Ressources naturelles Canada | Natural Resources Canada

Post-fire salvage logging in Canada: assessing the economic value of burnt trees for different industrial sectors

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Canadian Forest Service and Canadian Wood Fibre Centre

Wildfire Resilience and Biomass Supply
IEA Bioenergy and Université Laval
Québec, Canada, 5 October 2023

Canada

Aux portes de l'enfer

COLLABORATIO

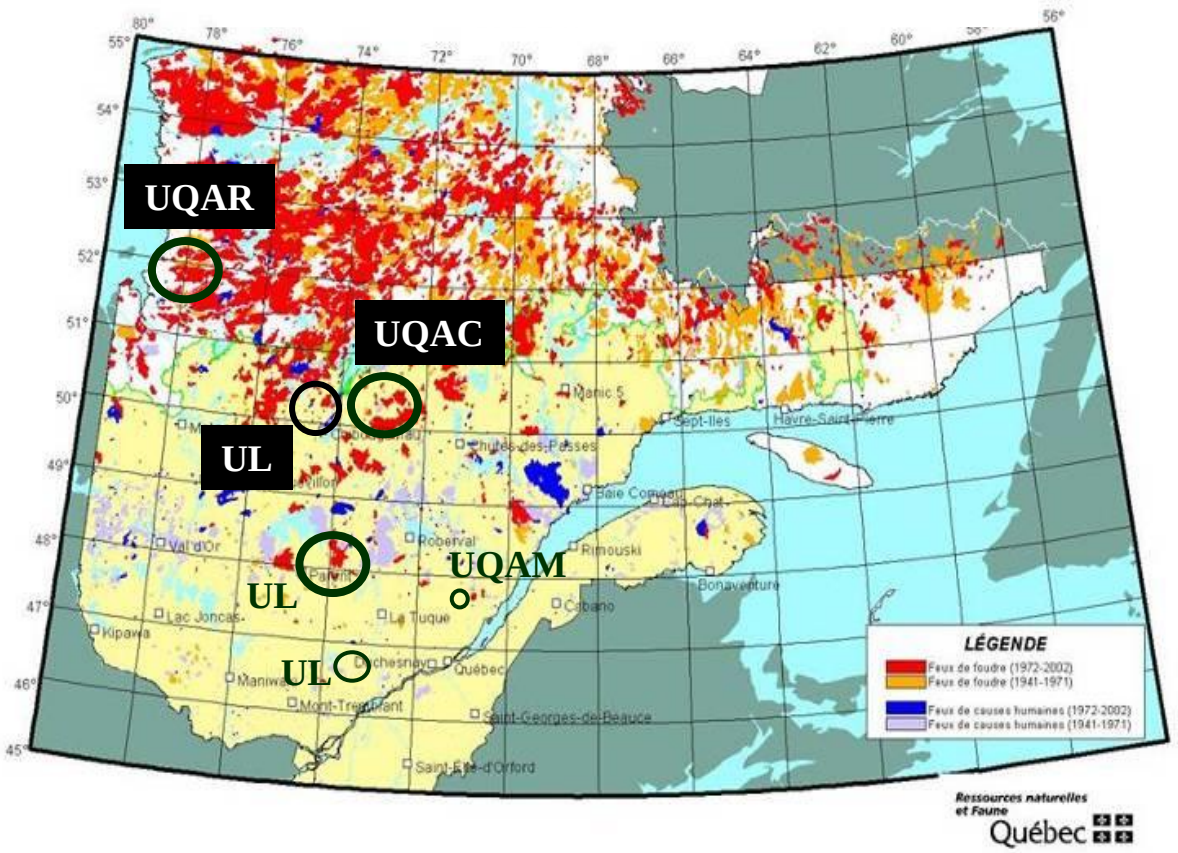
de forêt, dans le Parc des Grands-Jardins, qu'on croyait sous contrôle en milieu d'après-mi
gigantesques, devenant hors contrôle. Les gens qui luttaient contre le feu ont été évacués. Le brasier était d'une
ortes de l'enfer, comme le montre notre photo. Détails en page A 3.





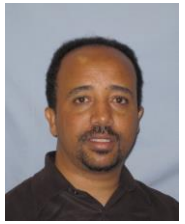

Projects in post-fire forests since 2000









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UQAC Université du Québec à Chicoutimi

