Prentiss & Carlisle
Forest Resource Management and Timberland Services

Timberland Investment
PERSPECTIVES

Northern Forest Futures Project: A Review

by Sam Radcliffe, Vice President

In 2016 the USDA Forest Service completed a large study examining the future of northern forests in a 20-state region – most of which comprises the operating region of Prentiss & Carlisle (Figure 1). The goal of the multi-year Northern Forest Futures Project (NFFP) was "to forecast how known and emerging natural resource and societal trends will alter the character of tomorrow's forests and how the resulting changes will alter the ability of forests to contribute to the wellbeing of people and communities."[1] Obviously, such forecasts could potentially be of great value to P&C and its clients as we develop strategies for managing the nearly two million acres of forest land under our charge.

The culminating report[2] ("2016 report") entitled "Future Forests of the Northern United States" summarizes the project but it is just one of several outputs with potentially useful information and analyses. There is also a report[3] ("2012 report") on baseline conditions, two reports on outdoor recreation trends[4] and projections[5], a web-based "dashboard" for summarizing and visualizing state and regional data[6], and a downloadable Access database[7] of relevant forest conditions data.

The overall approach of the project involved three general steps: (1) assess current forest conditions; (2) develop alternative futures based on identified issues and trends, and; (3) project forest conditions that would result from the alternative futures, for the period 2010-2060.

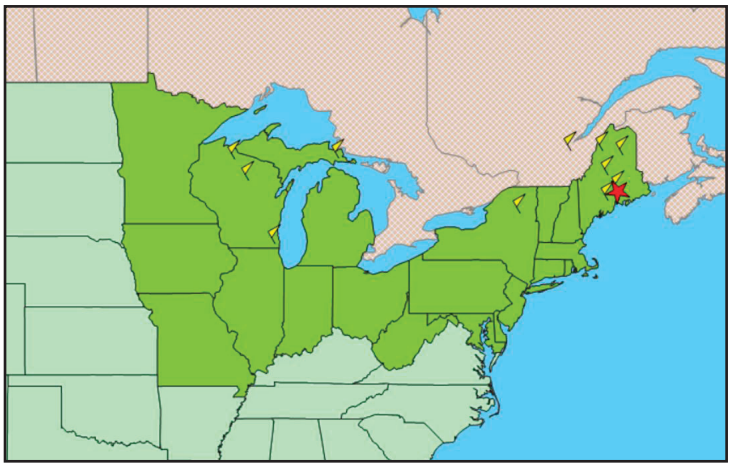

Figure 1. The Northern Forest Futures Study Area and Prentiss & Carlisle Office Locations.

Assessment of Current Forest Conditions

The project's assessment of forest conditions is based primarily on analysis of data produced in the Forest Service's Forest Inventory and Analysis (FIA) program, the system of permanent sample plots located on public and private lands throughout the country. The underlying data is not new information and is available elsewhere in detail. But unlike standard FIA reports, the NFFP organized data and analyses in the context of the Montreal Process criteria and indicators framework. To seven broad Montreal Process criteria was added an eighth on urban and community forests:

1. Conservation of biological diversity
2. Maintenance of productive capacity of forest ecosystems
3. Maintenance of ecosystem health and vitality
4. Conservation and maintenance of soil and water resources
5. Maintenance of forest contribution to global carbon cycles
6. Maintenance and enhancement of long-term multiple socioeconomic benefits to meet the needs of societies
7. Legal, institutional, and economic framework for forest conservation and sustainable management
8. Urban and community forests

From the perspective of industrially-oriented timberland investors, this organization is not particularly helpful. For example, information on forest ownership patterns, which has relevance to the assessment of timber supply, is found under the criterion related to conservation of biological diversity. Nevertheless, there are numerous informative graphics and tables within the 2012 report, such as the state-by-state comparisons of inventory trends. For example, Figure 2, taken from the 2012 report shows that inventories in Michigan and Wisconsin have continued to increase throughout the 2000's while Minnesota inventory leveled off, as did Maine inventory several decades ago.

One of the strong points of the project is that it brings together data beyond the standard FIA inventory statistics to weave its story. For example, landowner surveys were used to show that the number of private landowners increased and the average parcel size decreased from 1993 to 2006, suggesting a significant change in acres under management for timber.

