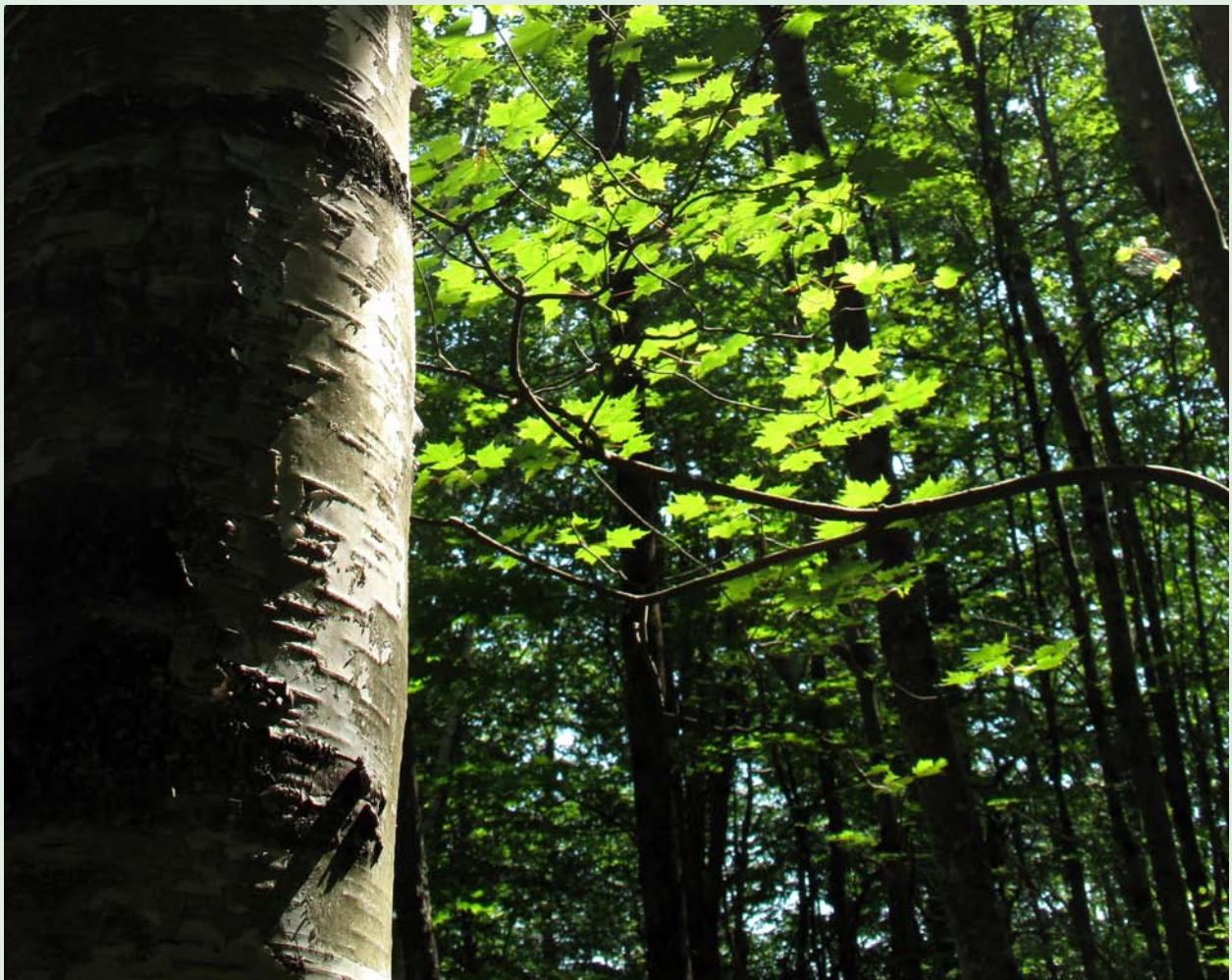




The
**ECONOMIC
IMPORTANCE
of
NEW HAMPSHIRE'S
FOREST-BASED
ECONOMY 2013**
North East *State* Foresters Association



I. Introduction

Thank you for reading this latest edition of the Economic Importance of New Hampshire's Forest-Based Economy. I hope you will find the material provided within valuable and informative. This latest installment updates and expands upon the facts and figures presented in earlier editions, provides trends over time, and paints a clear picture of how important our forests and trees are to our state's economy.

While the statistics in this publication focus on economic numbers and dollars, our forests are much more than that. Although hard to assign a number to, the value that our trees provide to our social and environmental well-being is almost limitless, and would undoubtedly multiply the figures found in this document many-fold. We are very fortunate in New Hampshire to live in a state that is 84% covered by trees; a state that is defined in large-part by our vast stretches of forest. These forests provide critical wildlife habitat, clean water, clean air, abundant recreational opportunities and store carbon, all while providing us a valuable renewable resource for a multitude of products from furniture to paper to fuel for heat and electricity production.

It should be noted that this expansive, healthy forest that is so important to our economy is predominantly privately-owned, at almost 76%. Therefore, maintaining this resource to provide benefits for future generations is largely in the hands of these 100,000+ landowners. An important incentive to continue maintaining land in forest is to ensure a healthy forest products industry. A vibrant industry not only provides for a healthy forest and important forest products, it also provides an economic motivation for forest landowners to keep their land in forest rather than development. This, along with wise forest management and tax policies, will help to protect our forests and secure the many values they provide, both economic and otherwise, well into the future.

Thank you,
Brad W. Simpkins
Director, NH Division of Forests & Lands
State Forester



Brad W. Simpkins, State Forester
New Hampshire Division of Forests
and Lands

Acknowledgements: Funding for this report was provided by the Public Service Company of NH and the U.S. Endowment for Forestry and Communities through the Northern Forest Center.

This report is an update of a series of similar reports that have been published for the State of New Hampshire by the North East State Foresters Association since the early 1990s. The goal is to capture the economic value of the forest-based economy of the State and provide analyses of trends for key economic indicators. The sectors covered in this report include forestry and logging, related trucking, wood products manufacturing, wood furniture and related products manufacturing, pulp and paper manufacturing, wood energy, and the forest-based recreational economy that includes camping, hiking, hunting, downhill skiing, cross-country skiing, snowmobiling, fall foliage viewing, and wildlife viewing. Additional discussions in this report, compared to past reports, include use of economic multipliers to give a truer picture of the forest-based economy, carbon content of the forests of New Hampshire and the relationship of ecosystem services to the forest-based economy.

Data for this report come from federal, state and private sources. For a full list sources, please see the end of this report.

We would like to thank the many people who assisted with the development of this report including Brad Simpkins and Jonathan Horton of the New Hampshire Division of Forests and Lands at the Dept. of Resources and Economic Development and Sarah Smith and Karen Bennett of the UNH Cooperative Extension.



II. Executive Summary

- Forest area and species – **New Hampshire’s forests cover 4,833,332 acres** of land or **84% of the State** and have largely been at this level since the 1980s. **Northern hardwood (beech, birch, maple) forests make up over 53%** of the forest cover.
- Forest ownership – New Hampshire’s forests continue to be largely privately owned by **individuals/families and business who together own over 76% of the forest**. The state owns 5% of the forests and the federal government, primarily through the White Mountain National Forest, own 14%.
- Forest inventory, growth vs. harvest – The forests of New Hampshire continue to add to the inventory of tree volume as net growth exceeds harvest annually. Currently, **New Hampshire’s forests grow 200.4 million cubic feet per year while approximately 138.8 million cubic feet of timber is harvested annually**. New Hampshire’s standing forest contains 6.3 billion cubic feet (196 million tons or 78.4 million cords) of timber 5 inches in diameter or larger.
- Value of forest industry economic sectors – The annual value of sales or output of **New Hampshire’s forest products industry totals nearly \$ 1.4 billion while the forest-based recreation economy is also worth approximately \$1.4 billion**. Approximately **7,756* workers are employed in the forest products, maple and Christmas tree sectors** while another **10,800 jobs are found in the sectors that include and support the forest recreation economy**. There are approximately 1200 loggers, 500 foresters and technicians, 800 truckers and 161 sawmills operating in the Granite State. Thirty-five of these sawmills produce the majority of sawed volume. Landowners received approximately \$30 million in stumpage payments for timber harvested in 2012. Of that, approximately \$3 million was paid in timber tax to NH communities.
- **Using multipliers** generated through IMPLAN, an economic model, **it is estimated that the forest products sector has \$2.4 billion in economic output and 12,818 jobs** when taking into account the rippling effect this industry has on the other parts of the economy.
- **Economic output and number of jobs in the forest products sector have been reduced since peaks in the 1990s and early 2000s**. This has mirrored similar trends in other manufacturing sectors in the U.S. as more and more manufacturing has moved to other parts of the world.
- While most of the wood harvested in New Hampshire is processed in New Hampshire, wood flows freely in the regional economy. In 2011, **1.315 million cords of wood were harvested in New Hampshire, 1.195 million cords were processed in New Hampshire while 665,000 cords were exported and 493,000 cords were imported**.

Table 1.

