



BIOMASS VALIDATION TRIALS

BiOS App

FEB. 2025

Brianna Brochez



Brianna Brochez
RPF

FPINNOVATIONS

FORESTRY WEST OPERATIONS GROUP

Brianna has worked with FPInnovations for 1.5 years in the forestry west fibre supply division.

She was worked across the forest section in British Columbia in consulting, industry, community forests, and research.

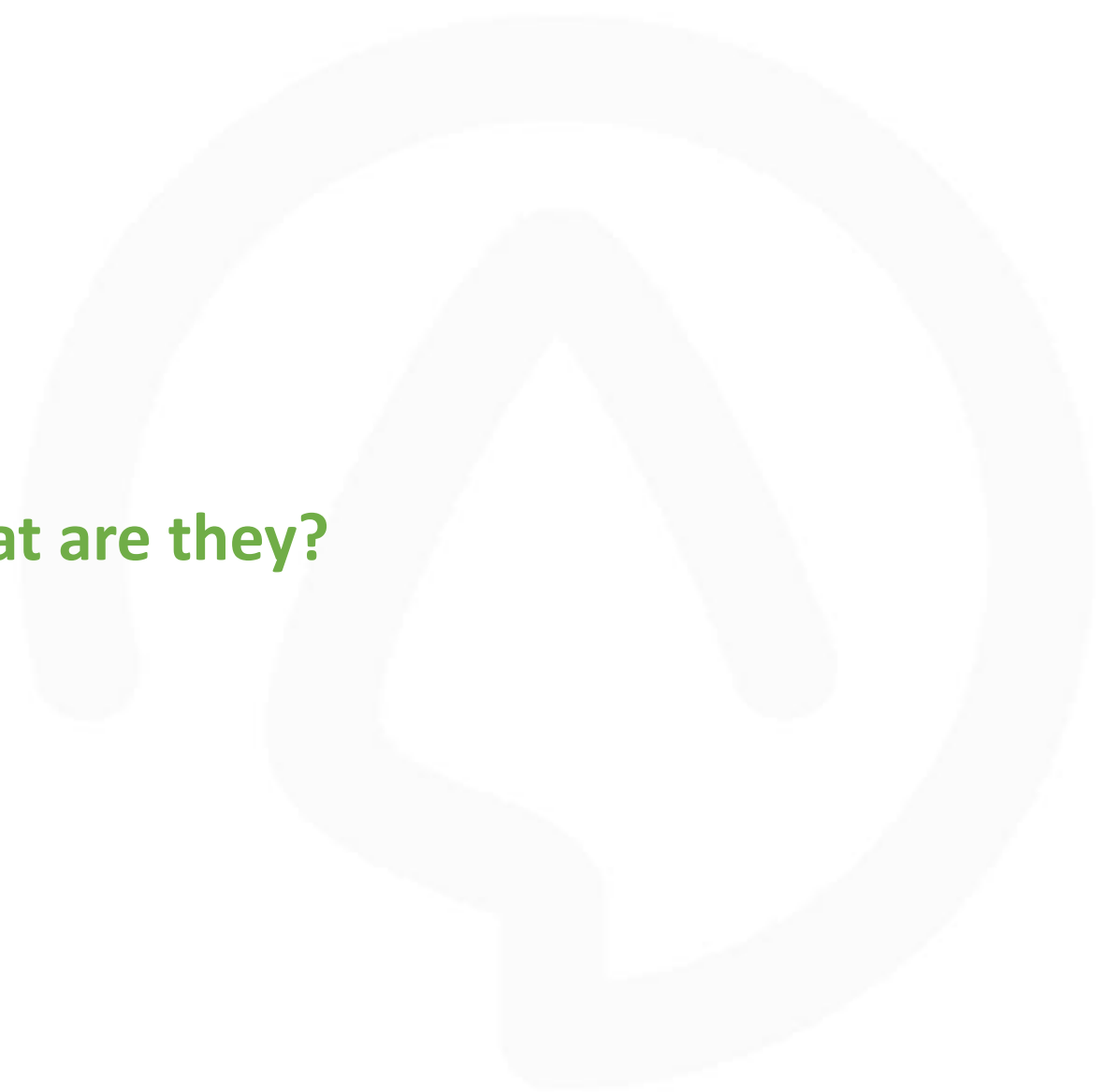
Her background is silviculture and fibre recovery, and she is registered with the Association of Fire Ecologists.

Brianna obtained her RPF in February 2024.





BIOS Validations: What are they?





BiOS

PAR/BY FPINNOVATIONS

BiOS Mobile Application

BiOS app validations – verify data inputs with field measurements.

Part of a larger initiative within the Ministry of Forests to develop a **Forest Residual Biomass Geographic Information System (Forest BioGIS)** and a **Forest Biomass Supply Information System (FBSIS)**.

- Develop bioeconomy clusters for advanced biomaterial manufacturing in BC
- Increase use of forest-origin biomass
- Improve area planning and decision making in fibre potential
- Support other initiatives such as GHG targets and emissions factors

BiOS

BiOS is a free App created by FPInnovations that is designed to calculate the volume of available roadside residue in a cutblock. The App is currently only available for tablets and can be downloaded by typing 'FPInnovations' into either the Google Play or Apple Store.

[BC MOF 2020](#)





How much residual fibre will this stand produce?







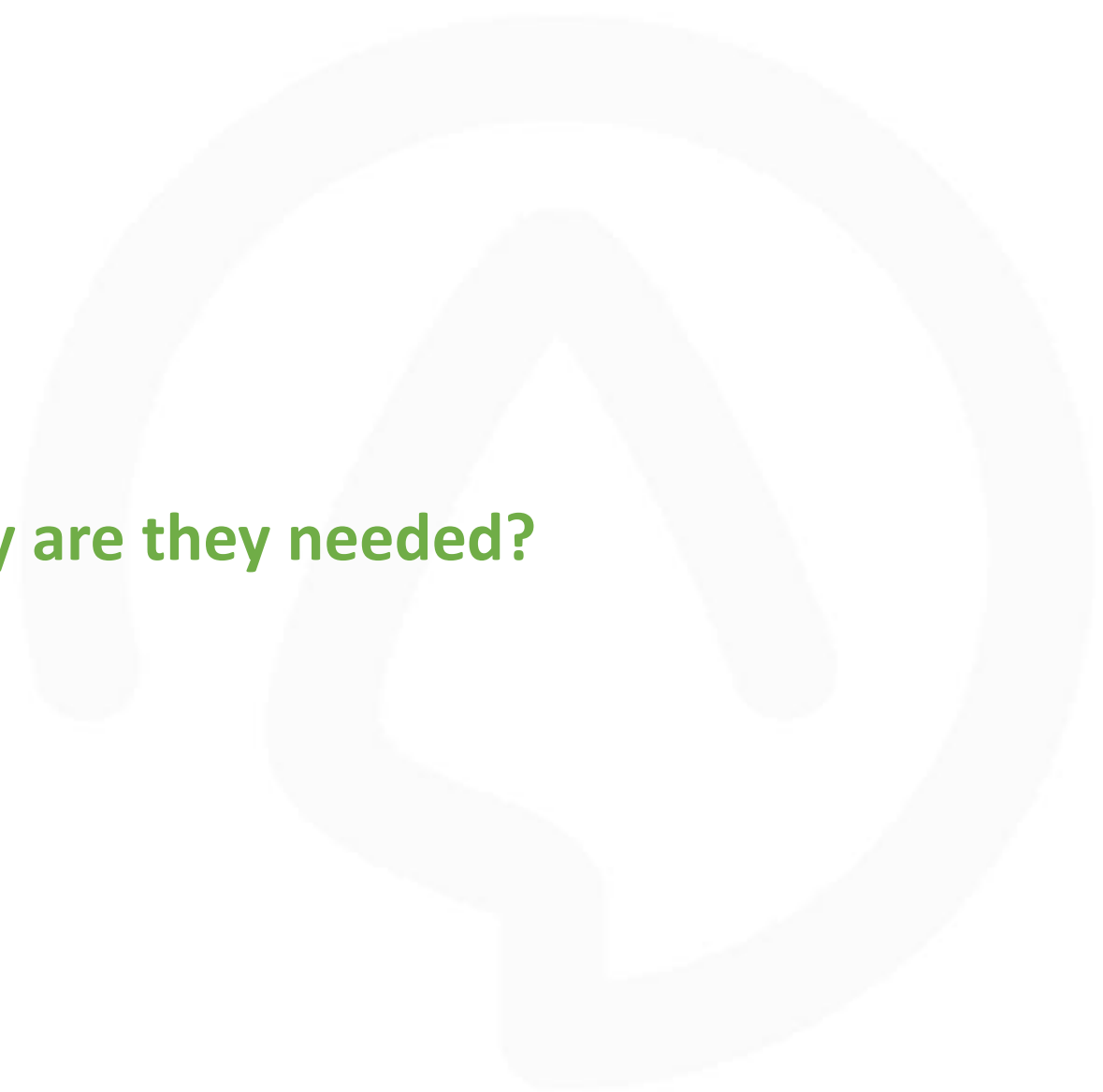


How much residual fibre will this stand produce?





BIOS Validations: Why are they needed?





BiOS Mobile Application

- Develop bioeconomy clusters for advanced biomaterial manufacturing in BC
- Increase use of forest-origin biomass
- Improve area planning and decision making in fibre potential
- Support other initiatives such as GHG targets and emissions factors



BiOS Mobile Application

- Develop bioeconomy clusters for advanced biomaterial manufacturing in BC
- Increase use of forest-origin biomass
- Improve area planning and decision making in fibre potential
- Support other initiatives such as GHG targets and emissions factors

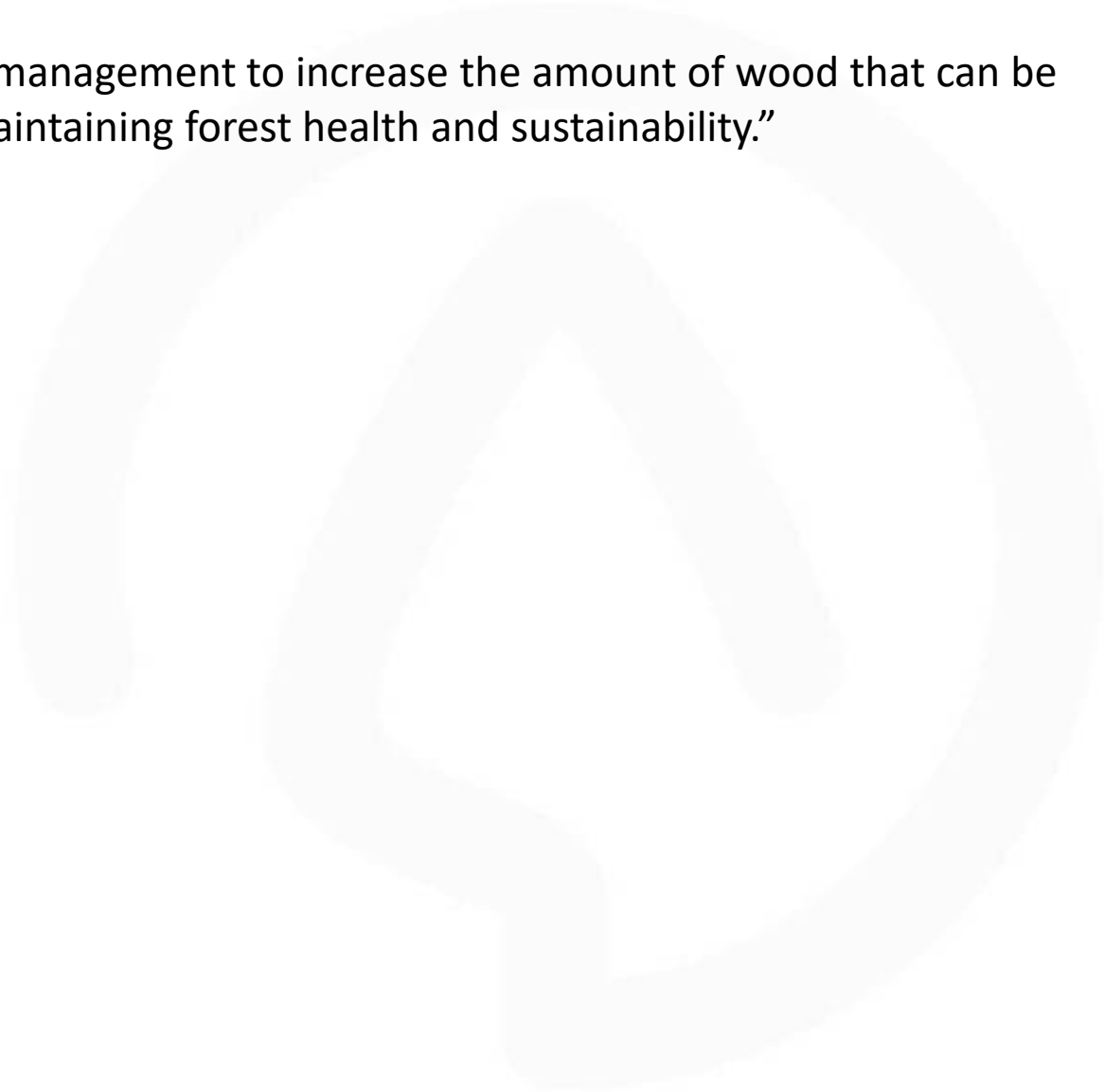
ENHANCED UTILIZATION





Enhanced Utilization

“The practice of improving forest management to increase the amount of wood that can be harvested while maintaining forest health and sustainability.”





