Wood Solutions for NetZero Preparedness

Centre for Research & Innovation in the Bio-Economy

Our Vision & Mission

CRIBE will develop and promote a sustainable, socially responsible, and profitable forest bio-economy in Ontario.

Our Scope

Ontario-focused,
Forest-based,
Next-generation.

CRIBE is...

A kick-starter of innovation

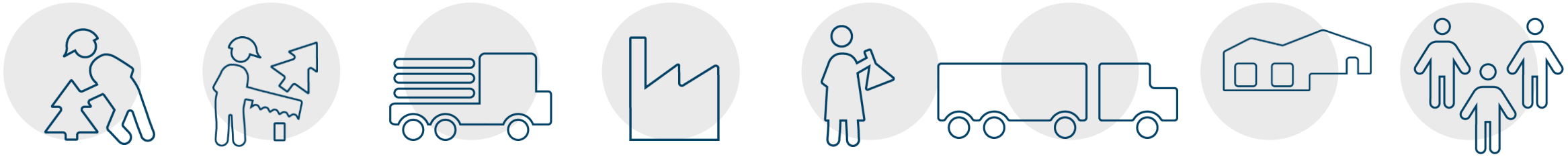
For every $1 invested in innovation programming, CRIBE leverages $4 of private sector investment.

A facilitator

We know and bring together the actors in the modern bio-economy, helping hundreds of companies and research institutes to partner, innovate and commercialize.

An enabler and accelerator

We fund innovative research and commercialization projects that bring the fore resources from Northern Ontario to innovative industries in Southern Ontario through collaboration network.



We support innovation and collaboration across value chains

to commercialize forest-based, made-in-Ontario solutions

$160M
Total Supported Project Value

38
Projects Funded to Date

32
Forums Held

24
Case Studies Launched

300+
Participating Organizations

5
Indivi

CRIBE Initiatives
2023

Funding Support
Innovation Challenges

Through our funding challenges, CRIBE facilitates the deployment of first-in-kind, commercial-ready forest-based technologies and products.

$160M
Total Supported Project Value

38
Projects Funded to Date

Nextfor
Our Collaboration Network

Nextfor is Canada's only industry-led collaboration network. Nextfor supports investment and growth through open collaboration and information sharing across value chains.

32
Forums Held

24
Case Studies Launched

300+
Participating Organizations

500+
Individuals Engaged

Nordic Colab

We have strong relationships with Nordic innovation agencies and companies and are actively working on inbound and outbound investment opportunities.

Our International Collaborative Partners

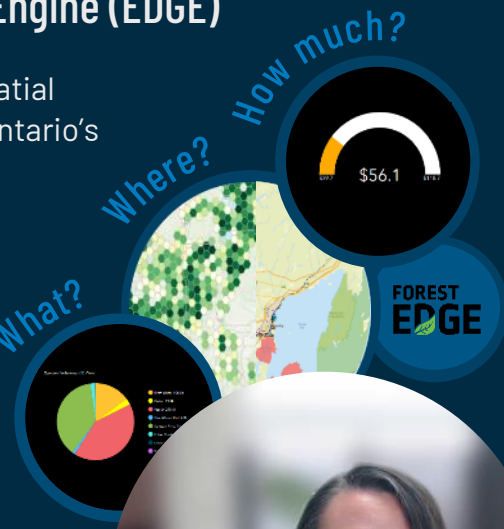
KTH Vetenskap och Konst
Region Värmland
Sting Bioeconomy
VTT
LignoCity
Karlstads Universitet
Paper Province
Business Sweden
RI.SE

Forest Economic Development Geospatial Engine (EDGE)

The ForestEDGE is a first-in-kind, free set of geo-spatial tools that allow interested parties to map and cost Ontario's forest resources, supporting investment attraction.

We developed the ForestEDGE to help potential proponents answer the questions: what type of forest fibre is available, where is it available, how much is available and at what cost.

Our geo-spatial tools place forestry data at your fingertips.



Use Cases

Potential Investor or Technology Provider
Uses Forest EDGE as a pre-feasibility site selection tool.

Regional Economic Development Officer
Uses Forest EDGE to identify regional opportunities within the forest bio-economy.

Our Collaboration Network

nextfor

Industry leaders working together to accelerate new technologies & products for Ontario's Forest Bio-Economy.

Learn more at nextfor.ca

- CRIBE operated Ontario forest-based **innovation network**
- Industry led system of open **collaboration forums**
- Open **information & communication sharing** platform
- **Funding challenges** to support market realization

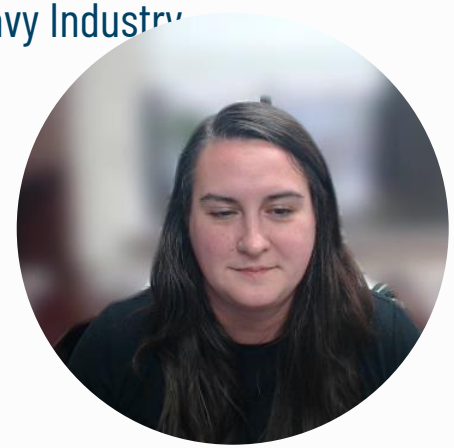
Nextfor Focus Areas

Forest Innovation

Lignin

Biocomposites

Biocarbon for Heavy Industry



We help industry partner, innovate, and commercialize.

Meet the Network

Highlight of active Nextfor participants

nextfor

Biocarbon for Heavy Industry

Supporting Ontario's Heavy Industry and their net zero goals.

ALGOMA STEEL INC.
STELCO The Steel Company of Canada
walker
mohawk COLLEGE
CARMEUSE
CHAR technologies
ArcelorMittal

Composites and Biomaterials

Identifying and developing low-carbon solutions for everyday products.

CPK INTERIOR PRODUCTS
HALIBURTON FOREST BIOCHAR
Western
in cooperation with Fraunhofer
WOODBRIDGE
Ckdpack.com Global Packaging & Logistics

Forest Innovation

Enabling the advancement of Ontario's Primary Forest Industry.

