Biomass potential from Canadian forests in the context of climate change

IEA Bioenergy T43 and Université Laval Workshop: Wildfire Resilience and Biomass Supply

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Fibre Supply

Forestry team manager with over 15 years of experience in biomass supply chain modelling and quality improvement practices. Participated in multiple business de-risking projects for large-scale biomass investments.

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Our Company at a Glance

Not-for-profit R&D world leader that specializes in creating scientific solutions to support the Canadian forest sector's competitiveness in the global marketplace.

Know-how
Since 1918

Employees
400

Funding
$68 million

Location
Canada

Members
93

Our Sectors and Industry Challenges

Innovation Centers of Excellence (ICE)

- **Forest Operations** ⟶
- Pulp and Paper
- Wood Products
- Bio-Sourced Products

Fibre costs and value

Fibre supply

Workforce

Sustainability, Safety and Carbon impact

The climate is changing and FPI is here to support the Canadian forest sector develop Resilient Fibre Supply strategies

Canadian forests

Prevention strategies, what to expect from salvage operations and how can the sector recover the most value from forest to ensure a sustainable environment

FIRESMART

Community fireproofing experience

SALVAGE OPS

Expectations for logging productivity impacts and maintenance costs increases

BIOMASS AVAILABILITY

Biomass availability from FireSmart + burnt forests

GOING FORWARD

What to expect from FPI research in the coming years to build resilient supply chains


FIRESMART

FireSmart

Forest Management and Wildfire Risk Reduction

- Canada has experienced devastating losses resulting from wildfires
- How can we protect communities, watersheds, infrastructure and timber?
- How can we reduce the threat of catastrophic loss?

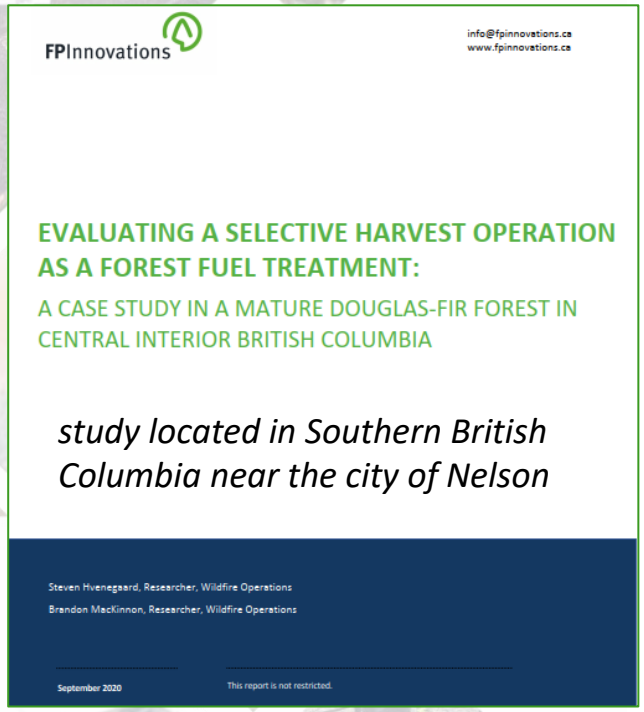
FPI Wildfire team - Data collection on experimental fires on fuel management

- Pre- and post-treatment fuel inventory
  - ✓ Stand characterization
  - ✓ Surface fuel loading
- Fire behaviour characteristics
  - ✓ Rate of spread
  - ✓ Fire intensity
- Fire effects
  - ✓ Fuel consumption
  - ✓ Stand mortality

From FireSmart Canada website - https://firesmartcanada.ca/

FireSmart

Forest Management and Wildfire Risk Reduction



Landscape level fuel break – Selective harvest

- Reduced wildfire intensity at the landscape level
- Improved wildfire detection
  - ✓ Quicker detection in less dense forest stands
- More efficient and safer suppression operations
  - ✓ Reduced fire intensity in treatment area permits suppression under higher hazard
  - ✓ Less dense forest stands allows for better situational awareness and easier movement through forest
  - ✓ Airtanker effectiveness – better retardant penetration through reduced canopy
- Maintained visual aesthetics
- Preserved ecological benefits

- **Wildfire risk reduction research**
  - Exploring innovative debris management techniques to increase secondary fibre utilization + better understanding of fire behaviour

FireSmart

Forest Management and Wildfire Risk Reduction

- **Selective harvest - Wildfire risk reduction research**
  - Gross cruised volume in 29 ha plot (330 m^3/ha)
  - Total harvest volume – 144 m^3/ha (43% removal)

Species	Merchantable volume, m	Planned removal, %
Douglas-fir	3,198	40
western red cedar < 47.5 cm DBH	2,481	90
western red cedar > 47.5 cm DBH	309	75
western hemlock	933	90
grand fir/ subalpine fir	221	90
western larch	1,085	40
deciduous, western white pine, lodgepole pine	234	25

