from	Andrew Fast <afast@ceunh.unh.edu>
to	Kristina Ferrare <kristina.ferrare@unh.edu>
date	Tue, Mar 23, 2010 at 9:28 AM
subject	Re: growth and yield
mailed-by	ceunh.unh.edu

Hi Kristina,

The following two attachments, "GrowthYieldWriteup" and "ForestProductsWriteup" were created by the silviculture working group. They got pulled out of the silviculture section in the initial draft with the intent of putting the growth and yield writeup as an appendix and the forest products writeup in either the timber harvesting or getting started section.

They did not make it into that initial draft and until recently, we were unaware of the oversight.

Hopefully, they can make it into the final version of GFGS. Both documents seem like relevant background information / reference material that is not too controversial.

Thanks,

Andy

Wood Products

The timber products commonly generated from New Hampshire's forests are sawtimber (veneer, sawlogs, bolts), cordwood (firewood and pulp), and biomass (chipwood). Sawtimber is usually the most valuable product by volume. For example, a trailer load of veneer may be worth more than 100 times the value of an equal volume of chipwood. Sawtimber is measured and sold per thousand board feet (MBF). Firewood is usually sold by the cord, while pulp and chipwood is usually weighed and marketed by the ton.

For landowners, the point of sale for timber is usually as the tree stands on the stump. *Stumpage value* is the value of standing timber; this is the value a landowner is paid when they sell timber. Once the tree is harvested, processed, and transported to market, timber is valuated at *market-delivered value*. The value-added by the logger's labor and use of equipment covers the logger's production cost and profit. This value-added is the difference between market-delivered and stumpage values.

Sawtimber is processed into more valuable products depending on the species and how clear, straight, and defect-free the wood is. Logs are downgraded by the number and kind of defects (knots, curves in the stem, rot, etc.). Poor-quality tree sections that are not marketable as logs may be processed and sold as firewood, pulp, chipwood, or left in the woods.

Under most circumstances, it is advantageous for landowners to manage their forests so that they grow and market the highest value timber products possible. All forests contain at least some low grade wood (low-quality trees are sometimes valuable for wildlife). However, silviculturally managing to favor the growth of well-formed, healthy, vigorous trees will provide the landowner with more options and revenue over the long term, than stewarding a forest replete with low-value products such as firewood.

There are a variety of factors that affect the value of wood products. They include: 1) supply and demand for different species and grades of wood, 2) harvesting costs 3) distance from markets and 4) seasonality, which affects wood flow and cost of logging.

Considerations:

- Sawtimber is usually more valuable, often dramatically, than firewood, pulp, or chips.
- For landowners, stumpage value is most often the relevant value for selling timber. Stumpage value is the value of the standing tree, before it is cut.
- While all forests contain at least some low-quality, low-value wood, it is not financially advantageous for a landowner to deliberately grow poor quality trees. Silvicultural management to favor the growth of high-quality, high-value timber products results in the greatest financial return over the long-term.
- Decisions loggers make about how to utilize and process a harvested tree can greatly impact the landowner's current financial return. Similarly, the type of logging equipment used and the care taken to operate a timber harvest may affect

the future value of the forest's residual trees.. Care should be taken to ensure that the appropriate equipment and logger are selected for a timber harvest.

- The landowner may consider professional preparation of a timber sale by a forester, including the selection and marking of the trees for harvest and sale.
- There are multiple sources that publish the general value of wood products including New Hampshire Department of Revenue Administration, *New Hampshire Timber Crier*, *Northern Woodlands*, and *The Sawlog Bulletin. However, stumpage values are nuanced and specific to the situation, with consideration to timber quality, quantity, logging costs, distance to market, and other factors.* Moreover, markets fluctuate rapidly and information from published sources may become quickly outdated. For landowners, a source of current market information specific to their forest may be made by hiring a NH licensed forester to appraise their timber's value.
- Specialty markets exist or may continue to emerge which provide alternatives to traditional forest products.

Recommended Practices:

- SAME PRACTICES FOR "MANAGING HIGH QUALITY TREES"
- Harvest may be adjusted consist with the goals of the management plan to take advantage of fluctuating markets for certain wood products

Cross Reference: Logging, Harvesting Equipment.

