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NORTHERN HARDWOODS RESEARCH INSTITUTE'S QUARTERLY NEWSLETTER

THE LEAFLET

HARVEST KNOWLEDGE, PROMOTE GROWTH

CLIENT-DRIVEN APPLIED RESEARCH

FOUR IMPORTANT SILVICULTURE PRINCIPLES

A Simplified Guide to the Successful Management of Hardwood Stands

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Introduction

IMPORTANT CONCEPTS TO REMEMBER WHEN IMPLEMENTING HARVEST-BASED SILVICULTURE IN MIXED AND HARDWOOD FORESTS ~ *By Gaetan Pelletier*

When managing a woodlot to generate value through the production of timber, it is becoming more and more important to base our silviculture prescriptions on sound biological concepts and theory. Planned activities to influence establishment, growth, composition, health, and quality of stands and trees are founded on a few key biological processes. In this article, we will revisit four very important notions that must be part of our treatment prescriptions and communicated to those who do the actual work.

FOUR PRINCIPLES OF SILVICULTURE

HARVEST-BASED SILVICULTURE IN MIXED & HARDWOOD FORESTS

Principle #1

TREES OF DIFFERENT SPECIES AND SIZE HAVE DIFFERENT MONETARY VALUES AND GROWTH RATES

Understanding the value difference from one species to another is critical. Too many modern 'management guides' are quick to advocate practices that promote species richness first and foremost. It is important to remember that value is a result of the product mix of an assortment of trees and their respective values. For example, red maple and beech yield 5-10% saw logs and the value of lumber is half that of sugar maple and yellow birch that yield 20-25% saw logs (*Figure 1*). In conjunction, this represents a considerable 4-5-fold difference in value. Silviculture is the ideal tool to grow your species of interest and value for the woodlot.

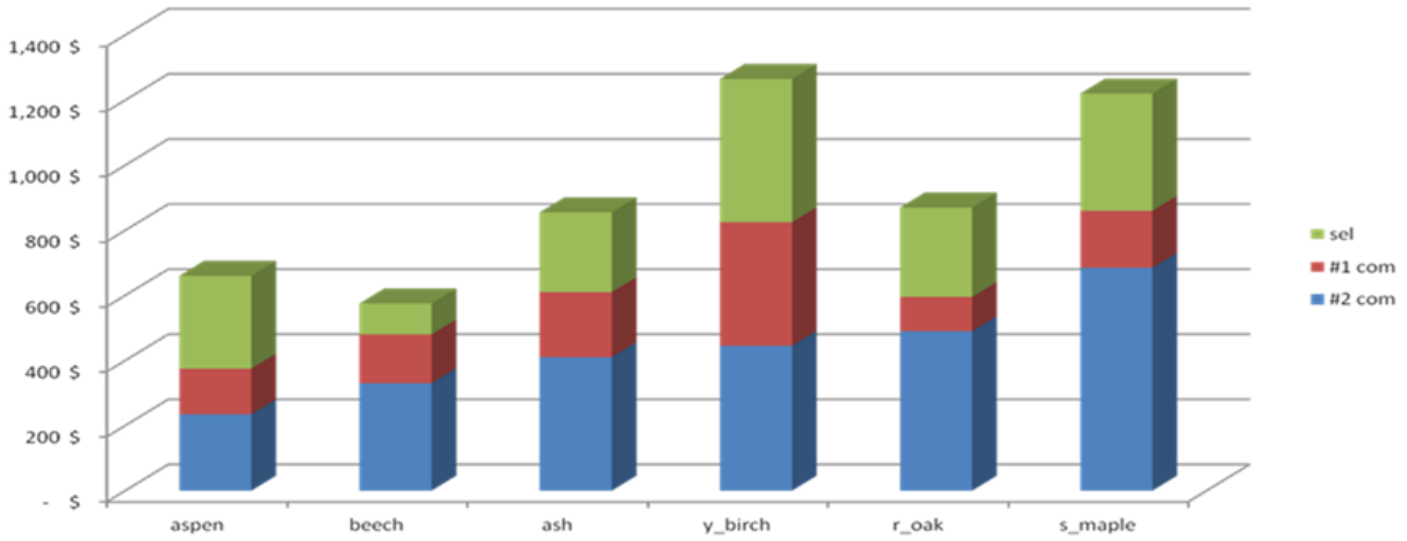

Figure 1. Relative value of selected hardwood species represented as green lumber prices for the Northeast (US$/1000 FBM)