- **Outcomes**
  - The post-harvest stand inventory indicated a favorable retention of species that were more drought- and fire-resistant + a reduction in diseased or dead stems

FireSmart

Economics of various FireSmart treatments

Pile & Burn

Treatment	Costs ($/ha)		Reference
	Min	Max	
Piling	400	800	Baxter 2010
Piling and burning	475	875	Baxter 2010
Burning roadside debris piles		150	Baxter 2010
Manual piling and burning	1350	2100	Harris 2014
Manual slash, pile, and burn		5000	Gray 2011b

Thinning & spacing

Treatment	Costs ($/ha)		Reference
	Min	Max	
Thinning and spacing with log recovery		4500	Gray 2011b
Thinning and spacing with log recovery		3000	Bulley 1999
Thinning and spacing with log recovery	1900	2200	Phillips 2004
Brush cutting (small mulcher)	665	950	Harris 2014
Brush cutting (large mulcher)	1365	1560	Harris 2014
Thinning (excavator)	1500	1800	Harris 2014
Thinning (feller buncher)	1700	2450	Harris 2014
Brush cutting – single and double pass	600	1000	FPInnovations 2014
Inter-tree spacing (mixed vs spruce stands)	1100	1300	FPInnovations 2014

Slash distribution

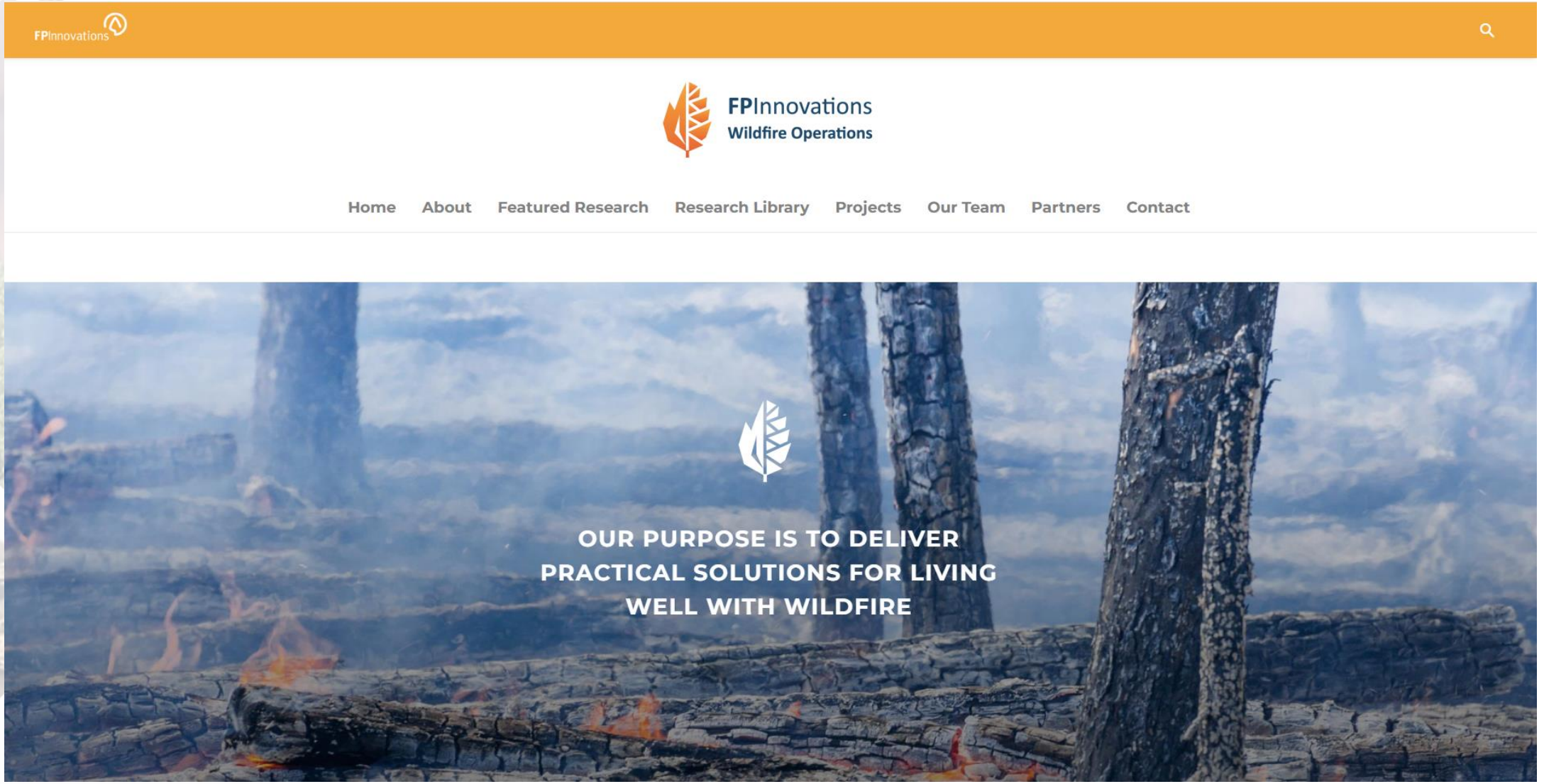
Treatment	Costs ($/ha)		Reference
	Min	Max	
Debris (slash) spreading	250	450	Baxter 2010 Harris 2014