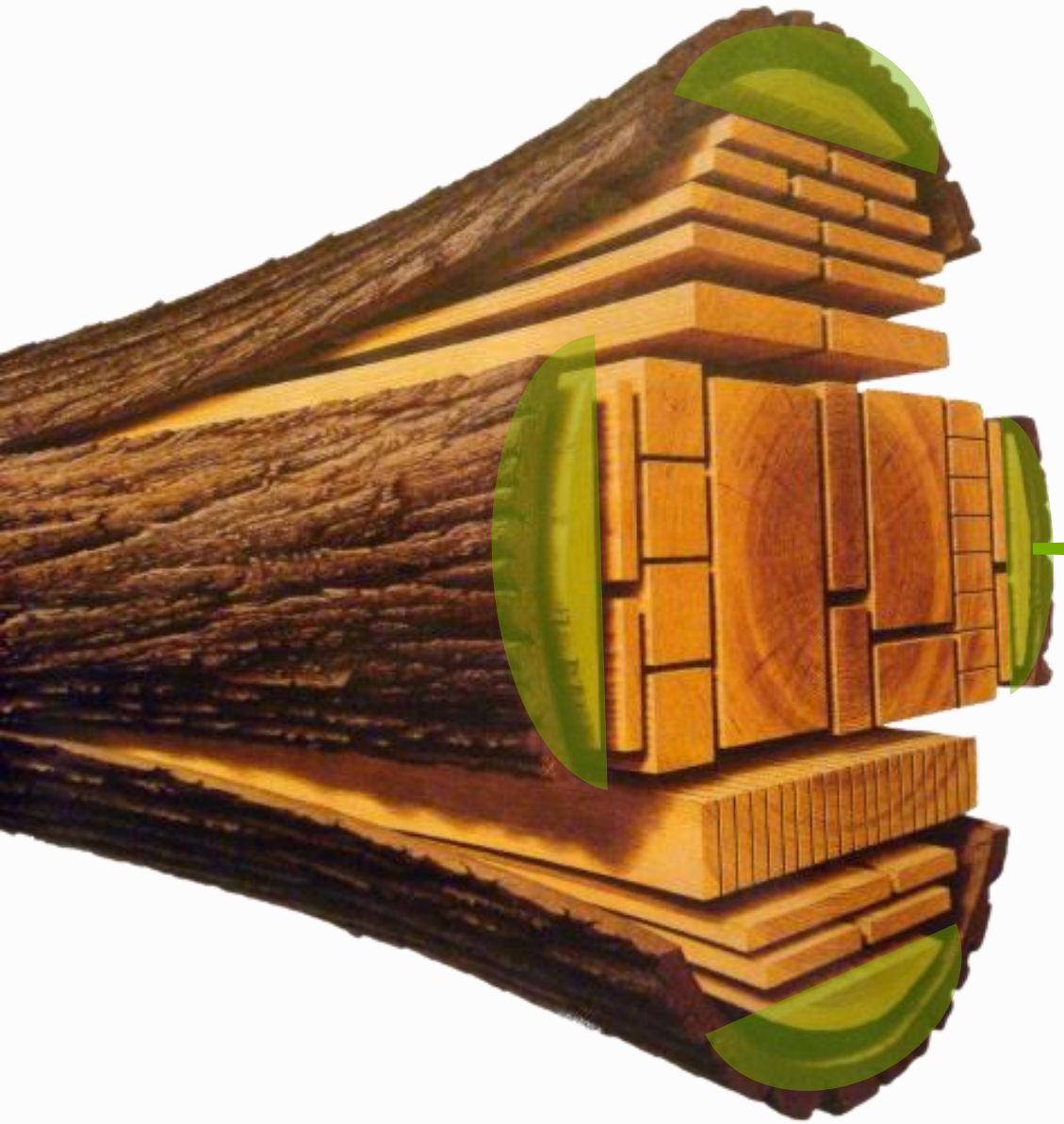
FPAC.ca APFC.ca
resolute Forest Products
wood WORKS! A Canadian Wood Council Program
FPInnovations
columbia FOREST PRODUCTS
FIRST RESOURCE MANAGEMENT GROUP
FORSITE Forest Management Specialists

High Performance Lignin

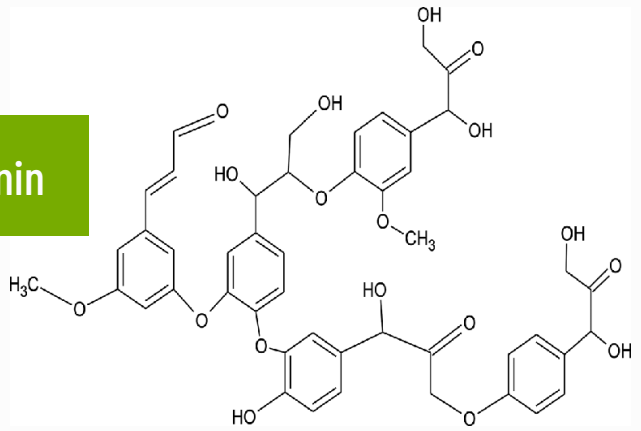
Bringing sustainable, lignin-based fossil fuel alternatives to market.

West Fraser
Lakehead UNIVERSITY
MICHIGAN STATE UNIVERSITY

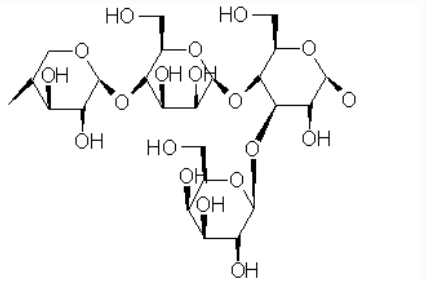
Extracting Whole-Tree Value from Ontario's Forest Resource



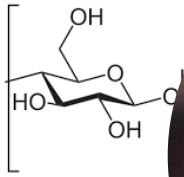
15-25% Lignin

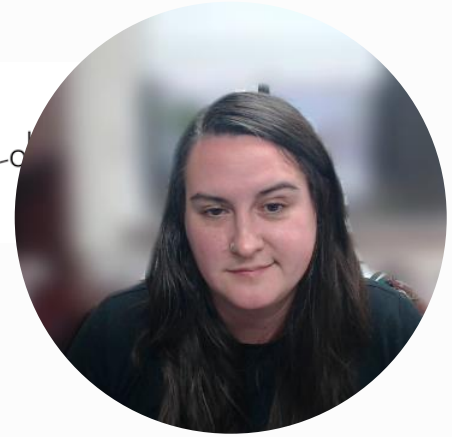


23-32% Hemicellulose



38-50% Cellulose





CRIBE Investments in Low-Carbon, Forest-Based Materials

Ontario's Opportunity

Photo taken from: https://elementfive.co/a-mass-timber-solution-for-rapid-affordable-housing/

The Forest EDGE

What does this have to do with GIS?