Gross State Output (GSP), Forest-based Manufacturing & Recreation, New Hampshire, 2011

| | millions of | jobs* |
|---|-------------|--------|
| Forestry, logging & trucking | \$150 | 2,860 |
| Wood products manufacturing | \$401 | 1,996 |
| Furniture and related product manufacturing | \$190 | 1,140 |
| Paper manufacturing | \$481 | 1,100 |
| Wood energy | \$166 | 470 |
| Christmas trees and maple syrup | \$6 | 190 |
| Sub-total direct | \$1,394 | 7,756 |
| Sub-total with multipliers | \$2,404 | 12,818 |
| Forest Recreation | \$1,400 | 10,800 |
| Total | \$3804 | 23,618 |

| | |
|---------------------------------------|----------|
| GSP, Forest Products Manufacturing | \$341 |
| GSP, All Manufacturing, New Hampshire | \$7,657 |
| GSP, Total for New Hampshire | \$64,975 |

*full-time equivalent jobs

GSP – Gross State Product includes value added, which is equal to its gross output minus its intermediate purchases from domestic industries or from foreign sources.

Gross Output – Includes the total value of all products produced and shipped by all producers (essentially sales).



III. The Forest Resource

Forest Area

At over 84% forest cover, New Hampshire is the second most forested state in the country behind Maine. Of the 4,833,332 forested acres in New Hampshire, 4,638,230 acres are considered “timberland,” meaning these lands are capable of producing repeated timber crops.

Data from the National Land Cover dataset from US Geological Survey shows that from the period of 2001 to 2006, the most recent data available, there was a net loss of 9,387 acres of forest to non-forest use.

A long-term forestland acreage trend analysis coordinated by the Harvard Forest shows that New Hampshire’s forested area is only somewhat less than when Europeans first arrived in North America (See Figure 1). It is estimated that in the year 1600 forests covered 5.6 million acres compared to today’s 4.8 million. The Granite State’s forests have grown back after reaching a low of 2.8 million acres in 1860. Since a recent peak in 1970, forest acreage has gone down approximately 300,000 acres but has leveled off in recent years.

Forest Ownership

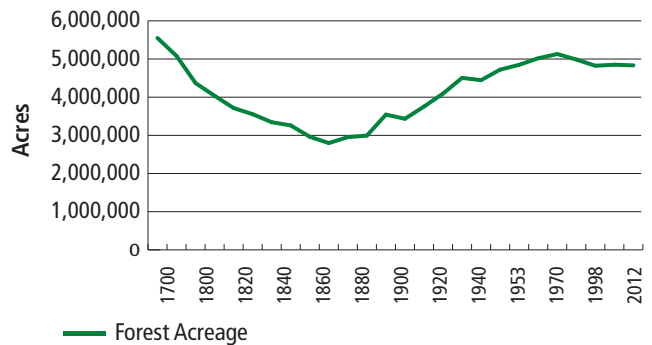
The individual/family forest and business owner sector continues to dominate the ownership of New Hampshire’s forest. Fully 68% of New Hampshire’s forests, or 3.6 million acres, are owned by individuals or families (Figure 2) and an additional 8% is owned by business¹. The State of New Hampshire owns 5% or approximately 211,000 acres of New Hampshire’s forest and the federal government, mostly in the White Mountain National Forest, another 14% at 672,000 acres. Cities, towns and counties own approximately 5% of the forests or approximately 226,000 acres.

Forest Types

New Hampshire’s forests are dominated by the northern hardwood type (beech, birch, maple) comprising more than 2.4 million acres of the New Hampshire woods. White-red pine (mostly white pine) cover 566,000 acres and spruce-fir another 378,000 acres.

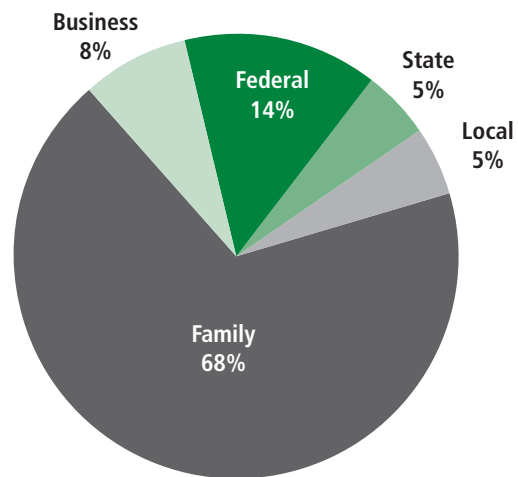
1. Business forest owners are generally large ownerships but some medium to small ownerships in the 5,000 acre category are included in this definition.

Figure 1
New Hampshire Forest Acreage



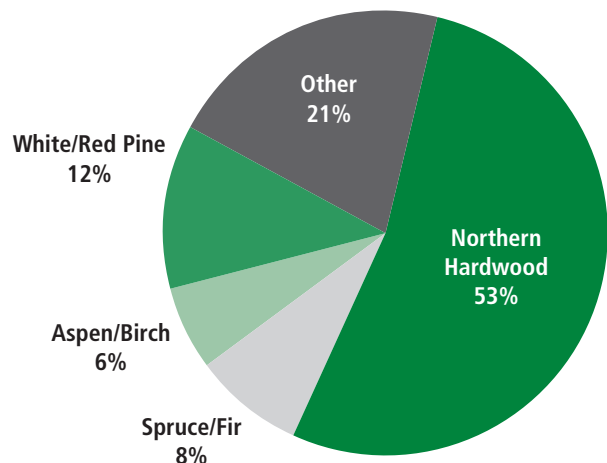
Source: USDA Forest Service, Forest Inventory and Analysis.

Figure 2
New Hampshire Timberland Ownership (acrage)



Source: USDA Forest Service, Forest Inventory and Analysis & private data

Figure 3
New Hampshire Forest Types



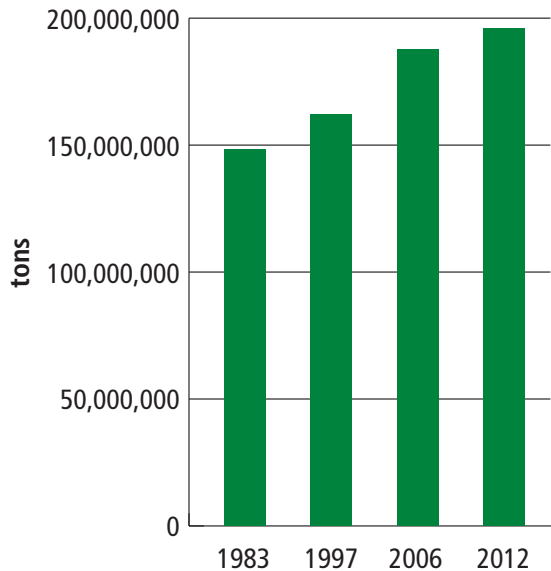
Source: USDA Forest Service, Forest Inventory and Analysis.



Timber Volumes

To understand the volume of wood growing in the forests of New Hampshire, it is most useful to look at inventory trends over time rather than just current volumes. Growth, mortality and harvest levels determine the overall changes over time. At gross volume levels, Figure 4 shows that standing volume of timber in New Hampshire increased approximately 32% from 1983 to 2012. Standing volume is nearly 196 million tons of wood in trees 5 inches and larger.

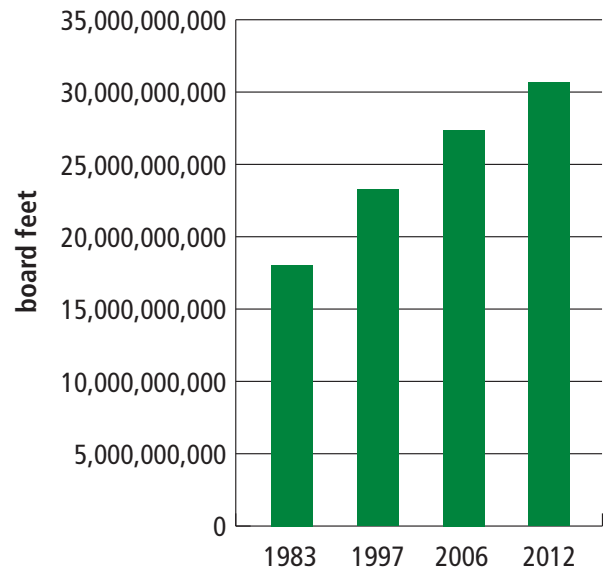
Figure 4
Biomass on Timberland - dry weight of merchantable bole 5" and up - New Hampshire



Source: USDA Forest Service, Forest Inventory and Analysis

From a timber value perspective, it is important to know what is occurring over time with the sawtimber component of the timber inventory in New Hampshire since sawtimber products are generally much more valuable than lower quality logs (pulpwood, firewood and energy chips). In Figure 5, we see that the volume of sawtimber trees also increased from 1983 to 2012, in this case, by over 70%.

