusta, Maine.

Maine Forest Service (MFS), Department of Conservation. 2010. Maine State Forest Assessment and Strategies. Maine Forest Service, Department of Conservation, Augusta. 225 pp.

Maine Forest Service (MFS. 2025a). 2003-2023 Silvicultural Activities Reports. Department of Agriculture, Conservation and Forestry, Maine Forest Service, Forest Policy and Management Division, Augusta, ME. [https://www.maine.gov/dacf/mfs/publications/annual\\_reports.html](https://www.maine.gov/dacf/mfs/publications/annual_reports.html)

Maine Forest Service (MFS. 2025b). 2003-2023 Wood Processor Reports. Department of Agriculture, Conservation and Forestry, Maine Forest Service, Forest Policy and Management Division, Augusta, ME. [https://www.maine.gov/dacf/mfs/publications/annual\\_reports.html](https://www.maine.gov/dacf/mfs/publications/annual_reports.html)

Maine Forest Service 2022. Recent Estimates and Future Projections of Maine's Timber Inventory, Forest Carbon Stocks and Sequestration Rates. Internal working draft.

Maine Ecological Reserves Scientific Advisory Committee. 2009. Ecological Reserves in Maine: A Status Report on Designation, Monitoring, and Uses. Maine Ecological Reserves Scientific Advisory Committee, Maine Natural Areas Program, Department of Conservation, Augusta, ME.

Maine Land Trust Network. 2025. Land Trusts Work for Maine. Maine Land Trust Network, Brunswick, ME (accessed on 1/27/2026 online at: <https://www.mltn.org/wp-content/uploads/2025/07/Land-Trusts-Work-for-Maine-2025-1.pdf>).

Martin, C.W., 1988. Soil disturbance by logging in New England: review and management recommendations. *Northern Journal of Applied Forestry*, 5(1), pp.30-34.

McCaskill, George L.; McWilliams, William H.; Barnett, Charles J.; Butler, Brett J.; Hatfield, Mark A.; Kurtz, Cassandra M.; Morin, Randall S.; Moser, W. Keith; Perry, Charles H.; Woodall, Christopher W. 2011. Maine's forests 2008. Resour. Bull. NRS-48. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northern Research Station. 62 p.

McWilliams, W.H., Butler, B.J., Caldwell, L.E., Griffith, D.M., Hoppus, M.L., Laustsen, K.M., Lister, A.J., Lister, T.W., Metzler, J.W., Morin, R.S. and Sader, S.A., 2005. The forests of Maine: 2003. *Resour. Bull. NE-164. Newtown Square, PA: US Department of Agriculture, Forest Service, Northeastern Research Station. 188 p., 164.*

Maine Climate Council - Science and Technical Subcommittee. 2024. Scientific Assessment of Climate Change and Its Effects in Maine - 2024 Update. A Report by the Scientific and Technical Subcommittee (STS) of the Maine Climate Council (MCC). Augusta, Maine. 268 pp. 3).

Mölder, A., Tiebel, M. and Plieninger, T., 2021. On the interplay of ownership patterns, biodiversity, and conservation in past and present temperate forest landscapes of Europe and North America. *Current Forestry Reports*, 7(4), pp.195-213.

Nave, L.E., DeLyser, K., Domke, G.M., Holub, S.M., Janowiak, M.K., Keller, A.B., Peters, M.P., Solarik, K.A., Walters, B.F. and Swanston, C.W., 2024. Land use change and forest management effects on soil carbon stocks in the Northeast US. *Carbon Balance and Management*, 19(1), p.5.

Neufeld, D.G., Alderfer, I., Bauman, Z. and Buckwalter, M., 2025. Headwaters to valley: Water quality in rivers transitioning from forest to agricultural bottomland. *Plos one*, 20(10), p.e0316514.

North Maine Woods, Inc. 2026. North Maine Woods is really three things: each is unique. North Maine Woods, Inc. Ashland, ME (accessed on 1/27/2026 online at: <https://northmainewoods.org/aboutus/whatisnmw/>).

O'Neill, K.P.; Amacher, M.C.; Perry, C.H. 2005. Soils as an indicator of forest health: a guide to the collection, analysis, and interpretation of soil indicator data in the Forest Inventory and Analysis program. Gen. Tech. Rep. NC-258. St. Paul, MN: USDA, Forest Service, North Central Research Station. 53 p

Powell, D.S. and Dickson, D.R., 1984. *Forest statistics for Maine, 1971 and 1982* (No. 81). US Department of Agriculture, Forest Service, Northeastern Station.

Professional Logging Contractors of the Northeast. 2026. Logging and Trucking in the Northeast: An Impact Study of the Industry Across the Region, 2024 Economic Contribution. Augusta, Maine.

Pugh, Scott A.; Turner, Jeffery A.; Burrill, Elizabeth A.; David, Winnie. 2018. The Forest Inventory and Analysis Database: population estimation user guide (Edition: November, 2018). U.S. Department of Agriculture, Forest Service. 166 p. [Online]. Available at web address: <http://www.fia.fs.fed.us/library/database-documentation/>.