Enhanced Utilization

“The practice of improving forest management to increase the amount of wood that can be harvested while maintaining forest health and sustainability.”

Residual Fibre Utilization Policy

✦ Last updated on August 1, 2022

Fibre Recovery Process

The Fibre Recovery Process focuses on improving the use of lower-quality timber in areas of the Ministry of Forests where there is a demand for the residual fibre from secondary users (pulp mills, pellet plants, bioenergy facilities, and other users of low quality logs) and business-to-business relationships have not been established.



Enhanced Utilization


“The practice of improving forest management to increase the amount of wood that can be harvested while maintaining forest health and sustainability.”

Residual Fibre Utilization Policy

✦ Last updated on August 1, 2022

Fibre Recovery Process

The Fibre Recovery Process of Forests where there is a bioenergy facilities, and other have been established.

 THE UNIVERSITY OF BRITISH COLUMBIA
 Faculty of Forestry

Policy Brief
August 2022

Flipping the Script on Residual Fibre: Enhancing Utilization for a Sustainable Forest Industry | Brief No. 2

Please note that this policy brief has not been peer reviewed. The views expressed are those of the author(s).

AUTHORS

J. Aeyelts, J. Bulkan, D. Roeser (Faculty of Forestry), X. Bi, R. Clift and H. Wang (Faculty of Applied Science Chemical & Biological Engineering) University of British Columbia





Enhanced Utilization

“The practice of improving forest management to increase the amount of wood that can be harvested while maintaining forest health and sustainability.”

Residual Fibre Utilization Policy

★ Last updated on August 1, 2022

Fibre Recovery Process

The Fibre Recovery Process of Forests where there is a bioenergy facilities, and other have been established.



Flipping the Sustainable

Please note that this policy brief has not been peer reviewed. The views expressed are those of the author(s).

AUTHORS

J. Aeyelts, J. Bulkan, D. Roeser (Faculty of Forestry), X. Bi, R. Clift and H. Wang (Faculty of Applied Science Chemical & Biological Engineering) University of British Columbia

FPIInnovations

Forest Operations | January 12, 2021

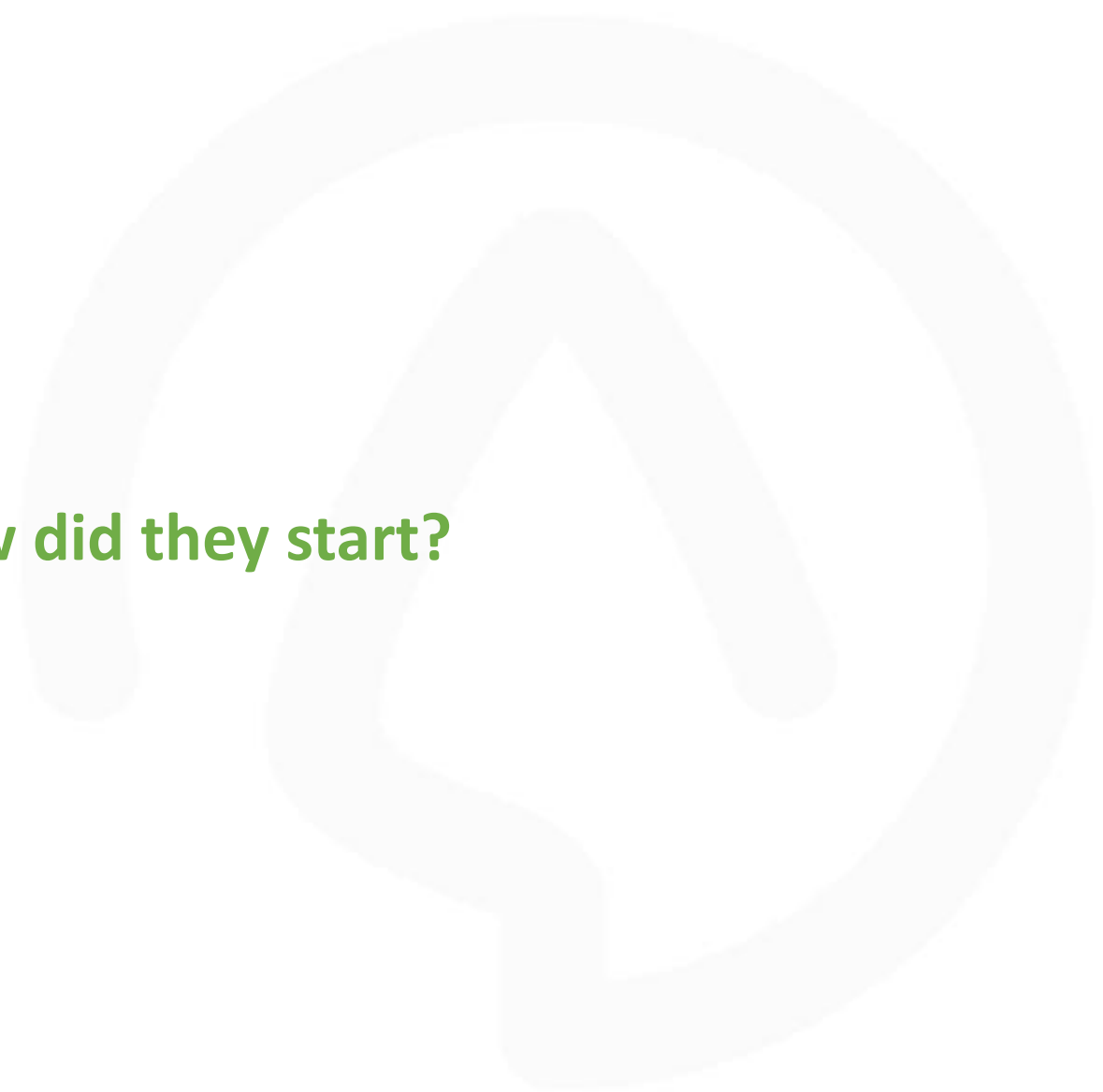


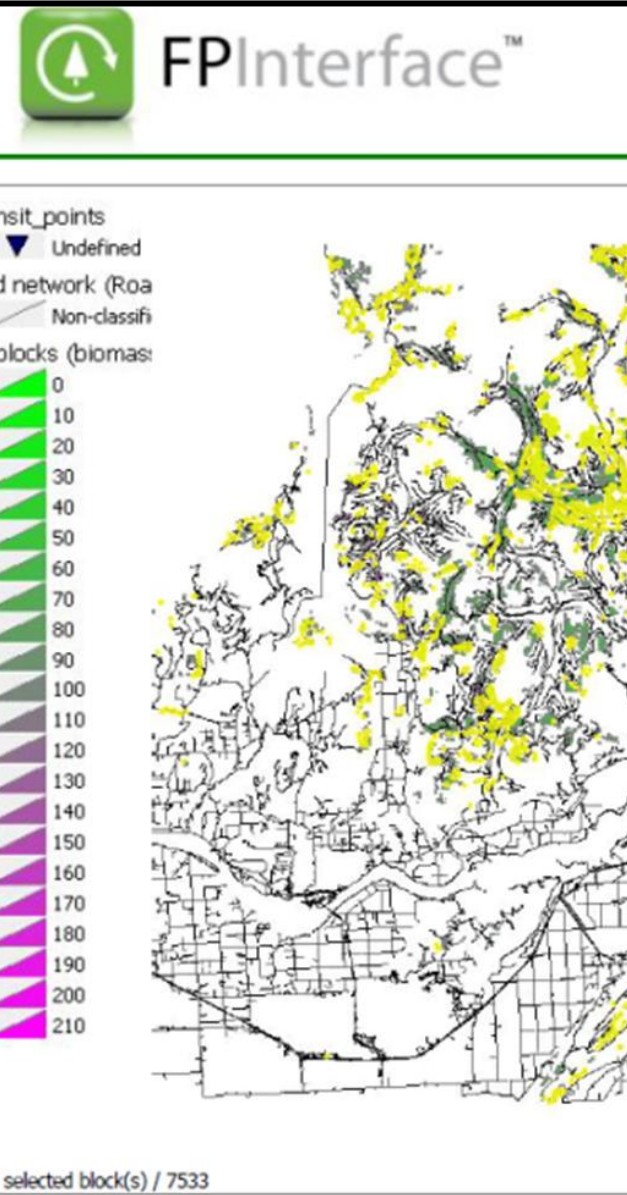
The extraction of residual fibre in British Columbia leading to the reduction of open-air burning of harvest residues is the focus of a new webinar series that will be offered in February and March 2021. Experts from FPIInnovations and the B.C. Ministry of Forests, Lands, Natural Resource Operations and Rural Development (FLNRORD) will host six sessions that will get you thinking about better fibre utilization and less burning.



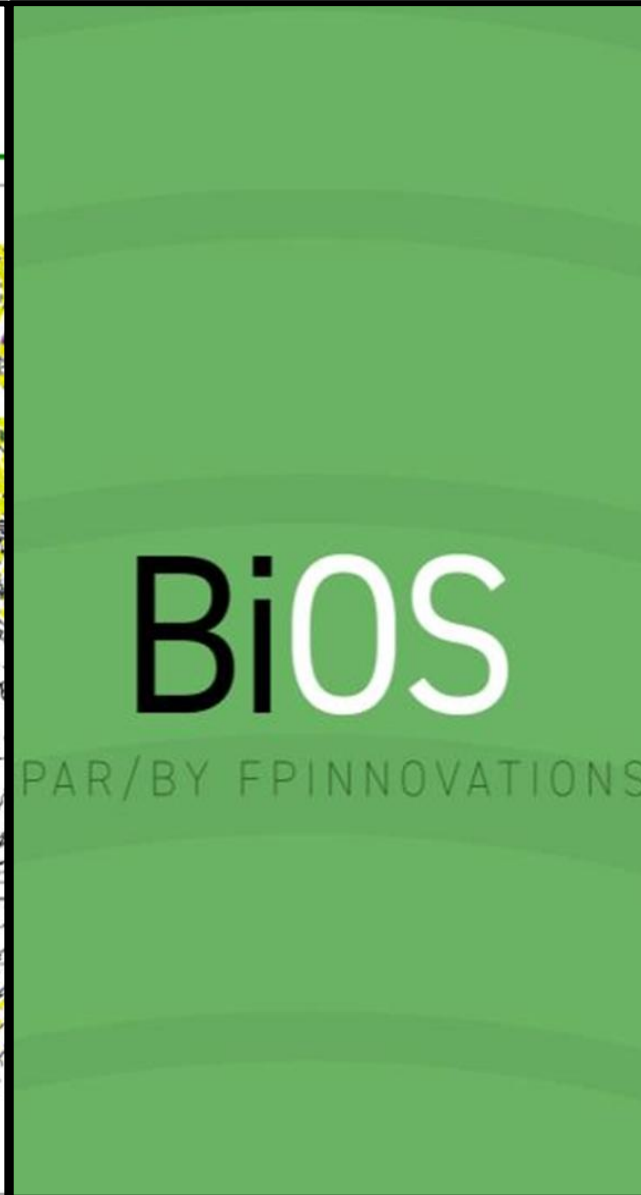


BIOS Validations: How did they start?