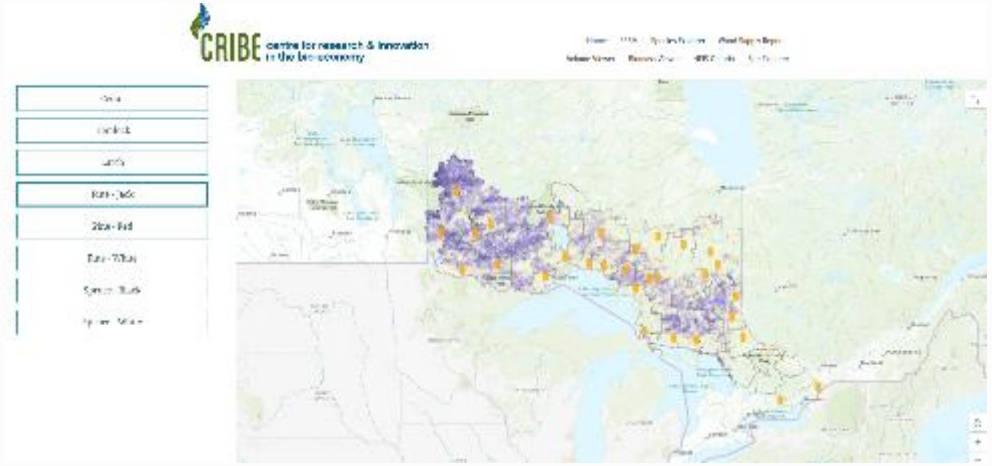
- We are an innovation accelerator for commercialization of new forest biomass-based products, we've become successful in this space because of our GIS tools
- On our **Forest EDGE** platform we also help share and showcase communities to attract investment
- Our pre-screening tool can be used and updated to get communities "on the map"
- First-in-kind geospatial platform free and open to the public to visualize and make open government data for economic development accessible

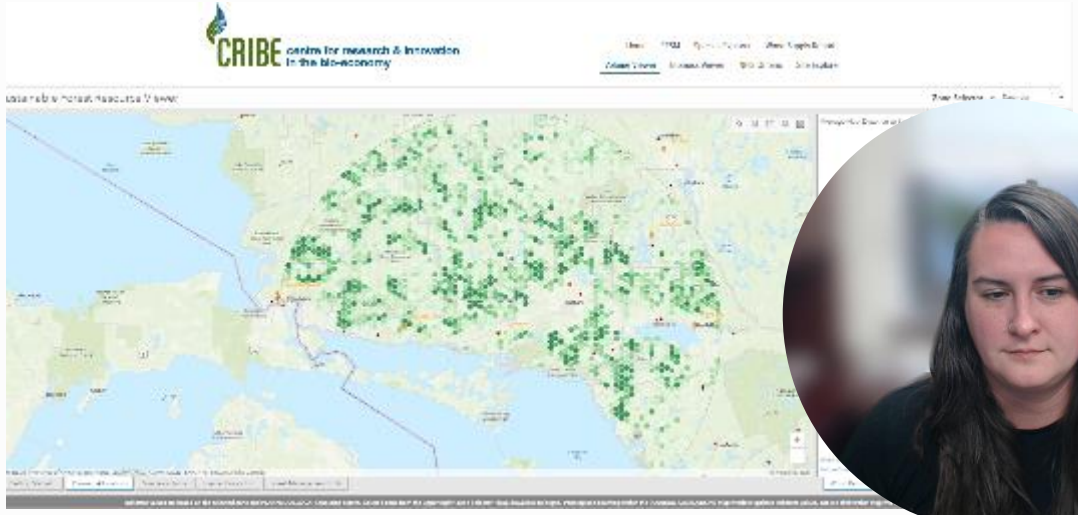
- What's new since last year:
  - Forest Information reference encyclopedia is updated and live for you to learn more about Ontario's most renewable resource the Boreal Forest, as well as how the forest industry in Ontario operates.
  - Site Selection & Municipal Economic Development Tool Beta Version*

The Forest EDGE

How it Started: "What, Where, How much?"

- 2019 Nextfor Innovation Forum topic areas on bioeconomy development and forest innovation led to EFSM Beta pilot project.
- Asked by project proponents, Government, decision makers, industries
- Connect with relevant and reputable decision makers and regional collaborators
- Help support the existing primary forest industry
- **Open, free**, **toolset** to support economic development