- Puhlick, J.J. and Fernandez, I.J., 2023. Change in soil carbon, nitrogen, and phosphorus after timber harvesting in northern hardwood forests. *Soil Science Society of America Journal*, 87(2), pp.404-416.
- Puhlick, J.J., and Weiskittel, A.R. 2021. Carbon stocks and sequestration on ecological reserves in Maine. General Technical Report. Maine Natural Areas Program, , Department of Agriculture, Conservation, and Forestry. Augusta, ME.
- Puhlick, J.J. and Fernandez, I.J., 2020. Influence of mechanized timber harvesting on soil compaction in northern hardwood forests. *Soil Science Society of America Journal*, 84(5), pp.1737-1750.
- Ramey, T.L. and Richardson, J.S., 2017. Terrestrial invertebrates in the riparian zone: mechanisms underlying their unique diversity. *BioScience*, 67(9), pp.808-819.
- Raison, R.J. and Khanna, P.K., 2011. Possible impacts of climate change on forest soil health. In *Soil health and climate change* (pp. 257-285). Berlin, Heidelberg: Springer Berlin Heidelberg.
- Rector, A., Allen, M., Nolan, C., Lazure, L., Stewart, D., Gabe, T. 2025. Report of the Maine State Revenue Forecasting Committee.
- Ribe, R.G., Nielsen-Pincus, M., Johnson, B.R., Enright, C. and Hulse, D., 2022. The Consequential Role of Aesthetics in Forest Fuels Reduction Propensities: Diverse Landowners' Attitudes and Responses to Project Types, Risks, Costs, and Habitat Benefits. *Land*, 11(12), p.2151.
- Russell, M.B., Woodall, C.W., Fraver, S., D'Amato, A.W., Domke, G.M. and Skog, K.E., 2014. Residence times and decay rates of downed woody debris biomass/carbon in eastern US forests. *Ecosystems*, 17(5), pp.765-777.
- Sathre, R. and O'Connor, J., 2010. Meta-analysis of greenhouse gas displacement factors of wood product substitution. *Environmental science & policy*, 13(2), pp.104-114.
- Schlawin, J., K. Puryear, D. Circo, A. Cutko, S. Demers, M. Docherty. 2021. An assessment of accomplishments and gaps in Maine Land Conservation. Maine Natural Areas Program, Augusta ME. [https://www.maine.gov/dacf/mnap/publications/LAPAC\\_2021techrept.pdf](https://www.maine.gov/dacf/mnap/publications/LAPAC_2021techrept.pdf)
- Simmons, J.A., Fernandez, I.J., Briggs, R.D. and Delaney, M.T., 1996. Forest floor carbon pools and fluxes along a regional climate gradient in Maine, USA. *Forest Ecology and Management*, 84(1-3), pp.81-95.
- Sewall Co., J.W. 1944. Report on timber and pulpwood resources of Maine for State Bureau of Taxation. Old Town. Typescript in Maine State Archives.
- Sustainable Forestry Initiative. 2022. SFI 2022 Forest Management Standard, Section 2. Sustainable Forestry Initiative, Washington, DC.
- Sustainable Forestry Initiative (SFI). 2026, SFI database. Washington, D.C. (accessed online on 1/5/2026 at: <https://sfidatabase.org/search/search-forest-area>).

Swanston, C., Brandt, L.A., Janowiak, M.K., Handler, S.D., Butler-Leopold, P., Iverson, L., Thompson III, F.R., Ontl, T.A. and Shannon, P.D., 2018. Vulnerability of forests of the Midwest and Northeast United States to climate change. *Climatic Change*, 146(1), pp.103-116.

Thompson, J.R., Carpenter, D.N., Cogbill, C.V. and Foster, D.R., 2013. Four centuries of change in northeastern United States forests. *PloS one*, 8(9), p.e72540.

The Montréal Process. 2015. The Montréal Process Criteria and Indicators for the Conservation and Sustainable Management of Temperate and Boreal Forests, Fifth Edition. Research Institute of Forestry, Chinese Academy of Forestry, Beijing, China.

U.S. Census Bureau, Population Division. 2024. Intercensal Estimates of the Resident Population for Counties in Maine: April 1, 2010 to April 1, 2020 (CO-EST2020INT-POP-23)

U.S. Census Bureau, Population Division. 2025. Annual Estimates of the Resident Population for Counties in Maine: April 1, 2020 to July 1, 2024 (CO-EST2024-POP-23)

USDA Forest Service. In press. Family Forest Ownerships of the United States, 2023: Results from the USDA Forest Service, National Woodland Owner Survey. Madison, WI: USDA Forest Service, Northern Research Station.

USDA Forest Service, Forest Inventory and Analysis Program, 2025. Forest Inventory EVALIDator web-application Version 2.1.2. St. Paul, MN: U.S. Department of Agriculture, Forest Service, Northern Research Station. [Available only on internet: <https://apps.fs.usda.gov/fiadb-api/evalidator>].