FPInterface TSA estimates
2011 - *ongoing*



BiOS App
2018-2019 dev



Validation Trials
2018-2025

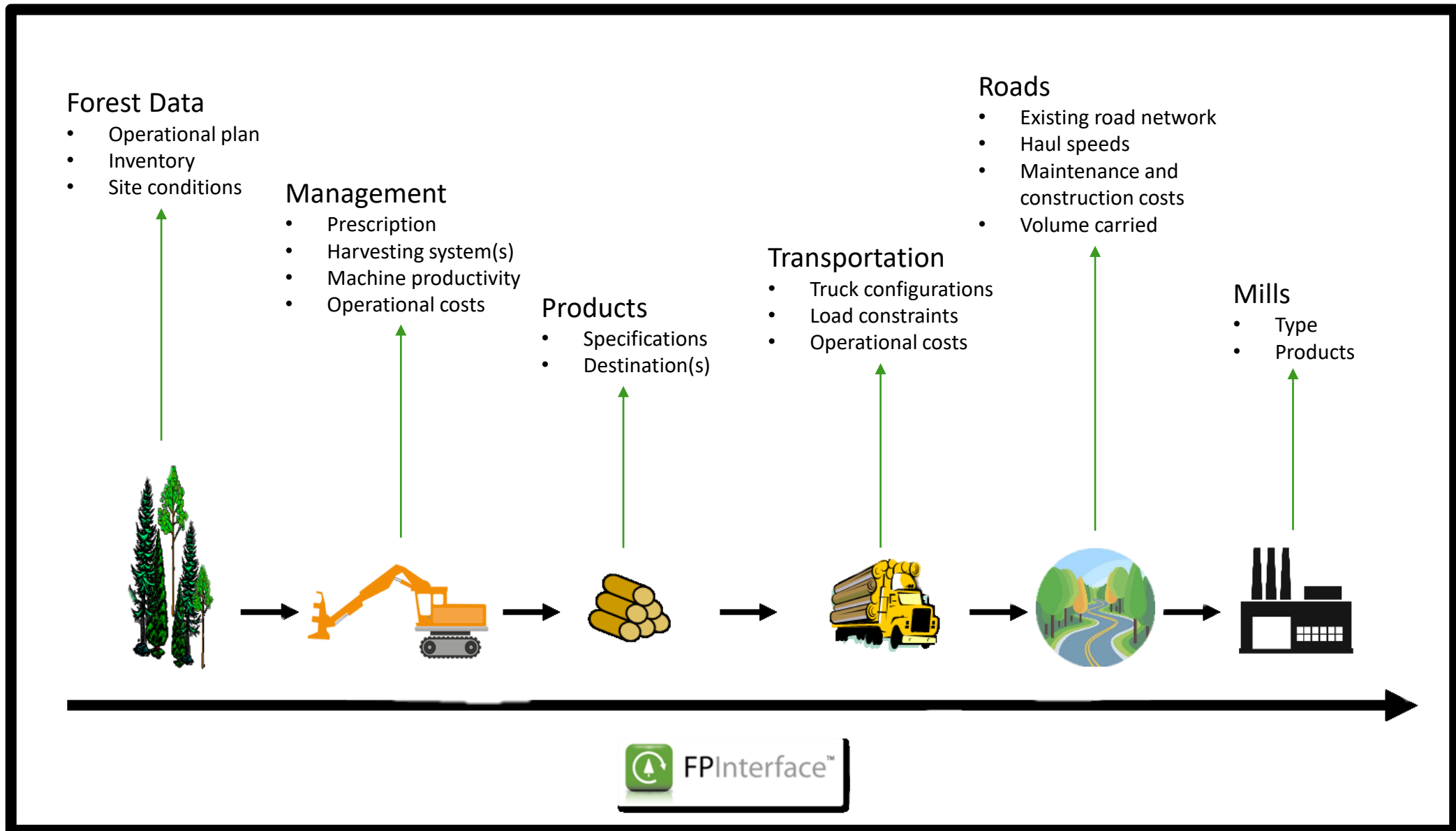
TSA Fibre Supply Analyses

FPInterface

- Modelling software developed by FPInnovations to estimate the amount of forest-origin volumes (merchantable and residual) within Timber Supply Areas
- 26 completed to date
- Inventory based on 10-20-year harvest data and road networks
- Currently does not include:
 - Woodlot Licenses
 - Tree Farm Licenses
 - Community Forest Agreements
 - First Nations Tenures

INPUTS


DATA TYPES, DATA REQUIREMENTS AND ASSUMPTIONS



3:34 PM Fri Mar 8 73% 🔋

BiOS Project A94836LN98K

Edit REPORT

 **BiOS** (Sabrina St-Onge)

A94836LN98K Logging operations: Full-tree with roadside processing

Field assessment Biomass operations: Pre-piling, Comminution (Roadside chipper 600 kW (800 hp))

Biomass recovery

Area	10.8 ha
Recovered biomass	558.2 odt
Average moisture content	26.0 %
Biomass yield	51.7 odt/ha
Biomass (odt)/Merchantable (m³)	0.202 odt/m³
Low heating value	14.6 MJ/kg
Fuel consumption	6.4 L/odt
GHG emissions (CO2eq)	9.7 tonnes

Biomass transport

Distance to Domtar inc. by road category	77.0 km
Operational (resource road)	12.0 km
Primary (resource road)	36.0 km
Public (paved)	29.0 km
Fuel Consumption	5.8 L/odt
GHG emissions (CO2eq)	8.9 tonnes

Biomass supply cost

Recovery (stump to roadside)	21.20 \$/odt
Transport (roadside to mill)	20.76 \$/odt
Total	41.96 \$/odt

Species breakdown

Species	Carbon delivered (tonnes)	Avoided GHG (tonnes CO2eq)	odt	odt/m³	odt/ha
Lodgepole pine	143.5	467.9	287.1	0.3877	26.58
White spruce	97.6	318.3	195.3	0.1431	18.08
Douglas fir interior	38.0	123.7	75.9	0.1161	7.03
	279.1	909.9	558.2	0.2023	51.69
Carbon ratio (delivered:emitted)	15:1				




BiOS Application

The app was developed after FPInterface to be used on mobile devices and produce **biomass flowcharts** that show how the fibre is distributed across the block from start to end.

3:34 PM Fri Mar 8 73%

BiOS Project A94836LN98K SS

[Edit](#) **REPORT** ↻

 **BiOS** (Sabrina St-Onge)

A94836LN98K Logging operations: Full-tree with roadside processing

Field assessment Biomass operations: Pre-piling, Comminution (Roadside chipper 600 kW (800 hp))

Biomass recovery

Area	10.8 ha
Recovered biomass	558.2 odt
Average moisture content	26.0 %
Biomass yield	51.7 odt/ha
Biomass (odt)/Merchantable (m³)	0.202 odt/m³
Low heating value	14.6 MJ/kg
Fuel consumption	6.4 L/odt
GHG emissions (CO2eq)	9.7 tonnes

Biomass transport

Distance to Domtar inc. by road category **77.0 km**

Operational (resource road)	12.0 km
Primary (resource road)	36.0 km
Public (paved)	29.0 km
Fuel Consumption	5.8 L/odt
GHG emissions (CO2eq)	8.9 tonnes

Biomass supply cost

Recovery (stump to roadside)	21.20 \$/odt
Transport (roadside to mill)	20.76 \$/odt
Total	41.96 \$/odt

Species breakdown

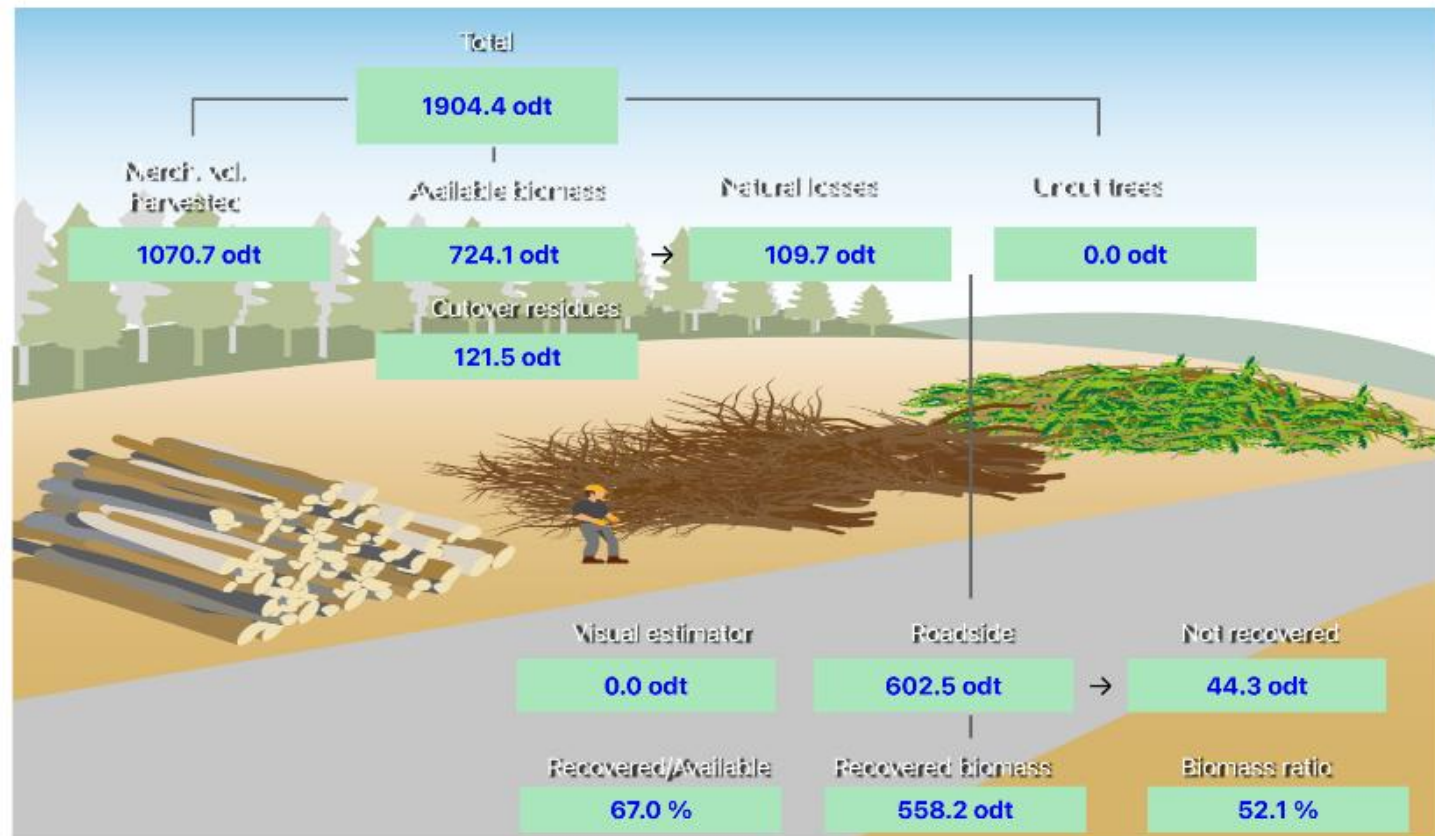
Species	Carbon delivered (tonnes)	Avoided GHG (tonnes CO2eq)	odt	odt/m³	odt/ha
Lodgepole pine	143.5	467.9	287.1	0.3877	26.58
White spruce	97.6	318.3	195.3	0.1431	18.08
Douglas fir interior	38.0	123.7	75.9	0.1161	7.03
Total	279.1	909.9	558.2	0.2023	51.69
Carbon ratio (delivered:emitted)	15:1				

BiOS Application

3:34 PM Fri Mar 8 73%

BiOS Project A94836LN98K SS

[Edit](#) **REPORT** ↻



Total
1904.4 odt

Merchantable Harvest: 1070.7 odt

Available Biomass: 724.1 odt

Natural losses: 109.7 odt

Uncut trees: 0.0 odt

Cut-over residues: 121.5 odt

Visual estimator: 0.0 odt

Roadside: 602.5 odt

Not recovered: 44.3 odt

Recovered/Available: 67.0 %

Recovered biomass: 558.2 odt

Biomass ratio: 52.1 %



INPUTS

Data from cruise, inventory data, visual assessment and knowledge of your operations.