Figure 5
Net Volume of sawtimber trees board feet 1/4 inch in New Hampshire



Source: USDA Forest Service, Forest Inventory and Analysis

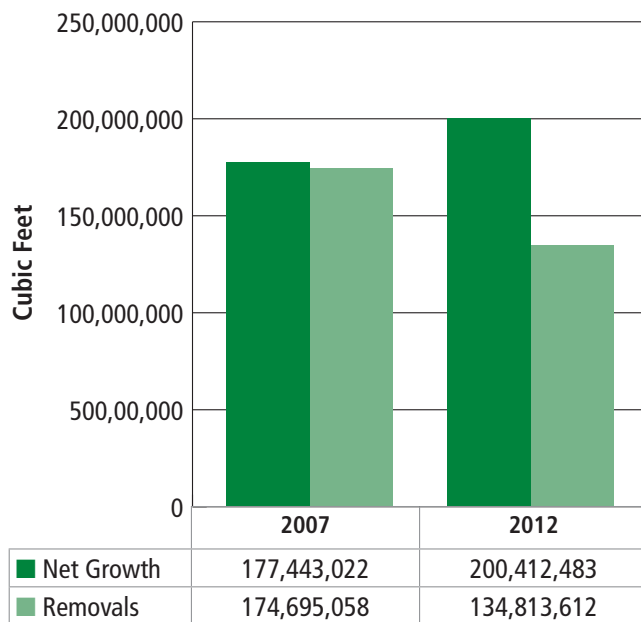


Sustainability - Growth, Mortality and Removals from New Hampshire's Forests

New Hampshire's forest inventory, in terms of volume and value, is increasing. To understand this better, we need to look at growth, mortality and tree removals. The USDA Forest Service's Forest Inventory and Analysis (FIA), where much of the data discussed so far in this report is derived, is also the best source for understanding growth, mortality and removals. The FIA data set is derived from a series of fixed, on-the-ground plots that are re-measured, roughly every five years. Each on-the-ground plot represents approximately six-thousand acres and has been providing forest data for over 50 years.

In Figure 6, the current FIA data shows that in New Hampshire' forests, annual net growth² is 200.4 million cubic feet per year. At the same time, approximately 134.8 million cubic feet of timber is harvested annually. The difference between the net growth and harvests - 65.6 million cubic feet - is the annual extra growth that accounts for the increasing inventory of trees in New Hampshire.

Figure 6
Growth vs. Harvest - New Hampshire forests



Source: USDA Forest Service, Forest Inventory and Analysis

The difference between forest net growth and harvests is a key measurement for understanding the sustainability of the use of the forest. There are other aspects of forest management, including the following, that further add to understanding the status of forest sustainability in a state:

- a. **Certified forestland** - There are a substantial number of acres of certified lands under the American Tree Farm System, Forest Stewardship Council and Sustainable Forestry Initiative in New Hampshire. About 863,000 acres of New Hampshire's forests are certified through one of these systems. In addition to the sustainable harvest levels discussed above, these voluntary standards cover a full range of requirements covering forestry, ecological, economic, and social issues.
- b. **Best Management Practices for Water Quality Protection** - The biggest impact to forests, aside from their conversion to a non-forest use, is forest harvesting activities. Truck roads, skidder trails, and presence of heavy equipment are integral to forest harvesting operations. Water quality degradation and soil erosion can result if proper procedures are not followed. New Hampshire, along with virtually all forested states in the country, has had in place for many years voluntary Best Management Practices for Forestry, commonly called best management practices or BMPs. The three certification programs all require use of BMPs and, more importantly, use of BMPs on forestry operations has become integrated into most forest operations in the last several decades. The culture in the forest industry has changed in that regard - it is simply no longer acceptable to negatively affect water quality or soils in forest operations.
- c. **Use of professional foresters and loggers** - The use of licensed foresters and certified loggers is key to assuring sustainable harvesting operations, whether lands are certified or not. Information from the National Woodland Owners Survey of the USDA Forest Service shows that foresters are involved in forest operations on over 54% of the harvests on family forest owner land in New Hampshire. Data from the NH Cooperative Extension review of Intent and Report of Cut reports from the timber tax showed that in 2011, 25% of the harvests had foresters involved. Additionally, a high percentage of loggers operating in New Hampshire are either trained or certified through the Professional Logger Program and/or Master Logger programs.

2. Net growth means the growth of the trees in the forest less the mortality of trees



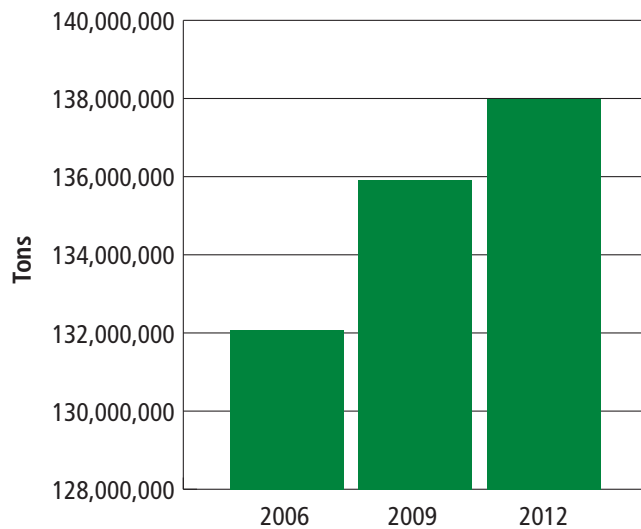
Carbon in New Hampshire's Forest

It is well known that trees and forests are an important element of the Earth's carbon equation. Science has shown that carbon dioxide levels are increasing, likely in large part due to emissions associated with human industry and transportation. Most scientists believe that this increase in carbon dioxide and other "greenhouse gases" is the key reason why planetary temperatures, on average, are on the rise. Forests naturally take carbon dioxide out of the atmosphere in their normal practice of photosynthesis, and the by-product emitted to the atmosphere is the oxygen that we breathe.

The result of this natural phenomenon is that as forests grow, and if their inventory of wood increases over time, they act as positive carbon sinks where atmospheric carbon dioxide is turned into carbon in the wood of the tree. Forests with increasing volumes and carbon mass can provide a positive benefit in the greenhouse gas equation.

According to FIA data, the carbon in the above-ground portion of trees one-inch in diameter or more has increased in New Hampshire over 4% from 2006 to 2012.

Figure 7
Aboveground carbon in live trees 1"+ in New Hampshire



Source: USDA Forest Service, Forest Inventory and Analysis



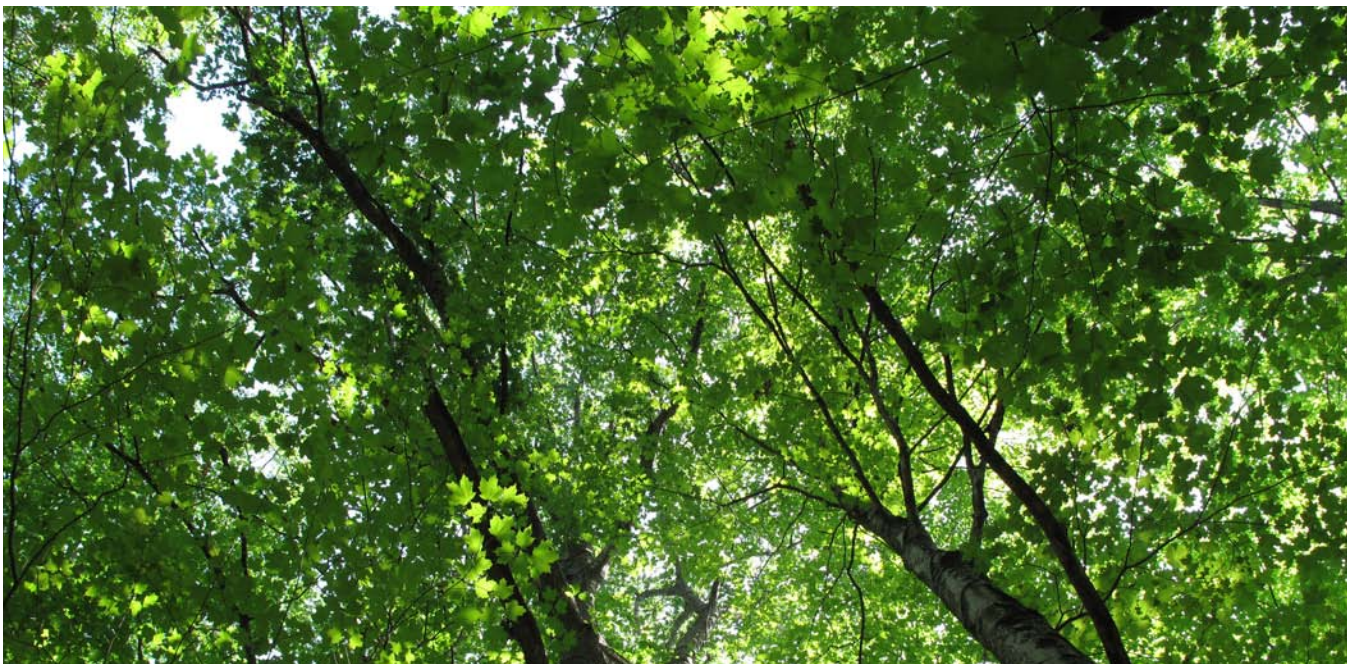
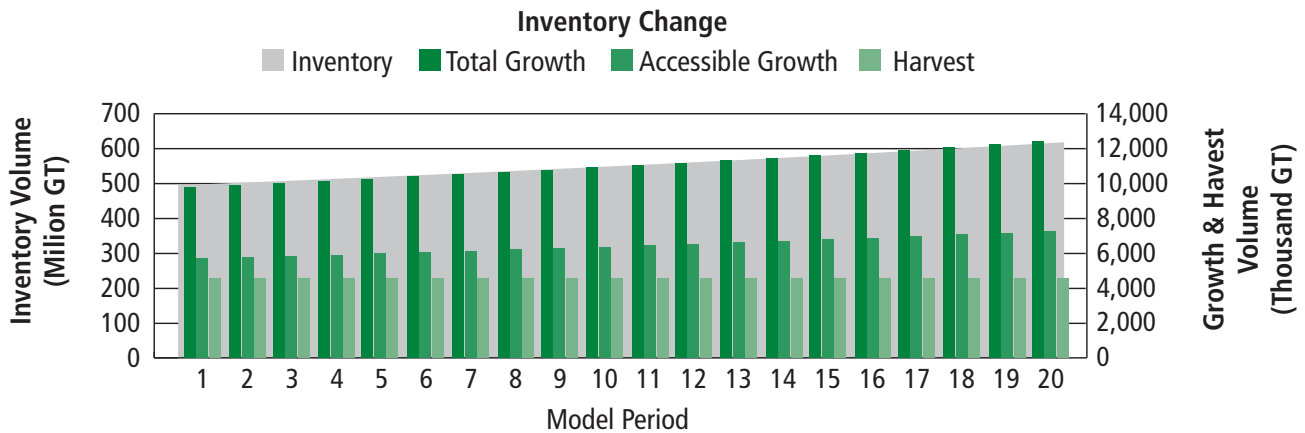
New Hampshire's Forest Projections