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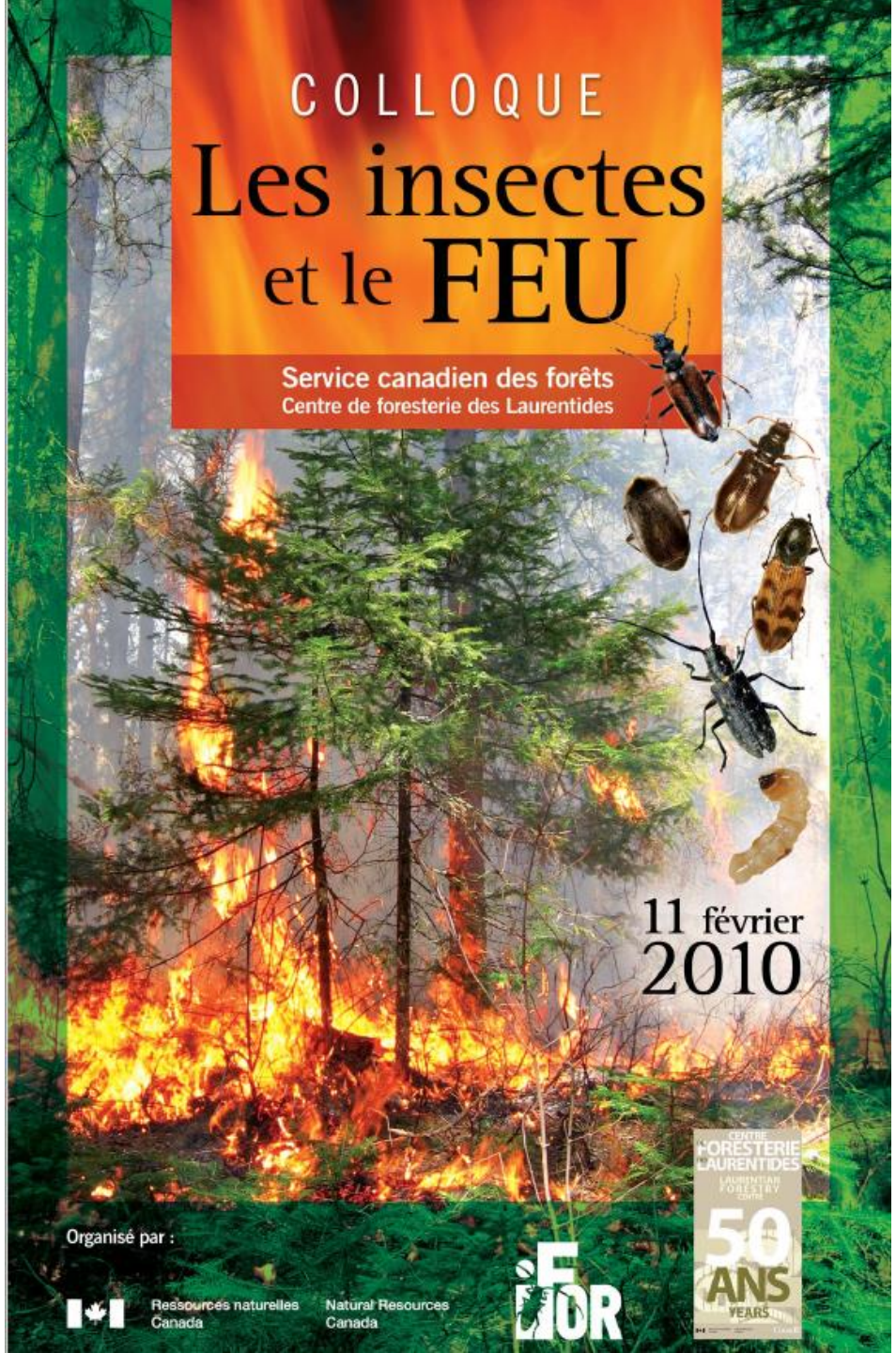
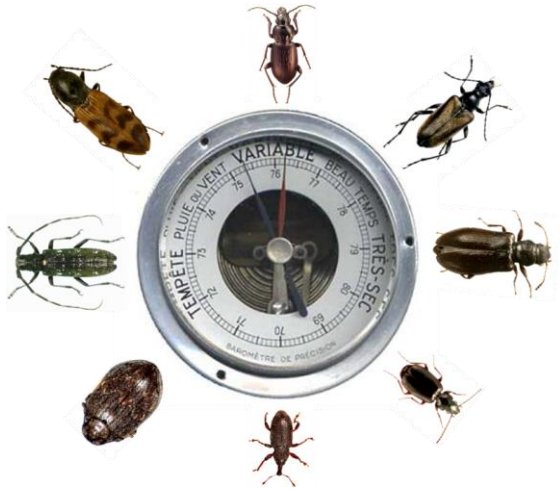


Insect sampling: 4-wing and Trunk-window traps

Insect sampling: boles collected, encaged and kept at ‘la Bûcheraie”



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REVIEW

Journal of Applied Ecology

Impacts of salvage logging on biodiversity: A meta-analysis

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Insect Conservation and Diversity

Insect Conservation and Diversity (2016) **9**, 402–415 doi: 10.1111/icad.12175

High conservation value forests for burn-associated saproxylic beetles: an approach for developing sustainable post-fire salvage logging in boreal forest

