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Bureau of Business and Economic Research

Labovitz School of Business and Economics

University of Minnesota Duluth

Driven to Discover

Consulting Report

Northeast Minnesota Forestry Analysis

10-year Projections

For

Iron Range Resources and Rehabilitation Board

Iron Range Resources

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About the Project

The objective of this project is to assess the economic impacts of four different scenarios on the forestry industry in Northeast Minnesota. The four scenarios include:

- **Scenario 1:** A baseline analysis that looks at current trends in harvest or removals to benchmark the change in tree species removals.
- **Scenario 2:** A 25 percent decrease in paper mill demand, as from an event such as a reduction in production of a paper mill.
- **Scenario 3:** An increase in the forest industry and, thus, an increase in harvesting of a variety of species.
- **Scenario 4:** An increase in the forest industry and, thus, an increase in the harvesting of biomass by 30 percent.

Scenario 3 also includes economic impacts for six different 50-mile-radius study areas: Cloquet, Duluth, Grand Marais, Grand Rapids, International Falls, and Two Harbors. Data from Minnesota's Forest Resources 2012 (June 2013) was used to make projections.

Economic Impacts of the Four Scenarios

Scenario 1 shows a decline in the species removals by ownership, with 86 percent of over 830,000 total cords of wood being removed from 2012 as compared to 2005. This amounts to over 710,000 total cords in 2012 with an **overall loss of 14 percent**.

Scenario 2 shows the effects on Carlton, Cook, Lake, and St. Louis counties result in a **decrease** of just under **$53.0 million in direct expenditures** related to forestry, which would cause a **total loss** of almost **$90.3 million in other spending**. Additionally, Scenario 2 events would cause a **decrease** in forest industry **revenue by** just over **$191.6 million**. This would result in **a total loss of** almost **$257.6 million in output spending**. Overall **employment** in all sectors, forestry and others, would **decline** in a loss of almost **754 employees**. That equates to almost **250 employees in the forest industry** and just over **504 employees in other economic sectors**.

Scenario 3 shows the effects on Carlton, Cook, Lake, St. Louis counties lead to an **increase** of just over **$27.3 million in direct expenditures** related to forestry, which would create a **total increase** of almost **$46.6 million in other spending**. **Revenue** in the forestry industry would **increase** by just over **$93.5 million**, which would result in a **total increase** of just over **$127.8 million in output spending**.

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Employment in the forestry industry would **increase by almost 159 employees** resulting in a **gain** of almost **391 employees** in other sectors for a **total increase** of almost **550 employees**.

Scenario 4 events would result in the total economic **output i**mpact of just over **$32.5 million** from a **direct output** of just over **$26.0 million** over the 10-year period. An **additional 54 jobs** would be created from the **26 jobs directly created** in the two sectors of Power Generation and Biochemical for a **total of 80 jobs**.

★★★

PROJECT DESCRIPTION

In 2003, the Minnesota Forest Resources Council (MFRC) Northeast Landscape Committee completed the first long-range forest landscape plan for 7.6 million acres in Cook, Lake, St. Louis, and Carlton counties. The first generation landscape plan was based in part on a 2002 Northern Minnesota Forestry Analysis prepared by the University of Minnesota, Duluth Labovitz School of Business and Economics. In 2011, the MFRC contracted with the School to update this analysis. This updated analysis is providing part of the basis for development of a second generation Northeast Landscape Plan. The revised plan is being developed by MFRC staff with guidance provided by the Northeast Landscape Committee.

This project will support the development of an economic framework for the second generation Northeast Landscape Plan. Developing forest-based economic development goals through the MFRC's Northeast Landscape Committee offers a unique opportunity to increase coordination and collaboration in support of increased forest-based economic development.

DELIVERABLES

This project's objective combines two BBER reports into one large study. The two reports are the Northeast Minnesota Forestry Analysis and the Northeast Minnesota Forestry Analysis 10-year Projections.

The first BBER report highlights current economic data on selected industries that can serve as part of the basis for specific forest-based economic goals in the revised plan. This update focused on specific elements of past forestry analysis done by the BBER, including collection and analysis of data for the following:

- An economic overview of both the Arrowhead and Northeast Regions of Minnesota.
- The economic importance of forestry to each region.
- An analysis of tourism and recreation industries with a brief comparison to forestry.

This report is a collection and analysis of data for the following:

- 10-year projections, with respect to housing, for forest-based industries value added, output and employment for the Northeast Region of Cook, Lake, St. Louis, and Carlton counties.
    - Minnesota Forest Resource Council staff worked with the BBER to integrate the 10-year projections into several planning scenarios were developed as part of the plan update process in cooperation with researchers from the University of Minnesota Boreal Forest

and Community Resilience Project. The intent is to include specific forest-based economic goals in the updated plan.

IMPACT PROCEDURES AND INPUT ASSUMPTIONS

INPUT-OUTPUT ANALYSIS

The mathematical input-output model used to estimate impacts in this study uses a matrix representation of the region's economy to predict the effect of changes in one industry on the others and by consumers, government, and suppliers on the economy. Input-output depicts inter-industry relations of an economy. It shows how the output of one industry is an input to each other industry. The matrix of the inputs and outputs shows how dependent each industry is on all the others in the economy, both as a consumer of its outputs and as a supplier of its inputs. Input-output economics has been used to study regional economies within a nation and has been used as a tool for national and regional economic planning. In addition, a main use of input-output analysis is to predict the economic impact of events as well as public investments or programs. It is this use of input-output analysis that is enacted in this study.

IMPLAN, LLC., [1] is the corporation that is responsible for the production of IMPLAN (IMpact analysis for PLANning) data and software. Using classic input-output analysis in combination with regional specific Social Accounting Matrices and Multiplier Models, IMPLAN provides a highly accurate and adaptable model for its users. The IMPLAN database contains county, state, zip code, and federal economic statistics, which are specialized by region, not estimated from national averages. These statistics are used to measure the effect of a given change or event on a regional or local economy.

[1] IMPLAN is used by state governments and the USDA Forest Service, among others. IMPLAN Group LLC, IMPLAN System (data and software), IMPLAN Group LLC, 16740 Birkdale Commons Pkwy, Suite 212, Huntersville, NC 28078. www.implan.com

IMPLAN's Social Accounting System describes transactions that occur between producers and intermediate and final consumers using a Social Accounting Matrix. One of the important aspects of Social Accounts is that they also examine non-market transactions, such as transfer payments between institutions. Other examples of these types of transactions would include government to household transfers in the form of unemployment benefits or household to government transfers in the form of taxes. Because Social Accounting Systems examine all the aspects of a local economy, they provide a more complete and accurate "snapshot" of the economy and its spending patterns.