SITE

Location

Area (ha)

Species

Species specifics



LOGGING

Skidding distance

Harvest date

Harvesting system



BIOMASS

Technical losses

Recovery date

Pre-pilling

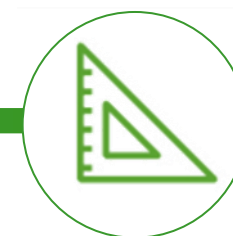
Communion



TRANSPORT

Truck
configuration

Destination



VISUAL ESTIMATOR

Pile shape

Pile
measurements

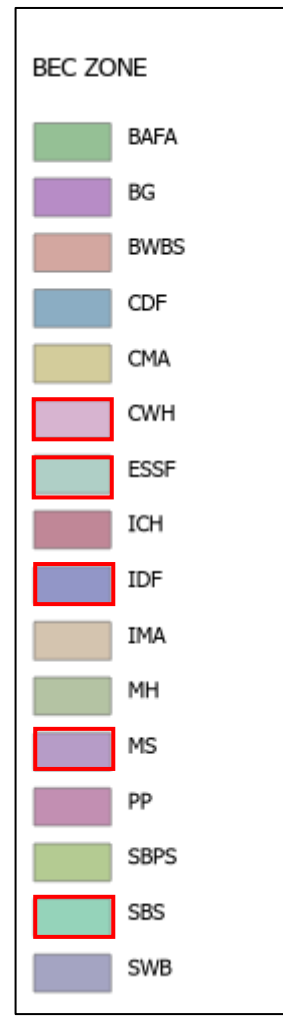
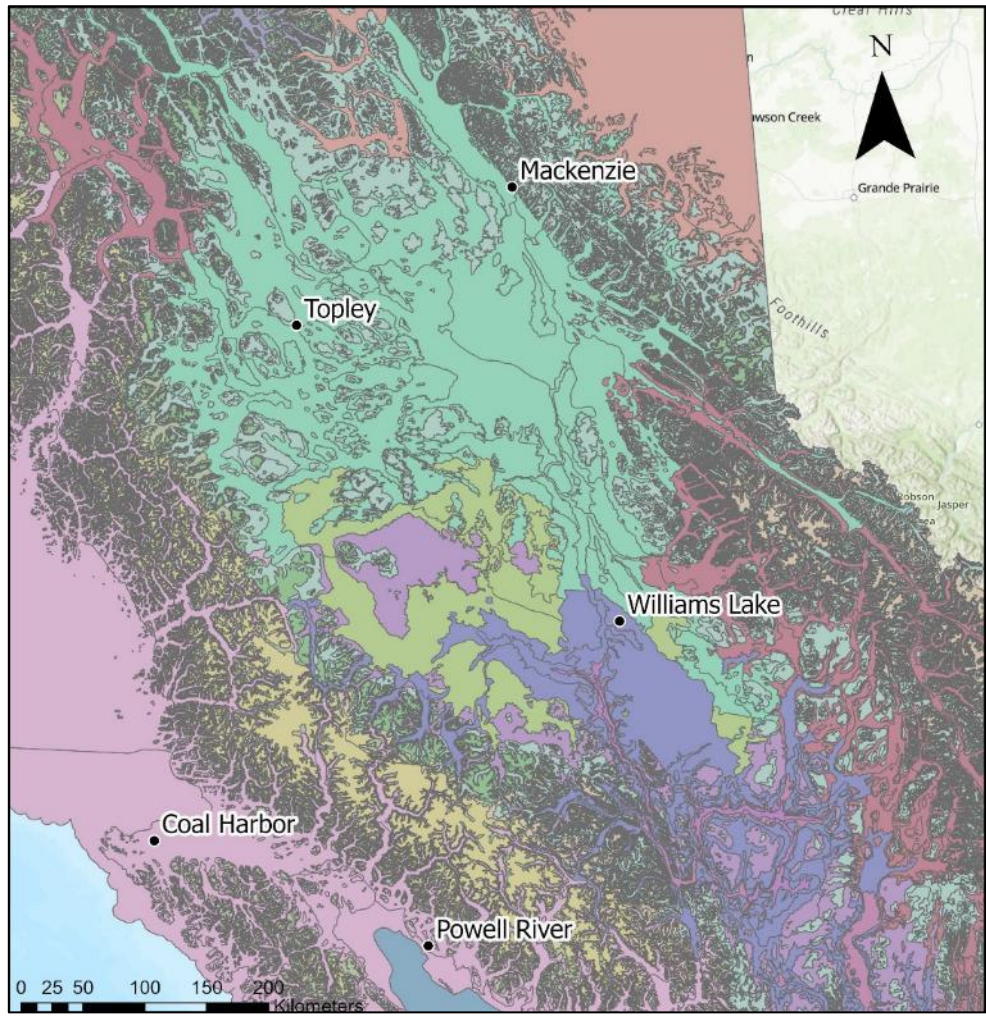
Bulking factor



Validation Trials

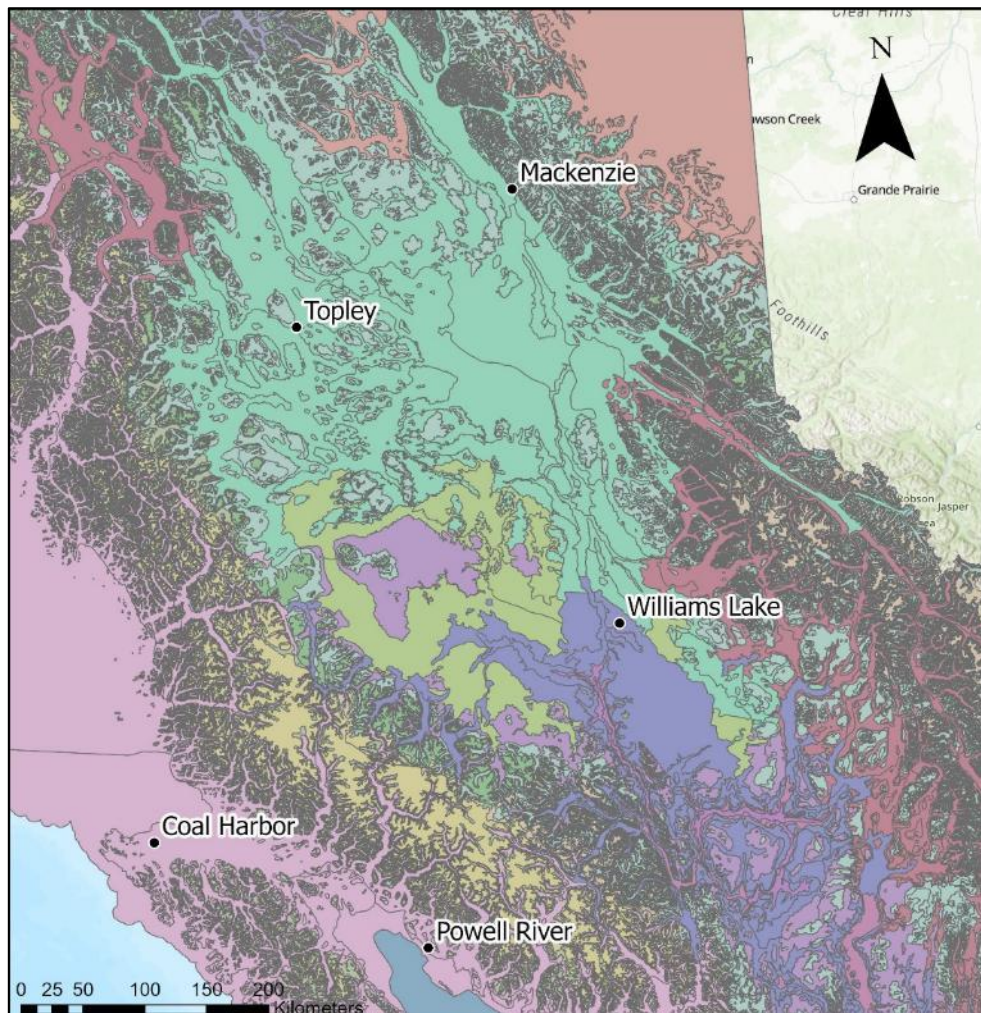
Validation trials to better app inputs and outputs and improve quality and accuracy of estimates.

- Pile shape – bulking factor
- Visual estimator – drone imagery and apparent volume measurements
- BEC zone improvement
- Other changes?

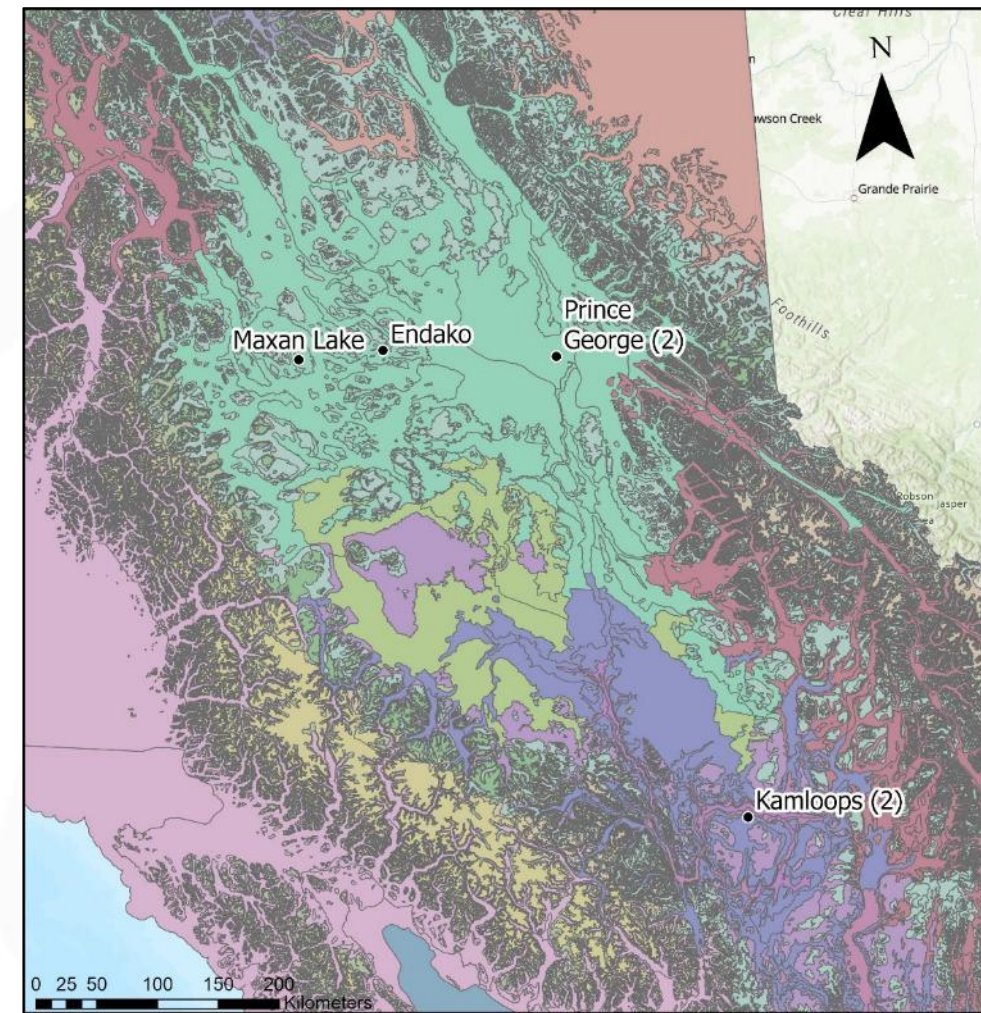
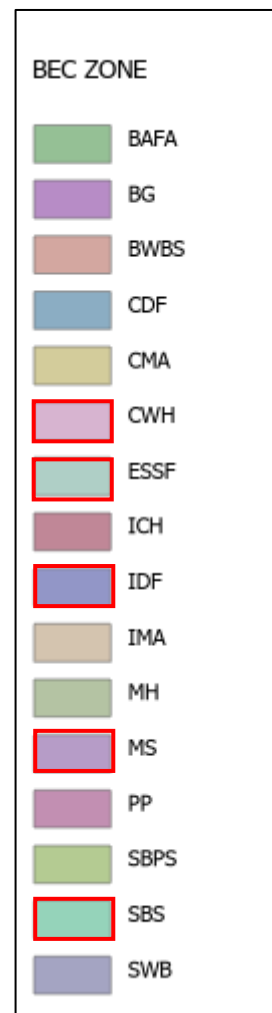


Trials 2018-2020

Validation trials have been ongoing since 2018 and span across several BEC zones in BC.