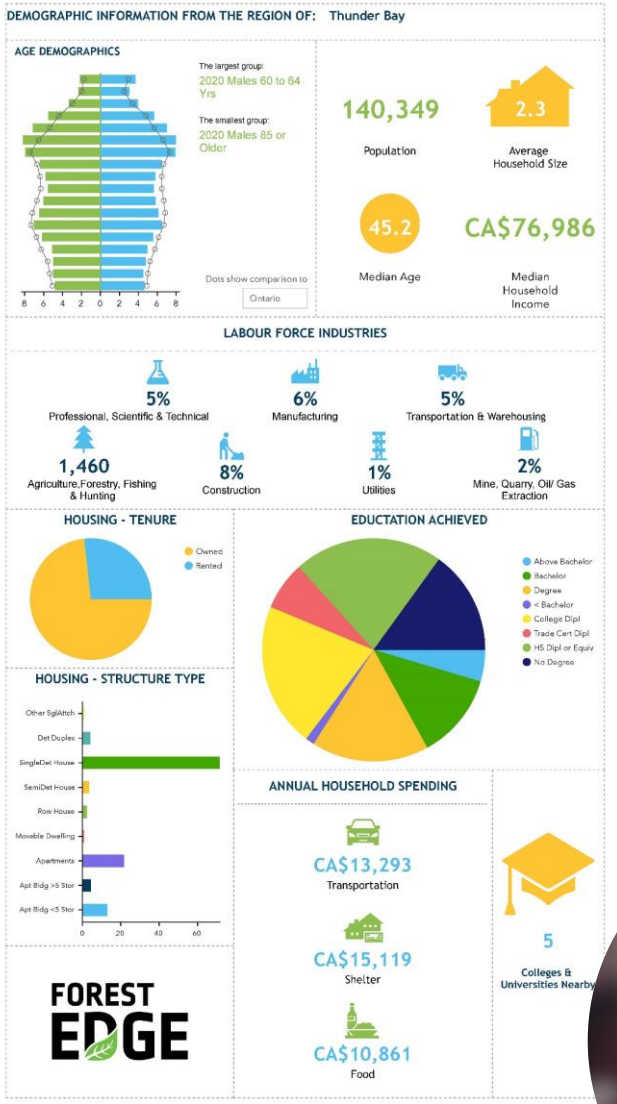


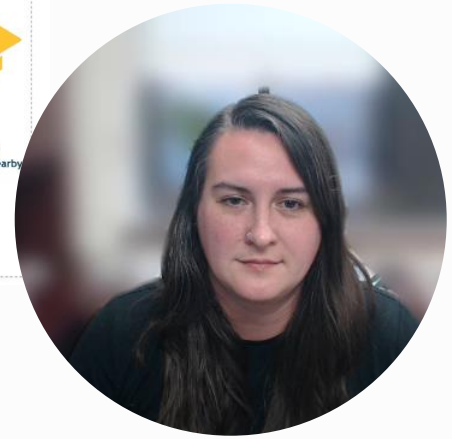


The Forest EDGE

Thunder Bay Regional Case Study

- Nextfor Northwestern Ontario regional working group identified open data gaps for economic development
- Thunder Bay Community Economic Development Corporation (CEDC) identified specific ways to address gaps
- Key guidance on how best to display demographic information and required information for investors
- Collaborated on SUIT Dashboard



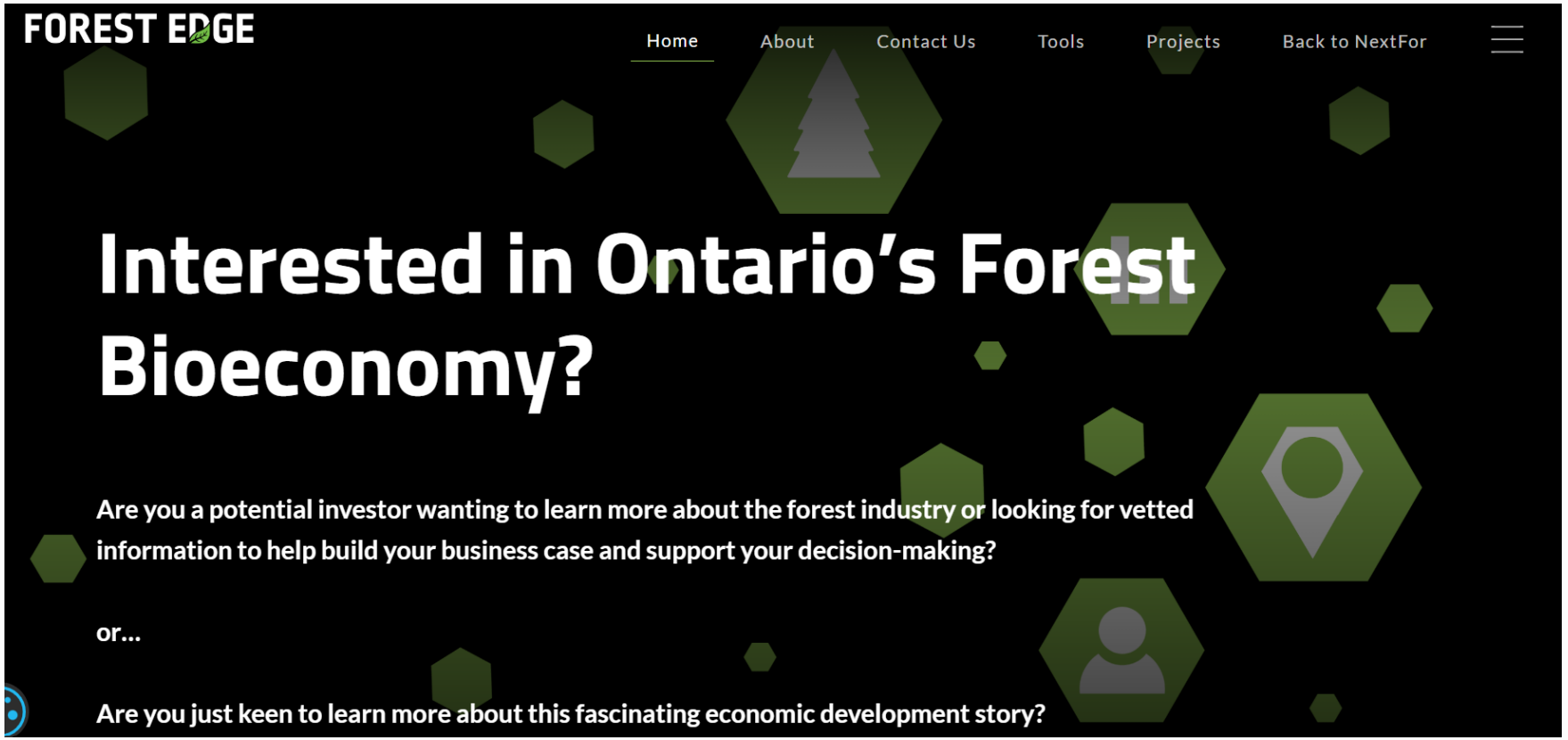


The Forest EDGE

What's New -Walkthrough and Demonstration

www.nextfor-forestedge.ca

Demonstration of relevant toolsets, data, understanding, use cases & current iteration



SUIT - Economic Develop | Sault_Ste_Marie_Infograp | EFSM Experience | ForestEDGE | FIRE_Web_Exp_3.0 | Opportunity Wood | New_Conservation | FIRE | Wood At Work

nextfor-forestedge.ca

New Chrome available

FOREST EDGE

info@cribe.ca +1 (807) 344 1180

Home About Contact Us Tools Projects Back to NextFor

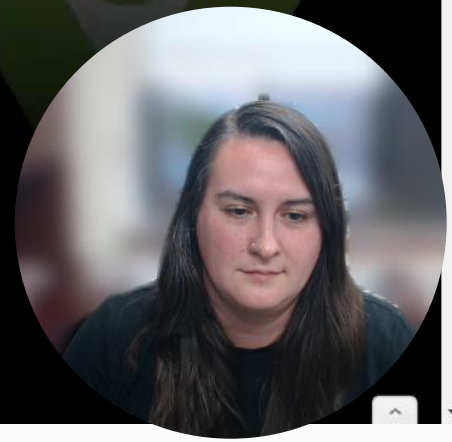
Interested in Ontario's Forest Bioeconomy?