IMPLAN also uses a multiplier model. Multipliers are a numeric way of describing the impact of a change. The Multiplier Model is derived mathematically using the input-output model and Social Accounting formats. Once there is a clear picture of the economy through the Social Accounting Matrix and Multipliers, its behavior can be predicted for a defined event, such as the construction of transmission lines.

MODELS

Models were created to include all impact model years beginning with 2012. The BBER used the timeline provided by the Minnesota Forest Resource Council.

Regional data for the impact models for value added, output, and employment measures were supplied by IMPLAN for this impact. Employment assumptions were provided to the researchers to enable creation of the impact models. All regional study definitions and impact model assumptions were agreed upon before work with the models began. Inputs include forestry demand or usage data and Forest Industry Analysis (FIA) removal time series data sets.

The BBER worked closely with the Minnesota Forest Resource Council Northeast Planning Committee in determining key assumptions for developing IMPLAN models.

IMPLAN MODELS

There are two components to the IMPLAN system, the software and databases. The databases provide all information to create regional IMPLAN models. The software performs the calculations and provides an interface for the user to make final demand changes. IMPLAN software version 3 was used in this analysis.

Comprehensive and detailed data coverage of the IMPLAN study areas by county, and the ability to incorporate user-supplied data at each stage of the model building process, provides a high degree of

flexibility in terms of both geographic coverage and model formulation. In this case, it is the definition of the counties of Minnesota and the definition of specific models for start-up and construction. Using the IMPLAN software and data, the BBER identified the industry's proposed expenditures in terms of the sectoring scheme for the model, in producer prices, and in historical dollars based on the year of the model and applied those dollars spent within the study area definition given for the impact analysis.

DATA

IMPLAN data files use federal government data sources including:

- US Bureau of Economic Analysis Benchmark I/O Accounts of the US
- US Bureau of Economic Analysis Output Estimates
- US Bureau of Economic Analysis REIS Program
- US Bureau of Labor Statistics County Employment and Wages (CEW) Program
- US Bureau of Labor Statistics Consumer Expenditure Survey
- US Census Bureau County Business Patterns
- US Census Bureau Decennial Census and Population Surveys
- US Census Bureau Economic Censuses and Surveys
- US Department of Agriculture Crop and Livestock Statistics

IMPLAN data files consist of the following components: employment, industry output, value added, institutional demands, national structural matrices, and inter-institutional transfers.

Impacts for the Northeast Minnesota Forestry models used the most recent IMPLAN data available, which is for the year 2011. All impacts are reported in 2013 dollars.

Economic impacts are made up of direct, indirect, and induced effects. The following are suggested assumptions for accepting the impact model:

- IMPLAN input-output is a production-based model.
- Employment numbers (from U.S. Department of Commerce secondary data) treat both full- and part-time individuals as being employed.
- Assumptions need to be made concerning the nature of the local economy before impacts can be interpreted.

- The IMPLAN model used was constructed for the year 2011 (most recent data available).

DEFINITIONS USED IN THIS REPORT

Measures

Gross Output: The value of local production required to sustain activities.

Value Added: A measure of the impacting industry's contribution to the local community; it includes wages, rents, interest, and profits.

Employment: Estimates are in terms of jobs, not in terms of full-time equivalent employees. Therefore, these jobs may be temporary, part-time, or short-term jobs.

Effects

Direct Effect: Initial new spending in the study area resulting from the project.

Indirect Effect: The additional inter-industry spending from the direct impact.

Induced Effect: The impact of additional household expenditures resulting from the direct and indirect impact.

Multiplier Effect: The idea that an initial amount of spending leads to increased consumption spending elsewhere. For example, an output multiplier of 1.67 means that every dollar directly spent by a particular entity will generate 67 cents in other sectors of the study area. Additionally, showcasing an employment multiplier of 1.26 means that one employee directly employed by a particular entity will generate another 0.26 employees in other sectors of the study area.

INDUSTRY DEFINITIONS

For this analysis, forestry sectoring is listed below and are divided into three sections. They are

- Primary Forest Products Manufacturing
- Secondary Forest Products Manufacturing
- Forestry and Logging

Data was for year 2011.

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IMPLAN Sectors Used

Source: IMPLAN

Primary Forest Products Manufacturing
Electric power generation, transmission, and distribution (only 1.7% applies to forestry)*
Sawmills and wood preservation
Veneer and plywood manufacturing
Reconstituted wood product manufacturing
Paper mills
Secondary Forest Products Manufacturing
Engineered wood member and truss manufacturing
Wood windows and doors and millwork manufacturing
Wood container and pallet manufacturing
Prefabricated wood building manufacturing
All other miscellaneous wood product manufacturing
Paperboard mills
Paperboard container manufacturing
Coated and laminated paper, packaging paper and plastics film manufacturing
All other paper bag and coated and treated paper manufacturing
Stationery product manufacturing
Sanitary paper product manufacturing
All other converted paper product manufacturing
Wood kitchen cabinet and countertop manufacturing
Nonupholstered wood household furniture manufacturing
Wood television, radio, and sewing machine cabinet manufacturing
Office furniture and custom architectural woodwork and millwork manufacturing
Showcase, partition, shelving, and locker manufacturing
Forestry and Logging
Forestry, forest products, and timber tract production
Commercial logging
Support activities for agriculture and forestry (only 2.2% applies to forestry)*
Transport by truck (only 1.2% applies to forestry)*

*The sector of Electric power generation, transmission, and distribution has been deflated to represent the portion of the sector specifically related to forestry. In this case, 1.7 percent of all electric power generation is directly related to forestry, according to the Energy Information Administration (EIA). Thus, the numbers reported in this analysis for electric power display 1.7 percent of its total to better reflect the current economic status of the forestry industry.

Some sectors among the Forestry and Logging section have been deflated to represent only the forestry related work done in that sector. For example, about 1.2 percent of all trucking is forestry related, according to the Minnesota Department of Economic Development, thus the original Value Added, Output, and Employment for Trucking in the Arrowhead Region have been multiplied by 1.2 percent to display Trucking specifically related to forestry.

MODELING POINTS

As noted in the IMPLAN User's Guide, IMPLAN modeling issues associated with small study areas of county-level impacts, like that in this report, include the following:

A small area can have a high level of "leakage." Leakages are any payments made to imports or value added sectors that do not in turn re-spend the dollars within the region.

A study area that is actually part of a larger functional economic region will likely miss important backward linkages. For example, linkages with the labor force may be missing. Workers who live and spend outside the study area may actually hold local jobs.

IMPLAN study areas are typically a collection of counties. A county is one of the smallest standard areas for IMPLAN data sets.