Trials 2018-2020



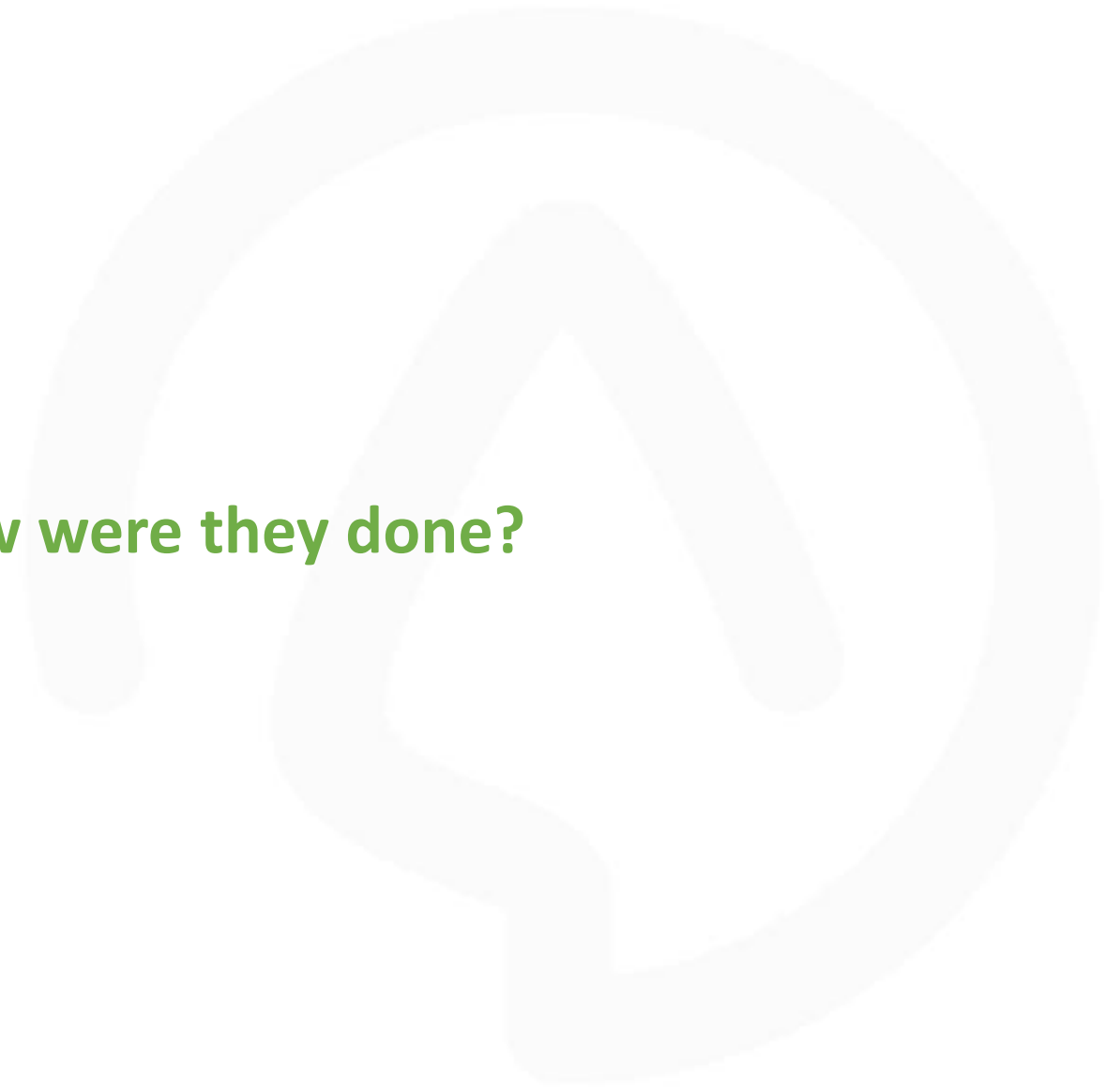
Trials 2024-2025

Validation trials have been ongoing since 2018 and span across several BEC zones in BC.

The sites from 2024-2025 are the focus of this presentation.



BIOS Validations: How were they done?

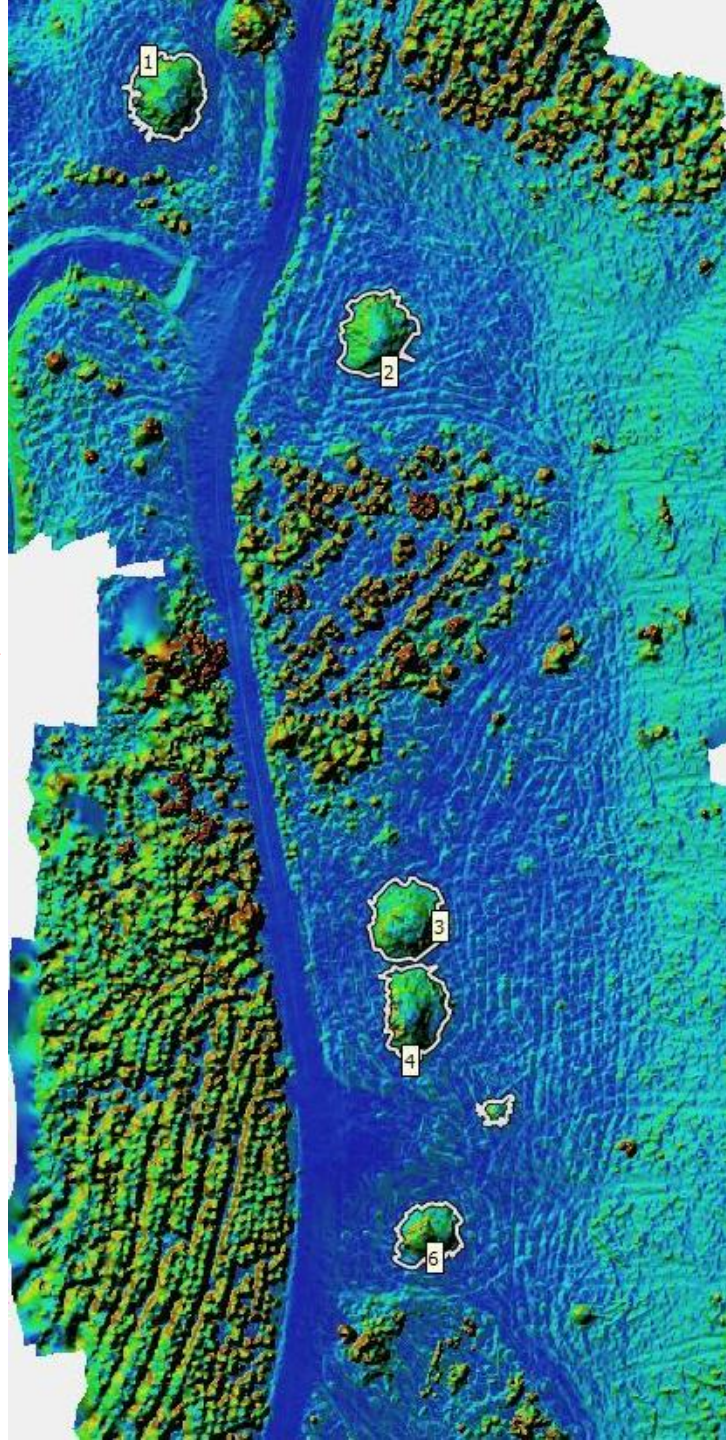


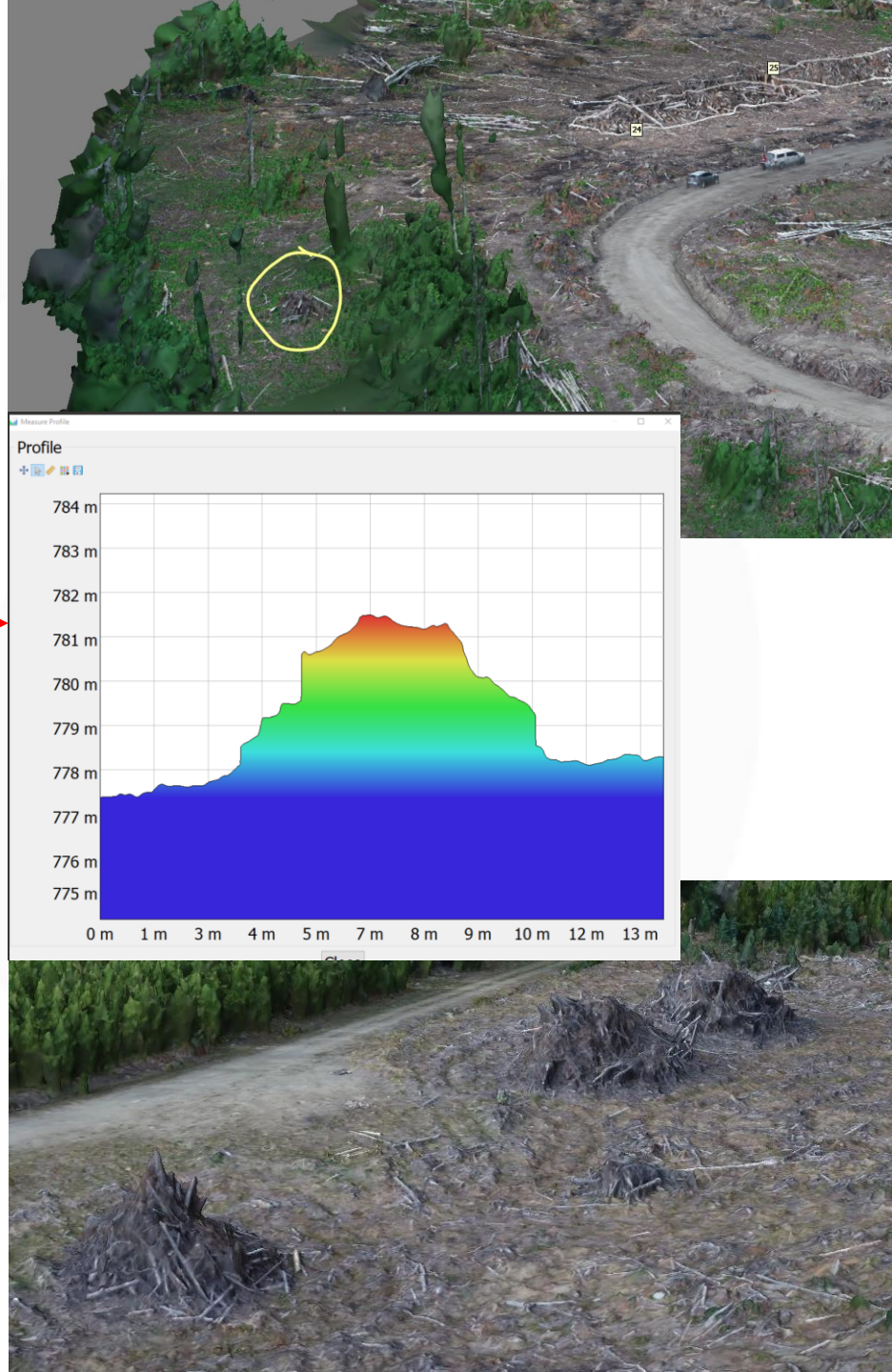
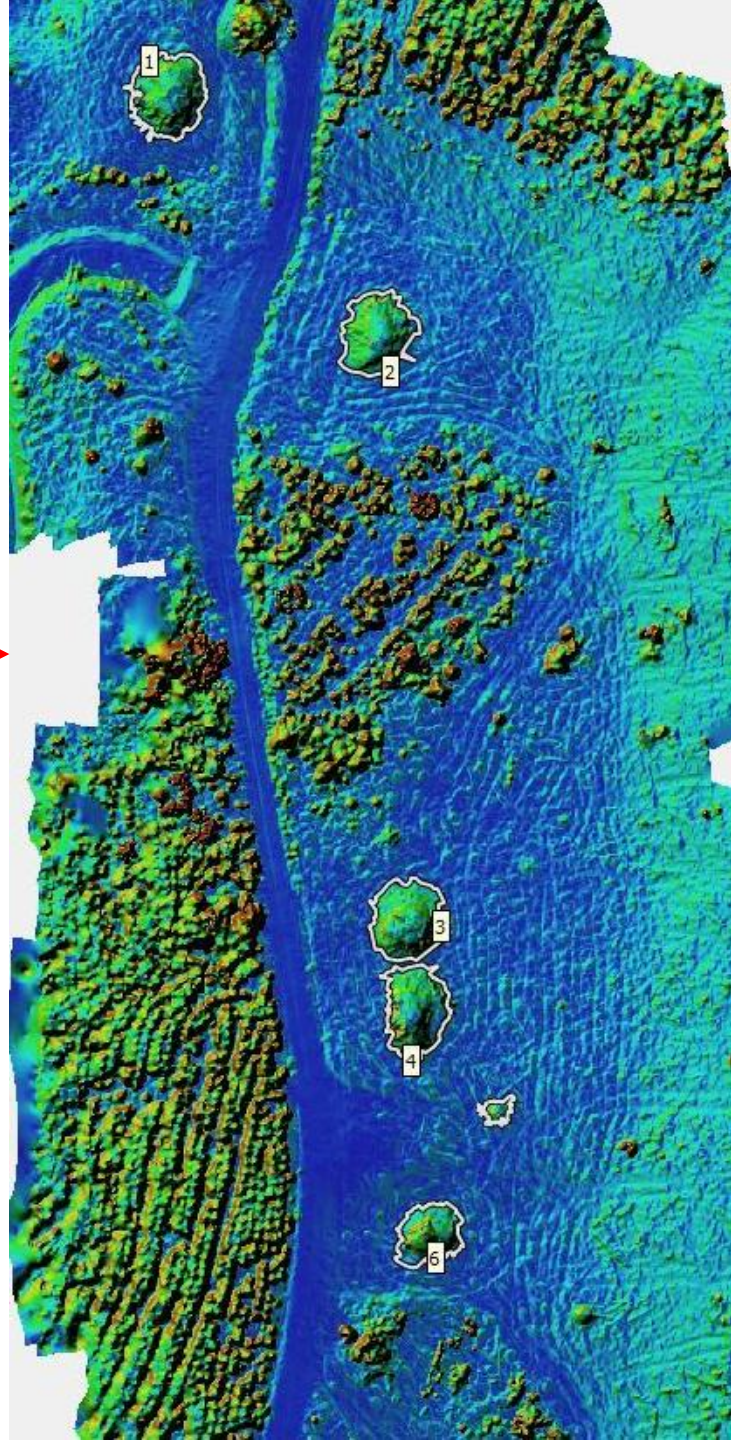