Slash recovery

Treatment*	Costs ($/ha)**		Reference
	Min	Max	
Integrated slash recovery	125	150	Volpé and Desrochers 2011
Non-integrated slash recovery	340	380	Volpé and Desrochers 2011

https://wildfire.fpinnovations.ca

Open access to research documents



SALVAGE OPS

Salvaging burnt wood

What to expect - PRODUCTIVITY

- **"Estimated" impacts on productivity (%) and costs ($/m³) observed**

  A comparative study was carried out to determine the impact of fire severity on the productivity of a cut-to-length harvesting operation

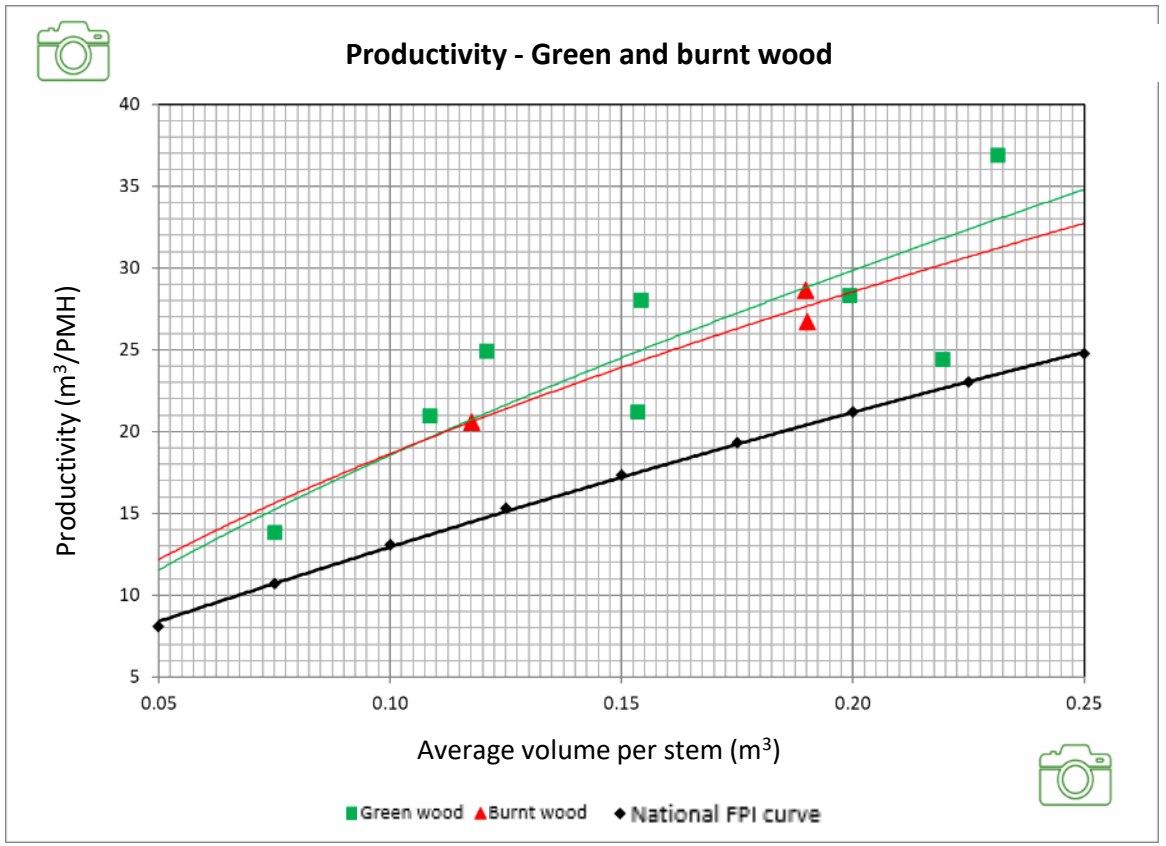
@ 0.100 m³/tige
=> No difference

@ 0.150 m³/tige
↓ 2.4 %

↑ 0.20 $/m³

@ 0.200 m³/tige
↓ 4.4 %

↑ 0.31 $/m³



Travel distances were greater in burnt wood, but felling and processing stems were quicker