NORTHEAST REGIONAL PRODUCT DEMAND

To review the estimated Northeast regional demand by major wood industries, Table 1 summarizes the wood species demand in cords into four groups - Minnesota Pulp Industries, Pulp Exports, Sawlogs and Other and Fuelwood. The total demand in 2010 accounts for 2.3 million cords. Aspen is the dominant species with almost 1.4 million cords of the total. Minnesota Pulpwood Industries demand accounts for over 1.8 million cords of wood in 2010.

Table 1: Minnesota DNR Estimates, NE Region, 2010 Harvest - Cords

	Minnesota Pulpwood Industries	Pulpwood Export	Sawlogs & Other	Fuelwood	Total - 2010 Harvest
Balsam Fir	140,900	4,000	7,500	0	152,400
White Birch	92,000	13,100	23,900	42,100	171,100
Maple	95,800	16,200	5,300	33,600	150,900
Aspen	1,232,700	45,900	64,600	49,700	1,392,900
Mixed Hardwoods*	24,900	4,800	103,300	65,700	198,700
Red, White, Jack Pine					
Mixed Softwoods**	247,000	11,500	14,900	18,100	291,500
Tamarack**	43,100	8,300	7,100	18,100	76,600
Spruce**	203,900	3,200	7,800	0	214,900
Total	**1,833,300**	**95,500**	**219,500**	**209,200**	**2,357,500**

* Mixed hardwoods include: White and red oak; soft maple; yellow birch; basswood and other

** Mixed softwood includes: White and black spruce; tamarack; cedar and other

Source: Minnesota's Forest Resources 2012 (June 2013)

Table 2 converts the total species cord demand into percentages. When Minnesota Pulpwood Industries and Pulpwood Exports are combined, they are 95 percent of the Balsam Fir and almost 92 percent of the total Aspen demand in Minnesota. The Combined Pulpwood group accounts for almost 89 percent of the Mixed Softwoods.

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Table 2: Minnesota DNR Estimates, NE Region, 2010 Harvest - Cords (%)

	Minnesota Pulpwood Industries	Pulpwood Export	Sawlogs & Other	Fuelwood	Combined Pulpwood	Total - 2010 Harvest
Balsam Fir	92.45%	2.62%	4.92%	0.00%	95.08%	100.00%
White Birch	53.77%	7.66%	13.97%	24.61%	61.43%	100.00%
Maple	63.49%	10.74%	3.51%	22.27%	74.22%	100.00%
Aspen	88.50%	3.30%	4.64%	3.57%	91.79%	100.00%
Mixed Hardwoods*	12.53%	2.42%	51.99%	33.06%	14.95%	100.00%
Red, White, Jack Pine						
Mixed Softwoods**	84.73%	3.95%	5.11%	6.21%	88.68%	100.00%
Tamarack**	56.27%	10.84%	9.27%	23.63%	67.10%	100.00%
Spruce**	94.88%	1.49%	3.63%	0.00%	96.37%	100.00%
Total	**77.76%**	**4.05%**	**9.31%**	**8.87%**	**81.82%**	**100.00%**

* Mixed hardwoods include: White and red oak; soft maple; yellow birch; basswood and other

** Mixed softwood includes: White and black spruce; tamarack; cedar and other

Source: Minnesota's Forest Resources 2012 (June 2013)

SCENARIOS INTRODUCTION

At several Northeast Landscape Committee meetings in 2013, potential ten-year scenarios were presented and discussed. Based on the committee feedback, four scenarios were modeled and various economic impacts were estimated. Two data sets and time periods, 2003-2011 and 2005-2012, were evaluated and modeled to determine impacts.

The BBER analyzed both data sets. Due to 2005-2012 data being more current, it was chosen as the data used for the study. The 2003 to 2011 timeframe and analysis can be found in the appendix.

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SCENARIO 1

Scenario 1 serves as a baseline analysis that looks at current trends in harvest or removals to benchmark the change in tree species removals. No economic impact was done for this scenario, but economic impacts were estimated for Scenarios 2-4.

Scenario 1 considers a rate of change in harvest over the last 10 years projecting into the next 20 years based upon historic removal rates. It serves as our baseline for projections and shows growth rates between

- 2003 – 2011
- 2005 – 2012

Table 3, on the following page, shows the 2005 and 2012 Northeast Region of Minnesota removals species by ownership. The decline in species removals is shown. The table reveals that the total removals in the Northeast Region were 714,326 cords or only 86 percent of the 2005 total of 832,467 cords. This is an overall loss of 14 percent. The individual species vary widely but generally show declines. Focusing on removals by ownership highlights a split in the 2005 to 2012 trend. County and federal ownership shows a positive growth in total removals, while state and private ownership had an overall loss in removals.

Table 3: Northeast Region, 2005 and 2012 Removals, Species by Ownership

Species	State				Counties				Private (FIA)				Federal				Total			
	2005	2012	change		2005	2012	Change		2005	2012	Change		2005	2012	Change		2005	2012	Change	
Balsam Fir	9,593	7,767.52	81%	-19%	19,439	22,842.00	118%	18%	15,266	6,740	44%	-56%	5,302	8,578	162%	62%	49,600	45,928	93%	-7%
White Birch****	18,908	6,682.71	35%	-65%	32,350	25,383.00	78%	-22%	27,337	39,119	143%	43%	11,224	18,285	163%	63%	89,819	89,470	100%	0%
Maple***	4,478	1,850.59	41%	-59%	12,246	12,241.00	100%	0%					886	2,492			17,610	16,583	94%	-6%
Aspen	76,398	52,830.72	69%	-31%	90,009	99,727.00	111%	11%	187,765	129,547	69%	-31%	56,268	57,015	101%	1%	410,440	339,119	83%	-17%
Mixed Hardwoods*	4,663	9,860.62	211%	111%	6,961	10,584.00	152%	52%	81,239	40,925	50%	-50%	28	1	5%	-95%	92,891	61,371	66%	-34%
Red Pine	6,614	11,732.17	177%	77%	3,690	7,049.00	191%	91%	32,161	9,779	30%	-70%	16,178	12,316	76%	-24%	58,643	40,877	70%	-30%
White Pine	494	161.85	33%	-67%	-	350.00	-	-	15,585	-	0%	-100%	13	26	206%	106%	16,091	538	3%	-97%
Jack Pine	2,909	1,270.40	44%	-56%	6,994	3,154.00	45%	-55%	5,307	2,750	52%	-48%	2,016	3,854	191%	91%	17,226	11,028	64%	-36%
Mixed Softwoods**	5,781	1,632.00	28%	-72%	14	200.00	1429%	1329%	7,418	7,248	98%	-2%	1	17	1688%	1588%	13,214	9,097	69%	-31%
Tamarack**	1,324	2,744.99	207%	107%	4,871	4,407.00	90%	-10%	874	5,775	661%	561%	2	70	3524%	3424%	7,071	12,998	184%	84%
Spruce**	12,203	19,227.70	158%	58%	20,839	29,407.00	141%	41%	21,771	30,789	141%	41%	5,048	7,893	156%	56%	59,860	87,317	146%	46%
Totals	143,367	115,761.27	81%	-19%	197,413	215,344.00	109%	9%	394,723	272,673	69%	-31%	96,965	110,548	114%	14%	832,467	714,326	86%	-14%