USDA Forest Service, Forest Inventory and Analysis Program, 2026. Forest Inventory EVALIDator web-application Version 2.1.2. St. Paul, MN: U.S. Department of Agriculture, Forest Service, Northern Research Station. [Available only on internet: <https://apps.fs.usda.gov/fiadb-api/evalidator>]

U.S. Geological Survey (USGS), 2024, Annual NLCD Collection 1 Science Products: U.S. Geological Survey data release, <https://doi.org/10.5066/P94UXNTS>.  
<https://www.usgs.gov/centers/eros/science/annual-national-land-cover-database>

Valipour, M., Johnson, C.E., Battles, J.J., Campbell, J.L., Fahey, T.J., Fakhraei, H. and Driscoll, C.T., 2021. Simulation of the effects of forest harvesting under changing climate to inform long-term sustainable forest management using a biogeochemical model. *Science of the Total Environment*, 767, p.144881.

Vickery, B.W., Germain, R.H. and Bevilacqua, E., 2009. Urbanization's impact on sustained yield management as perceived by forestry professionals in central New York. *Forest policy and economics*, 11(1), pp.42-49.

Vorster, A. G., Choi, C. T. H., Prentice, A. M., Young, N., Kuegler, O., Gaetani, M., West Fordham, A., & Bucholz, E. 2024. Colorado forest carbon inventory: Forest ecosystem and harvested wood product carbon accounting framework through 2019. Colorado State Forest Service Report. Fort Collins, CO: Colorado State Forest Service.

Warrington, B.M., Aust, W.M., Barrett, S.M., Ford, W.M., Dolloff, C.A., Schilling, E.B., Wigley, T.B. and Bolding, M.C., 2017. Forestry best management practices relationships with aquatic and riparian fauna: A review. *Forests*, 8(9), p.331.

Westfall, J.A., Coulston, J.W., Moisen, G.G. and Andersen, H.E., 2022. Sampling and estimation documentation for the enhanced Forest inventory and analysis program: 2022. Gen. Tech. Rep. NRS-GTR-207. Madison, WI: US Department of Agriculture, Forest Service, Northern Research Station. 129 p., 207, pp.1-129.

Westfall, J.A., Coulston, J.W., Gray, A.N., Shaw, J.D., Radtke, P.J., Walker, D.M., Weiskittel, A.R., MacFarlane, D.W., Affleck, D.L., Zhao, D., Temesgen, H., Poudel, K.P., Frank, J.M., Prisley, S.P., Wang, Y., Sánchez, A.J., Auty, D., and Domke, G.M. 2024. A national-scale tree volume, biomass, and carbon modeling system for the United States. Gen. Tech. Rep. WO-104. Washington, DC: US Department of Agriculture, Forest Service., 104.

Wigley, T.B., Miller, D.A. and Yarrow, G.K., 2007. Planning for bats on forest industry lands in North America. *Bats in forests: conservation and management (MJ Lacki, JP Hayes, and A. Kurta, eds.)*. Johns Hopkins University Press, Baltimore, Maryland, pp.293-318.

Wilkerson, E., Hagan, J.M. and Whitman, A.A., 2010. The effectiveness of different buffer widths for protecting water quality and macroinvertebrate and periphyton assemblages of headwater streams in Maine, USA. *Canadian Journal of Fisheries and Aquatic Sciences*, 67(1), pp.177-190.

Wolff, S. and Schweinle, J., 2022. Effectiveness and economic viability of forest certification: A systematic review. *Forests*, 13(5), p.798.

Woodall, C.W., D'Amato, A.W., Bradford, J.B. and Finley, A.O., 2011. Effects of stand and inter-specific stocking on maximizing standing tree carbon stocks in the eastern United States. *Forest Science*, 57(5), pp.365-378.

Woodall, C.W., Albright, T., Butler, B.J., Crocker, S.J., Frank, J., Goff, T.C., Gormanson, D.D., Kenefic, L.S., Kurtz, C.M., Lister, T.W. and Miles, P.D., 2022. Maine forests 2018: summary report. Resource. Bull. NRS-126. Madison, WI: US Department of Agriculture, Forest Service, Northern Research Station. 16 p., 126.

Woodall, C.W., D'Amato, A.W., Bradford, J.B. and Finley, A.O., 2011. Effects of stand and inter-specific stocking on maximizing standing tree carbon stocks in the eastern United States. *Forest Science*, 57(5), pp.365-378.

Woollard, T.F., Harrison, D.J., Simons-Legaard, E.M. and Fagan, K.E., 2024. Functional responses in American marten habitat selection indicate cumulative effects of progressive habitat change. *Ecosphere*, 15(1), p.e4715.

Zhou, D., Xiao, J., Liu, S., Huang, L., Zhang, L., Fan, J. and Zhao, S., 2026. Global impacts of transportation infrastructure on forest degradation and loss. *Nature Communications*.