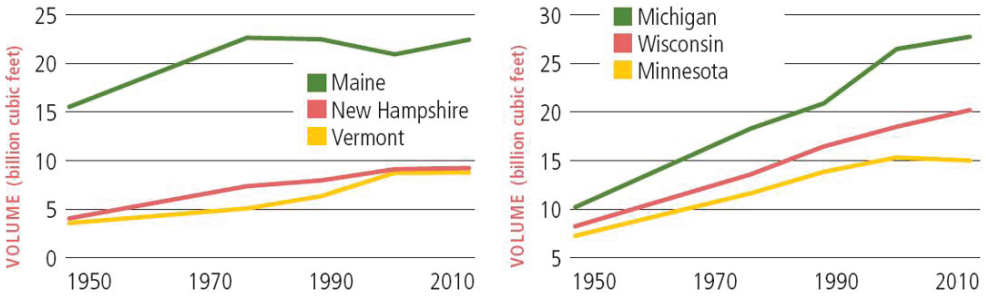

Figure 2. Growing-stock Volume on Timberland by State, 1953 to 2007.

It seems as if the language of economics was scrupulously avoided throughout the reports. The ratio of annual growth to removals – a common metric to indicate timber supply/demand balance – is referred to in the 2012 report as "an indicator of the intensity of wood utilization". The ratio is portrayed as a result of "management intensity and product utilization" rather than of economic availability, markets, and prices. Management intensity has nothing to do with high growth/removals ratios in place such as Delaware, Rhode Island, Illinois, Indiana, and New Jersey. Notably, in Maine growth and removals are roughly in balance while in Michigan and Wisconsin growth is about twice the level of removals.

Similarly, in sections on insect and disease risks, several damaging insects are discussed but often in the context of landscape disturbance or urban forest concerns rather than regional economics. In Maine, Michigan and Wisconsin outbreak populations of spruce budworm are expected within 3 to 10 years. During the last outbreak in Maine in the 1970's and 1980's this pest killed millions of acres of spruce-fir stands, and cost the region's economy many hundreds of millions of dollars[8].

Alternative Futures

Current (2010) forest conditions were projected for fifty years under different scenarios. Specification of the alternative futures is perhaps the most difficult aspect of the project to understand. It starts with four "storylines" adopted from the Intergovernmental Panel on Climate Change (IPCC) which represent sets of assumptions about future global socioeconomic conditions and are given cryptic names A1, A1B, A2 and B2. We are told "The key point for readers is that the labels identify relatively high (A2), medium (A1, A1B), and low (B2) future emissions of greenhouse gases." It is understandable why the IPCC would focus on greenhouse gases as a distinguishing characteristic, but that simplification says nothing about the world in which those gases were generated. Based on Table 1, the labels identify a world with a continuum of very high (A1, A1B) to medium (A2, B2) global economic growth and energy use. They are associated with medium (A1, A1B) to low (A2, B2) economic growth in the US. It would be useful to know what "high, medium, low" represent in terms of numeric GDP growth rates.

The next step in scenario development involved coupling the storylines with general circulation models, which estimate the temperature and precipitation change associated with the different levels of greenhouse gas emissions. Apparently, the Forest Service has developed procedures by which these climate changes can be assigned to individual FIA plots.

The final step was to couple storyline/circulation model combinations with assumptions about harvest levels. This was the most disappointing aspect of the project because the harvest levels seemed to be externally developed rather than estimated as a response to alternate economic and energy futures. Two harvest levels were used: continuation of recent trends, or increased harvesting with more wood biomass used for energy.

The combinations of storylines (4), circulation models (6) and harvest levels (2) could have resulted in 48 different scenarios. Ultimately thirteen scenarios were analyzed, with seven labeled "primary" and more heavily reported on in the 2016 report. Figure 3 shows the projected harvest levels for the seven primary scenarios. Unlike conventional forest projections, all scenarios are treated as equally likely. This

Storyline	Economic Growth		Population Growth		Global Energy Use	Greenhouse Gas Emissions	Movement Toward Renewable Energy
	Global	US	Global	US			
A1	Very High	Medium	Medium	Medium	Very High	Medium	Rapid
A1B							Medium
A2	Medium	Low	Medium	Low	High	High	Slow
B2	Medium	Low	Medium	Medium	Medium	Low	Medium

Table 1. Descriptors of IPCC Storylines Based on Table 2.1 in the 2016 Report.

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Table 2. Descriptors of Primary Scenarios Analyzed in the NFFP.

Scenario	Harvest Assumption	Economic Growth		Movement Toward Renewable Energy	Global Energy Use	Greenhouse Gas Emissions
		Global	US			
A1B-C	Recent Trends	Very High	Medium	Medium	Very High	Medium
A1B-BIO	Increased Biomass					
A2-C	Recent Trends	Medium	Low	Slow	High	High
A2-BIO	Increased Biomass					
A2-EAB	Recent Trends					
B2-C	Recent Trends	Medium	Low	Medium	Medium	Low
B2-BIO	Increased Biomass					

places a great burden on the reader who is interested in the condition of our forests but does not regularly study the U.S. and global economies.