Using the Northern Forest Biomass Project Evaluator³ tool developed by the North East State Foresters Association through a grant provided by the USDA Forest Service, we are able to take a look at a possible future inventory of the forests of New Hampshire. The evaluator provides a computer model of net growth based on input of a number of variable factors. Figure 8 shows a likely 20 year future projection of the forest resource in New Hampshire based on assumptions that harvest levels stay constant, timberland acreage is reduced slightly over time and the growth rate is reduced slightly over time.

In this likely future, the total growth and accessible growth increases and the total inventory increases from 490.1 million tons of standing forest at the beginning of the period to 613.6 million tons at year 20 including all live woody biomass. This represents a 25% increase in standing volume of the forests of New Hampshire, across all ownerships and acreages.

Figure 8
Northern Forest Biomass Project Evaluator –
A steady state run for New Hampshire for 2013-2023

Inventory totals are for all live, above-ground biomass on timberland.



3. Go to www.nefainfo.org to obtain a working version of the model for your own use.



Forest Health

The effects of climate change on the forests of New Hampshire remain uncertain. This phenomenon may even increase forest growth, and we simply do not know enough to suggest long-term effects on the trees directly from climate change.

The three insects of greatest concern today are hemlock woolly adelgid, emerald ash borer and Asian longhorned beetle. At the moment, the Asian longhorned beetle is still in the Worcester, MA area and heroic efforts, at great cost, are attempting to eradicate it. The other two are found in New Hampshire, but fortunately, only affect two tree species: ash and hemlock. No big losses have occurred yet in New Hampshire, but hemlock woolly adelgid is being found throughout southern NH counties and a recent discovery of emerald ash borer in the Concord area is substantial.

Spruce budworm may show up again which could affect a small acreage in New Hampshire. The last outbreak was in the late 1970s, and it resulted in the mortality of vast acreages of spruce-fir forests from Maine to New York. Should another outbreak of spruce budworm appear, it could have significant effects in the very spruce-fir forests that regenerated beginning in the late 1970s following the last outbreak.

Lastly, invasive plants, such as autumn olive, buckthorn, Japanese knotweed, bittersweet and garlic mustard all appear to be growing in area and reach. As these invaders become more established, forest trees are being affected and in some cases are crowded out by these invasive plants. Climate change and related temperature increases may stimulate growth of valuable trees but it also allows invasive plants to get established and grow faster as well.

ECONOMIC MULTIPLIERS

The data used for economic output and jobs in this report are for direct jobs and output. All sectors of the economy have connections to other parts of the economy that are not recognized in direct jobs and output numbers. Economic multiplier formulas are often applied to better represent the effect of a sector on the economy. In the past reports like this from NEFA, economic multipliers have not been used for the forest products sector and sub-sectors. As in the past reports, the way the forest recreation jobs and economic value have been developed is by an industry standard that uses a multiplier-like approach to value the effect that the recreation economy has on New Hampshire.

There are a number of readily acceptable economic multiplier formulas and we have chosen to use IMPLAN here because it was created with the forest products industry in mind. Compared to an annual value to the economy of \$1.4 billion, with IMPLAN multipliers, the forest products economy output is valued at over \$ 2.4 billion annually. Without multipliers, the forest products economy jobs are estimated at 7,756 and with multipliers 12,818 jobs.



IV. Forest-Based Economy – current status and trends

The forest-based economy of New Hampshire, one of the oldest industry sectors in the State, includes forest products and non-consumptive uses of the forests.

Forest products manufacturing includes the forestry, logging, and trucking components in which management, harvesting, and transportation move the raw material from the forest to various markets for processing. From there, primary products are manufactured into solid wood products in sawmills, out-of-state veneer mills, and wood chip reconstituted mills such as oriented strand board plants or particle board manufacturers though the latter two are not found in the Granite State at this time. These primary products are then used by secondary manufacturers in making finished goods such as furniture, moldings, and turned wood products. Although there are no longer wood pulp mills in New Hampshire, there are paper manufacturing plants that obtain pulp material from out-of-state pulp mills. Some of the timber harvested in NH's forests goes to these pulp mills. Lastly, the growing wood energy sector includes large wood-fired power plants, medium to small sized commercial facilities using woody biomass to create heat and/or electricity, and at the residential level where homeowners heat their homes with firewood or wood pellets.

Forest-based recreation is a large and growing part of the economy. Thousands of people visit New Hampshire's forests for camping, hiking, hunting, downhill skiing, cross-country skiing, snowmobiling, wildlife viewing, and fall foliage viewing.

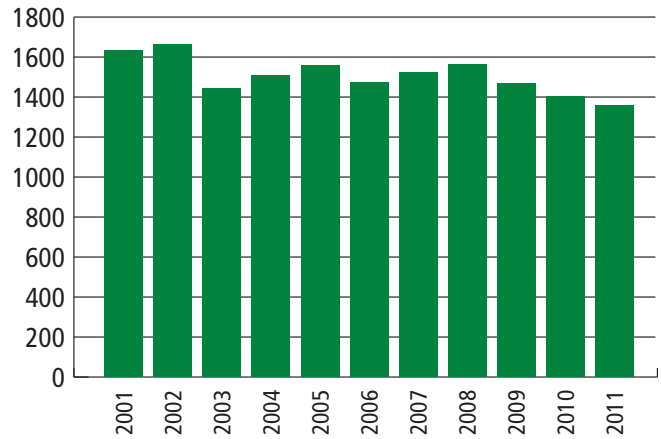
It must be noted that some of the data included in the next sections are from 2012 but most are from 2011. Activity and output in the forest products manufacturing sector has seen a big upturn in 2013 as the country comes out of the recession and the economy recovers. The data below does not show this.

Forestry, logging, and trucking

The forestry, logging, and primary trucking sectors of the economy move logs, pulpwood, firewood, or chips from the forest to their primary manufacturing market. Employment in this sector is estimated at 1,359 jobs down from a high of over 1,665 in 2002 (see Figure 9). Payroll for forestry and logging in New Hampshire exceeds \$86 million annually (Figure 10) and has trended upward since 2009.

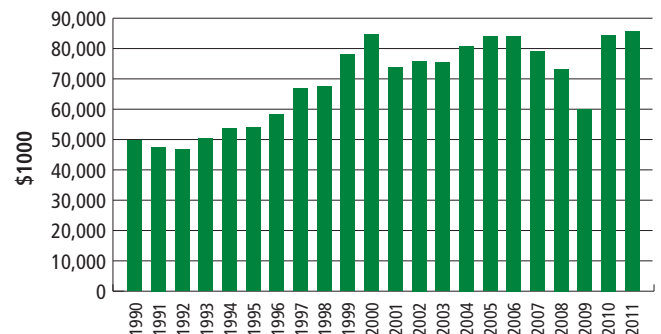
The annual economic activity for forestry trucking, found in the form of annual sales or value of shipments, is over \$ 59 million (Figure 11).