Salvaging burnt wood

What to expect – FIBRE UTILIZATION

- **Lower merchantable wood recovery**

  - Burnt wood requires **50% more** cuts off the butt to achieve desired quality, and therefore fewer logs are manufactured from burnt stems

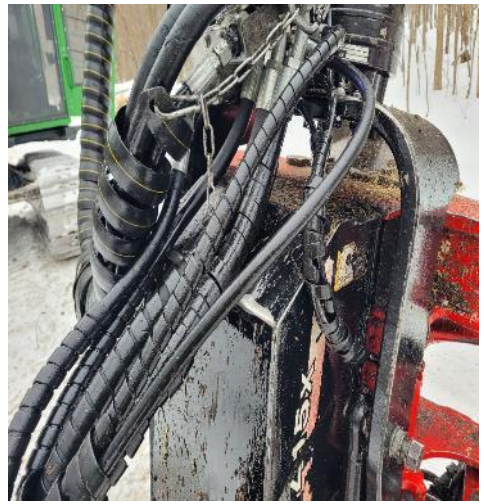
  - The average volume per log is greater in burnt wood, but the number of logs per stem is lower

- **Biomass recovery opportunities…**

Salvaging burnt wood

What to expect - MAINTENANCE

- **Lubricants & Hydraulics**
  - Affected: Bushings, Bearings and Pins
  - To do: Lubrication, Cleaning, Maintenance



- **Filters**
  - Expect significant increase in replacement

- **Electronics**
  - Airborne carbon particles from harvesting burned wood, is conductive
  - Sticks to rubber and plastic connectors and wires
  - Can disrupt sensitive electronics

Salvaging burnt wood

What to expect – Health & Safety

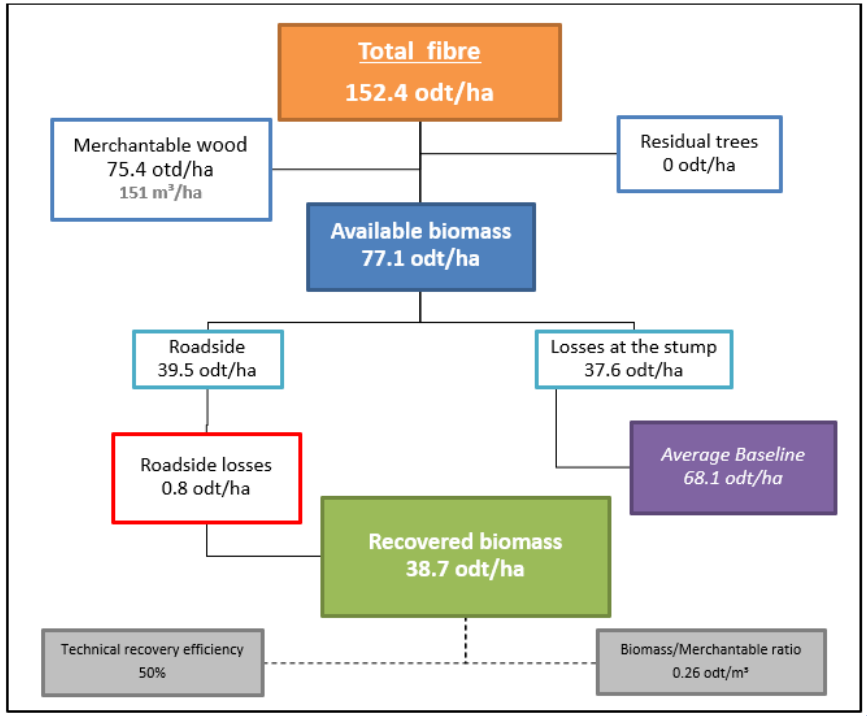
- **Carbon Dust**
- **Possible cabin heat in summer**
  - Awareness
  - Cleanliness
  - Maintenance