Are you a potential investor wanting to learn more about the forest industry or looking for vetted information to help build your business case and support your decision-making?

or...

Are you just keen to learn more about this fascinating economic development story?

FOREST EDGE HAS WHAT YOU NEED!



The Forest EDGE

What's Next!

How to adapt forest management plans based on forest fire prevention

How to utilize and retrieve burnt wood for bio chemicals & biofuels

Integration of site selection metrics into spacial dashboard

Integration of data from municipalities – in a more seamless process

Data viewer for all new and updated layers for public use and analysis

Stay Engaged and Collaborate with Us!

1. **Access information** by becoming a Nextfor user at www.nextfor.ca/register
2. **Visit the ForestEDGE** to explore data and view forest based opportunities in Ontario www.nextfor-forestedge.ca
3. **Stay tuned** for Nordic Colab, Sustainable Building Solutions, Biocarbon, and Forest Innovation forums
   - **Upcoming Nextfor event – May 2** in Toronto – RSVP at https://nextfor.ca/event/innovation-symposium/
4. **Contact us to talk about collaboration opportunities with ForestEDGE**

   Sarah Bencic, Program & GIS Innovation Coordinator – sarah.bencic@cribe.ca

Financial support from

Canada Ontario

Appendix

Table 1 Product deliveries at mill destinations in Scenario #2

Destination	Product	9 year mean volume delivered/yr	Mean Haul Cost ($/m³)
Manitou Forest Products (Emo)	PWR saw	21,961	$13.20
Nickel Lake Lumber (Fort Frances)	PWR saw	21,961	$10.53
Barwick	PO osb	350,981	$13.97
	BW osb	19,495	
Resolute Sapawe	SPW saw 16'	340,019	$12.77
Resolute Thunder Bay	SPF saw 10'	76,249	$19.79
Resolute Ignace	SPF saw 10'	105,251	$15.70
TOTAL		935,917	

THE OPPORTUNITY WOOD

Based on Scenario #2, the opportunity wood was identified as the volumes of NMV that were unharvested at the end of 9 years, and the waste NMV remaining in harvested blocks (such as SPF pulp or BW biofuel), or the biomass residue (undersize and defect) generated by primary harvest operations. These products remaining in the forest can be categorized into their distance and cost from various destinations and evaluated as potential new entrant opportunities on the forest.

The Forest EDGE

Boundary Waters Modeling

- Extension of baseline modeling completed to update EFSM
  - Detailed operational wood flow and advanced techniques to promote specific available wood fibre
- Helps proponents understand complex interactions in the forest products supply chain and tenure system

FindWood – Analyzing Ontario for Opportunity Wood

Case Study – Forsite Consultants

- Conducted by Forsite Consultants
- FindWood is an analytical approach to quantifying economic development opportunities in Ontario's forests.
- Investigating the entire primary wood products supply chain to evaluate the health of the current supply chain, and where opportunities can co-exist with existing facilities.

The analysis considers:

- The complex interactions of **existing and yet-to-be-built infrastructure**, **spatial wood supply**, **harvest logistics**, and **primary forest consumers**;
- The **existing tenure system**
- **Whether there is competition** for forest products, which have implications on costs and availability, and;
- **The availability of forest raw materials** and the factors that impact their economic and operational accessibility

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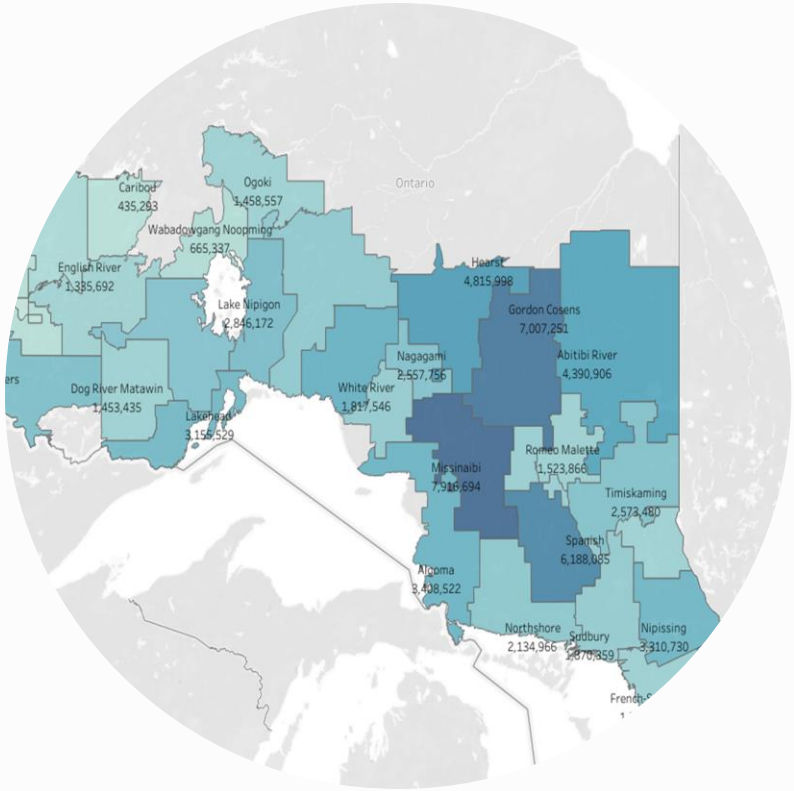
FindWood – Analyzing Ontario for Opportunity Wood

Case Study – Forsite Consultants

- **Opportunity wood is the product of this analytical approach** to analyzing Ontario's forest resource. The analysis seeks to provide reliable estimates of:
  - How much wood is available for economic development?
  - Where is the opportunity wood and how much does it cost?
  - How can we promote economic development activities that create the greatest value while providing mutual benefit to the existing industry?