Larger trees to a certain degree, tend to have a higher proportion of high-grade products. But, as a tree ages, it loses vigour and value. Larger trees (DBH > 50cm) add more discoloured wood volume than clear wood volume as they keep growing. Eventually, discoloration will lead to decay where wood properties start being affected. Consequently, stem quality declines in larger trees, sawlog recovery diminishes and timber value/m^3 sharply declines in trees larger than 45-50cm at breast height (*Figure 2*).

As a tree increases in diameter, so does its growth rate for diameter and basal area until it starts to peak. The threshold is dependent on many factors such as species and competition for resources however, the growth apex for our northern species occurs around 40-50 cm of DBH (*Figure 2*).

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HARVEST-BASED SILVICULTURE IN MIXED & HARDWOOD FORESTS

Principle #1, cont'd

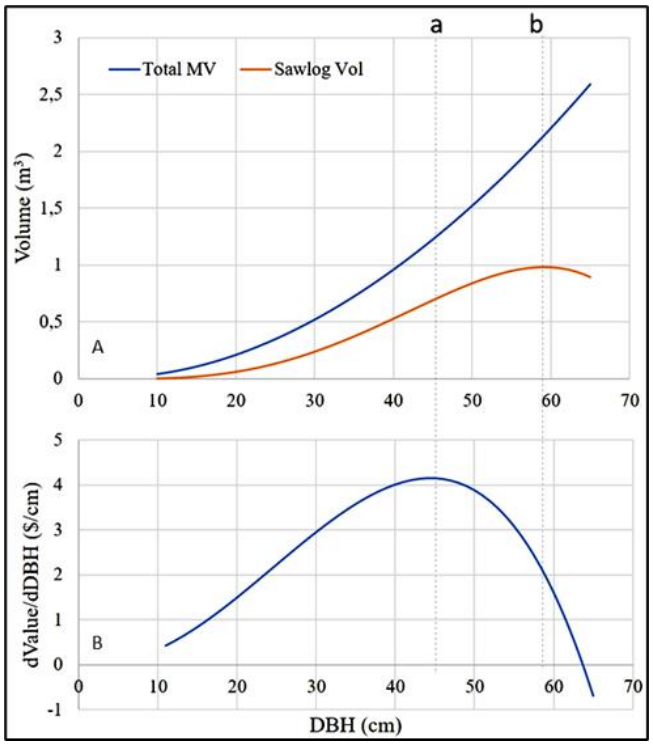

Figure 2. Sawlog recovery and timber value as trees grow.

Barring other important ecosystem service objectives such as protecting habitat and diversity, land managers should aim to retain a relatively low proportion of large trees after treatment if they wish to sustain high growth rates for their stands.

FOUR PRINCIPLES OF SILVICULTURE

HARVEST-BASED SILVICULTURE IN MIXED & HARDWOOD FORESTS

Principle #2

STAND BASAL AREA (COMPETITION), TREE VIGOUR AND TREE SIZE IN INTERACTIONS, IMPACT RATES OF STAND AND TREE GROWTH

The effect of tree size on growth rate is compounded when we consider the additional factor of stand competition. At least in the case of sugar maple and yellow birch, the more open the stand is, the higher the growth rate will be on residual trees. The concept is illustrated in *Figure 3.*