Figure 9
New Hampshire forestry, logging & trucking jobs



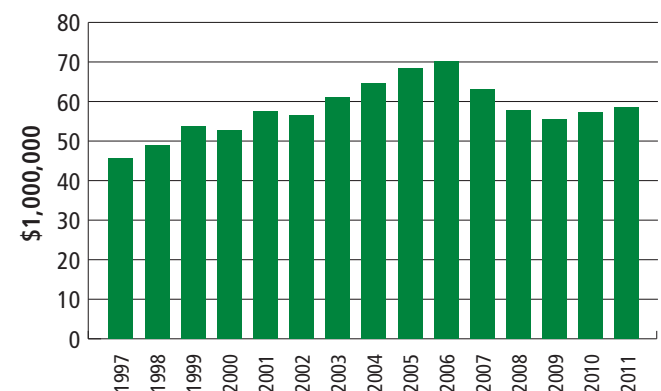
Source: U.S. Census Bureau – Census of Manufactures 2013 & industry estimates

Figure 10
New Hampshire forestry and logging payroll



Source: U.S. Census Bureau – Census of Manufactures 2013

Figure 11
Forest products transport value of shipments in New Hampshire



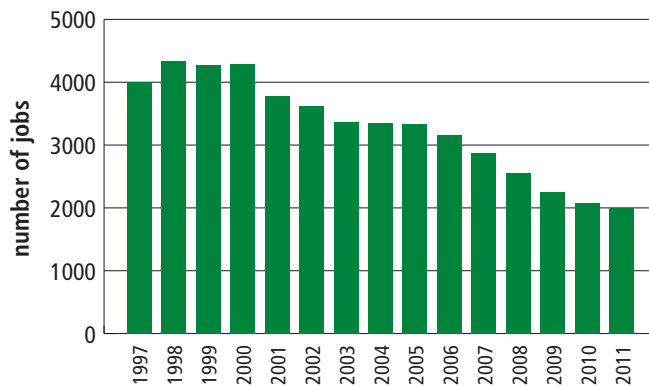
Source: U.S. Census Bureau – Census of Manufactures 2013 and trucking industry non-published data



Primary manufacturing – wood products

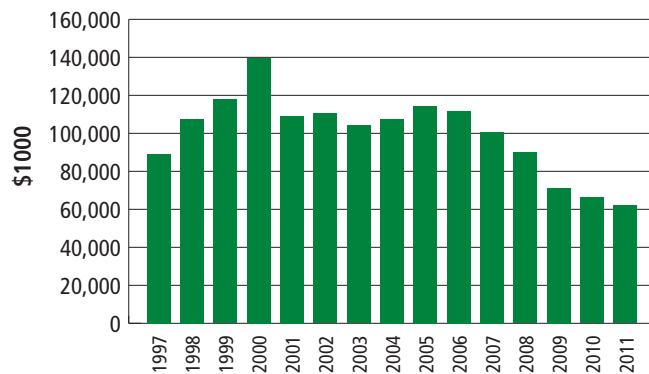
Makers of lumber employ 1,996 workers, which is down from a high of approximately 4,336 in the year 1998. Interestingly, during the period from 1997 to 2011, worker productivity increased. In 2011, it took about 60% the number of workers to produce the same value of wood products as in 1997⁴. Payroll in the wood products sector is approximately \$ 62 million annually. As seen in Figure 13, payroll has decreased since a high of \$ 140 million in 2000.

Figure 12
New Hampshire wood manufacturing jobs



U.S. Dept. of Commerce – Bureau of Economic Analysis

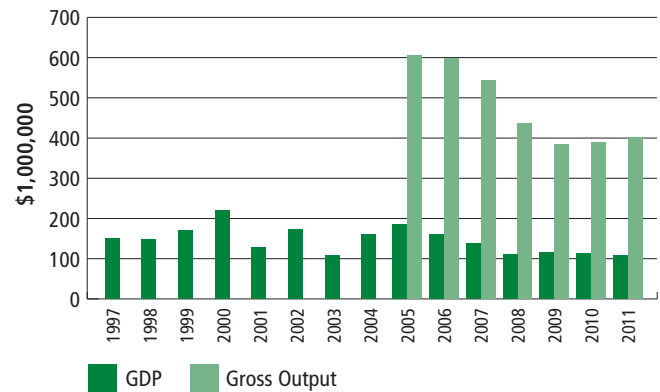
Figure 13
New Hampshire wood products manufacturing payroll



U.S. Dept. of Commerce – Bureau of Economic Analysis

Lastly, annual economic output, in the form of annual sales or value of shipments for the wood products sector is approximately \$ 401 million in New Hampshire. This sector peaked with economic output of approximately \$ 600 million in 2005.

Figure 14
New Hampshire wood products manufacturing output



U.S. Dept. of Commerce – Bureau of Economic Analysis & Census of Manufactures

GDP – Gross Domestic Product includes value added, which is equal to its gross output minus its intermediate purchases from domestic industries or from foreign sources.

Gross Output – Includes the total value of all products produced and shipped by all producers (essentially sales).

4. Worker productivity analysis based on value of product rather than volume is complicated by the fact that prices per unit of product tend to rise with inflation over time.



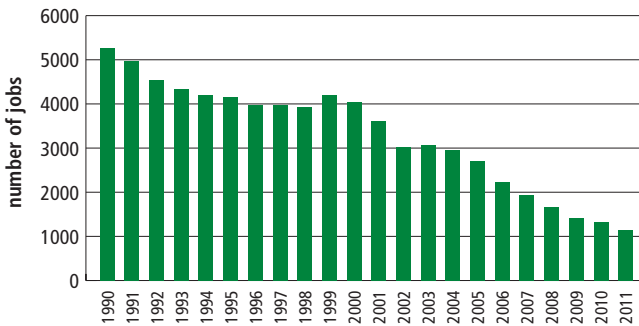
Pulp and paper

The pulp and paper industry combines primary manufacturing in the pulp facilities and secondary in the papermaking section of the plant. In most cases, these two activities take place in the same facility. However, there are no pulp mills in New Hampshire but there are paper-making plants. These facilities employ over 1,100 workers, down from approximately 5,200 in 1990 when there were two operating pulp mills in the state. Worker productivity in paper manufacturing has also increased over the last 20 years. Payroll in the paper sector is approximately \$61 million annually. Payroll has decreased since a high of \$175 million in 1990.

While there are no pulp mills in New Hampshire, the logging infrastructure annually still harvests nearly 419,000 cords of pulpwood for pulp mills in New York and Maine.

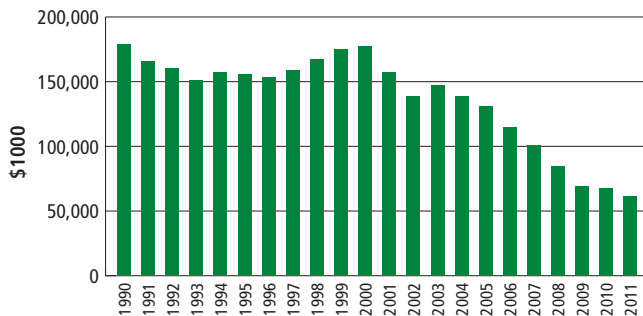
Annual economic output, in the form of sales or value of shipments for the pulp and paper sector, is approximately \$481 million in New Hampshire (Figure 17).

Figure 15
New Hampshire paper manufacturing jobs



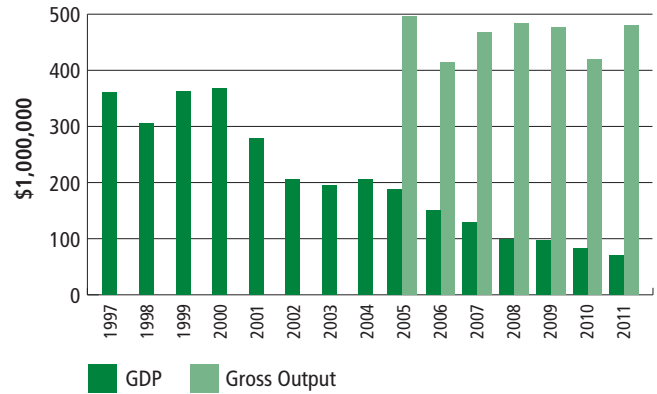
U.S. Dept. of Commerce - Bureau of Economic Analysis

Figure 16
New Hampshire paper worker annual payroll



U.S. Dept. of Commerce - Bureau of Economic Analysis & New Hampshire Department of Labor

Figure 17
New Hampshire Manufacturing output

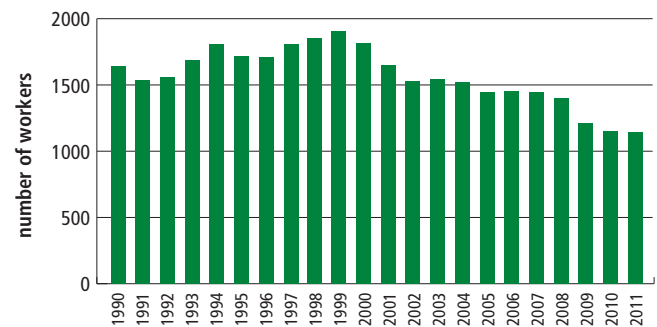


U.S. Dept. of Commerce - Bureau of Economic Analysis & Census of Manufactures

Secondary manufacturing (furniture and related) - wood products

In the secondary wood products manufacturing sector - furniture, moldings, turnings and all production where the primary solid products are transformed into final or parts for final consumer products - New Hampshire employs over 1,140, which is down from a high of approximately 1,900 in 1999. As in other sectors, worker productivity has increased rapidly over the last 20 years. In 2011 it took only 67% of the workers it took to produce a unit of value in the secondary wood products sector as it did in 1990. The secondary wood products sector payroll in New Hampshire is approximately \$36 million annually. It has decreased since a high of \$59 million in 2000 but has been steady in the last several years. Lastly, annual economic output, in the form of sales or value of shipments for the secondary wood products sector, is approximately \$190 million in New Hampshire (Figure 20).