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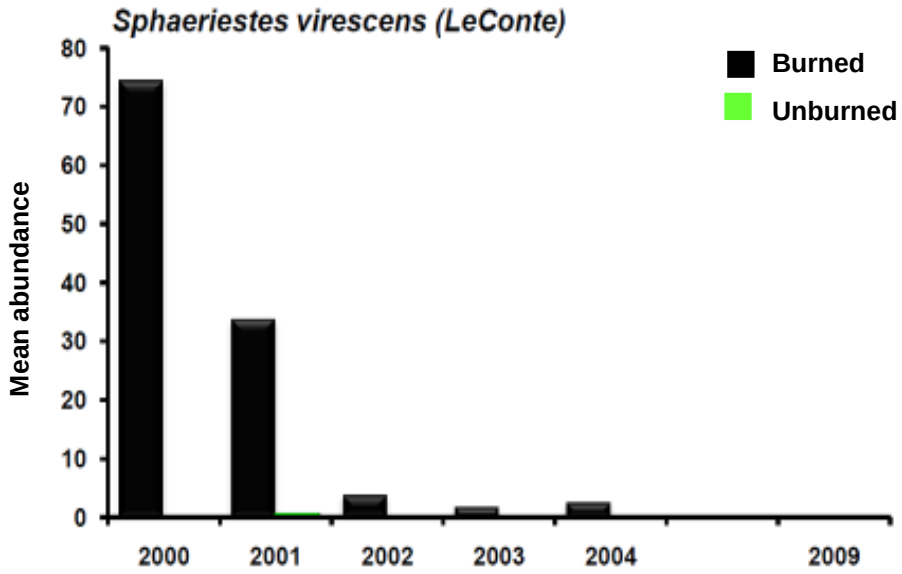
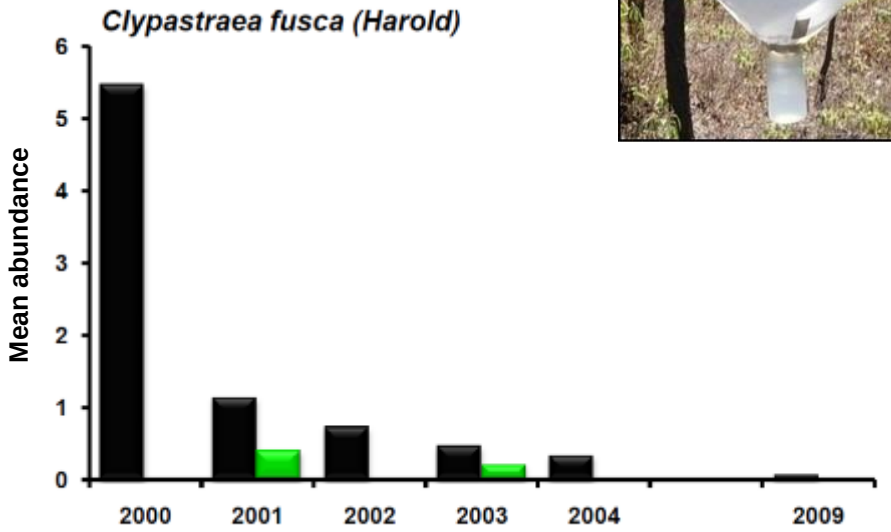
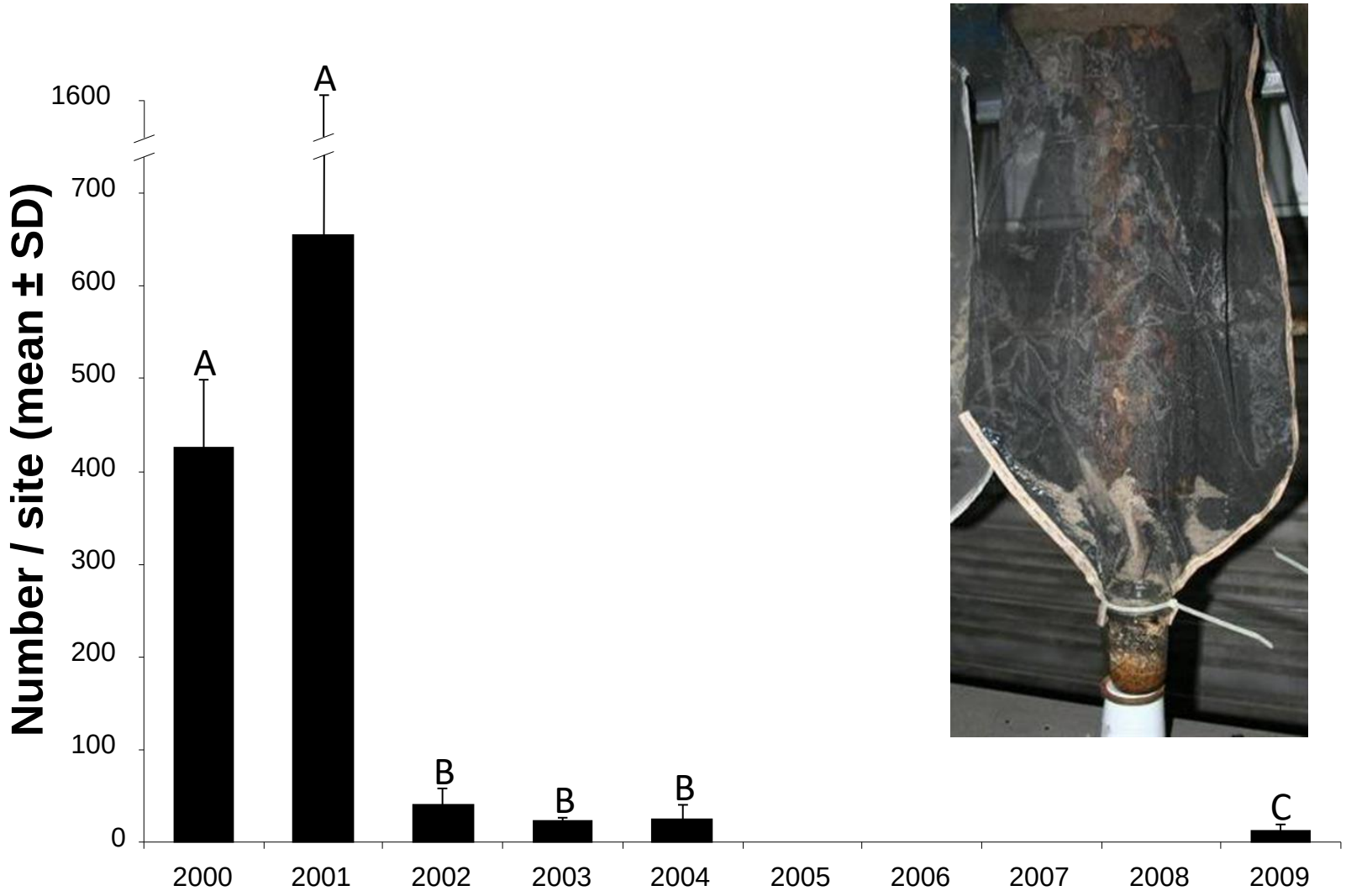
Post-fire salvage logging: a conservation issue ?

Parc des Grands-Jardins: Twice as many insects and species after fire; population pulses for “pyrophilic species”





Parc des Grands-Jardins: Beetle abundance in snags: 1 – 10 years after wildfire



Post-fire salvage logging: an economic issue

CFS CANADIAN FOREST SERVICE
cfs.nrcan.gc.ca

Branching out

from the Canadian Forest Service ▪ Laurentian Forestry Centre

Number 26
2006

Optimizing salvage harvesting and conserving biodiversity

In today's context of diminishing forest potential, the salvage harvesting of burned timber in boreal forests is becoming a significant method of maintaining lumber supplies for the forestry industry. However, strategies for the salvage harvesting of burned timber must also ensure conservation of biodiversity.

Burned area in the Parc des Grands-Jardins.
Photo: G. Pelletier

Whitespotted sawyer. Photo: J.P. Laplante

Larva. Photo: T. Arcand

Black-backed woodpecker. Photo: Antoine Nappi

Burned forests provide habitats for a large number of wildlife species. For example, black-backed woodpeckers take advantage of the sudden overabundance of insects in the burn debris. However, one of the insects these birds are particularly fond of, the whitespotted sawyer, is a cause of concern for the forest industry. Favourite targets of whitespotted sawyers are large, slightly burned trees with high commercial value. Since the damage to the wood caused by the larvae can greatly reduce the economic value of the trees after a year or two, it is important to quickly salvage burned timber.