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HARVEST-BASED SILVICULTURE IN MIXED & HARDWOOD FORESTS

Principle #2, cont'd

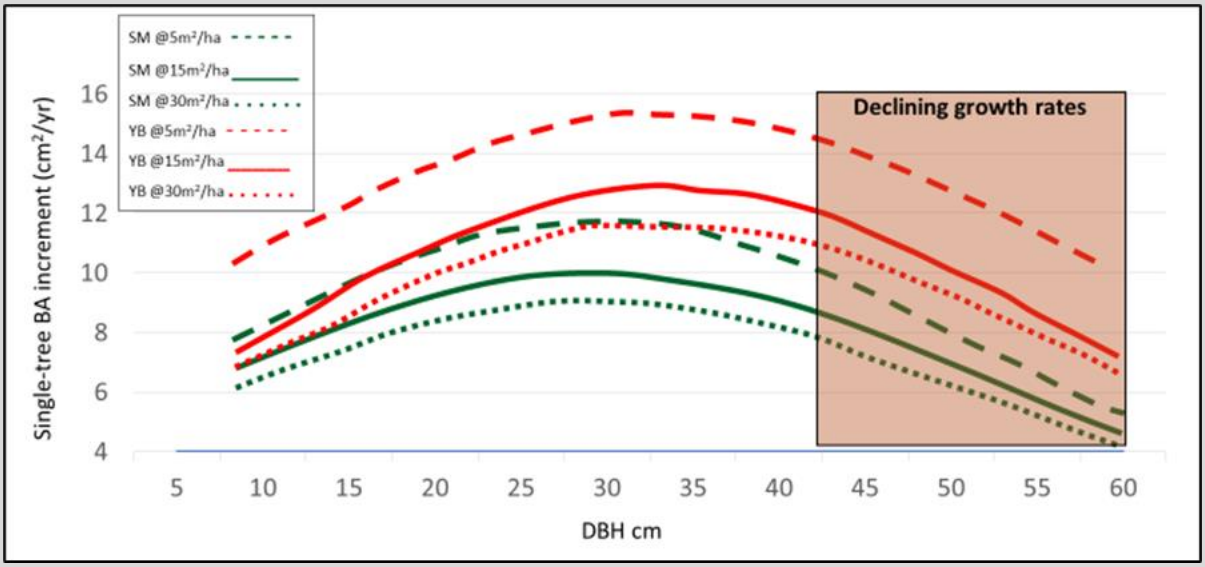

Figure 3. Interactions between Species, Tree Size and Growing Space on individual-tree growth rates

Figure 4. A very unhealthy sugar maple stand where more than ¾ of the trees are of unacceptable growing stock (UGS)

This does not offset the notion that larger trees grow the least. The natural reflex to be on the safe side and leave more than enough basal area after treatment may not be the best course of action. When deciding on the specific trees to leave as crop trees, it is important to consider tree quality, health, and vigour to determine the right silvicultural regimes. Tree health is a vital element of quality and grade but very few jurisdictions systematically characterize trees for those features in their inventory. Vigour takes into account tree health as well as competition for light and other resources (Figure 4).

Maintaining ideal growth rate requires a high proportion of vigorous trees, and at harvest an emphasis on prioritizing the removal of unacceptable growing stock is essential.

FOUR PRINCIPLES OF SILVICULTURE

HARVEST-BASED SILVICULTURE IN MIXED & HARDWOOD FORESTS

Principle #3

RESIDUAL BASAL AREA AND RELEASE OF CROP TREES IMPACT STAND GROWTH AND REGENERATION DYNAMICS

There is very strong evidence of a narrow range of residual basal area where growth of residual crop trees is optimal. In mixed and hardwood stands of our region, basal area growth can reach the value of 0.8 m^2/ha yr. The ideal window for optimal stand growth is between 14 and 18 m^2/ha ha. Leaving more basal area after treatment will cost in growth. Not leaving enough will deplete the growing stock and encourage the establishment of intolerant and pioneer species. Controlling the harvest intensity (percent basal area removed) is important in the recruitment of new cohorts of desired species *(Figure 5)*.