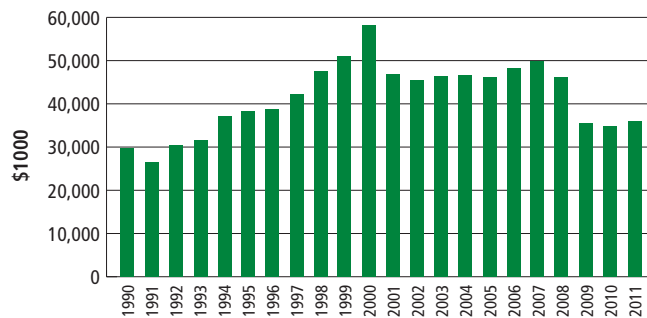
Figure 18
New Hampshire secondary wood products manufacturing jobs



U.S. Dept. of Commerce - Bureau of Economic Analysis

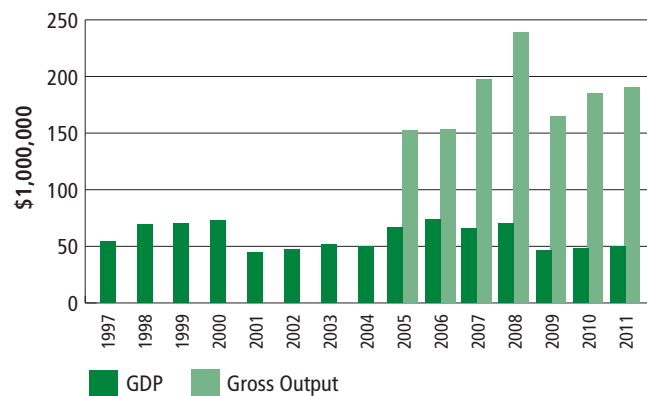


Figure 19
Secondary wood products manufacturing payroll in New Hampshire



U.S. Dept. of Commerce - Bureau of Economic Analysis & New Hampshire Department of Labor

Figure 20
New Hampshire secondary wood products manufacturing output



U.S. Dept. of Commerce - Bureau of Economic Analysis & Census of Manufactures

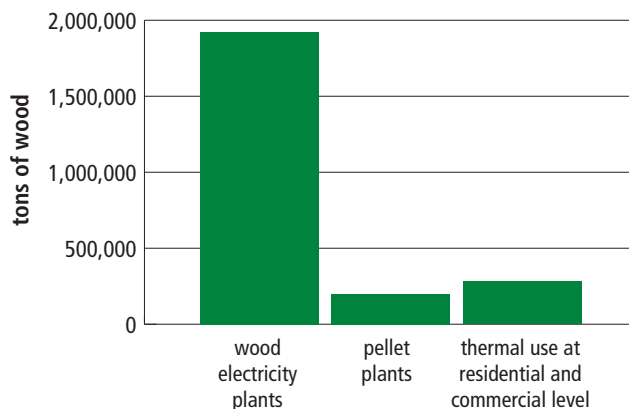


Wood Energy

While the last decade has seen wood energy gain increased attention at the national level, New Hampshire has a long history of using wood for thermal and electric energy generation. Many New Hampshire homes use wood as a primary or supplemental form of heating, and community-scale biomass applications, such as heating schools with wood boilers, has been substantial for about a decade and continues to grow. New Hampshire has seven operating utility-scale biomass plants generating renewable electricity and an eighth is scheduled to begin operation in the first quarter of 2014.

Biomass fuel users – most of which goes to fuel the biomass electricity plants – use approximately 2.4 million green tons of wood annually, largely harvested from New Hampshire’s forest as part of normal timber harvesting operations.

Figure 21
New Hampshire wood energy by sector



Source: New Hampshire Division of Forests and Lands, UNH Cooperative Extension and Innovative Natural Resource Solutions LLC.

Note: Pellet plant output here represents the production of pellets at NH facilities – not use of the energy.

Wood use for heating using wood chips and wood pellets in homes and businesses continues to grow in New Hampshire. A wood pellet manufacturing plant in New Hampshire consumes an estimated 200,000 green tons of feedstock raw material. Additionally, users of firewood, chips, and pellets to heat homes or businesses use some 280,000 green tons annually.

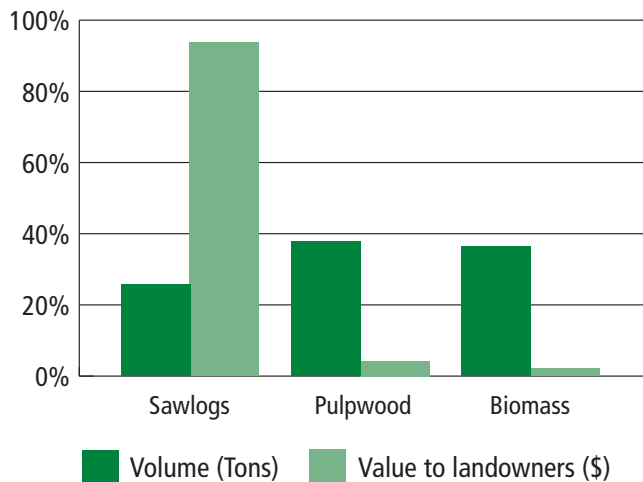
According to the U.S. Census Bureau, 2011 American Community Survey, an estimated 8% of New Hampshire homes use wood as the primary or significant heating source, and a large number of homes also use wood as supplemental heat. For many years wood has been fueling community-scale heating, such as schools and municipal buildings.



Over 75 commercial facilities use wood chips or pellets for heating in New Hampshire, and the number is increasing rapidly. Biomass energy generates electricity, provides heat, and is expected someday to be a source for liquid fuel. Biomass is a locally sourced fuel, and - unlike most other energy sources used in New Hampshire - benefits the local economy through jobs in the harvesting, processing, and use of wood. Switching to biomass from fossil fuels often results in emissions reductions, depending upon the application and the fuel being replaced or offset. Biomass fuel is made from low-grade wood that is generally not suited for higher value markets. In providing a market for low-grade wood, it provides landowners and land managers options and opportunities for practicing forestry. In many applications, biomass is cost competitive, and can provide consumers with an opportunity to save money, use a renewable fuel, and support the local economy. In today's economy, homeowners who switch from using fuel oil to wood pellets can save 50% on their heating fuel bill. It is estimated that there are 470 direct jobs in the wood energy sector not including the timber harvesting and trucking sectors which are counted in another section of this report.

People sometimes question whether wood use for energy can be sustainable in New Hampshire. Overall, as shown in Figure 6, New Hampshire is harvesting far less than the forest is growing, which allows for the inventory of trees to increase over time. The value of harvesting trees for wood energy is very low relative to other products such as sawlogs that go to a mill to be processed into boards. Figure 22

Figure 22
Typical volume vs. value of timber harvested in the Northern Forest region



Source: From typical harvest volumes and values in Maine, New Hampshire, New Hampshire and New York - state data

shows that the economics of wood energy products make it unattractive for landowners to harvest only biomass since its value is too low. Today, a typical forest landowner in the northeastern U.S. will receive only \$1 per ton of biomass chips harvested. Nor do loggers profit much from selling biomass. A logging company most often harvests a full suite of products - from sawlogs to pulpwood to firewood and biomass chips - allowing them to cover their costs and make a small profit on the overall harvest. Typically, they cannot survive on harvesting biomass chips alone. Landowners harvest lower value products to improve the quality of the remaining trees in order to reap larger returns in the future when the higher value trees grow to maturity. Regardless of the kind of harvest, loggers have adopted best management practices to protect water quality, and over 863,000 acres of New Hampshire's forests are certified to Tree Farm, Forest Stewardship Council, or Sustainable Forestry Initiative standards. This helps ensure the sustainability of the harvesting on those lands.

Most of the energy wood harvested in New Hampshire stays in New Hampshire or in the immediate region. The value of the wood, which is low relative to its volume and weight, usually makes it cost prohibitive to ship very far from where it is harvested. Some wood pellet mills in the southern U.S. are exporting pellets to Europe, but that is not occurring yet from New Hampshire. The local demand for New Hampshire-produced wood pellets continues to be strong.

Christmas trees and maple syrup

The Christmas tree and maple syrup industries are small but well-recognized as important to the local economy. In 2012, the wholesale and retail sale of maple syrup and related products totaled over \$4 million while Christmas tree sales were \$1.8 million. It is estimated that there are over 190 full-time equivalent jobs in the maple and Christmas tree sectors in New Hampshire.