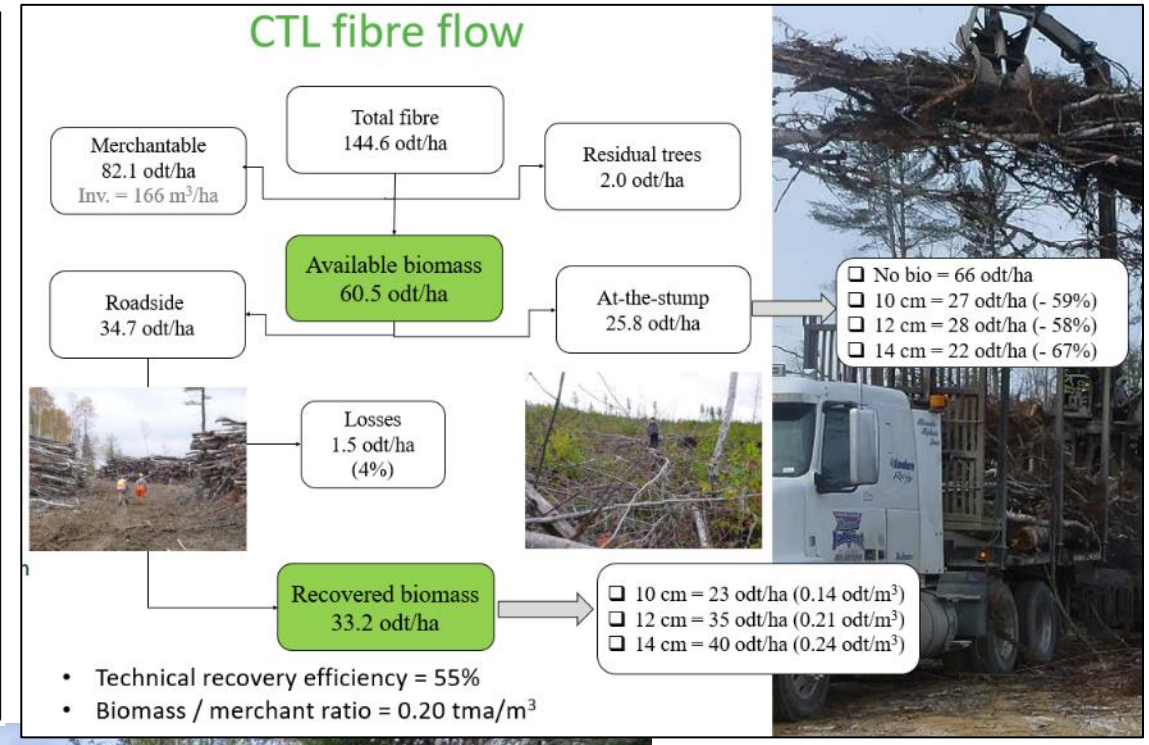
BIOMASS AVAILABILITY

Biomass availability

Forest biomass potential

Typical biomass flows



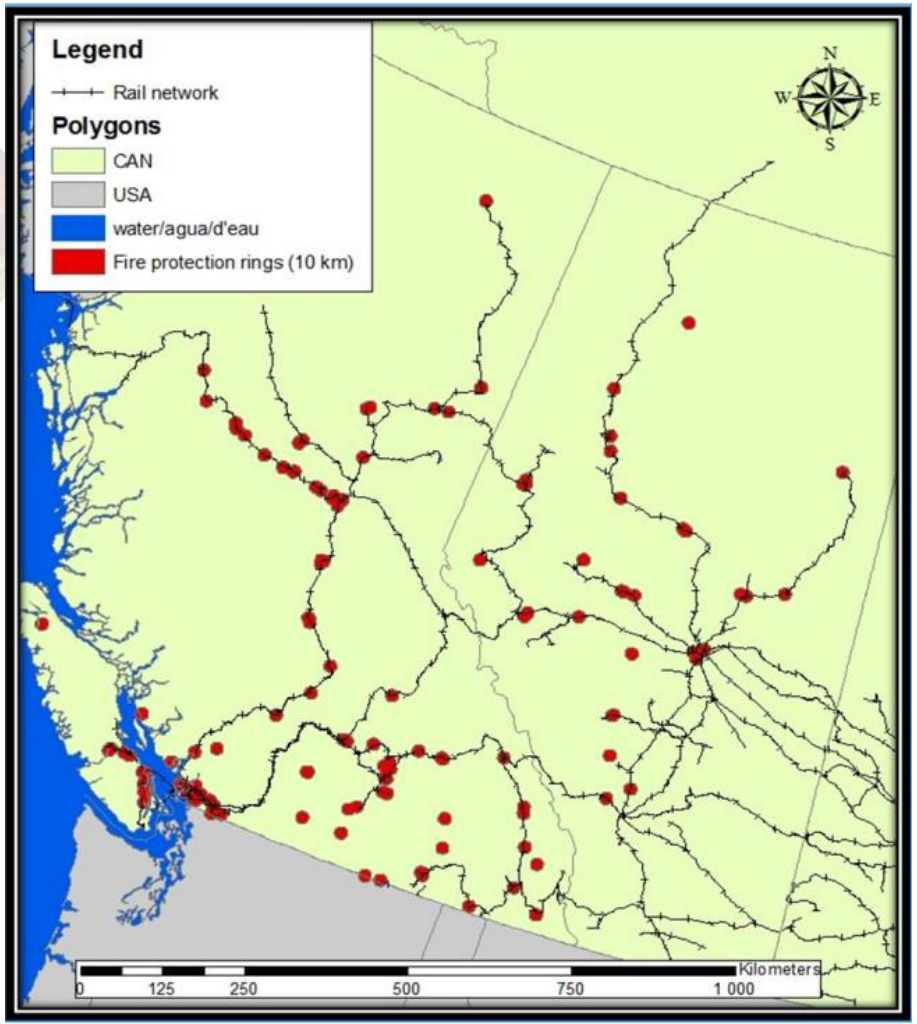


Biomass availability

Potential for biomass recovery from FireSmart treatments

- **for British Columbia and Alberta**

  Fire protection rings (10 km) around forest communities



BC opportunity = 2.5 M odt/yr
AB opportunity = 850k odt/yr

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Potential of FireSmart treatments for fuelling the bioeconomy