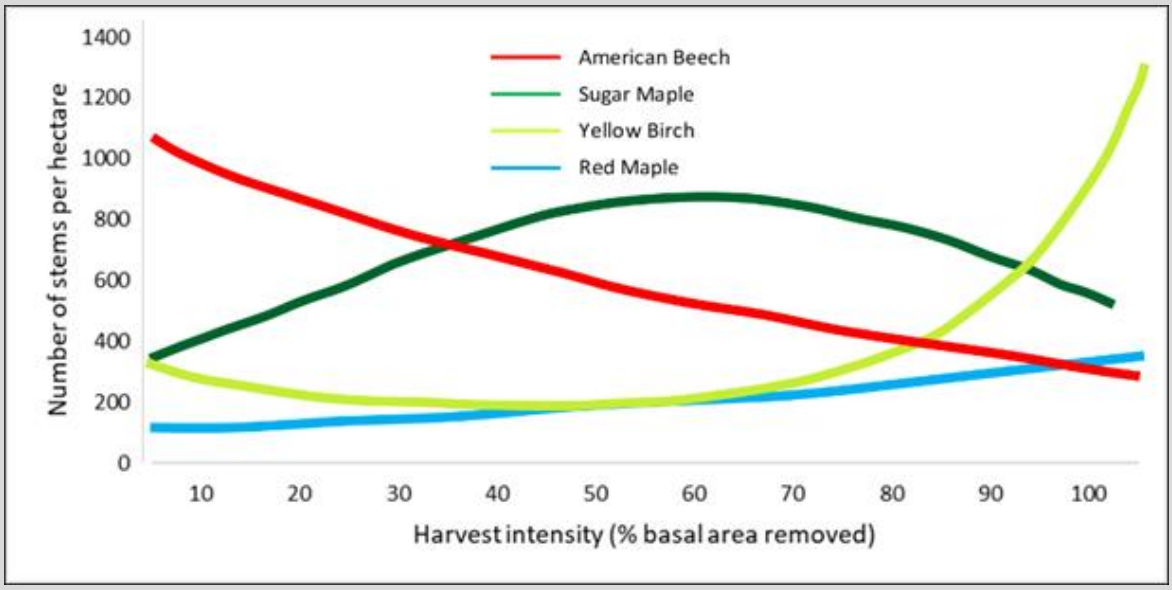

Figure 5. Relationship between percent removal and the number of saplings by species after 20 years in Northern New Brunswick.

FOUR PRINCIPLES OF SILVICULTURE

HARVEST-BASED SILVICULTURE IN MIXED & HARDWOOD FORESTS

Principle #3, cont'd

Low residual basal area might also encourage the production of new epicormic branches and encourage growth of existing ones thus reducing grade and quality. In those instances, leaving non-competing 'trainer-trees' will discourage this situation. As a rule of thumb, a target residual basal area of 16-20 m^2/ha of trees larger than 10cm is appropriate for most partial cuts (*Figure 6*).

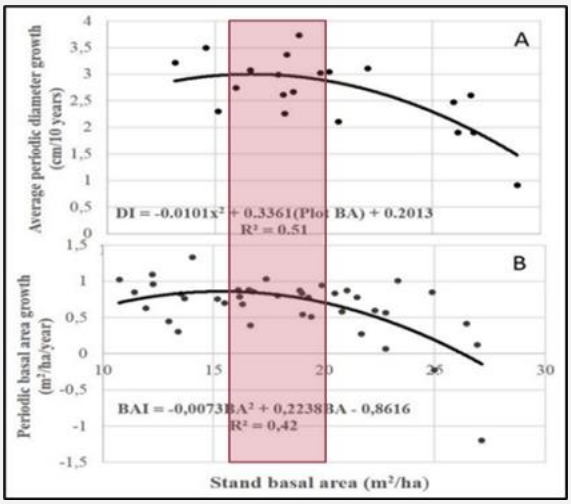

Figure 6. Basal area and diameter growth according to target residual basal area

Simply reaching the target average basal area in the stand is not adequate as a certain uniformity in the distribution of crop trees is needed. The crowns of these crop trees must be released to eliminate direct competition.

Mechanical harvesting systems where extraction trails are a necessity can add a layer of complexity. These trails should be factored in and the ratio of trails to green strip must be considered. In regulated treatments such as commercial thinning and single-tree selection, the ratio in trails should be less than 25%. Furthermore, trees in the green strip require even spacing with their crowns released from the edge of the trail to the extent of the boom reach.