Source: Tim O'Hara, Minnesota Forest Industries

The key assumption in Scenario 1 is that the 2005 to 2012 species removal trend will continue for the next five- and ten-year timeframe. Assuming each species removal percentage trend, a five-year and 10-year projection is estimated, shown in Table 4 below. All species, except spruce and tamarack are projected to decline. The total removal in five years for the region is estimated to drop to 629,939 cords from 714,326 cords in 2012. In ten years, this total removal is estimated to fall to 545,553. These losses would have significant impacts on the northeast Minnesota landscape.

Table 4: Northeast Region, Scenario 1 - Cords (2005-2012)

	2012 Removals	2005 Removals	Change	% Change	Annual Change	Annual % Change	5-year Projection	10-year Projection
Balsam Fir	45,928	49,600	(3,673)	-7.40%	(524.70)	-1.06%	43,304.06	40,680.57
White Birch	89,470	89,819	(350)	-0.39%	(49.95)	-0.06%	89,219.81	88,970.07
Maple	16,583	17,610	(1,027)	-5.83%	(146.68)	-0.83%	15,849.97	15,116.59
Aspen	339,119	410,440	(71,321)	-17.38%	(10,188.71)	-2.48%	288,175.71	237,232.19
Mixed Hardwoods*	61,371	92,891	(31,519)	-33.93%	(4,502.76)	-4.85%	38,857.52	16,343.72
Red Pine	40,877	58,643	(17,767)	-30.30%	(2,538.10)	-4.33%	28,186.24	15,495.73
White Pine	538	16,091	(15,553)	-96.66%	(2,221.87)	-13.81%	(10,571.11)	(21,680.45)
Jack Pine	11,028	17,226	(6,198)	-35.98%	(885.36)	-5.14%	6,601.53	2,174.72
Mixed Softwoods**	9,097	13,214	(4,117)	-31.16%	(588.15)	-4.45%	6,156.42	3,215.65
Tamarack**	12,998	7,071	5,927	83.81%	846.65	11.97%	17,231.12	21,464.38
Spruce**	87,317	59,860	27,456	45.87%	3,922.33	6.55%	106,928.35	126,540.00
Total	**714,326**	**832,467**	**(118,141)**	**-14.19%**	**(16,877.29)**	**-2.03%**	**629,939.61**	**545,553.18**

* Mixed hardwoods include: White and red oak; soft maple; yellow birch; basswood; ash and other

** Mixed softwood includes: Spruce; tamarack; cedar and other

Source: Tim O'Hara, Minnesota Forest Industries

SCENARIO 2

Scenario 2 considers a 25 percent decrease in paper mill demand, as from an event such as a reduction in production of a paper mill.

Assumptions supplied for this scenario are:

The species affected are those most harvested for pulpwood – Balsam Fir, Aspen and Mixed Softwoods (Tamarack, Spruce, and others). The remaining species in the study stay at the rates developed in Scenario 1.

Table 5: Northeast Region, Scenario 2 - Cords (2012)

	2012 Removals	2022 Removals	Change	% Change	Annual Change	Annual % Change	10-year Projection
Balsam Fir	45,928	34,446	(11,482)	-25.00%	(1,148.19)	-2.50%	34,445.66
White Birch	89,470	86,770	(2,699)	-3.02%	(269.93)	-0.30%	86,770.27
Maple	16,583	61,753	45,170	272.38%	4,516.97	27.24%	61,753.00
Aspen	339,119	254,339	(84,780)	-25.00%	(8,477.98)	-2.50%	254,339.43
Mixed Hardwoods*	61,371	35,223	(26,148)	-42.61%	(2,614.83)	-4.26%	35,223.00
Red Pine	40,877	21,948	(18,929)	-46.31%	(1,892.90)	-4.63%	21,947.78
White Pine	538	41,069	40,531	7530.46%	4,053.12	753.05%	41,069.45
Jack Pine	11,028	28,007	16,978	153.95%	1,697.84	15.40%	28,006.68
Mixed Softwoods**	9,097	6,823	(2,274)	-25.00%	(227.43)	-2.50%	6,822.88
Tamarack**	12,998	9,748	(3,249)	-25.00%	(324.95)	-2.50%	9,748.39
Spruce**	87,317	65,488	(21,829)	-25.00%	(2,182.92)	-2.50%	65,487.53
Total	**714,326**	**570,378**	**(143,948)**	**-20.15%**	**(14,394.79)**	**-2.02%**	**570,378.15**

* Mixed hardwoods include: White and red oak; soft maple; yellow birch; basswood; ash and other

** Mixed softwood includes: Spruce; tamarack; cedar and other

Source: Tim O'Hara, Minnesota Forest Industries

Table 6 shows the Value Added, Output, and Employment impacts of Scenario 2 on Carlton, Cook, Lake, and St. Louis counties in Minnesota. The table shows that the events in Scenario 2 would lead to a decrease of just under $53.0 million in direct expenditures on wages, rents, interests, and profits related to forestry, which would cause a total loss of almost $90.3 million in other spending. This leads to a value added multiplier of 1.70.

As illustrated in Table 6, the events in Scenario 2 would cause revenue in the forestry industry to decrease by just over $191.6 million, which would result in a total loss of almost $257.6 million in output spending throughout the four-county area. This leads to an output multiplier of 1.34.

Table 6 also illustrates that the events in Scenario 2 in the four-county area would cause employment in the forestry industry to decrease by almost 250 employees. This leads to a loss of just over 504 employees in other sectors of the economy, totaling a loss of almost 754 employees, with an employment multiplier of 3.02.

Table 6: Northeast Region, Scenario 2 Impacts

Source: IMPLAN	***Direct Effect***	***Indirect Effect***	***Induced Effect***	***Total Effect***
Value Added	($52,994,403)	($20,906,933)	($16,378,666)	($90,280,002)
Output	($191,605,467)	($38,522,546)	($27,463,807)	($257,591,820)
Employment	(249.6)	(255.9)	(248.4)	(753.9)

Table 7 reports the top ten impacted IMPLAN sectors from an assumed 25 percent decline in paper mill demand for wood. The output gives an indication of the dollar size of each sector, while the percentages show the relative sizes of the impacts. Logging would be the second most negatively impacted sector and all other listed sectors would also be negatively impacted.