FindWood – Analyzing Ontario for Opportunity Wood

Case Study – Forsite Consultants

Methodology:

- The analysis is conducted using several sources of data
  - Mill Model, Harvest Block Model, Road Network Model
- FindWood is developed using the Patchworks forest estate model
- In FindWood, the team solves for:
  - What year to harvest a timber block;
  - The destination for each fibre type within each block;
  - The least cost route to each mill destination via Ontario and forest road network.

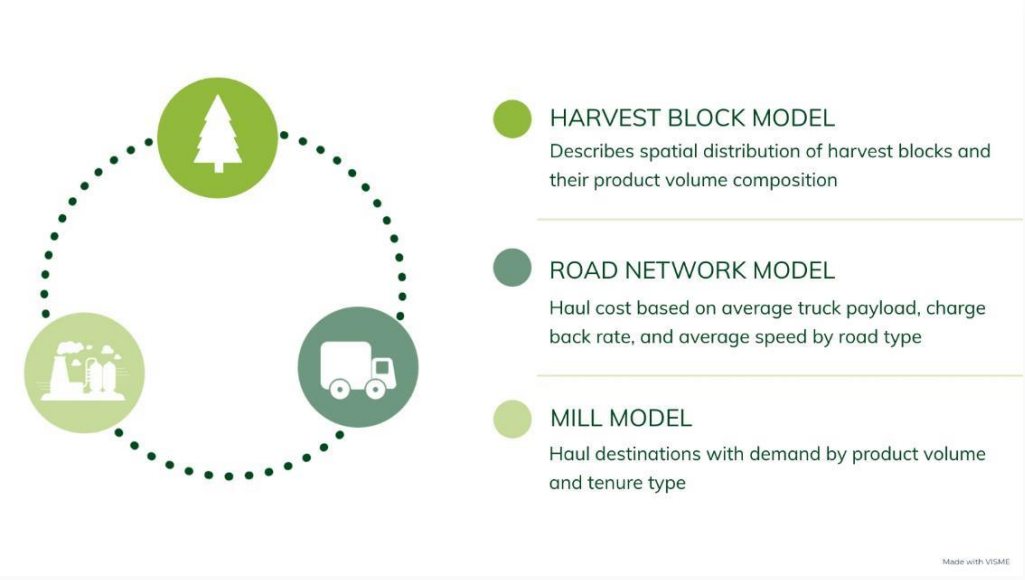


Image from Forsite Consultants

FindWood – Analyzing Ontario for Opportunity Wood

Case Study – Forsite Consultants

Opportunity Wood as an Economic Development Tool

- Simply providing a location and annual demand for forest products, a new scenario can be developed in Patchworks and the **feasibility and supply chain impacts can be quantified.**
- The results will tell the proponent about the feasibility of a facility of a given size, the cost profile of the timber arriving at the location, the crown forests that could supply the volumes and the impact of the new facility on existing mills in the supply chain.