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Principle #4

HARVEST SEASON, SYSTEM AND TRAIL NETWORK GREATLY IMPACT THE CREATION OF SUBSTRATE FOR GERMINATION AND THE ESTABLISHMENT OF REGENERATION.

In harvest-based silviculture treatments where one of the goals is to establish a new stand of trees, timing of the treatment is critical. Late winter operations under a heavy snow cover are not likely to benefit from soil mixing from the tracks of the machines. Plan your trail network accordingly to increase the number of seed germination beds (*Figure 7*).

Harvesting in the dormant season (fall and winter) when residual trees are less prone to mechanical damage is a good choice but not if the trees targeted for removal regenerate by means of root suckers and stump sprouts such as poplars, red maple and beech.

Figure 7. The choice of harvesting systems and trail pattern impact logging debris and germination substrates

CONCLUSION

In the end, plan your treatment according to these few basic principles and remember:

⇒ Formulate a prescription that identifies the residual stand density (or stand basal area)

⇒ Prescribe the season and the trail network

⇒ Outline the cutting instructions of what trees to cut and how many to retain, ensuring the details of the species preferences, size distribution, tree quality and crop tree release are included.

IN THE SPOTLIGHT:
AV GROUP: First adopter of the NHRI Silviculture Prescription System

Kevin Larlee, former Vice-President Fibre Supply and Government Relations AV Group (2016-2020) was instrumental in leading the company to integrate the NHRI Silviculture Prescription System (SPS). Mr. Larlee is a long standing member of the NHRI Board of Directors since it's inception in 2012.

For this edition of *In the Spotlight* we interviewed Pierre Mezzetta who shared the AV Group's experience as SPS pioneers. They were the first company to adopt the NHRI system into their operations approximately 5 years ago.

Can you explain why your company made the decision to implement the NHRI SPS?

AV Group was looking for methods to quickly stratify stands into operational units which would allow us to maximize the return both today and in the future for the value of the forest and to maintain a healthy hardwood forest.

What steps did AV Group decide to take prior to putting the SPS into operation?

We initially started with a small test, similar to the Crown models because a large percentage of our lands are on Crown land. Once the Department of Natural Resources were on board with SPS, AV Group was fully committed to using it in every forest type they manage.

What was the main goal that you were looking to achieve? Was it to improve your operations or to make better Silviculture choices?

Our #1 goal was Silviculture objectives. A lot of the decisions being made in the past were focused on a single element of the cycle of the hardwood forest. With the SPS we were able to look at it from a long term perspective; one treatment is going to lead to the next treatment which leads to the best forest. For us, this means a resilient hardwood dominated forest that is producing an abundance of maple and yellow birch. If we grow healthy, tolerant hardwood forests, we can expect more value from the products we produce.

What would you say there are the long term benefits of using the SPS? Are there any short term benefits?

I think from a long term perspective, we are seeing a better regeneration of Silviculture coming up underneath which is giving us hope compared to some of the old prescriptions we had tried. *cont'd pg. 10*

Established in 1997, AV Group is a member of the Aditya Birla Group based in India, and its mandate is to produce specialty pulp products to service the textile industry. Their mission is to be the global leader in dissolving grade pulp production by adhering to the highest standards of safety, quality and responsible sustainability.

AV Group is comprised of two dissolving pulp mills in New Brunswick for the production of cellulose used for textiles and has over 1200 people employed directly. It is one of New Brunswick's largest employers.

AV Group manages over 1.6 million acres of company-owned and public (Crown) land under two Crown licenses.

LEARN MORE !

IN THE SPOTLIGHT
AV GROUPS: First adopter of the NHRI Silviculture Prescription System

These old prescriptions favoured beech and other species which are not necessarily the best for creating a resilient hardwood forest.

With this system, it is still in its infancy but we are seeing more tolerant species like maple, yellow birch and ash which are the preferred species for AV Group.