Using studies of successive series of insects found after fires have occurred in the black spruce forests of the Parc des Grands-Jardins[1], Canadian Forest Service researchers have drawn up guidelines for a salvage harvesting procedure that would help reduce losses attributable to whitespotted sawyers and conserve biodiversity:

1) In the year after the fire, salvage harvesting of burned timber should be focused first on lightly burned stands of trees of large diameter that are easy to access, i.e. on stands that are not only the most profitable, but also the most vulnerable to attack by sawyers.

1 The Parc des Grands-Jardins is located in the Charlevoix Region, east of Quebec City. In the early summer of 1999, a fire destroyed nearly 51 km² of black spruce forest.

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2) Stands that are difficult to access (e.g. road system not developed) and therefore costly to salvage, should be dedicated to the conservation of biodiversity.

3) Timber from stands of large-diameter trees that are severely burned should be salvaged in the second year since these trees are much less affected by wood-eating insects.

4) Salvage harvesting of timber from stands of small-diameter trees (either lightly or severely burned) does not appear problematic for the moment since they are of little interest to the industry. These stands also support epigaeic insect fauna similar to that in stands of large diameter trees, which gives them value in terms of biodiversity conservation.

Entry (right) and exit (left) holes.
Photo: C. Germain

This research work, originally intended to expand our knowledge of the wildlife that colonizes burned forests and the conditions required to promote this colonization, is also being used in applications essential to sustainable forest management. The research findings are being used to improve practices and put forward salvage harvesting solutions that reconcile socio-economic and ecological interests.

Whitespotted sawyers are relentless borers

Whitespotted sawyers have a two-year life cycle. The females deposit their eggs in the natural crevices of bark. The grooves dug along the surface of the bark by young larvae in the initial stages of development have little impact on softwood lumber production because the bark is removed in sawmills. However, the larvae start to burrow into the wood in the fall. The following spring, they burrow into the core of the tree, then return to the surface at the end of the summer. These U-shaped burrowings into the heart of the wood cause much more damage because they cannot be removed in sawmill operations.

Damage under the bark.
Photo: C. Monnier

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PARTENARIAT INNOVATION FORÊT