Table 7: Northeast Region, Scenario 2, Economic Output Impacts

Description	2011 Output	Percent Change
Paper Mills	$582,801,280	-25.1%
Commercial logging	$35,079,352	-5.7%
Services to buildings and dwellings	$70,517,448	-1.1%
Management of companies and enterprises	$161,197,568	-1.1%
Maintenance and repair construction of nonresidential structures	$217,868,704	-1.0%
Architectural, engineering, and related services	$138,733,344	-0.7%
Wholesale trade businesses	$496,239,680	-0.7%
Food services and drinking places	$507,917,472	-0.3%
Private hospitals	$1,372,209,920	-0.1%
Nursing and residential care facilities	$426,180,832	-0.1%

Source: IMPLAN

SCENARIO 3

Scenario 3 considers an increase in the forest industry and, thus, an increase in harvesting of a variety of species.

Assumptions supplied for this scenario are:

Usage is indicative of

- *Sawmills - Pines other than White will double their rate of harvest. White Pine will stay static, as its numbers have already declined at a rate that precludes it from being harvested further.*
- *Paper mills - Balsam Fir, Aspen, and Mixed Softwood (Tamarack, Spruce, and others) will all increase by 10 percent.*
- *Oriented strand board (OSB) – Aspen will increase 15 percent.*

**Note – Aspen increases over two usages; therefore, it increases a total of 25 percent in this scenario.*

Table 8 shows the 2012 cord removals and the resulting 2022 projected removals under Scenario 3 assumptions. The total removals would jump up to 990,221 cords by 2022 from 714,326 in 2012. A number of species are projected to double over the ten years, and many other species will increase by 10 percent.

Table 8: Northeast Region, Scenario 3 - Cords (2012)

	2012 Removals	2022 Removals	Change	% Change	Annual Change	Annual % Change	10-year Projection
Balsam Fir	45,928	50,520	4,593	10.00%	459.28	1.00%	50,520.30
White Birch****	89,470	90,364	895	1.00%	89.47	0.10%	90,364.24
Maple***	16,583	18,242	1,658	10.00%	165.83	1.00%	18,241.69
Aspen	339,119	593,459	254,339	75.00%	25,433.94	7.50%	593,458.67
Mixed Hardwoods*	61,371	122,743	61,371	100.00%	6,137.13	10.00%	122,742.64
Red Pine	40,877	81,753	40,877	100.00%	4,087.67	10.00%	81,753.49
White Pine	538	1,076	538	100.00%	53.82	10.00%	1,076.46
Jack Pine	11,028	22,057	11,028	100.00%	1,102.83	10.00%	22,056.65
Mixed Softwoods**	9,097	10,007	910	10.00%	90.97	1.00%	10,006.89
Tamarack**	12,998	14,298	1,300	10.00%	129.98	1.00%	14,297.64
Spruce**	87,317	96,048	8,732	10.00%	873.17	1.00%	96,048.38
Total	**714,326**	**990,221**	**275,895**	**38.62%**	**27,589.50**	**3.86%**	**990,221.03**

* Mixed hardwoods include: White and red oak; soft maple; yellow birch; basswood; ash and other

** Mixed softwood includes: Spruce; tamarack; cedar and other

***Increase Maple by 10% due to significant increase between 2003 and 2011

****Increase White Birch by 1% due to rate of increase between 2003 and 2011

Source: Tim O'Hara, Minnesota Forest Industries

Table 9 below shows the Value Added, Output, and Employment impacts of Scenario 3 on Carlton, Cook, Lake, and St. Louis counties in Minnesota. The table shows that the events in Scenario 3 would lead to an increase of just over $27.3 million in direct expenditures on wages, rents, interests, and profits related to forestry, which would create a total of almost $46.6 million in other spending. This leads to a value added multiplier of 1.71.

As illustrated in Table 9, the events in Scenario 3 would cause revenue in the forestry industry to increase by just over $93.5 million, which would result in a total increase of just over $127.8 million in output spending throughout the four-county area. This leads to an output multiplier of 1.37.

Table 9 also illustrates that the events in Scenario 3 in the four-county area would cause employment in the forestry industry to increase by almost 159 employees. This leads to a gain of almost 391 employees in other sectors of the economy, totaling an increase of almost 550 employees, with an employment multiplier of 3.46.

Table 9: Northeast Region, Scenario 3 Impacts

Source: IMPLAN	***Direct Effect***	***Indirect Effect***	***Induced Effect***	***Total Effect***
Value Added	$27,308,817	$9,942,720	$9,338,055	$46,589,593
Output	$93,521,723	$18,630,047	$15,657,413	$127,809,183
Employment	158.6	154.8	236.1	549.5

Table 10 shows the top ten IMPLAN sectors that are most affected by the expansion assumption in Scenario 3. The growth in sawmills, paper mills, and oriented strand board also has a positive effect on other impacted sectors. The dollar output gives an indication of the dollar size of each sector, while the percentages show the relative sizes of the impacts. Other service sectors including, Maintenance and Repair Construction of Nonresidential Structures, Wholesale Trade Businesses, and health care providers are positively impacted.

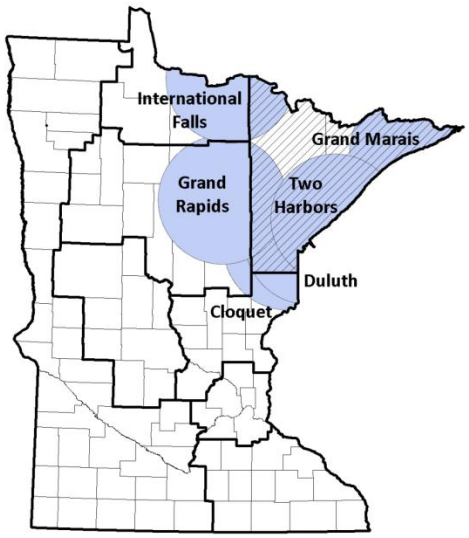
Table 10: Northeast Region, Scenario 3, Economic Output Impacts

Description	2011 Output	Percent Change
Sawmills and wood preservation	$18,755,332	27.3%
Reconstituted wood product manufacturing	$34,003,476	15.1%
Paper Mills	$582,801,280	10.0%
Commercial logging	$35,079,352	3.5%
Services to buildings and dwellings	$70,517,448	0.5%
Maintenance and repair construction of nonresidential structures	$217,868,704	0.4%
Wholesale trade business	$496,239,680	0.3%
Food services and drinking places	$507,917,472	0.2%
Private hospitals	$1,372,209,920	0.1%
Nursing and residential care facilities	$426,180,832	0.1%

Source: IMPLAN

50-MILE STUDY AREA RADIUS

Figure 1: The Six Study Areas of Scenario 3



Source: Clarence Turner, Minnesota Department of Natural Resources and the Minnesota Forest Resources Council

The map above in Figure 1 illustrated the study area of approximately a 50-mile radius around each of the timber industry production facilities. The following analysis breaks down the six major production facilities. Economic impacts are determined for each local area and the affected counties.