Internal Report IR-06-27

June 2014

By:
Sylvain Volpé, Researcher, Forest Feedstocks

Natural Resources Canada

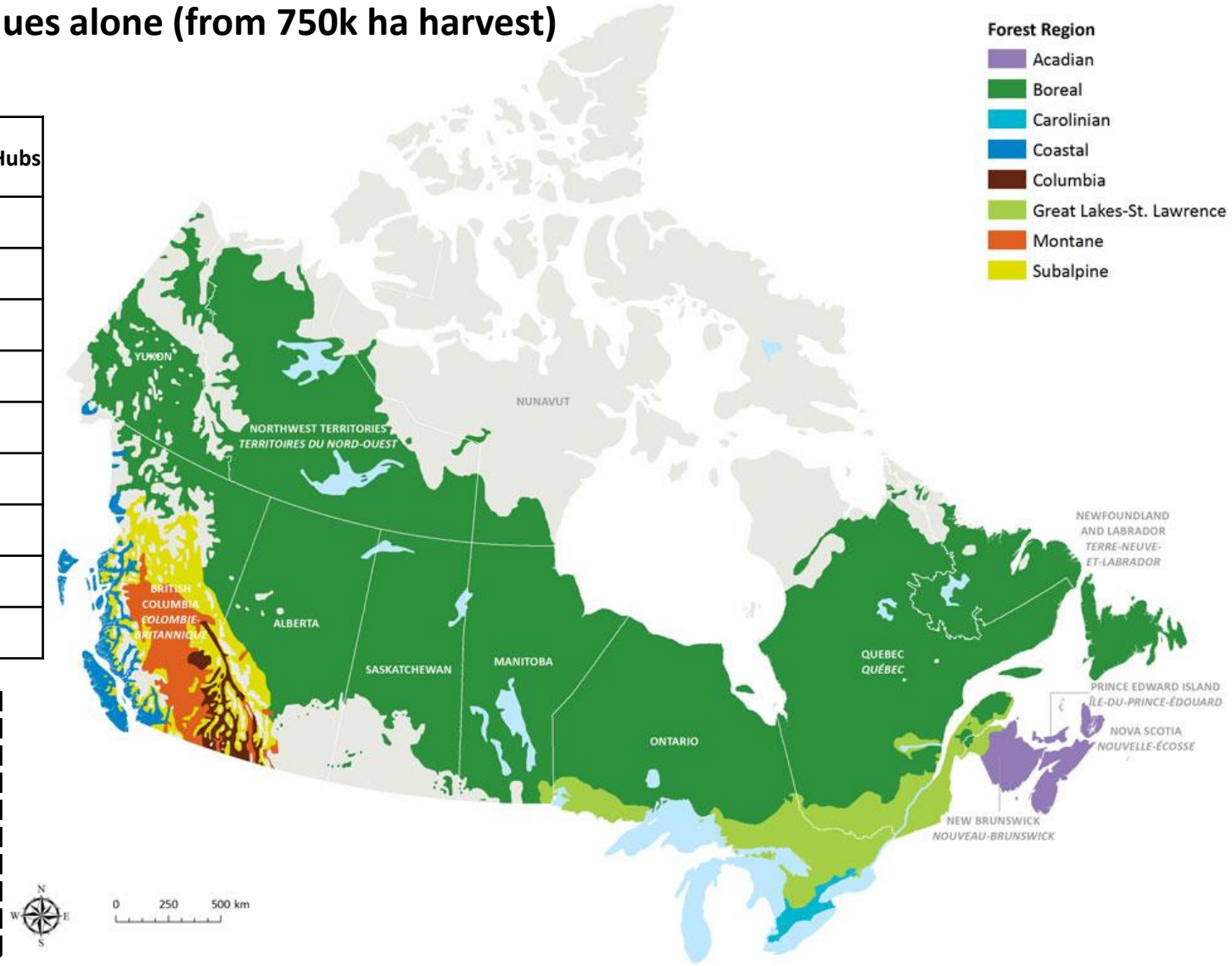
Biomass availability

Potential biomass from regular logging operations

- **17M odt/yr in logging residues alone (from 750k ha harvest)**

Province	Harvest (m3/yr)	Tree size (m3/tree)	Recoverable logging residues		# of Bio Hubs
			odt/m3	odt/yr	
BC Coastal	13 000 000	1,000	0,05	650 000	1
BC Interior	38 000 000	0,400	0,11	4 180 000	7