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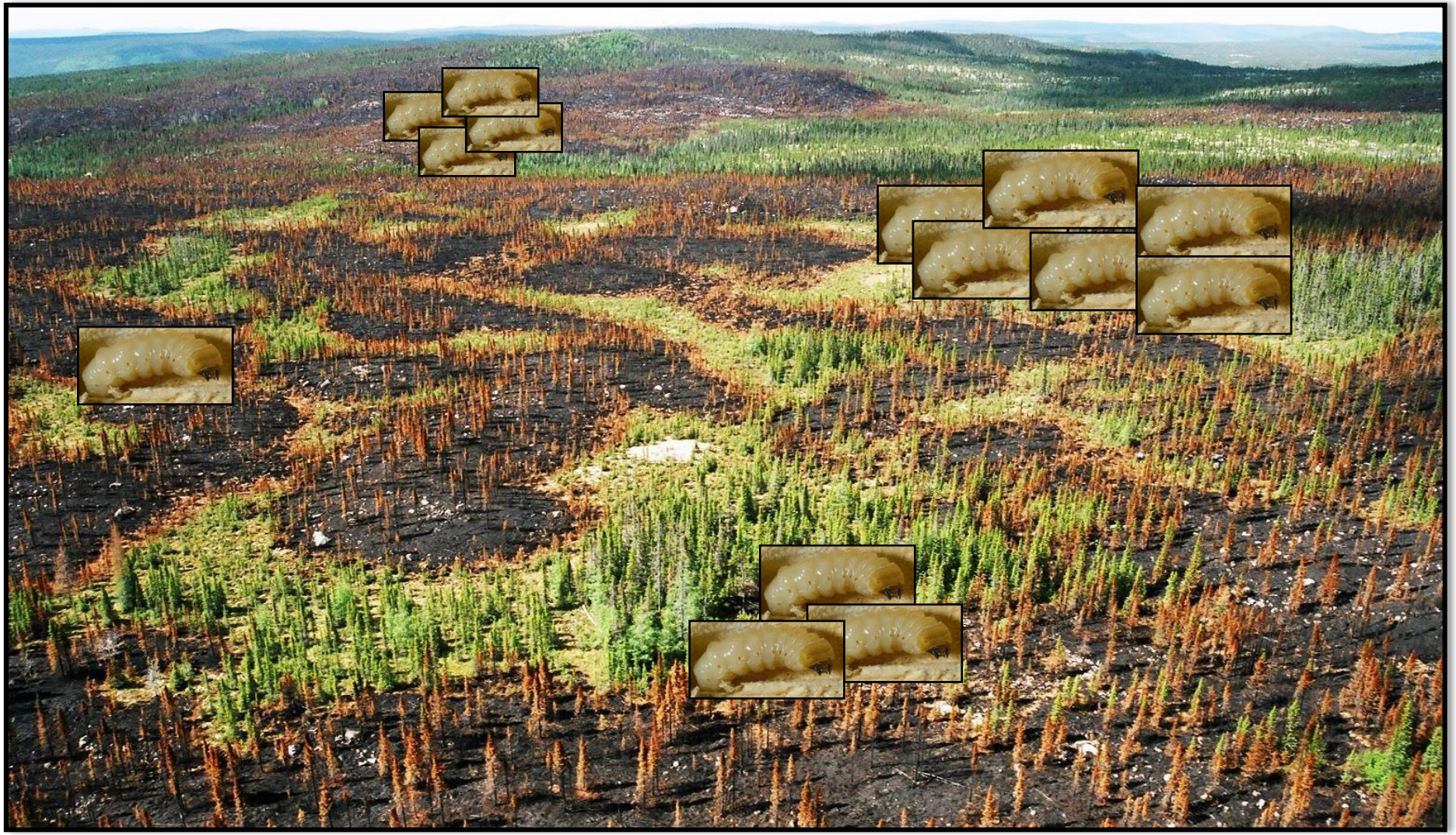
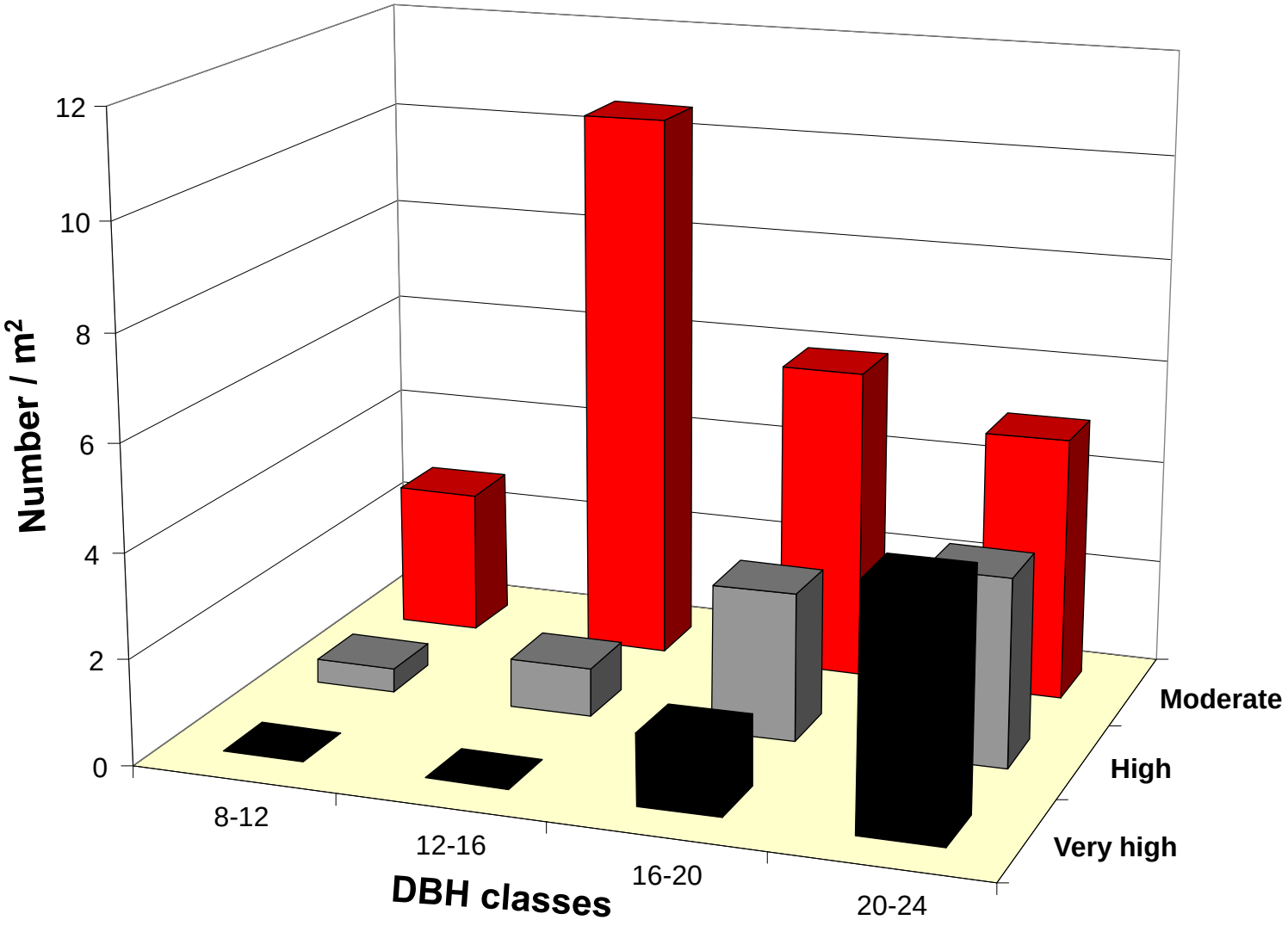
Burn severity: a key attribute for biological legacy