Suggested Reading:

New Hampshire Department of Revenue Administration Website Average Stumpage Prices: http://www.nh.gov/revenue/munc_prop/avgstumpval.htm

Growth and Yield

Forest growth refers to the volume of wood or biomass that a site produces over a period of time. Timber yield is the marketable timber volume available for harvest, or produced, at a given point in time or during a particular period. Many factors influence forest growth and how much timber is ultimately produced. Factors include site and soil conditions, species composition, forest health, and climate patterns. Forest disturbances, both past and present, as manifested in stand structure, play a major role in timber yield

Silvicultural management influences the density of trees, species composition, and the structural characteristics of forests. Timber growth rates may be accelerated by providing tree crowns with adequate space. Value growth may be optimized by providing valuable, and potentially valuable, trees appropriate space. Forest growth rates are typically optimal on moist, fertile soils. As soil fertility decreases, there are fewer nutrients to support potential growth relative to a more productive site. Stocking guides may be referenced to help determine optimal stand densities for particular forest types.

	northern hardwoods		red oak		white pine		spruce-fir-hemlock	
	M	UM	M	UM	M	UM	M	UM
Growth BA (ft^2/yr) BF/ac/yr Ft^3/ac/yr	0.91-2.29	0.91-1.74	-	0.2-0.7	2.2-3.15	-	Up to 2.65	-
	150-250	-	200-300	25-535	400-835	550	200-250	35
	40-55	-	50-60	10-130	100-205	141	55-65	9
Diameter growth (in. /decade	1.5-2.5	1.0	1.7-2.6	0.9-2.0	0.4-2.3	0.8	Up to: 2.9 (hemlock) 1.7 (spruce) 2.4 (fir)	-
	P	Avg.	P	Avg.	P	Avg.	P	Avg.
Yield (BF/ac)	20,000	7,190	20,000	8,830	80,000	10,425	40,000 (spruce) 35,000 (fir) 40,000 (hemlock)	6,825

(M) = managed, (UM) = unmanaged, (P) = potential, (Avg.) = average, (BA) = basal area, (BF) = Board feet, (AC) = acre, (YR) = year

Consideration of forest growth—both on a stand and tract level—provides landowners and foresters a framework to strategize a realistic yield plan over a given time horizon. Silvicultural management helps insure that the forest remains productive. A complete (holistic) management approach takes into account ecological factors (such as habitat, soil integrity, water quality, disturbance potential), social aspects (aesthetic, recreational), and financial factors (markets, access logistics, etc.).

Sustainability is an important issue to forest landowners: will their forest—and New Hampshire's forests—remain productive? For timber yield to remain sustainable, the volume of wood removed from a property usually does not exceed the volume grown over a management period, usually a *planned* cutting cycle. Furthermore, the integrity and health of the forest must be protected.

Considerations:

- Consideration of forest growth provides a framework to devise a realistic timber yield plan for any given forest property.
- To remain sustainable, timber yield typically does not exceed forest growth over the planned harvest cycle.
- The integrity of the forest—trees, soils, water, wildlife—and its systems must be considered to optimize forest productivity.

Recommended Practices:

- A forest inventory will provide baseline information about present timber volumes and projected growth. Future inventories can reference the baseline inventory to determine if forest harvesting is occurring at a sustainable level.

Cross Reference: Soil Nutrients 1.2, Forest Structure 5.2, Managing for High Quality Trees 5.3, ** Inventory Section **.

Suggested Reading:

Davis, L.S. and K. Norman Johnson.1987. *Forest Management*. McGraw-Hill Book Company.

Frank, R.M. and B.M. Blum. The Selection System of Silviculture in Spruce-Fir Stands – Procedures, Early Results, and Comparisons with Unmanaged Stands. 1978. USDA Forest Service Research Paper NE-425. 20p.

Hornbeck, J.W. and Leak, W.B. 1992. Ecology and management of northern hardwood forests in New England. USDA Forest Service General Technical Report NE-159. 44p.

Marquis, D.A. 1969. Thinning in Young Northern Hardwoods: 5-Year Results. USDA Forest Service Research Paper NE-139. 22p.

Moser, J.W. *Introduction to Forest Growth and Yield*. Central Hardwood Notes No 5.01 North Central Research Station, St. Paul MN. 5p.

Sampson, T.L. 1983. A stocking guide for northern red oak in New England. Master's Thesis. University of New Hampshire.

Solomon, D.S. 1977. The Influence of Stand Density and Structure on Growth of Northern Hardwoods in New England. USDA Forest Service Research Paper NE-362

Solomon, D.S., Herman, D.A., and W.B. Leak. 1995. Fiber 3.0: am ecological growth model for northeastern forest types. USDA Forest Service General Technical Report NE-204. 24p.

Solomon, D. S. and Leak, W.B. 2000. Growth and stocking of eastern hemlock (*Tsuga canadensis*) in New England. *In:* K.A. McManus, K.S.Shields, D.R. Souto (eds.). *Proceedings: Symposium on Sustainable Management of Hemlock Ecosystems in Eastern North America.* USDA Forest Service General Technical Report NE-267, p. 43-49.

Steinman, J.R. 1992. A comprehensive evaluation of spruce-fir growth and yield in Maine as related to physical and chemical soil properties. Ph.D. diss., Univ. of Maine. Orono.

Ward, J.S. 2002. Crop Tree Release Increases Growth of Mature Red Oak Sawtimber. Nor. J. Appl. For. 19(4) 149-154