SILVICULTURE PRESCRIPTIONS FOR COMPLEX BOREAL STANDS

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Colloque International. Pour une sylviculture adaptee a la foret boreale irreguliere et sa faune
Baie Comeau, Quebec
Old irregular structured forests
Québec N.Shore/Gaspe >120 years

Bergeron et al 2007

Clear-cut

Partial cut

Selection cut

OLD-GROWTH
1. There are parallels between BC and Quebec over public and ecologists concerns over harvesting irregular structured old growth

2. What available technical guidance is there on spruce/fir stand dynamics and silviculture?

3. There are huge inherent limitations in Crown land innovative boreal silviculture

4. There are notions realities and concepts that are important…but may not be true

5. Professional silviculture prescriptions are needed: history of BC experience in upgrading foresters silviculture education: Case history of sub-professional partial cut/retention prescriptions
1. Parallels between BC and Quebec over public and ecologists concerns over harvesting old growth

- 1990s: public protests about clear cuts Clayoquot in BC, L’erreur boreale in Quebec
- Search for “science base” followed by silviculture systems trials with detailed ecosystem studies/recognition of old growth values and stand dynamics/
- “Ecological integrity” recognized and course and fine filters used for biodiversity protection with emulation of natural disturbance patterns in cutblock layout.
- Calls for use of selection cutting (jardinage)
1. Parallels between BC and Quebec over public and ecologists concerns over harvesting old growth (more)

- Government downloads more responsibility to professional foresters to prepare appropriate silviculture prescriptions/
- Companies look for “social license” by certification/
- Present and future landscape conditions become important: visuals, old growth representation, public consultation
- Weyerhaeuser Company announces the end of clear cutting in BC by use of VR and then sells out and leaves BC.
- Companies withdraw from forest management leadership as the industry goes into economic crisis. Variable retention within clear cuts blocks widely adopted.
2. Examples of available experience and technical guidance on spruce/fir stand dynamics and silviculture

1. US Forest Service 1973 silviculture guide for even-aged and uneven-aged management of spruce fir
2. New stand density management diagrams.
3. Documentation of budworm effects on stand structure
4. Comparison of landscapes with reverse J stand structure old growth with gap dynamics versus even-aged insect origin with self thinning in Newfoundland.
5. Problem of butt rot in balsam fir.
6. History and necessity for aerial spraying for spruce budworm protection; sad history of Cape Breton Island forests
US Forest Service practical field guide to prepare 20 different silviculture prescriptions for even-aged and uneven-aged management. It has as stocking guides and vigour classes.

A Silvicultural Guide for SPRUCE-FIR in the Northeast


A slide/tape show was prepared

USDA Forest Service General Technical Report NE-6

There is 100 years of experience on how to manage spruce fir and a huge amount of literature, most not online today.
Stocking guide for partial cuts in spruce fir stands: need to maintain" B level stocking:

Figure 7.—Growing-stock guide for even-aged spruce-fir, based on the number of trees in the main canopy, average diameter, and basal area per acre. The area above the A-level represents overstocked stand conditions. Stands between the A- and B-levels are adequately stocked. Stands between the B and C-levels should be adequately stocked within 10 years or less. Stands below the C-level are understocked.
Stand structure goals for selection cuts in spruce fir

Table 4.—Stocking goals for uneven-aged stands at the start of 5-, 10-, and 20-year operating intervals, by management objective, number of trees per acre, and basal area per acre

<table>
<thead>
<tr>
<th>D.b.h. class (inches)</th>
<th>Management objective 1: Pulpwood product; Operating interval</th>
<th>Management objectives 2, 3, and 4: Multiple product; Operating interval</th>
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A stand density management diagram for spruce–balsam fir mixtures in New Brunswick by Edwin Swift, Margaret Penner, Rolland Gagnon and Jason Knox
MARS/AVRIL 2007, VOL. 83, No 2 — THE FORESTRY CHRONICLE

Stand density management diagrams (SDMDs) can assist the forest manager in examining potential yield implications of stand density management decisions. Data from New Brunswick, Nova Scotia, and Quebec indicate a single SDMD is not appropriate for mixtures of balsam fir and spruce (red and black). The maximum size density line is flatter for mixtures than for pure species stands.
Silviculture affects composition, growth, and yield in mixed northern conifers: 40-year results from the Penobscot Experimental Forest
Paul E. Sendak, John C. Brissette, and Robert M. Frank