Methodology

1. Secure a site where grinding operations are planned
2. Obtain cruise compilations, site plans and scale reports for app inputs
3. Perform field measurements
 - UAV imagery acquisition
 - CWD line transects
 - Moisture contents
 - Topping diameters
 - Pile footprint line transects
4. Produce BIOS app flowchart
5. Compare outputs with field measurements









BiOS

A roadside biomass volume calculator

March 9th, 2021
 Stu Spencer, Senior Researcher



Copie et redistribution interdites. | Copying and redistribution prohibited.

BiOS Tutorials
 FPInnovations - 1/7

BiOS Tutorial: How to Start a Project - 4:35
 FPInnovations

2 BiOS Tutorial: How to Fill Out the Species Page - 5:00
 FPInnovations

3 BiOS Tutorial: How to Fill Out the Logging Page - 3:55
 FPInnovations

4 BiOS Tutorial: How to Fill Out the Biomass Recovery Page - 5:18
 FPInnovations

5 BiOS Tutorial: How to Fill Out the Transport Page - 6:01
 FPInnovations

6 BiOS Tutorial: How to Fill Out the Visual Estimator Page - 6:15
 FPInnovations

7 BiOS Tutorial: How to Use the Media Page and Generate a... - 9:38
 FPInnovations

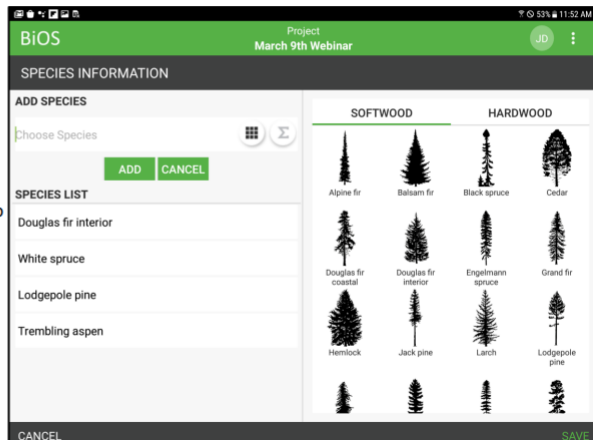
BiOS App Walkthrough

Species Page

Step 1 – Add a species from the species list.

Most species found in Canada and all merchantable species in BC have been included.

As with most aspects in BiOS, the user can go back and adjust entry data to reflect new circumstances (ie fire, insect, weather).



BiOS Tutorial

How to start a project

BiOS Tutorials
 FPInnovations · Playlist

BiOS Tutorials: How to Start a Project - 4:35
 BiOS Tutorials: How to Fill Out the Species Page - 5:00

View full playlist




7 videos



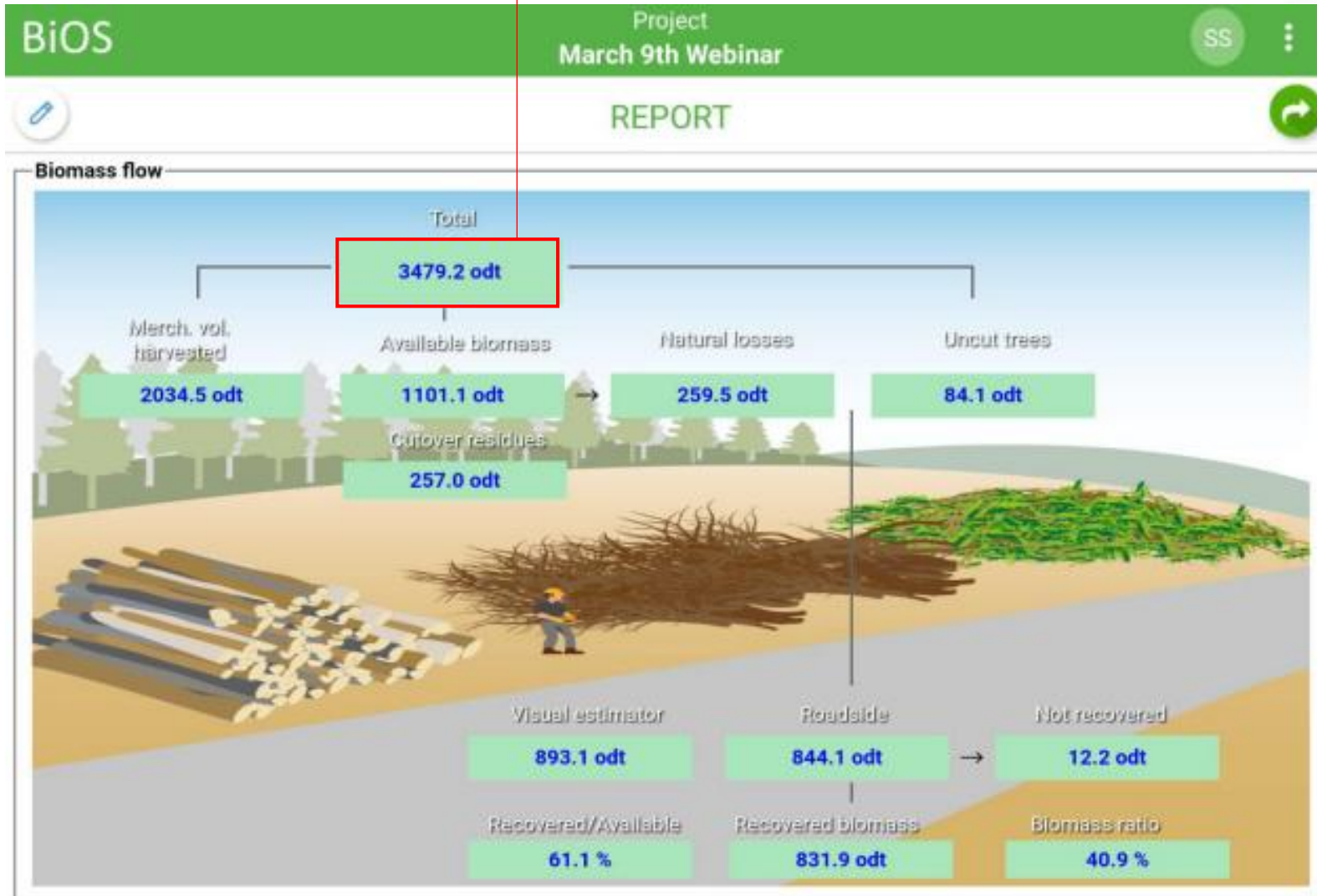
Validation Specifics

Key metrics that were the focus of the validation trials were:

- Bulking factors – app uses a default 20%
 - 10-pile trial
- Do these differ depending on BEC zone?

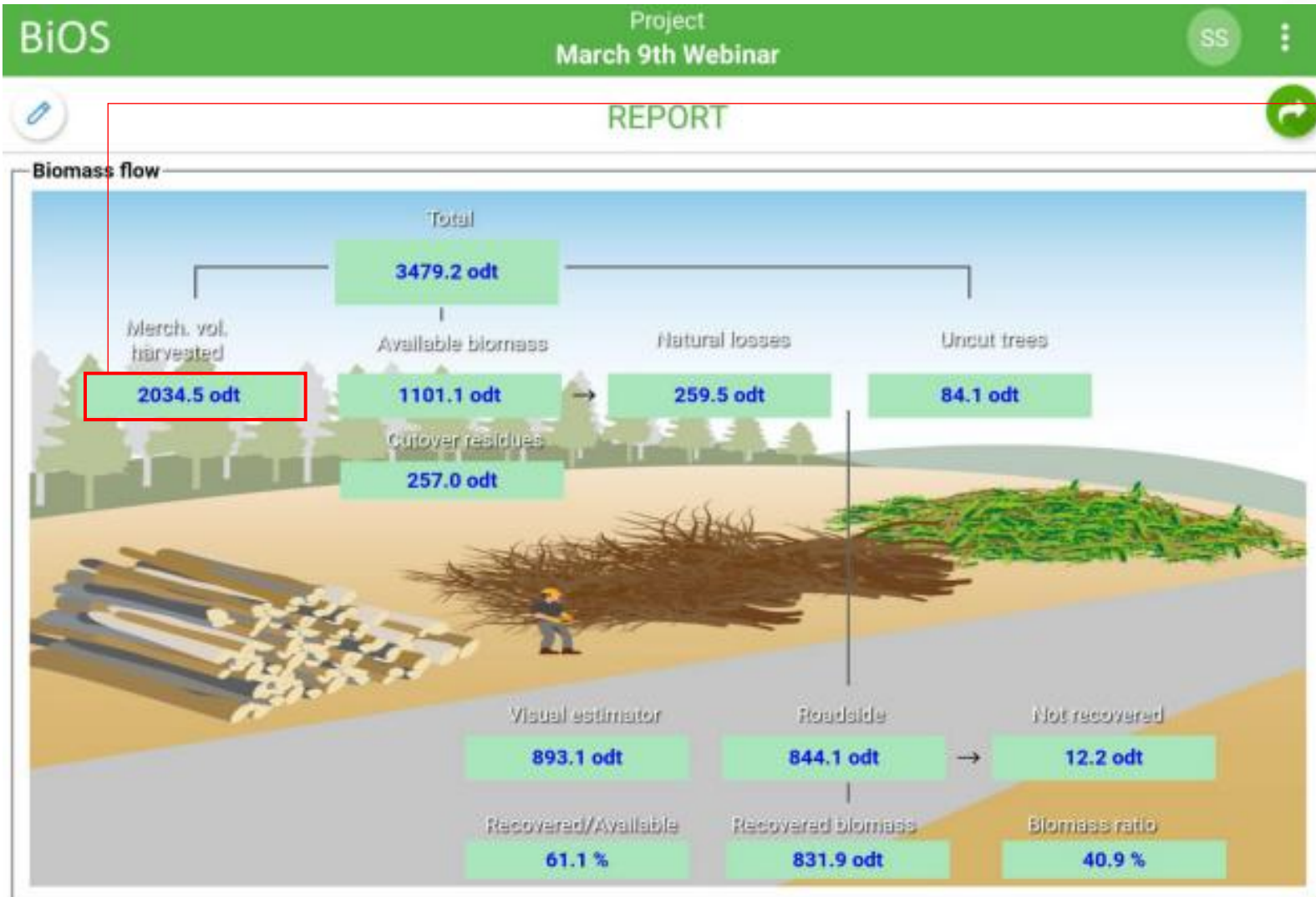
PILE DEFINITIONS		PILE FOOTPRINTS (MAP LAYERS)	
ADD PILE		PILE SHAPE	
Pile list Number of piles: 3 Total estimated dry weight: 28.3 odt		 CONE	 WINDROW
Pile #1 Apparent volume: 49.9 m ³ Estimated dry weight: 4.3 odt		 ORIENTED	PILE MEASUREMENTS
Pile #2 Apparent volume: 39.5 m ³ Estimated dry weight: 3.4 odt		Height #1 <u>1.6</u> m	
Pile #3 Apparent volume: 239.9 m ³ Estimated dry weight: 20.6 odt		Height #2 <u>0</u> m	
		Height #3 <u>0</u> m	
		Length #1 <u>30.6</u> m	
		Width #1 <u>9.8</u> m	
		Width #2 <u>0</u> m	
		Width #3 <u>0</u> m	
		BULKING FACTOR	
		Select pile bulking factor	
		<u>Loose slash (20%)</u>	