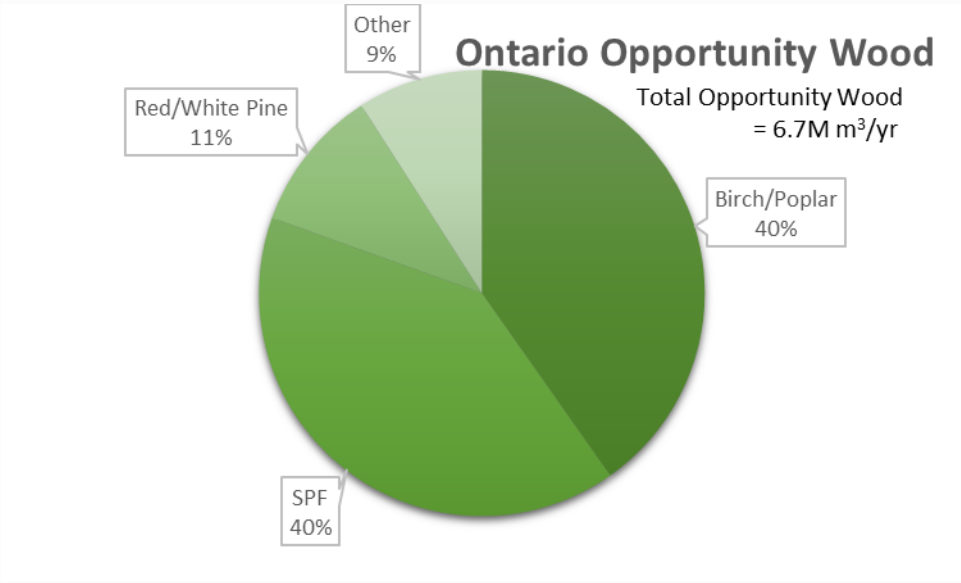
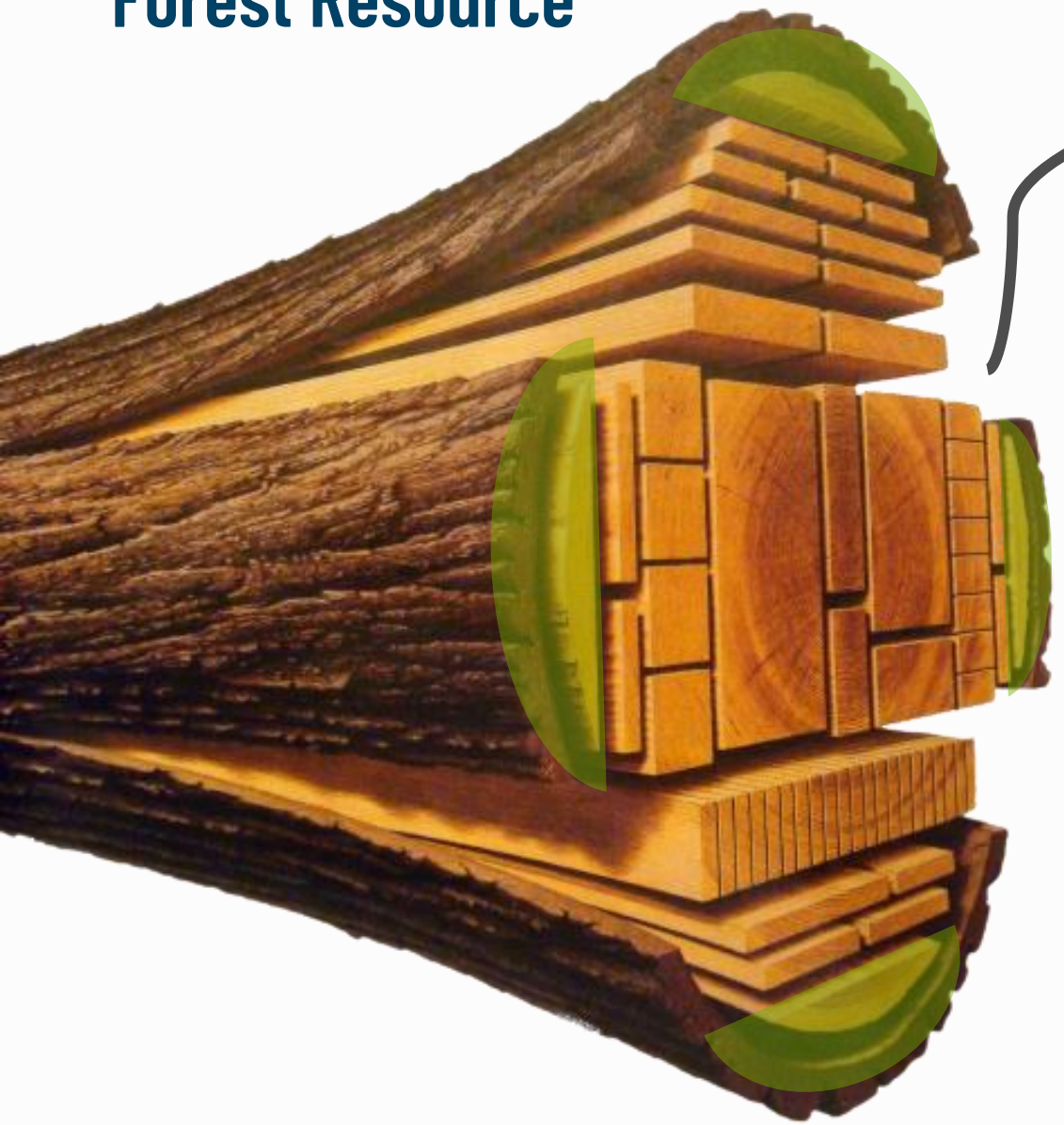


Image from Forsite Consultants

Extracting Whole-Tree Value from Ontario's Forest Resource



6.7 M m^3 Merchantable Fibre Opportunity

Residuals, Co-Products and Harvest Slash

- Opportunity for innovative applications - Residuals
- Challenge for innovative applications
  - **Requires increased and sustained production** of Long-Lived Wood Products
  - Access to residuals long term
  - **How can other sectors integrate into the forest products value chain?**

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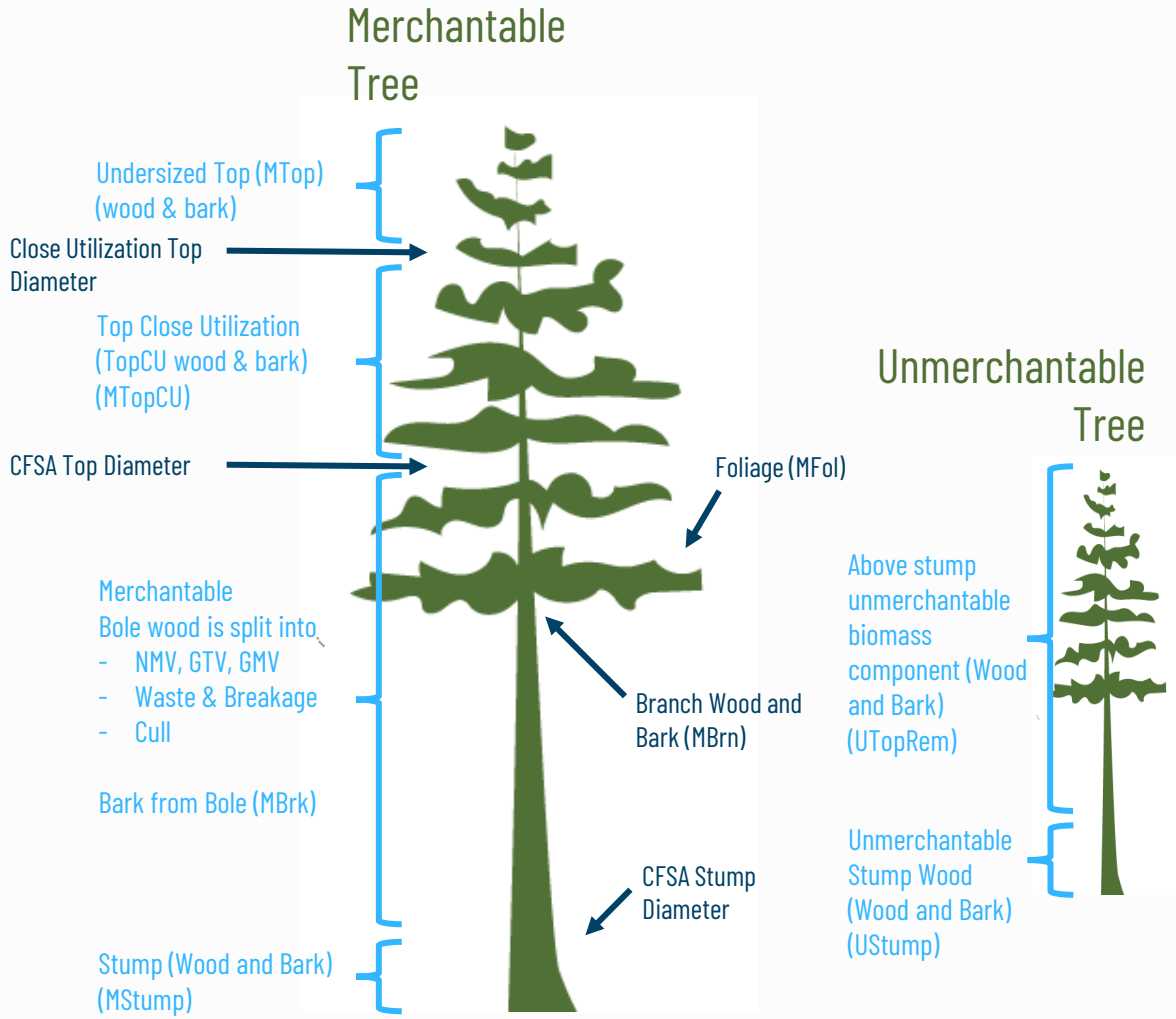
Residual Biomass