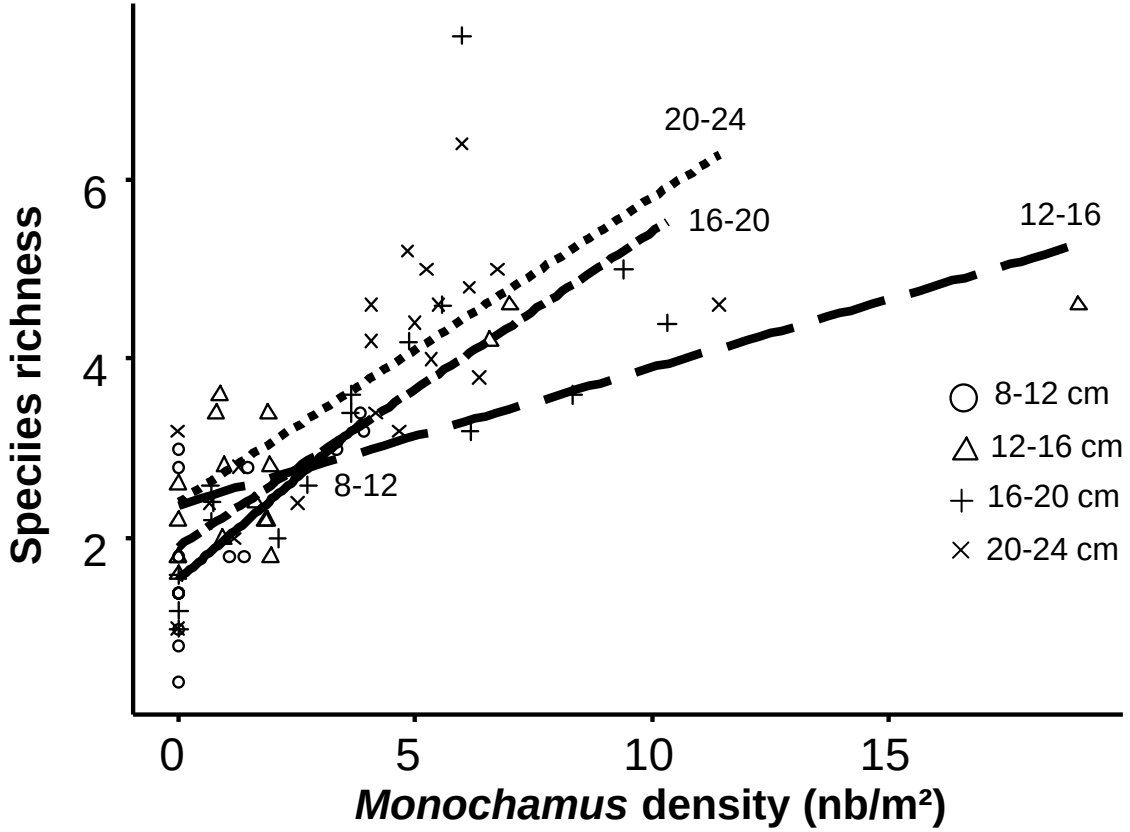


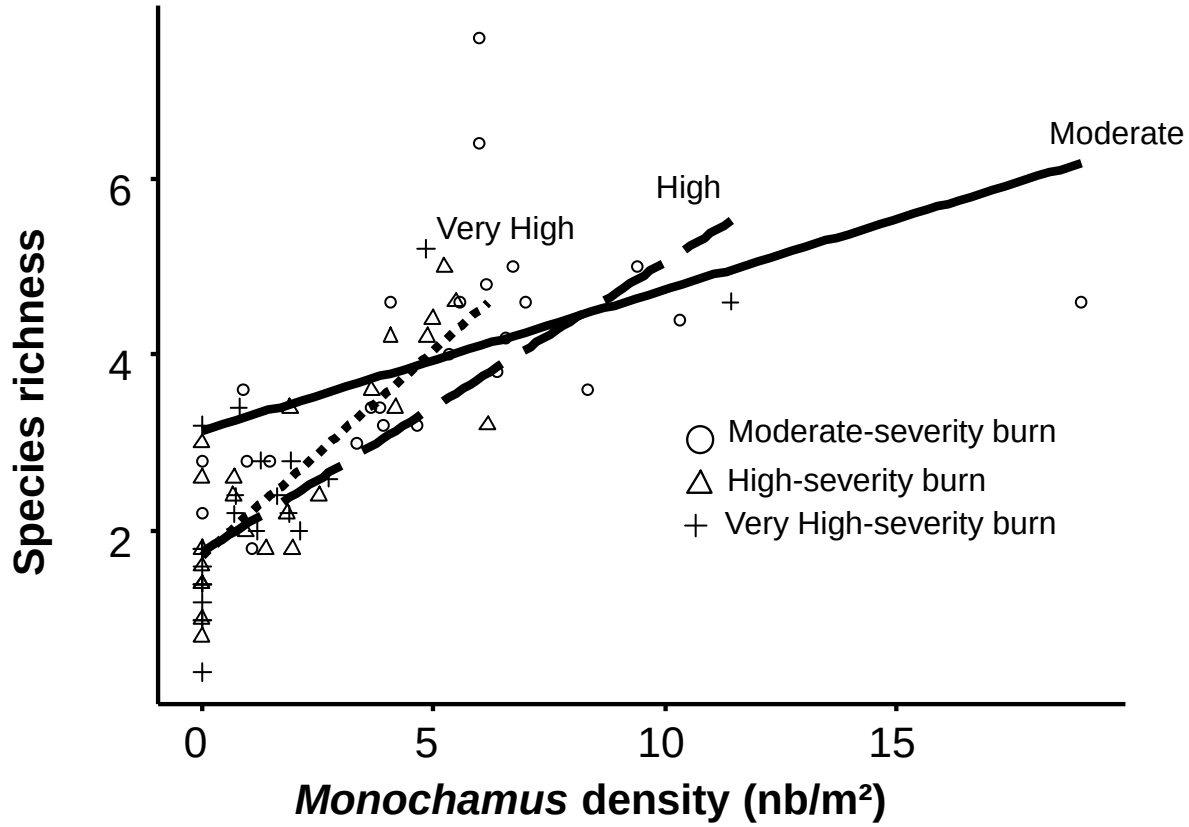
Monochamus scutellatus emerged from Black spruce logs Chibougamau burns 2005



Maximising benefits ($$$) and conserving biodiversity? Yes, it is possible

Avoiding stands severely damaged by *Monochamus* reduces economic losses to industry and maximizes benefits for biodiversity