Cloquet
Assumption: Paper mills – Aspen removals will increase by 10 percent.

Table 11 shows the Value Added, Output, and Employment impacts of a 10 percent increase in Aspen removals on the Cloquet area, which includes Carlton, Lake, and St. Louis counties. The table shows that a 10 percent increase in Aspen removals will lead to an increase of just under $21.2 million in direct expenditures on wages, rents, interests, and profits related to forestry, which will create a total of just over $36.1 million in other spending. This leads to a value added multiplier of 1.70.

As illustrated in Table 11, a 10 percent increase in Aspen will cause revenue in the forestry industry to increase by just over $76.6 million, which will result in a total increase of just over $102.9 million in output spending throughout the three-county area. This leads to an output multiplier of 1.34.

Table 11 also illustrates that a 10 percent increase in Aspen in the three-county area will cause employment in the forestry industry to increase by almost 100 employees. This will lead to a gain of almost 201 employees in other sectors of the economy, totaling an increase of almost 301 employees, with an employment multiplier of 3.01.

Table 11: Cloquet Impacts

Source: IMPLAN	***Direct Effect***	***Indirect Effect***	***Induced Effect***	***Total Effect***
Value Added	$21,197,762	$8,326,789	$6,593,682	$36,118,233
Output	$76,642,185	$15,242,033	$11,039,313	$102,923,531
Employment	99.8	101.2	99.5	300.5

Duluth
Assumption: Paper mills – Spruce removals will increase by 8 percent.

Table 12 shows the Value Added, Output, and Employment impacts of an 8 percent increase in Spruce removals on the Duluth area, which includes Carlton, Lake, and St. Louis counties. The table shows that

an 8 percent increase in Spruce removals will lead to an increase of just under $17.0 million in direct expenditures on wages, rents, interests, and profits related to forestry, which will create a total of just under $28.9 million in other spending. This leads to a value added multiplier of 1.70.

As illustrated in Table 12, an 8 percent increase in Spruce removals will cause revenue in the forestry industry to increase by just over $61.3 million, which will result in a total increase of just over $82.3 million in output spending throughout the three-county area. This leads to an output multiplier of 1.34.

Table 12 also illustrates that an 8 percent increase in Spruce removals in the three-county area will cause employment in the forestry industry to increase by almost 80 employees. This will lead to a gain of almost 161 employees in other sectors of the economy, totaling an increase of over 240 employees, with an employment multiplier of 3.01.

Table 12: Duluth Impacts

Source: IMPLAN	***Direct Effect***	***Indirect Effect***	***Induced Effect***	***Total Effect***
Value Added	$16,958,209	$6,661,432	$5,274,944	$28,894,585
Output	$61,313,750	$12,193,628	$8,831,449	$82,338,827
Employment	79.9	80.9	79.6	240.4

Grand Marais

Assumption: Sawmills – Red Pine and Jack Pine will double their rate of harvest.

Table 13 shows the Value Added, Output, and Employment impacts of doubling Red Pine and Jack Pine removals in the Grand Marais area, which includes Cook and Lake Counties. The table shows that doubling Red Pine and Jack Pine removals will lead to an increase of just over $1.9 million in direct expenditures on wages, rents, interests, and profits related to forestry, which will create a total of just under $3.0 million in other spending. This leads to a value added multiplier of 1.58.

As illustrated in Table 13, doubling Red Pine and Jack Pine removals will cause revenue in the forestry industry to increase by just under $6.2 million, which will result in a total increase of just under $8.2 million in output spending throughout the two-county area. This leads to an output multiplier of 1.32.

Table 13 also illustrates that doubling Red Pine and Jack Pine removals in the two-county area will cause employment in the forestry industry to increase by 21 employees. This will lead to a gain of just over 18

employees in other sectors of the economy, totaling an increase of over 39 employees, with an employment multiplier of 1.86.

Table 13: Grand Marais Impacts

Source: IMPLAN	*Direct Effect*	*Indirect Effect*	*Induced Effect*	*Total Effect*
Value Added	$1,940,314	$456,886	$583,801	$2,981,001
Output	$6,152,754	$1,003,657	$1,007,000	$8,163,411
Employment	21.0	8.1	10.2	39.3

Grand Rapids

Assumption: Paper mills – Spruce removals will increase by 10 percent.

Table 14 shows the Value Added, Output, and Employment impacts of a 10 percent increase in Spruce removals in the Grand Rapids area, which includes Carlton and St. Louis Counties. The table shows that a 10 percent increase in Spruce removals will lead to an increase of just under $21.2 million in direct expenditures on wages, rents, interests, and profits related to forestry, which will create a total of just over $36.1 million in other spending. This leads to a value added multiplier of 1.70.

As illustrated in Table 14, a 10 percent increase in Spruce removals will cause revenue in the forestry industry to increase by just over $76.6 million, which will result in a total increase of just over $102.9 million in output spending throughout the two-county area. This leads to an output multiplier of 1.34.

Table 14 also illustrates that a 10 percent increase in Spruce removals in the two-county area will cause employment in the forestry industry to increase by almost 100 employees. This will lead to a gain of just under 201 employees in other sectors of the economy, totaling an increase of just under 301 employees, with an employment multiplier of 3.01.

Table 14: Grand Rapids Impacts

Source: IMPLAN	*Direct Effect*	*Indirect Effect*	*Induced Effect*	*Total Effect*
Value Added	$21,197,762	$8,326,789	$6,593,682	$36,118,233
Output	$76,642,185	$15,242,033	$11,039,313	$102,923,531
Employment	99.8	101.2	99.5	300.5

International Falls

Assumption: Paper mills – Aspen, Maple, Birch, Pine, Spruce, and Mixed Softwoods will increase by 5 percent.

Table 15 shows the Value Added, Output, and Employment impacts of a 5 percent increase in Aspen, Maple, Birch, Pine, Spruce, and Mixed Softwoods removals in the International Falls area, which includes St. Louis County. The table shows that a 5 percent increase in these removals will lead to an increase of just over $3.7 million in direct expenditures on wages, rents, interests, and profits related to forestry, which will create a total of just under $6.2 million in other spending. This leads to a value added multiplier of 1.68.

As illustrated in Table 15, a 5 percent increase in these removals will cause revenue in the forestry industry to increase by just under $12.1 million, which will result in a total increase of just over $16.2 million in output spending throughout the single-county area. This leads to an output multiplier of 1.34.