Alberta	25 000 000	0,300	0,12	3 000 000	5
Saskatchewan	4 000 000	0,200	0,15	600 000	1
Manitoba	1 000 000	0,200	0,15	150 000	0
Ontario	14 000 000	0,200	0,15	2 100 000	4
Quebec	29 000 000	0,200	0,15	4 350 000	7
Atlantic	14 000 000	0,200	0,15	2 100 000	4
Total	**138 000 000**	**0,349**		**17 130 000**	**29**

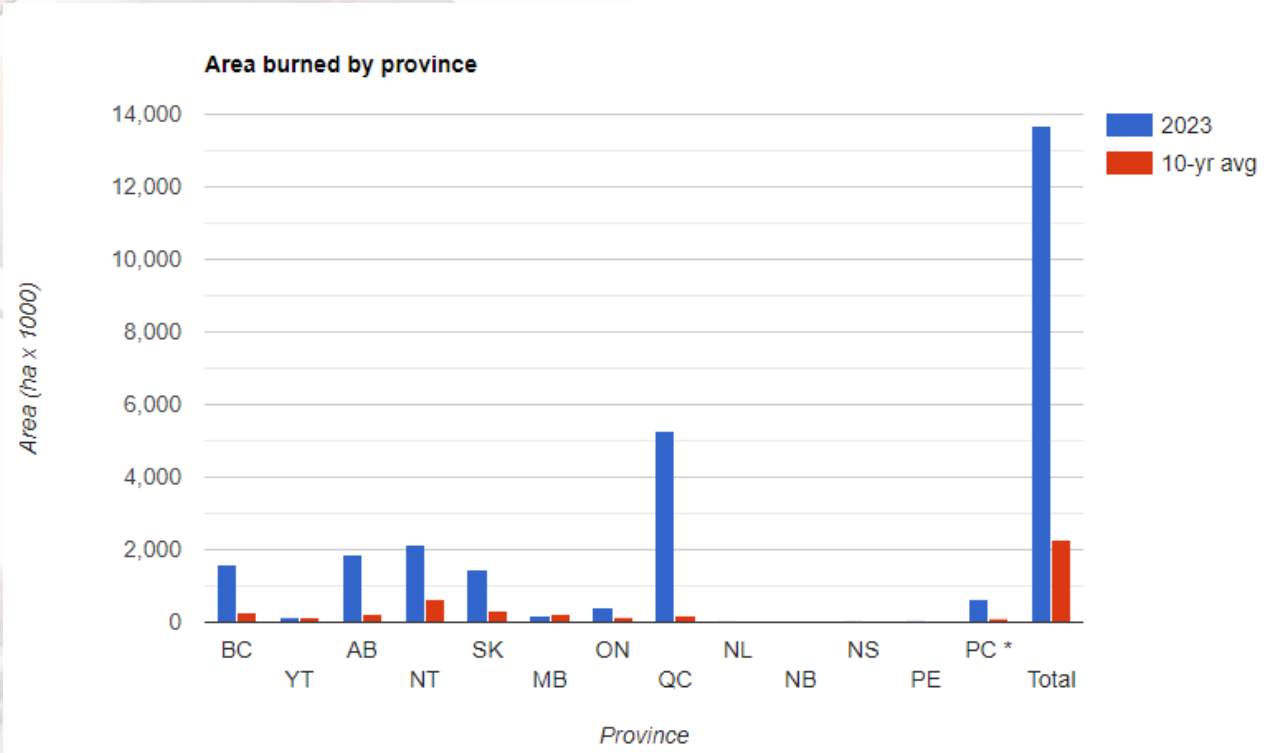
Canada has a potential to host 29 BioHubs to meet the needs of large emitters looking to decarbonize their operations (Oil & Gas, Steel, Mining) by 2030!