880

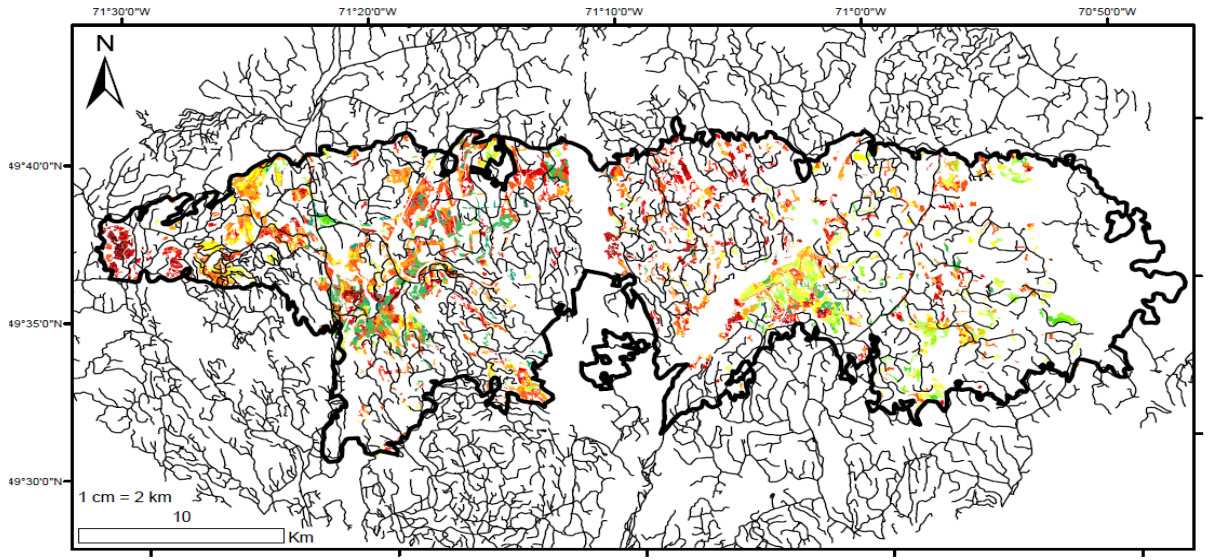
NRC Research Press

ARTICLE

A flexible approach for predicting and mapping postfire wood borer attacks in black spruce and jack pine forests using the differenced normalized burn ratio (dNBR)[1]

Jonathan Boucher, Christian Hébert, and Eric Bauce

Probabilité de dommage par le longicorne noir dans le feu 395 selon une approche par peuplement

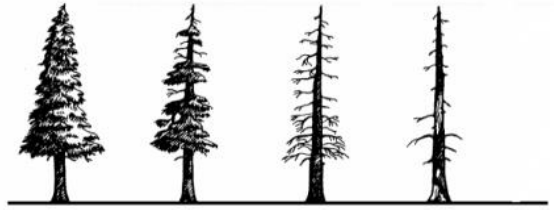


Auteur : Anne Cotton-Gagnon Date : 10 septembre 2020

Learnings from Eastern Canada – Fibre degradation

1. Characterization of dead and sound wood – Black spruce

- Barrette, J.; Pothier, D.; Auty, D.; Achim, A.; Duchesne, I.; Gélinas, N. 2012. **Lumber recovery and value of dead and sound black spruce trees grown in the North Shore region of Québec.** Ann. For. Sci. 69:603-615.
- Barrette, J.; Pothier, D.; Duchesne, I. 2015. **Lumber and wood chips properties of dead and sound black spruce trees grown in the boreal forest of Canada.** Forestry 88(1):108-120.



Tree degradation classes according to Hunter (1990)

2. Literature review on the dynamics of dead tree degradation

- Barrette, J.; Thiffault, E.; Saint-Pierre, F.; Wetzel, S.; Duchesne, I.; Krigstin, S. 2015. **Dynamics of dead tree degradation and shelf-life following natural disturbances: can salvaged trees from boreal forests "fuel" the forestry and bioenergy sectors?** Forestry 88:275-290.

Shelf-life of dead trees following natural disturbances in Canada: 1-2 yrs for lumber; 3-4 y for pulp; then ***bioenergy***…

- The most suitable time to salvage trees for the production of **lumber** in stands **killed by either spruce budworm or fire** is generally limited to 1–2 years after death.
- For the production of **pulp and paper**, trees can usually be salvaged for as long as the wood moisture content remains above the fibre saturation point, but usually is not recommended after 3 or 4 years following death. Past this period, salvaged trees may yield better opportunities for the bioenergy sector.

Barrette, J.; Thiffault, E.; Saint-Pierre, F.; Wetzel, S.; Duchesne, I.; Krigstin, S. 2015. Forestry 88:275-290. doi:10.1093/forestry/cpv007.

Lumber & wood chip quality of *dead** trees

**from isolated mortality events (no wildfire)*

Forestry An International Journal of Forest Research

Institute of Chartered Foresters

Forestry 2015; **88**, 108–120, doi:10.1093/forestry/cpu033
Advance Access publication 18 September 2014

Lumber and wood chips properties of dead and sound black spruce trees grown in the boreal forest of Canada

Julie Barrette[1]*, David Pothier[2] and Isabelle Duchesne[3]

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[2]*Laval University, 2405 rue de la Terrasse, QC, Canada G1V 0A6*
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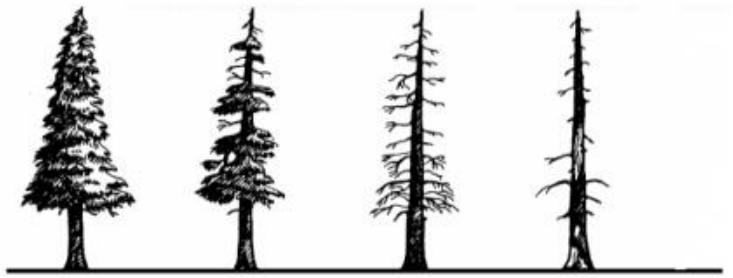


Hunter 1&2 (Living) Hunter 3 Hunter 4 (Dead)

Tree degradation classes according to Hunter (1990)

Dead trees* had significantly lower lumber stiffness and strength than living trees

Lumber stiffness (MOE)

Lumber strength (MOR)

2 x 4

- **Lumber was still good for structural applications**
- Wood chips from dead trees had lower moisture content

**from isolated mortality events*

Barrette, J.; Pothier, D.; Duchesne, I. 2015. Forestry 88(1):108-120. doi:10.1093/forestry/cpu033.

Canada

Ongoing CFS research – Assessing lumber quality and value of fire-killed trees

1. Evaluate the effect of burn severity on **lumber volume recovery, lumber visual grades (NLGA), and lumber economic value** through time (up to 2-3 years after tree death)

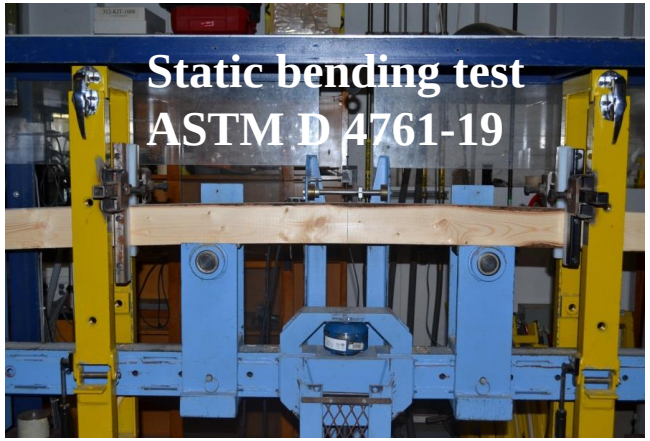
2. Evaluate the effect of burn severity on **lumber mechanical properties** (modulus of elasticity (MOE), modulus de rupture (MOR), densité, humidité etc.