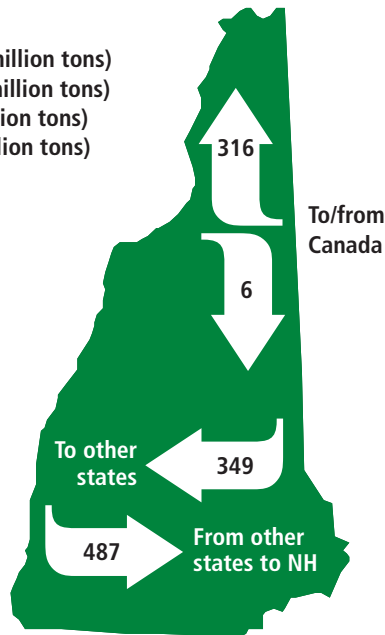


Wood flows and harvest over time

Timber harvested in New Hampshire does not all stay to be processed in New Hampshire. Wood processed in New Hampshire is not all harvested exclusively in New Hampshire. Wood flows into and out of New Hampshire are based on many factors, such as proximity to markets, travel routes, backhauls, and business relationships, among others. Figure 23 shows the flows of wood in and out of New Hampshire. Wood flows freely in the regional economy. States cannot regulate flow of wood products among states or to and from Canada under the interstate commerce laws.

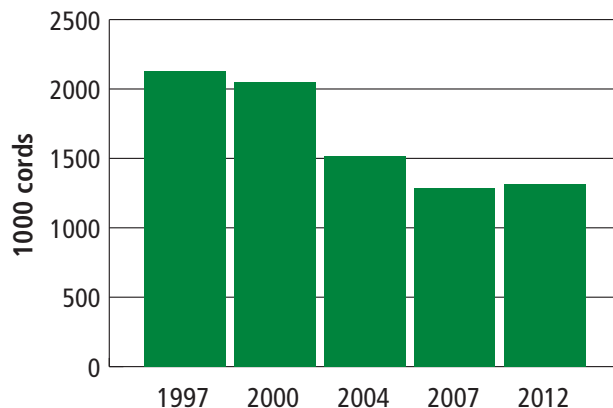
Figure 23
Wood Flows to and from New Hampshire
- in 1000 cords

Harvested: 1315 (3.3 million tons)
Processed: 1195 (3.0 million tons)
Exported: 665 (1.7 million tons)
Imported: 493 (1.2 million tons)



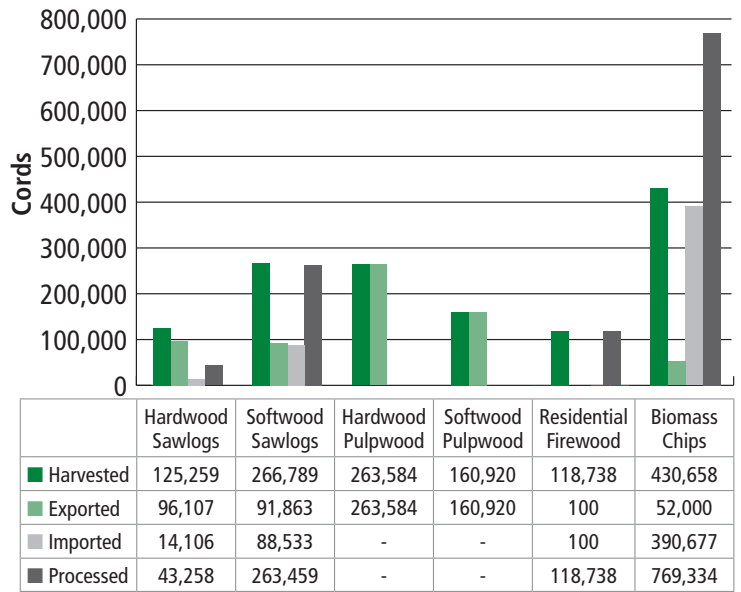
Source: New Hampshire Division of Forests & Lands 2011, Innovative Natural Resource Solutions LLC

Figure 25
Volume of wood harvested in
New Hampshire



Source: NH Division of Forests and Lands and NEFA

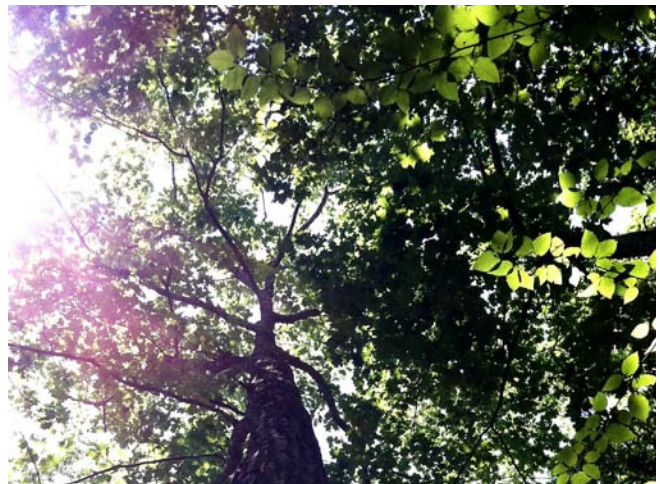
Figure 24
Wood Flows in New Hampshire, 2011



Source: New Hampshire Division of Forests and Lands, Innovative Natural Resource Solutions LLC

Note: to convert to tons, multiply cords by 2.4 tons per cord for softwood and 2.5 tons per cord for hardwood.

The forest products trend data shown elsewhere in this report clearly show a smaller, more efficient forest products industry exists today compared to 15 or 20 years ago, just as the other manufacturing sectors in our U.S. economy have changed during this period. Despite that, there is still a significant forest products economy in New Hampshire. During that time period, however, the volume of timber harvested from New Hampshire's forest has dropped from just over 2.25 million cords in 1997 to just under 1.3 million cords in 2011, with the latter year still part of the recession period (Figure 25).

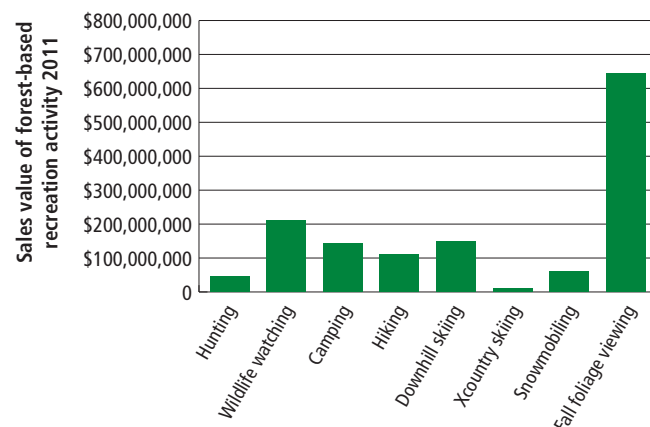


Forest-based Recreation/Tourism

Forests dominate New Hampshire's landscape, so a large percentage of recreation and tourism activities in New Hampshire are linked to the forest. Still, it is challenging to estimate the specific contribution made by the forest environment to recreation and tourism expenditures. Some activities take place primarily in the forest environment, including camping, hiking, hunting, downhill skiing, cross-country skiing, snowmobiling, fall foliage viewing, and wildlife viewing. In this analysis, we assume that 75% of the value of these activities is directly attributable to the forests of New Hampshire. For fall foliage viewing, we assume a percentage of 100%. The method used for the forest recreation sector is a multiplier-like approach so that, if comparisons between the forest products sector and the forest recreation sectors are made, they should be based on the multiplier applied output and employment numbers previously reported in the forest products section of this report.

The key data source for the economic value of forest recreation in past NEFA publications like this one has been the National Survey on Recreation and the Environment from the USDA Forest Service. While this source is used again, additionally we have used results from the new National Survey of Fishing, Hunting, and Wildlife-Associated Recreation, conducted most recently in 2011 by the U.S. Fish and Wildlife Service of the federal Department of Interior. Because of this new data source, numbers in this report are not directly comparable to past reports for recreation and so trend data is not shown.

Figure 26
Economic value of Forest Recreation in New Hampshire



Sources: Multiple sources including National Survey on Recreation and the Environment from the USDA Forest Service and National Survey of Fishing, Hunting, and Wildlife-Associated Recreation

The forest-based recreational activities listed above contribute \$1.4 billion in sales annually to the New Hampshire economy. These are distributed among purchases at food and beverage stores, service stations, lodging places, eating and drinking establishments, and a host of other retail trade or service sectors. Fall foliage viewing is the largest contributor with over 47% of the total sales, and is followed by, in order, wildlife watching, downhill skiing, camping, hiking, snowmobiling, hunting, and cross-country skiing (Figure 26).

About 10,800 people are employed in forest-based recreation and tourism sectors with payrolls of \$177 million annually. Trend data is not supplied here as it is not directly comparable to past reports because of the use of new data sources. The recreation economy in New Hampshire has, overall, not changed a significant amount since 2007 given the lead up and then recovery from the recession.