Validation Specifics



Total = Gross merchantable volume

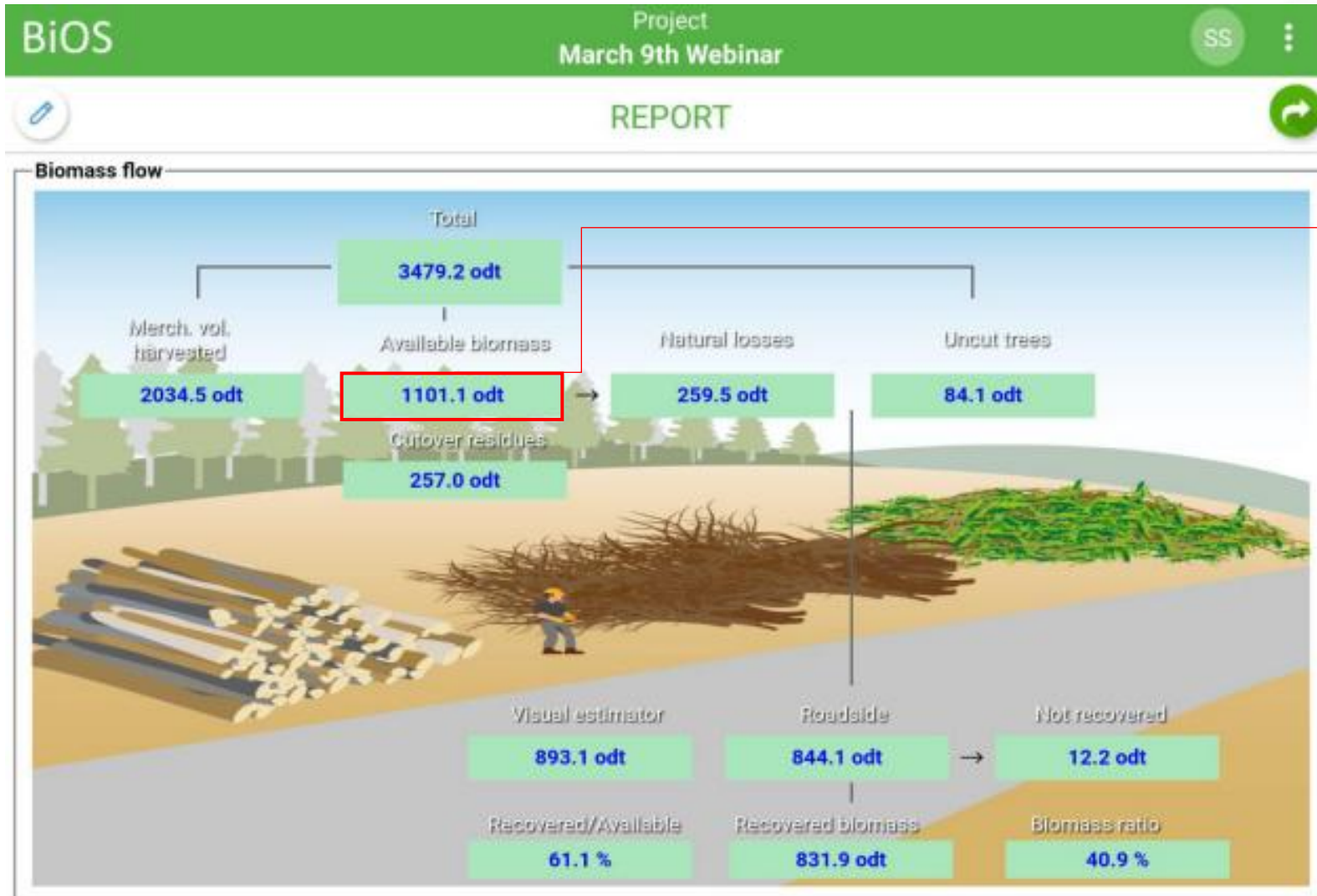
Validation Specifics



Total = Gross merchantable volume

Merch. Vol. harvested = Scale report volumes

Validation Specifics

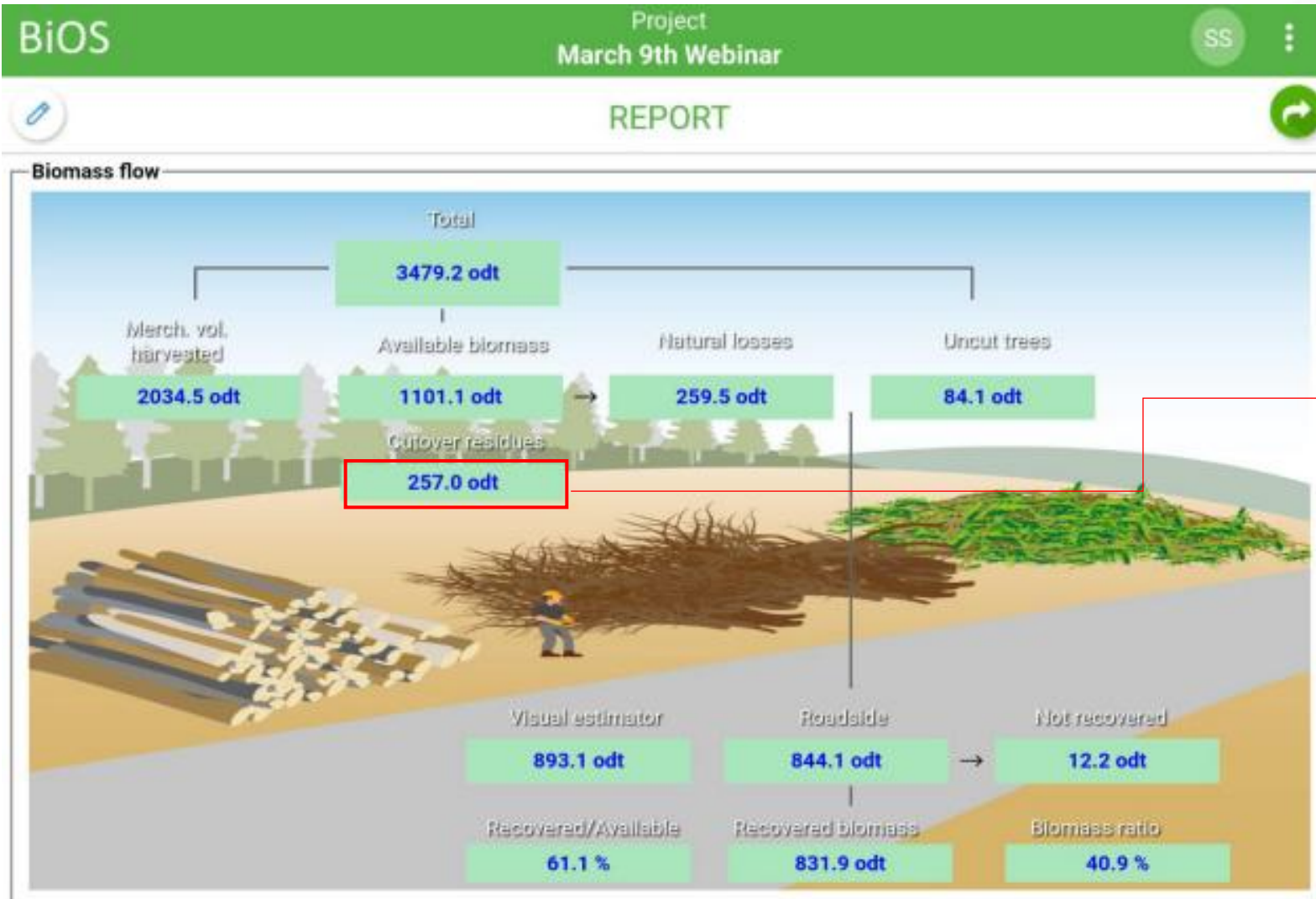


Total = Gross merchantable volume

Merch. Vol. harvested = Scale report volumes

Available biomass = CWD transects and debris pile weights (chipped + pile footprint)

Validation Specifics



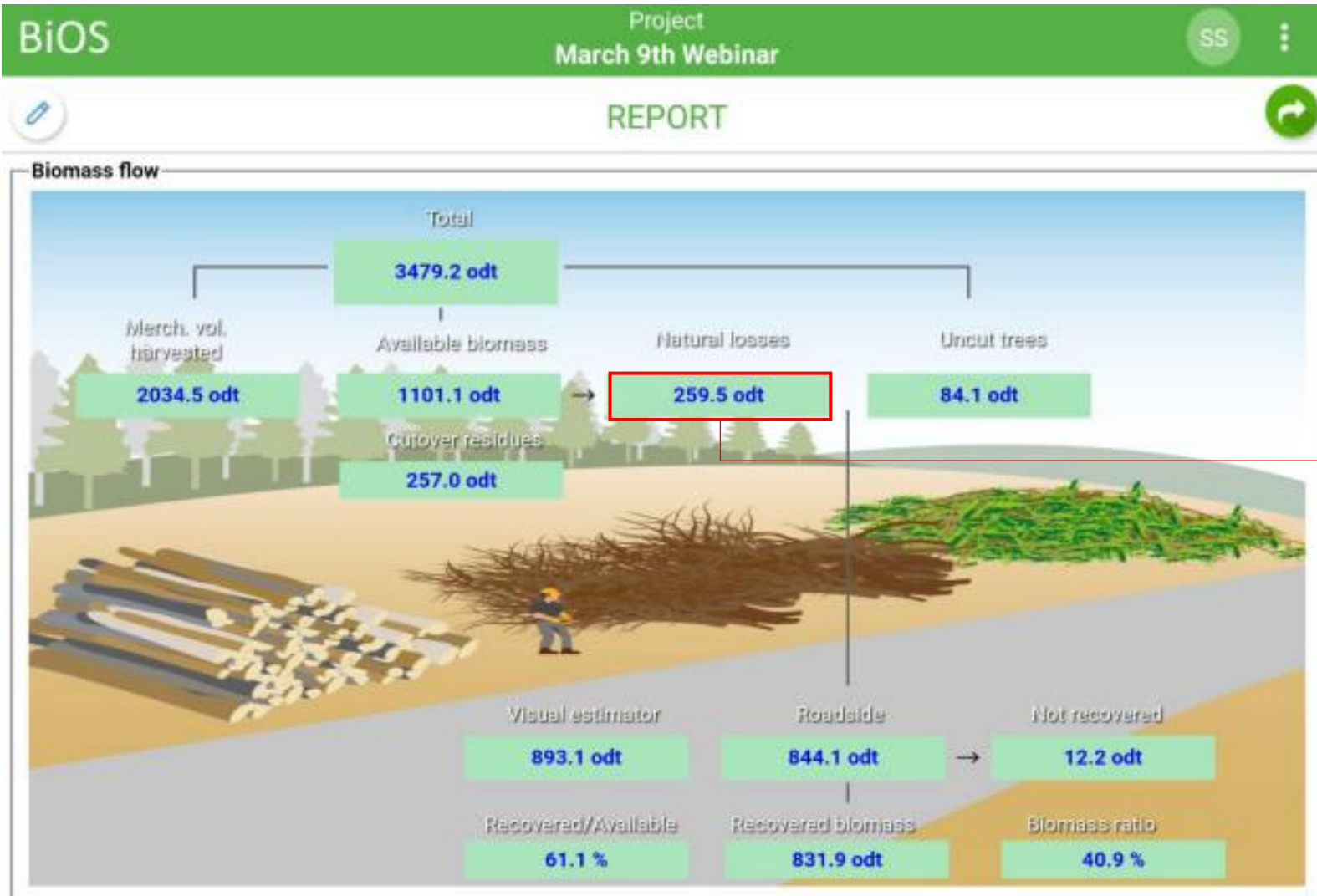
Total = Gross merchantable volume

Merch. Vol. harvested = Scale report volumes

Available biomass = CWD transects and debris pile weights (chipped + pile footprint)