Is lumber quality affected by burn severity?

Is fire-killed wood more brittle? Is tree size important?

		Burn severity				
Year 0 – 2023	**(n = 120)**	**Unburned**	**Low**	**Moderate**	**High**	**Very High**
DBH Group	**DBH range (cm)**	**Living trees (control)**	**Live-Heated trees**	**Scorched trees**	**Charred trees (partly)**	**Charred trees (entirely)**
1	9.1 – 13	6	6	6	6	6
2	13.1 – 17	6	6	6	6	6
3	17.1 – 21	6	6	6	6	6
4	21.1 – 25	6	6	6	6	6
Total		**24**	**24**	**24**	**24**	**24**
Year 1 - 2024	**(n = 96)**					
1	9.1 – 13	-	6	6	6	6
2	13.1 – 17	-	6	6	6	6
3	17.1 – 21	-	6	6	6	6
4	21.1 – 25	-	6	6	6	6
Total		**0**	**24**	**24**	**24**	**24**
Year 2 - 2025	**(n = 96)**					
1	9.1 – 13	-	6	6	6	6
2	13.1 – 17	-	6	6	6	6
3	17.1 – 21	-	6	6	6	6
4	21.1 – 25	-	6	6	6	6
Total		**0**	**24**	**24**	**24**	**24**

Study Approach – Assessment of lumber product quality and value of SBW- (2022) and **fire**-killed trees (2023-24-25)



NRCan - Office of Energy Research and Development

Assessing quantity, quality, and reliability of biomass from salvage harvesting for the Canadian bioeconomy

Burned trees vs Value for bioenergy

BIO-Phase 2023

Tree : ENX (X-260)

-Unique No of tree

Log : ENX-LogX (1-5)

-0.5-1m, 1.5-2m, 4.5-5m, 7.5-8m & 10.5-11m

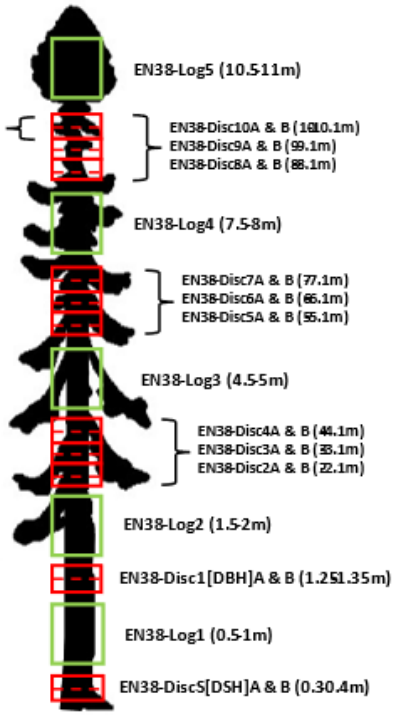
50 cm Log

Disc : ENX-DiscX (S,1-X & A and B)

-DSH (0.3-0.4m), around DBH (1.25-1.35), 2-2.1 & up to 7.7cm in diameter

5 cm Disc B
5 cm Disc A

General diagram example for EN38



		Burn severity				
Year 0 Fall 2023	**(n = 60)**	**Unburned**	**Low**	**Moderate**	**High**	**Very High**
DBH Classes	Diameter min-max (cm)	Living trees (control)	Live-Heated trees	Scorched trees	Charred trees (partly)	Charred trees (entirely)
1	9.1 – 13	3	3	3	3	3
2	13.1 – 17	3	3	3	3	3
3	17.1 – 21	3	3	3	3	3
4	21.1 – 25	3	3	3	3	3
Total		**12**	**12**	**12**	**12**	**12**
Year 1 Fall 2024	**(n = 48)**					
1	9.1 – 13	-	3	3	3	3
2	13.1 – 17	-	3	3	3	3
3	17.1 – 21	-	3	3	3	3
4	21.1 – 25	-	3	3	3	3
Total		**0**	**12**	**12**	**12**	**12**
Year 2 Fall 2025	**(n = 48)**					
1	9.1 – 13	-	3	3	3	3
2	13.1 – 17	-	3	3	3	3
3	17.1 – 21	-	3	3	3	3
4	21.1 – 25	-	3	3	3	3
Total		**0**	**12**	**12**	**12**	**12**
Year 3 Fall 2026	**(n = 32)**					
1	9.1 – 13	-	3	3	3	3
2	13.1 – 17	-	3	3	3	3
3	17.1 – 21	-	3	3	3	3
4	21.1 – 25	-	3	3	3	3
Total		**0**	**12**	**12**	**12**	**12**
Year 4 Fall 2027	**(n = 32)**					
1	9.1 – 13	-	3	3	3	3
2	13.1 – 17	-	3	3	3	3
3	17.1 – 21	-	3	3	3	3
4	21.1 – 25	-	3	3	3	3
Total		**0**	**12**	**12**	**12**	**12**

What are the impacts of fire severity and associated disturbances on salvaged biomass quality? 5-year OERD project will answer some of the questions!

- 1. Evaluate the impact of disturbance characteristics on biomass chemical, mechanical, and physical wood properties.
- 2. Evaluate the impact of disturbance characteristics on solid biofuels, liquid biofuels and biomaterials quality.
- 3. Evaluate the impact of biomass characteristics on solid biofuels, liquid biofuels and biomaterials quality.
- 4. Evaluate the impact of chemical and physical wood properties on solid biofuels, liquid biofuels and biomaterials quality.