Projection Results

In the 2016 report, the modeling results are presented in the form of individually authored essays on the eight Montreal Process criteria listed above. Detailed numeric projection data is found in the appendix, and a great deal of detail is contained in the available Access database.

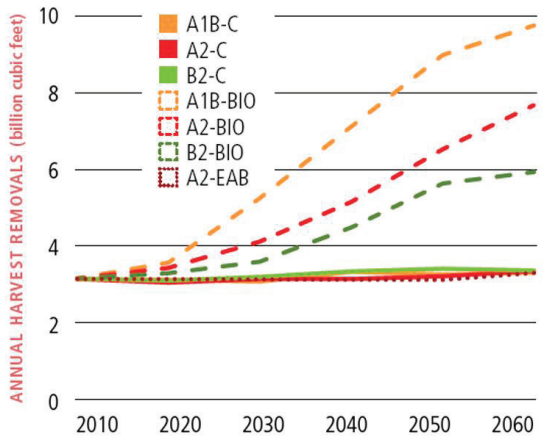

Figure 3. Projection of Timber Harvest Levels Under Seven NFFP Scenarios.

Some of the more interesting findings:

- If harvesting rates observed in the recent past continue into the future, differences in projections of forest conditions in the northern region would be small. (Figure 4)
- Differences were found to be modest until at least 2040 among the scenarios that continued with current rates of harvest, and there was no evidence that over this period the effects of climate change would overwhelm the changes resulting from forest aging, species succession, harvest, and land-use conversion.
- The levels of increased biomass harvesting for energy assumed in three scenarios appear to be too large to be sustainable through 2060. (Figure 4)
- Under all projections for northern forests, the growth-to-removals ratio would be <1.0 (indicating an unsustainable situation over the long term) from 2035 to 2055; by 2060, the ratio would increase to 1.2 if harvesting rates observed in the recent past (2003 to 2008) continue into the future.
- Paper and paperboard production is projected to be variable in the next decade and is expected to decrease before 2060 under scenarios that assume a constant rate of harvesting without added demand for bioenergy feedstocks.
- Production of lumber and wood panels is expected to increase under a scenario that assumes large gains in urbanization but would decrease under scenarios that assume smaller gains in urbanization.
- The removals in Pennsylvania, Michigan, Maine, and Wisconsin are expected to account for about half of the total removals in the North. Predictions suggest that hardwoods will continue to dominate timber production and account for about three-fourths of total removals.

My biggest criticism of the project is that the biomass harvesting scenarios are extremely unlikely. The economics of biomass production and utilization are such that resources are typically limited to forest and mill residues which can be transported only relatively short distances. Production of biomass is a by-product of production of traditional forest products, so the two harvest paths cannot diverge as dramatically as shown in Figure 3. The only way such massive biomass production would become economic is through drastically increased energy prices, which is the opposite of what many are predicting for the coming decades. The U.S. may in fact become a net exporter of oil and gas, suggesting very low prices. Regardless, the type of inventory drawdown due to biomass production depicted in Figure 4 would not likely be politically feasible. In using this report, I recommend completely ignoring the biomass scenarios.

That leaves us with four scenarios, all of which result in essentially the same future, when statistical and modeling uncertainties are considered. Given that IPCC work drove

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scenario development, it is ironic that climate change insignificantly impacted the projections of future forest conditions.

In the end, it seems like the scope of this project was too large in terms of geography and issue definition to be useful for private strategic planning. The diversity of economic and forest conditions within the 20-state region prohibits useful region-wide conclusions, although the database with detailed state projections could prove useful. Even that projection detail though is tied to scenarios that have little granularity or range of possible futures with respect to timber supply and demand. In our business, it makes more sense to think globally and forecast locally.

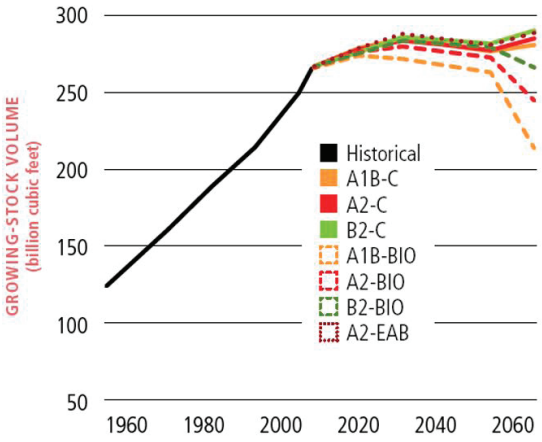

Figure 4. Projection of Growing Stock Volume Under Seven NFFP Scenarios.

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2. Shifley, Stephen R.; Moser, W. Keith, eds. 2016. Future Forests of the Northern United States. Gen. Tech. Rep. NRS-151. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northern Research Station. 388 p.
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