Table 15 also illustrates that a 5 percent increase in these removals in the single-county area will cause employment in the forestry industry to increase by 15 employees. This will lead to a gain of just over 32 employees in other sectors of the economy, totaling an increase of just over 47 employees, with an employment multiplier of 3.13.

Table 15: International Falls Impacts

Source: IMPLAN	*Direct Effect*	*Indirect Effect*	*Induced Effect*	*Total Effect*
Value Added	$3,722,442	$1,205,210	$1,238,792	$6,166,444
Output	$12,056,658	$2,105,296	$2,063,905	$16,225,859
Employment	15.0	13.7	18.5	47.2

Two Harbors
Assumption: Oriented strand board (OSB) – Aspen will increase by 10 percent.

Table 16 shows the Value Added, Output, and Employment impacts of a 10 percent increase in Aspen removals in the Two Harbors area, which includes Carlton, Cook, Lake, and St. Louis Counties. The table shows that a 10 percent increase in Aspen removals will lead to an increase of just over $1.6 million in direct expenditures on wages, rents, interests, and profits related to forestry, which will create a total of just under $2.6 million in other spending. This leads to a value added multiplier of 1.63.

As illustrated in Table 16, a 10 percent increase in Aspen removals will cause revenue in the forestry industry to increase by just under $3.3 million, which will result in a total increase of just under $4.9 million in output spending throughout the four-county area. This leads to an output multiplier of 1.49.

Table 16 also illustrates that a 10 percent increase in Aspen removals in the four-county area will cause employment in the forestry industry to increase by just under 12 employees. This will lead to a gain of just under 14 employees in other sectors of the economy, totaling an increase of just under 26 employees, with an employment multiplier of 2.17.

Table 16: Two Harbors Impacts

Source: IMPLAN	***Direct Effect***	***Indirect Effect***	***Induced Effect***	***Total Effect***
Value Added	$1,644,223	$210,076	$701,574	$2,555,873
Output	$3,295,303	$396,532	$1,176,191	$4,868,026
Employment	11.7	2.8	11.0	25.5

SCENARIO 4 – BIOMASS

Scenario 4 considers an increase in the forest industry and, thus, an increase in the harvesting of biomass.

Assumptions supplied for this scenario are:

Usage is indicative of

- *Biomass – Biomass usage will increase by 30 percent in 10 years utilizing the estimated usage of biomass for 2012 as a baseline. (Oven Dried Tons), a 30 percent increase results.*

Table 17: Biomass Usage 2012-2022 – Assumptions

Sectors	**Usage in ODT** (oven dried tons)
Power Generation	500,000
Biochemical	150,000
Total	**650,000**

Source: BBER

Definitions, which are listed below, were used from *Conditions & Trends, Second Generation Northeast Landscape Plan* [2] to estimate the economic impact of potential growth in biomass utilization.

Timberland biomass

Forest biomass is an estimate of the total dry weight of live trees (at least 1 inch d.b.h. - diameter at breast height) on the landscape including bark but excluding foliage. Biomass has five components for most tree species (bole, tops and limbs, saplings, stump, and belowground).

- Bole - Biomass of a tree at least 5 inches d.b.h. from 1 foot above the ground to a 4-inch top outside bark or to a point where the central stem breaks into limbs.
- Tops and limbs - Total biomass of a tree at least 5 inches d.b.h. from a 1-foot stump minus the bole.
- Saplings - Total aboveground biomass of a tree from 1 to 5 inches in d.b.h.
- Stump - Biomass of a tree 5 inches d.b.h. and larger from the ground to a height of 1 foot.

[2] Minnesota Forest Resources Council Northeast Planning Committee

- Below ground biomass - Biomass of coarse roots with a root diameter ≥ 0.1 inch. This is a modeled estimate, calculated on live trees with a diameter of ≥ 1 inch and dead trees with a diameter ≥ 5 inches.

Table 18 highlights the availability of biomass in the Northeast Landscape. The total above ground biomass in 2012 was estimated to be 111,684,822 dry weight short tons. For this analysis, stumps were excluded, so the total biomass available is reduced by 4.1 million short tons to 107,454,811.

Table 18: Estimated biomass in dry weight (short tons)

(live trees on timberland in the Northeast Landscape, 2012 Species Group)

	Merchantable bole	Tops and limbs	Saplings	Stumps	Total above ground biomass	Below ground biomass	Total biomass
Eastern white and red pine	7,153,262	1,244,404	253,932	353,027	9,004,624	2,057,340	11,061,964
Jack pine	2,034,481	364,760	174,957	120,237	2,694,435	622,454	3,316,889
Spruce and balsam fir	13,268,884	2,482,710	7,615,574	896,593	24,263,761	5,794,408	30,058,169
Other softwoods	7,755,320	1,291,085	1,056,097	542,936	10,645,438	2,467,845	13,113,283
Maple	7,401,437	2,316,471	2,426,689	475,953	12,620,551	2,517,430	15,137,981
Ash	4,119,622	1,307,145	1,351,245	310,147	7,088,158	1,414,043	8,502,201
Aspen	14,937,038	4,629,775	6,697,475	780,597	27,044,885	5,407,882	32,452,767
Other hardwoods	10,829,244	3,307,516	2,478,304	654,791	17,269,857	3,415,378	20,685,235
Eastern noncommercial hardwoods	45,189	17,901	985,293	4,730	1,053,113	246,520	1,299,633
Total	**67,544,477**	**16,961,767**	**23,039,566**	**4,139,011**	**111,684,822**	**23,943,300**	**135,628,122**

The biomass usage of Commercial forest biomass using facilities for Minnesota was benchmarked in 2010 by the Minnesota Department of Natural Resources and detailed in their report, Outlook for Forest Biomass. The Northeast Region facilities are highlighted below in Table 19 and show a total of approximately 750,000 tons of biomass was used in 2010. These values were reduced by one-third to estimate the 2012 biomass use for the eight facilities resulting in an estimated total of 500,000 tons of biomass.