Abstract:
This long-term experiment in Maine, U.S.A., was designed to provide information on the best silvicultural practices for managing stands of mixed northern conifers in northeastern U.S.A. We evaluated growth and yield and changes in species composition, quality, and structure during the first 40 years of the experiment. Replicated treatments include the selection system, uniform shelterwood, unregulated harvesting, and diameter-limit cutting. Can. J. For. Res. 33:2116-2128.
A breakup from 250 m³/ha at about age 140 years. 

The photo and stand table graphs from a selection trial in high site old natural black spruce stand of m³/ha. The graphs show the reverse stand structure after the removal of 25 to 60% of the volume. (Weetman 5). It was concluded that in sheltered locations it may be possible to maintain old growth stands like these by section cut.

It is a fire origin stand that has escaped fire for over 30 years and is NDT2.
Newfoundland study sites

Comparison of old growth, rot mediated, spruce fir landscape and lower elevation budworm/looper mediated landscape.

John McCarthy UBC PhD.

Stand structure and dynamics
Main River: high elevation, too cold for insects, old growth landscape

- Structure regulated by small-scale (<200 m²) gap-phase disturbance mediated by fungal butt and root rots.

- Stands all-aged, multi-sized and multi-storied.

- Old-growth stage of stand development.
Silviculture prescriptions for very old spruce/fir with reverse J diameter distributions unaffected by spruce budworm since the growing season is too short for the insect? Are selection cuts really feasible with very slow growth rates and low operable volumes? Should they be left uncut=Main River controversy
Low elevation, Looper/budworm insect-mediated landscape: even-aged patches.
• Structure regulated by large-scale (0.5 – 1000 ha+) patch mortality mediated by recurrent insect herbivory.

• Modal or near-modal stand diameter, height and age distributions.

• Patch mosaic of even-aged stands in various ages and stages of stand development (chronosequence).

• Prescrition: clear cut, natural regen then PCT
Jardinage in western high elevation spruce/fir (ESSF)?

- Not used in western high elevation Engelmann spruce/subalpine fir which is nearly all old growth with gap dynamics bark beetle caused
- Costly, not economically feasible to commit to uneven-aged management with permanent roads and long operating cycles and marking under BDQ regulation. 75 years of research by US Forest Service

In BC use of small patch clear cuts which are planted: “Group selection”

Not used on Prairies due to long landscape history of even-aged stands after fire
Jardinage: its popular appeal

- In 1990s demonstrations and arrests in BC it was seen by the public and environmental NGOs and some conservation biologists as the “solution” to clear cutting.

- Classical central European use in the tradition of Bholley in spruce fir in Switzerland was re-assessed.
3. Inherent limitations in Crown land boreal silviculture

- Remote; low yields; long rotations; low value stands; low stumpage returns per hectare; partial cuts reduce increase delivered wood costs with feller bunchers; long truck hauls.

- Licensee companies have no equity in the forests and they are very reluctant to invest company money on Crown lands; little funding for silviculture and corporate forest management systems and research.

- Use of protected advanced growth for regeneration and partial cuts results in irregular stands whose yields do not match fire origin even aged yield tables.

- Dense natural regeneration requires expensive pre-commercial thinning to advance the operability of stands in the harvest queue.
3. Inherent limitations in Crown land innovative boreal silviculture ....more

- Use of reduced stumpage or stumpage offset opens up accusations of “subsidy” in US countervailing tariff issue. This is why BC companies pay full regen. costs today.

- Yield uncertainties and risk of loss of growing stock to fires, wind, budworm attack etc produces difficulties in spatial based wood supply models such as Stanley/Woodstock. Harvest queues and allowable cuts can be problematic.

- Rapid change of forestry staffs and corporate structures.

- Government regulations on landscape design, hydrology, biodiversity and habitat limit cutblock layout and increase management and access costs as compared to private lands in US and Canada.
Very high risk of budworm and windthrow losses

Short even aged rotations are saver
• Dense natural regeneration requires expensive pre-commercial thinning to advance the operability of stands in the harvest queue.