Figure 27
Jobs and Annual Payroll - New Hampshire forest recreation economy

| Jobs | Payroll |
|--------|---------------|
| 10,831 | \$177,851,201 |

Value of Ecosystem Services

The purpose of this publication is to show the economic value of the forest-related economy in New Hampshire. The data provided shows those parts of the goods and services provided by New Hampshire's forests that can be measured and, generally, has a monetary value placed on it within the economy. Other goods and services from New Hampshire's forests are not so readily measured in dollars and cents, especially the natural assets called ecosystem services. Forest ecosystems are ecological life-support systems that provide a full suite of goods and services that are vital to human health and livelihood. They include wildlife habitat and biological diversity, clean air, clean water and watershed services, scenic landscapes, and carbon storage, which we discussed briefly but did not place a monetary value on.

Carbon in forests and, more accurately, a tree's ability to sequester carbon from carbon dioxide in the air into wood through photosynthesis is now taking on monetary value for some forest owners through the California greenhouse gas regulatory process. Prices being paid in 2013 range from \$10 to \$12 per ton of carbon sequestered, but prices in this infant market can fluctuate wildly. A rough average of carbon being



sequestered in New Hampshire's forest that can be monetized in these new markets is likely between 0.5 ton and 1.5 tons of carbon per acre per year, depending on the age, forest type and stocking of the forest, among other factors. Though modest, it may be the start of converting valuable ecosystem services to an economic form humans understand best – money in a marketplace. Regardless, ecosystem services not yet monetized should be considered a valuable part of the forest-based economy in New Hampshire.

Position of forest-based economy in the overall economy

The forest-based economy plays a significant role in the overall economy of New Hampshire. Figure 28 shows that the annual value of the forest-based economy output including forest recreation is \$2.8 billion (\$3.8 billion with multipliers). Gross State Product for all of New Hampshire's Forest Products Manufacturing is \$341 million while the GSP of all Manufacturing is \$7.7 billion.

Figure 28
New Hampshire Forest-based economy vs. overall economy

| | millions of | jobs* |
|---|-------------|--------|
| Forestry, logging & trucking | \$150 | 2,860 |
| Wood products manufacturing | \$401 | 1,996 |
| Furniture and related product manufacturing | \$190 | 1,140 |
| Paper manufacturing | \$481 | 1,100 |
| Wood energy | \$166 | 470 |
| Christmas trees and maple syrup | \$6 | 190 |
| Sub-total direct | \$1,394 | 7,756 |
| Sub-total with multipliers | \$2,404 | 12,818 |
| Forest Recreation | \$1,400 | 10,800 |
| Total | \$3804 | 23,618 |

| | |
|---------------------------------------|----------|
| GSP, Forest Products Manufacturing | \$341 |
| GSP, All Manufacturing, New Hampshire | \$7,657 |
| GSP, Total for New Hampshire | \$64,975 |

*full-time equivalent jobs

Sources: U.S. Dept. of Commerce – Bureau of Economic Analysis & Census of Manufactures; USDA statistics, private data, IMPLAN
GSP – Gross State Product includes value added, which is equal to its gross output minus its intermediate purchases from domestic industries or from foreign sources.

Gross Output – Includes the total value of all products produced and shipped by all producers (essentially sales).

Issues with potential to affect the future forest economy

There are a number of issues that could affect the future forest-based economy in New Hampshire.

- **Land removed from active management** – If significant acreages of forestland are removed from the working forest, those acres may still provide the backdrop for the forest recreation/tourism part of the economy but will no longer also provide the raw material for the forest products manufacturing sectors of the economy. This can also occur when forest land is fragmented by development.
- **Climate change** – In the short-term, slightly longer growing seasons resulting from shortened winters and slightly warmer temperatures, given all other things being equal, may increase the growth of New Hampshire's trees and provide for slightly longer warm weather periods each year for recreation in the woods. Shortened winters may have negative effects on that portion of the recreation economy. This phenomenon may benefit parts of the forest-based economy. Should climate change also result in increased forest pest problems (or result in other changes), the perceived benefits could be offset. Over the long-term, any positive effects from climate change could disappear should temperature increases and climate changes not modify over time.



- **Loss of markets** – For the forest products sector from the woods to the mill, robust market opportunities are extremely important. The trend data shown in this report depicts a smaller overall forest products manufacturing industry than 20 years ago with trends suggesting continued contraction. The positive sign is that the industry is producing more product per worker than ever before and diversifying markets. The wood energy sector continues to grow, particularly for thermal installations in homes, schools etc. The wood electricity generating plants continue to operate and account for the vast majority of wood used in energy but their future, given changing electricity markets and public policy, is uncertain.
- **Loss of tree species** – As with the changes brought on in the forest economy when American chestnut dropped out of the forest due to the chestnut blight in the 20th century, new pathogens and invasives may do the same for species like ash and hemlock, with unknown effects.
- **Reduced federal and state support for forestry assistance programs** – Certain forest activities, chiefly forest management by the tens of thousands of private forest owners in New Hampshire, have been subsidized, in part, by the federal government in the form of cost-share payments for management plans and a variety of forest management activities. The New Hampshire Forest and Lands staffing levels are also being affected by state budget issues as are those on the White Mt. National Forest. It is expected, in these times of reducing federal budgets in discretionary spending, that cost-share opportunities will dwindle, resulting in less forest improvement work on the ground for that subset of the forest owner population that has taken advantage of the financial assistance.
- **Federal and state tax and other policies** – Business owners in the forest products and forest recreation sectors in New Hampshire have long said that stable public policies are important for business. Changing policies, however well-meaning they might be, make for a challenging business environment.
- **Cost of travel** – A large portion of the forest-based recreation economy in New Hampshire is based on individuals traveling from other locations to visit New Hampshire and enjoy the beauty of this heavily forested state. The price of transportation fuels is a key factor in whether tourists decide to travel to New Hampshire. As transportation fuels continue to increase, fewer out of state tourists may visit the forests of New Hampshire. On the other hand, an upward trend in transportation fuels can also result in more local populations choosing to stay for local recreation.

NEW HAMPSHIRE DIVISION OF FORESTS AND LANDS

The New Hampshire Division of Forests and Lands, within the Department of Resources and Economic Development, is a multi-service agency dedicated to conserving New Hampshire's rural and urban forest landscape and maintaining a sustainable forest products industry; protecting the health and productivity of forests against insects, diseases, invasive plants & animals, wildfire and weather events; and enhancing the stewardship of NH's private and public forest land.

The mission of the Division of Forests and Lands is to protect and promote the values provided by trees, forests, and natural communities. This mission is accomplished responsible management of the State's forested resources; by providing forest resource information and education to the public; and the protection of these resources for the continuing benefit of the State's citizens, visitors, and forest industry.

The statutory authority and guidance for the Division is set forth in Title XIX-A Forestry where it states the agency "shall execute all matters pertaining to forestry, forest management, and forestlands, within the jurisdiction of the State..."

You can reach the New Hampshire Division of Forests and Lands at 603-271-3456 or at www.nhdf.org

The National Association of State Foresters, a non-profit organization that is made up of the individuals who head the state forestry agencies in the U.S, periodically reviews information about the state agencies that oversee forestry in their respective state. The most recent report on this topic is "State Foresters by the Numbers: Data and Analysis from the 2010 NASF State Forestry Statistics Survey" and can be found at www.stateforesters.org website under publications.



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North East *State* Foresters Association (NEFA)

NEFA'S Mission

The North East *State* Foresters Association (NEFA) is the State Foresters of Maine, New Hampshire, Vermont, and New York cooperating with the US Forest Service State & Private Forestry on issues of common interest (see www.nefainfo.org).

This booklet is part of a series on the economic importance and value of forest-based manufacturing and forest-related recreation and tourism of the four states in the NEFA region. Past reports can be viewed at www.nefainfo.org.

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CONTACT INFORMATION - Board of Directors

Brad Simpkins

Director and NEFA Treasurer
Division of Forests and Lands
NH Dept. of Resources
and Economic Development
PO Box 1856
Concord NH 03302-1856
(603) 271-2214 Phone
(603) 271-6488 Fax
brad.simpkins@dred.nh.gov

Doug Denico

Director Maine Forest Service
Main Department of Conservation
22 State House Station
Augusta ME 04333
(207) 287-2795 Phone
(207) 287-8422 Fax
doug.denico@maine.gov

Robert Davies

Director Division of Lands & Forests
New York Department of
Environmental Conservation
625 Broadway
Albany NY 12233-4250
(518) 402-9405 Phone
(518) 402-9028 Fax
rkdavies@gw.dec.state.ny.us

Steven Sinclair

Director of Forests and NEFA Chair
Vermont Department of Forests,
Parks and Recreation
1 National Life Drive, Davis 2
Montpelier, VT 05620-3801
(802) 828-1531 Phone
(802) 828-1531 Fax
steve.sinclair@state.vt.us

Terry Miller

NEFA Ex-Officio member
USDA Forest Service, State
and Private Forestry
271 Mast Rd
PO Box 640
Durham NH 03824
(603) 868-7694 Phone
(603) 868-1066 Fax
twmiller@fs.fed.us

Charles A. Levesque

Executive Director
NEFA
PO Box 2911
Concord NH 03302-2911
(603) 229-4965 Phone
nefa@inrsllc.com