Table 19: Commercial Forest Biomass Used - Calculated in Oven Dry Tons (ODT) 2010

Commercial facility	Location	ODT utilized 2010	ODT utilized 2012 (66%)	Facility type[1]
Sappi	Cloquet	>150,000	100,000	Industrial CHP
Boise Cascade	International Falls	<25,000	16,667	Industrial CHP
UPM-Rapids Energy Center	Grand Rapids	>150,000	100,000	CHP
MN Power-Hibbard Energy Center	Duluth	>100,000	66,667	CHP
Laurentian Energy Authority	Virginia-Hibbing	>100,000	66,667	CHP
Bio Pellets	Deer River	<25,000	16,667	Wood pellets/heat
Keetac	Keewatin	100,000	66,667	CHP
Mountain Timber	Mountain Iron	100,000	66,667	Wood pellets
TOTAL		**750,000**	**500,000**	

[1] CHP is combined heat and power production
Source: MNDNR 2010c Outlook for Forest Biomass

The 650,000 tons in biomass use with be split into two IMPLAN sectors as shown in Table 17 on page 24. The Power Generation sector will expand by 1.7 percent and The Biochemical sector will grow by 10 percent. The economic impact on the Northeast region of this expansion is shown in Table 20 below. The direct value added impact of $12.1 million will result in a total economic impact of over $15.8 million. The total economic output impact will be just over $32.5 million from a direct output of just over $26.0 million. An additional 54 jobs will be created from the 26 jobs directly created from the two sectors ten-year growth.

Table 20: Northeast Region, Scenario 4 Impacts

	Direct Effect	*Indirect Effect*	*Induced Effect*	*Total Effect*
Value Added	$12,058,971	$2,025,010	$1,700,715	$15,784,696
Output	$26,060,840	$3,635,861	$2,851,355	$32,548,056
Employment	26.2	28.7	24.8	79.7

APPENDIX

Tables 21-23 are courtesy of Clarence Turner, Minnesota Department of Natural Resources and the Minnesota Forest Resources Council through a Forest Inventory Analysis. The data represented highlight a different timeframe than the data supplied by the Minnesota Forest Industries. The data is provided here for comparative purposes.

Table 21: Northeast Region, Scenario 1 - Cords (2003 -2011)

	2011 Removals	2003 Removals	Change	% Change	Annual Change	Annual % Change	5-year Projection	10-year Projection
Balsam Fir	49,529	48,226	1,303	2.70%	162.85	0.34%	50,343.17	51,157.40
White Birch	86,770	67,650	19,120	28.26%	2,390.03	3.53%	98,720.42	110,670.56
Maple	61,753	14,628	47,125	322.16%	5,890.63	40.27%	91,206.13	120,659.25
Aspen	223,810	265,266	(41,456)	-15.63%	(5,182.00)	-1.95%	197,900.00	171,990.00
Mixed Hardwoods*	35,223	28,600	6,623	23.16%	827.88	2.89%	39,362.38	43,501.75
Red Pine	21,948	13,270	8,678	65.40%	1,084.78	8.17%	27,371.67	32,795.55
White Pine	41,069	10,088	30,981	307.11%	3,872.67	38.39%	60,432.79	79,796.14
Jack Pine	28,007	22,905	5,102	22.27%	637.72	2.78%	31,195.29	34,383.90
Mixed Softwoods**	64,727	73,148	(8,421)	-11.51%	(1,052.63)	-1.44%	59,463.88	54,200.75
Tamarack**	3,320	4,236	(916)	-21.62%	(114.50)	-2.70%	2,747.50	2,175.00
Spruce**	53,557	48,246	5,311	11.01%	663.88	1.38%	56,876.38	60,195.75
Total	**612,836**	**543,781**	**69,055**	**12.70%**	**8,631.92**	**1.59%**	**655,995.71**	**699,155.30**

* Mixed hardwoods include: White and red oak; soft maple; yellow birch; basswood; ash and other

** Mixed softwood includes: Spruce; tamarack; cedar and other

Source: Clarence Turner FIA data

Table 22: Northeast Region, Scenario 2 - Cords (2011)

	2011 Removals	2021 Removals	Change	% Change	Annual Change	Annual % Change	10-year Projection
Balsam Fir	49,529	37,147	(12,382)	-25.00%	(1,238.22)	-2.50%	37,146.71
White Birch	86,770	86,770	-	0.00%	-	0.00%	86,770.27
Maple	61,753	61,753	-	0.00%	-	0.00%	61,753.00
Aspen	223,810	167,858	(55,953)	-25.00%	(5,595.25)	-2.50%	167,857.50
Mixed Hardwoods*	35,223	35,223	-	0.00%	-	0.00%	35,223.00
Red Pine	21,948	21,948	-	0.00%	-	0.00%	21,947.78
White Pine	41,069	41,069	-	0.00%	-	0.00%	41,069.45
Jack Pine	28,007	28,007	-	0.00%	-	0.00%	28,006.68
Mixed Softwoods**	7,850	5,888	(1,963)	-25.00%	(196.25)	-2.50%	5,887.50
Tamarack**	3,320	2,490	(830)	-25.00%	(83.00)	-2.50%	2,490.00
Spruce**	53,557	40,168	(13,389)	-25.00%	(1,338.93)	-2.50%	40,167.75
Total	**612,836**	**485,662**	**(127,174)**	**-20.75%**	**(12,717.42)**	**-2.08%**	**485,661.89**

* Mixed hardwoods include: White and red oak; soft maple; yellow birch; basswood; ash and other

** Mixed softwood includes: Spruce; tamarack; cedar and other

Source: Clarence Turner FIA data

Table 23: Northeast Region, Scenario 3 - Cords (2011)

	2011 Removals	2021 Removals	Change	% Change	Annual Change	Annual % Change	10-year Projection
Balsam Fir	49,529	54,482	4,953	10.00%	495.29	1.00%	54,481.84
White Birch****	86,770	87,638	868	1.00%	86.77	0.10%	87,637.98
Maple***	61,753	67,928	6,175	10.00%	617.53	1.00%	67,928.30
Aspen	223,810	391,668	167,858	75.00%	16,785.75	7.50%	391,667.50
Mixed Hardwoods*	35,223	70,446	35,223	100.00%	3,522.30	10.00%	70,446.00
Red Pine	21,948	43,896	21,948	100.00%	2,194.78	10.00%	43,895.56
White Pine	41,069	82,139	41,069	100.00%	4,106.94	10.00%	82,138.89
Jack Pine	28,007	56,013	28,007	100.00%	2,800.67	10.00%	56,013.36
Mixed Softwoods**	7,850	8,635	785	10.00%	78.50	1.00%	8,635.00
Tamarack**	3,320	3,652	332	10.00%	33.20	1.00%	3,652.00
Spruce**	53,557	58,913	5,356	10.00%	535.57	1.00%	58,912.70
Total	**612,836**	**862,844**	**250,008**	**40.80%**	**25,000.83**	**4.08%**	**862,844.43**

* Mixed hardwoods include: White and red oak; soft maple; yellow birch; basswood; ash and other

** Mixed softwood includes: Spruce; tamarack; cedar and other

***Increase Maple by 10% due to significant increase between 2003 and 2011

****Increase White Birch by 1% due to rate of increase between 2003 and 2011

Source: Clarence Turner, FIA Data