We are noticing a short term benefit in some stands as well. The SPS prescription allows us to open them up a bit more, allowing for more efficient operations.

How would you describe the involvement of the Field Team and Management of your company to test the system? Were there any challenges?

Internally, everyone was on board. We had a lot of faith in the effort and research that NHRI was doing to gain positive results. As soon as we could, we went ahead with it.

Our biggest challenge was encouraging the operators in the field to look at it through a different lens. They were used to the old system and old way of doing things. It took us a some time to reach that point of mutual understanding. The efforts and research have been proven in the results. ◆

The NHRI's Silviculture Prescription System is a 5-step process that starts with the description of a stand and ultimately recommends very specific treatments in forests that are dominated by hardwoods. The NHRI Silviculture Prescription System was introduced in 2015 and its implementation was gradually undertaken in various stands of all tenure types in New Brunswick. From these trials, several improvements were recommended and led to the re-design of the SPS. Version 2.0 of the SPS was completed in January 2020. Improvements brought to our original SPS include:

⇒ Simplified framework

⇒ New nomenclature of silviculture systems to minimize confusion on two-aged/extensive systems (formerly called "Irregular Shelterwoods)

⇒ More robust logic for treatment determination

⇒ Better instructions for implementation.

LEARN MORE

UPCOMING EVENTS

The Atlantic Forest Research Collaborative hosts several e-lectures as professional development opportunities. Participants have attended from across the Atlantic Region, northeast US, the UK and Europe. Watch the most recent e-lecture now !

MORE INFO

UPCOMING EVENTS

NHC 2021 NORTHERN HARDWOOD CONFERENCE
Bridging Science and Management for the Future

Virtual Event
June 15-16, 2021

Northern hardwood forests occupy millions of hectares in the eastern United States and Canada, representing one of the most economically important and ecologically diverse forests in eastern North America. Northern hardwood silviculture is diverse and complex as well and has been the focus of extensive research for over 80 years. Today, managers continue to seek innovative sustainable management solutions to address the expanding challenges facing this forest type, including serious threats such as invasive species, inadequate tree regeneration and shifts in composition, degraded timber quality, herbivory, climate change, nitrogen deposition, and forest fragmentation. The 2021 Northern Hardwood Conference (NHC) will give researchers, academia, and forest managers from across the range a forum to learn, share, and discuss cutting edge science and innovative management practices to sustain healthy and productive northern hardwood forests.

MORE INFO

UPCOMING EVENTS

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2022 NORTHERN HARDWOODS CONFERENCE

CONFIRM YOUR ATTENDANCE TODAY!

Forestry professionals will meet in Fredericton, New Brunswick, Canada for the 2022 Northern Hardwoods Conference, presented by the Atlantic Forest Research Collaborative (AFRC) at the University of New Brunswick (UNB) and the Northern Hardwoods Research Institute (NHRI). The event is scheduled over three days, August 16, 17 and 18.

The event will feature scientific conference talks at UNB or the Fredericton Conference Centre and a hands-on workshop in managed forests near the city. As part of the conference, a demonstration forest, prepared in collaboration with the New Brunswick Department of Natural Resources and Energy Development and AV Group will be used to showcase the NHRI Silviculture Prescription System and novel technology tools that have been developed in its support.

The conference will be developed under the framework of the "digitalization of the forest products/bio-economy value chain"; an innovative Canadian initiative in which New Brunswick will be the pilot landscape and NHRI will be involved in a leadership role. This conference will illustrate key steps to the restoration and the sustainability of hardwood and mixed wood forests in the Northeast of North America.

The showcase forest site will be used as a state-of-the art educational and training tool to demonstrate adaptive silviculture techniques focused on problem solving and finding solutions at the operational level. The demonstration forest is also a site for training foresters and technicians from UNB, l'Université de Moncton, the Maritime College of Forest Technology and the University of Maine.

The event partners include the Province of New Brunswick, AV Group, UNB, l'Université de Moncton and the Canadian Forest Service, as well as private landowners and forest managers.

For more information and to register, contact: Gaetan Pelletier

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