Ongoing Quantification Efforts…

- Case study work:
  - Resolute Wingtra High Resolution Drone study (legacy slash/biomass pile quantification)
  - Southeastern ON Mill Residual study
  - Greenmantle Forest Management Inc Low quality hardwood quantification
  - NFMC BDO Zone study
  - Existing modelling work for Biomass portion of EFSM
- Areas for further exploration:
  - Continue regionally appropriate sampling protocol
  - Additional verification and defensible field studies
  - Harvest system integration

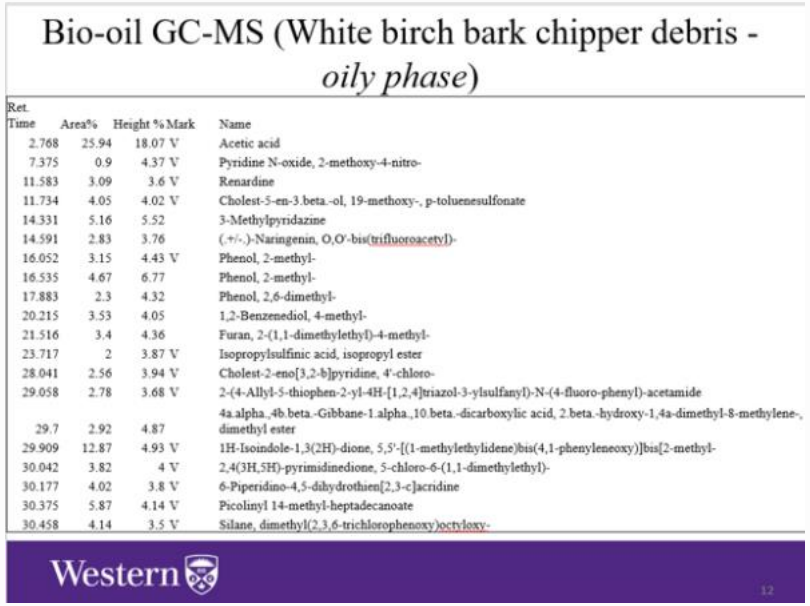


CRIBE | nextfor

Characterization of Residual Biomass

Case Study – ICFAR at Western University

- Value chain development indicates mill residuals, harvest residuals, and unmerchantable hardwood is major opportunity
- Characterization completed or ongoing with many regional samples
    - Building database of underutilized forest feedstocks in ON
- This information is useful for bioenergy, biomaterial pre-feasibility investigation



Bio-oil GC-MS (White birch bark chipper debris - *oily phase*)

Ret. Time	Area%	Height %	Mark	Name
2.768	25.94	18.07	V	Acetic acid
7.375	0.9	4.37	V	Pyridine N-oxide, 2-methoxy-4-nitro-
11.583	3.09	3.6	V	Renardine
11.734	4.05	4.02	V	Cholest-5-en-3.beta.-ol, 19-methoxy-, p-toluenesulfonate
14.331	5.16	5.52		3-Methylpyridazine
14.591	2.83	3.76		(-+/-.)-Naringenin, O,O'-bis(trifluoroacetyl)-
16.052	3.15	4.43	V	Phenol, 2-methyl-
16.535	4.67	6.77		Phenol, 2-methyl-
17.883	2.3	4.32		Phenol, 2,6-dimethyl-
20.215	3.53	4.05		1,2-Benzenediol, 4-methyl-
21.516	3.4	4.36		Furan, 2-(1,1-dimethylethyl)-4-methyl-
23.717	2	3.87	V	Isopropylsulfinic acid, isopropyl ester
28.041	2.56	3.94	V	Cholest-2-eno[3,2-b]pyridine, 4'-chloro-
29.058	2.78	3.68	V	2-(4-Allyl-5-thiophen-2-yl-4H-[1,2,4]triazol-3-ylsulfanyl)-N-(4-fluoro-phenyl)-acetamide
29.7	2.92	4.87		4a.alpha.,4b.beta.-Gibbane-1.alpha.,10.beta.-dicarboxylic acid, 2.beta.-hydroxy-1,4a-dimethyl-8-methylene-, dimethyl ester
29.909	12.87	4.93	V	1H-Isoindole-1,3(2H)-dione, 5,5'-[(1-methylethylidene)bis(4,1-phenyleneoxy)]bis[2-methyl-
30.042	3.82	4	V	2,4(3H,5H)-pyrimidinedione, 5-chloro-6-(1,1-dimethylethyl)-
30.177	4.02	3.8	V	6-Piperidino-4,5-dihydrothen[2,3-c]acridine
30.375	5.87	4.14	V	Picolinyl 14-methyl-heptadecanoate
30.458	4.14	3.5	V	Silane, dimethyl(2,3,6-trichlorophenoxy)octyloxy-

Western

12

Image from ICFAR at Western University

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Deployable Technology Pathways for Low Grade Woody Biomass Residuals

Challenges

- Overcoming feedstock supply hurdles and bridging the gap between sectors
  - Forest products/managers → Potential biomass end users
- Ensuring reliable access and understanding of forest fibre supply across Ontario (e.g. Opportunity Wood, **and Residual Biomass**)
- Understanding support mechanisms for partnership and project development