Pre-commercial thinning
Abitibi/Bowater contractor Mistassini.
$500/ha

Earn up to $2000/week.

When to do it?
Benefits?
Who pays?

Globe and Mail July 5, 2008
The incidence of rot in balsam fir was highest for the saw log product class (79%).
• The incidence of overall rot levels in balsam fir was higher for spaced (52%) than control (36%) plots.
Further separation showed butt rot occurred more frequently in spaced stands (47% vs. 25%) and stem rot occurred more frequently in control stands (14% vs. 7%). Only the difference in butt rot was statistically significant.
There are notions, realities and concepts that are important.. but may not be true

1. Old boreal stands accumulate humus and may decline in yield due to paludification unless clear cut and burned.

2. Irregular and patchy regen of sites with Kalmia and Ledum can revert to permanent heathlands (‘Heathland degeneration”). 1 million ha Kalmia heathland in Newfoundlad
There are notions, realities and concepts that are important but may not be true.

3. The default and only safe and “scientific” way to ensure sustainability is the always emulate natural disturbance patterns, stand structures and landscape age classes since the ecosystems are known to be resilient to such disturbances (“Naturalistic doctrines”).

4. Natural Disturbance Type 1 stands with irregular structures and gap dynamics must be maintained and not converted to even-aged stands (very popular).
5. Professional silviculture prescriptions are needed:

- The origin of silviculture prescriptions in US Forest Service and 17 years of the operation of the Silviculture Institute of BC.

- Problems with poor prescriptions in irregular stands
History of Silviculture Prescriptions. Bitterroot Controversy

An independent study of the problem by Dean Arnold Bolle of the University of Montana’s School of Forestry. Bolle appointed a select group of faculty members from the University of Montana to investigate,

“the unfortunate irony that the most competent foresters were rewarded with office jobs and promptly removed from timber sale supervision”

Terraced hillsides Bitterroot National Forest Montana 1970s, Created by foresters not loggers.

US Forest Service requires all timber sales on US National Forests have a silviculture prescription prepared by a Certified Silviculturist.

Silviculture Institutes set up in US universities to educate national forest staff. BC creates the Silviculture Institute of BC at UBC in 1983. 240 RPFs graduate with Diploma in Advanced Silviculture over 17 years. Required: 6 two week in residence Modules
Prescriptions required in BC for every cut block on about 170,000 ha per year of cut = ca 77 million/year M3

Silviculture Institute of BC 1983-2000  Six 2-week modules of in residence education by up to 50 instructors Module 6 was the defense of a prescription in the field.

250 Registered Professional Foresters graduated with a UBC Diploma in Advanced Silviculture.

Financed by BC Ministry of Forests
The following issues and areas of concern were identified on blocks in BC where a high level of dispersed retention and a multi-storied stocking standard was prescribed:

> A lack of understanding regarding the concepts associated with silvicultural systems prescribing high levels of dispersed retention.
> There is a misapplication of the single tree selection silvicultural system resulting in selective harvesting practices rather than uneven-aged management.
> A lack of clearly defined stand structural goals and future forest conditions.
> A lack of detailed information, to support development and implementation of complex silvicultural systems such as single tree selection, and irregular shelterwood.
More BC Prescription problems

A poor linkage between stocking standards, the type of prescribed silvicultural system and the identified objectives. Where there are no clear objectives economics appear to be the driving force behind some of the practices being prescribed and implemented.

> Inappropriate use of the multi-storied stocking standard resulting in lack of stratification between distinctly different treatments between areas with regeneration obligations and those areas fully stocked with only minor volumes removed.

> A lack of detailed leave tree criteria for residual layer 1, 2 and 3 trees which contribute towards meeting the silvicultural obligations.

> High grading or removal of the best trees from the stand for short term economic gain and resulting site occupancy with poor quality residual trees.
Forest dynamics operate too slowly for it to be possible to create a "new" forest in the lifetime of even several human generations. Thus, the key question for contemporary society is "what future forest do we want to leave to subsequent generations?"

Gordon Baskerville

THE END/FIN

Even if you’re on the right track, you’ll get run over if you just sit there.

Will Rogers