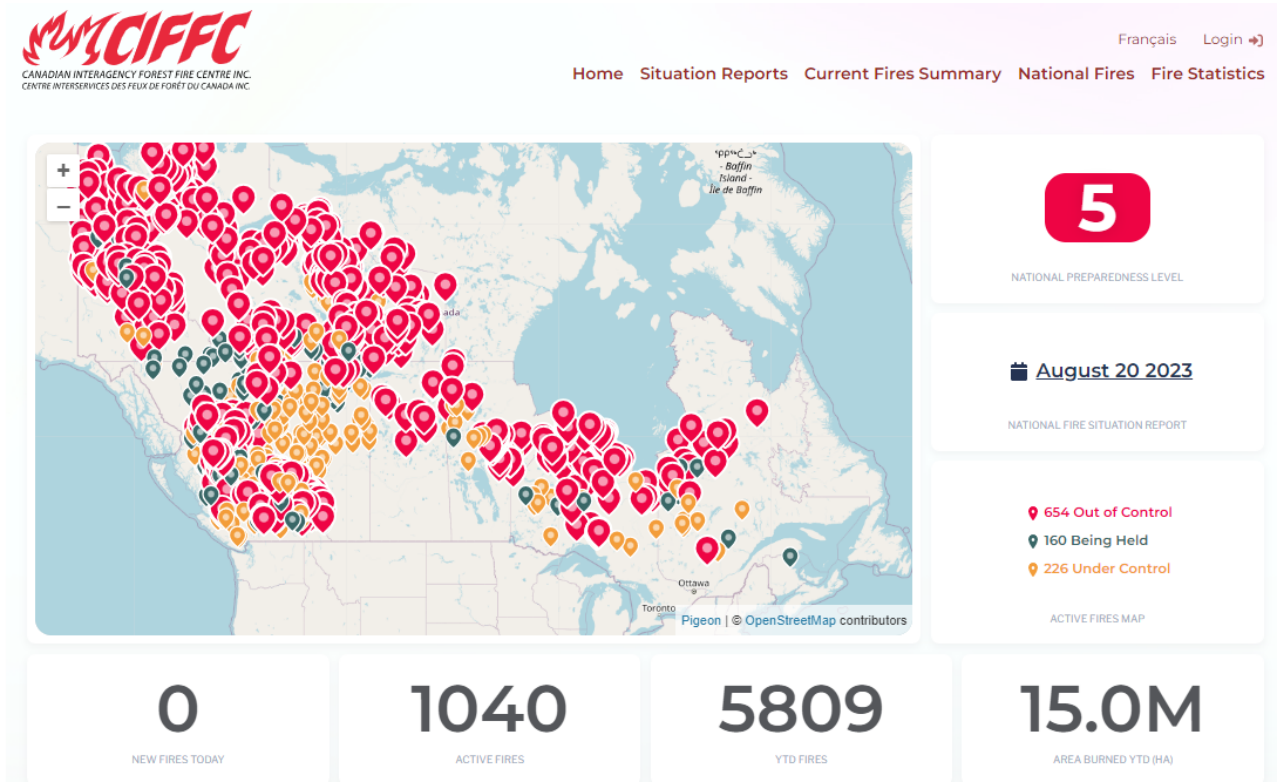


Biomass availability

Potential for biomass recovery from FireSmart treatments

- **Record breaking season in 2023**
  - Wildfire season began early and continuing late
  - 7.5 x the 15-year average for hectares burnt





Biomass availability

Potential for biomass recovery from FireSmart treatments

- **Long term forecast**
  - Larger more unwieldy fires, climate trending towards warmer
  - Greater frequency of fires, wider geographic area of impact
  - Number of wildfires in Canada projected to double by 2050 - Gov of Canada

- **Potential at national stage…**
  - Economical volumes to assess…
  - How many ha/yr of FireSmart…




GOING FORWARD

FPI Research Information Sharing and Feedback (RISF)

Webinar, Aug 24 (200 participants)

- **Needs from Industry and Government**
  - Wildfire research with most benefit
    - ✓ Protection of forests
    - ✓ Fuel treatments to reduce hazards
  - Harvesting productivity in fire damaged stands
    - ✓ Leverage harvester/processor head data to better understand impact on productivity
  - Processing fire damaged logs (maximize value at sawmill)
    - ✓ Optimal debarker setup
    - ✓ Moisture sorting for dry wood
  - Challenges of using burnt wood for pulping
    - ✓ Loss in fibre length and strength

Burnt wood recovery

Project ideas

- **Use of standardized data and burn pattern classification**
  - Harvesting history of green stands
  - Standardized, georeferenced data
  - Productivity studies with long-term follow-ups

Burn severity classification	
Low Severity	 
Moderate Low Severity	 
Moderate High Severity	 
High Severity	 

Resilient Fibre Supply

Canada Gov Priorities

- **Increase wildfire resilience efforts**
- **Promote sustainable biomass utilization**

Objectives of IEA Bioenergy T43

- **Wildfire Resilience and Biomass Supply**
  - Explore policies and projects aimed at increasing community resilience to wildfires while utilizing biomass for energy or other bioproducts, thereby reducing greenhouse gas emissions
  - Provide insights and knowledge from best practices and case studies that can inform policy development
    - ✓ Call for proposals : Wildfire Resilient Futures Initiative in late fall/early winter
  - Examine the financial viability of utilizing recovered fibre to generate bioenergy/bioproducts, offsetting costs associated with wildfire mitigation and restoration

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QUESTIONS?

Contact
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Merci / Thank you

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