Cutover residues = CWD transects

Validation Specifics



Total = Gross merchantable volume

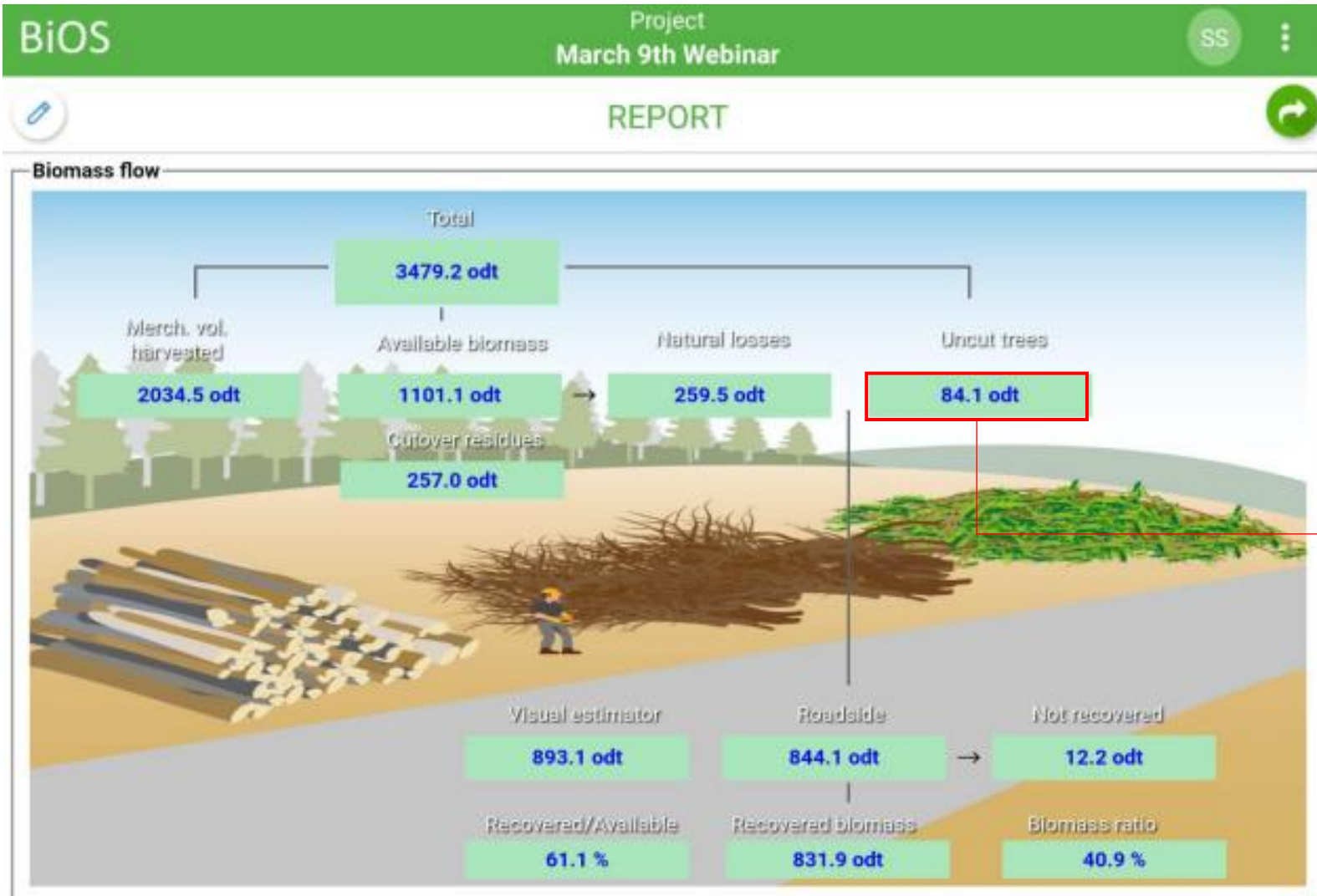
Merch. Vol. harvested = Scale report volumes

Available biomass = CWD transects and debris pile weights (chipped + pile footprint)

Cutover residues = CWD transects

Natural losses = *not measurable*

Validation Specifics



Total = Gross merchantable volume

Merch. Vol. harvested = Scale report volumes

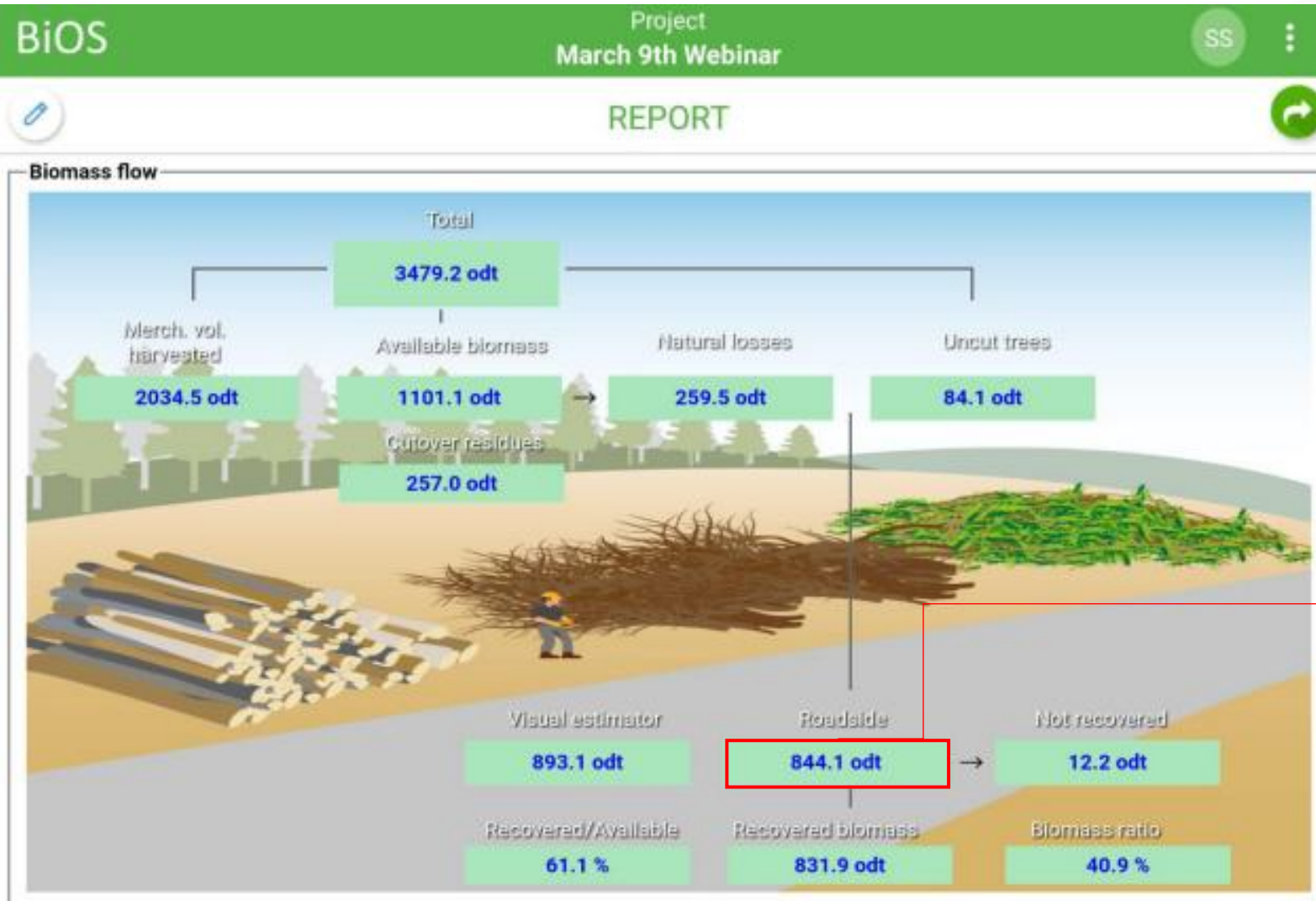
Available biomass = CWD transects and debris pile weights (chipped + pile footprint)

Cutover residues = CWD transects

Natural losses = *not measurable*

Uncut trees = retention patches

Validation Specifics



Total = Gross merchantable volume

Merch. Vol. harvested = Scale report volumes

Available biomass = CWD transects and debris pile weights (chipped + pile footprint)

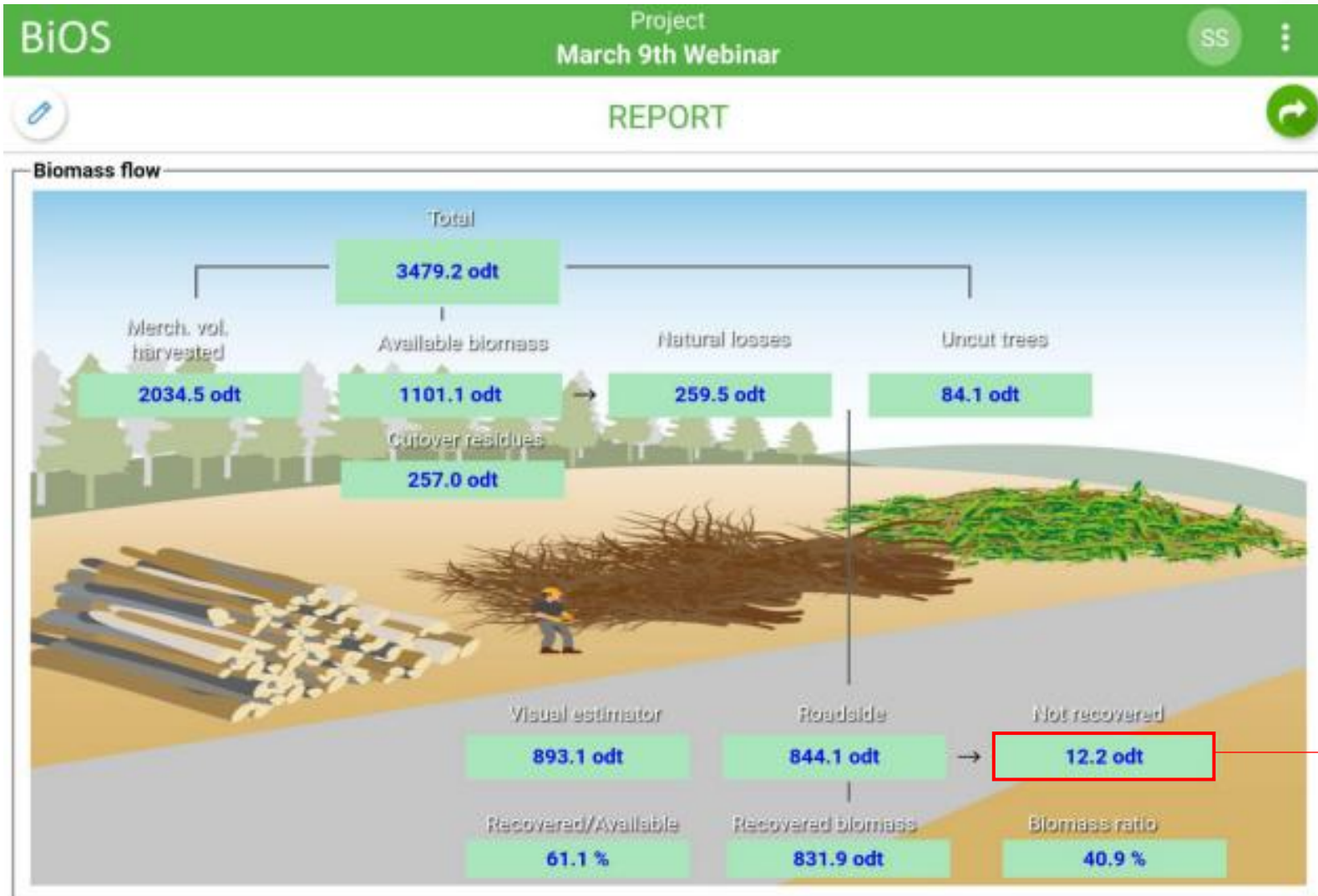
Cutover residues = CWD transects

Natural losses = *not measurable*

Uncut trees = retention patches

Roadside = debris pile weights (chipped + pile footprints)

Validation Specifics



Total = Gross merchantable volume

Merch. Vol. harvested = Scale report volumes

Available biomass = CWD transects and debris pile weights (chipped + pile footprint)

Cutover residues = CWD transects

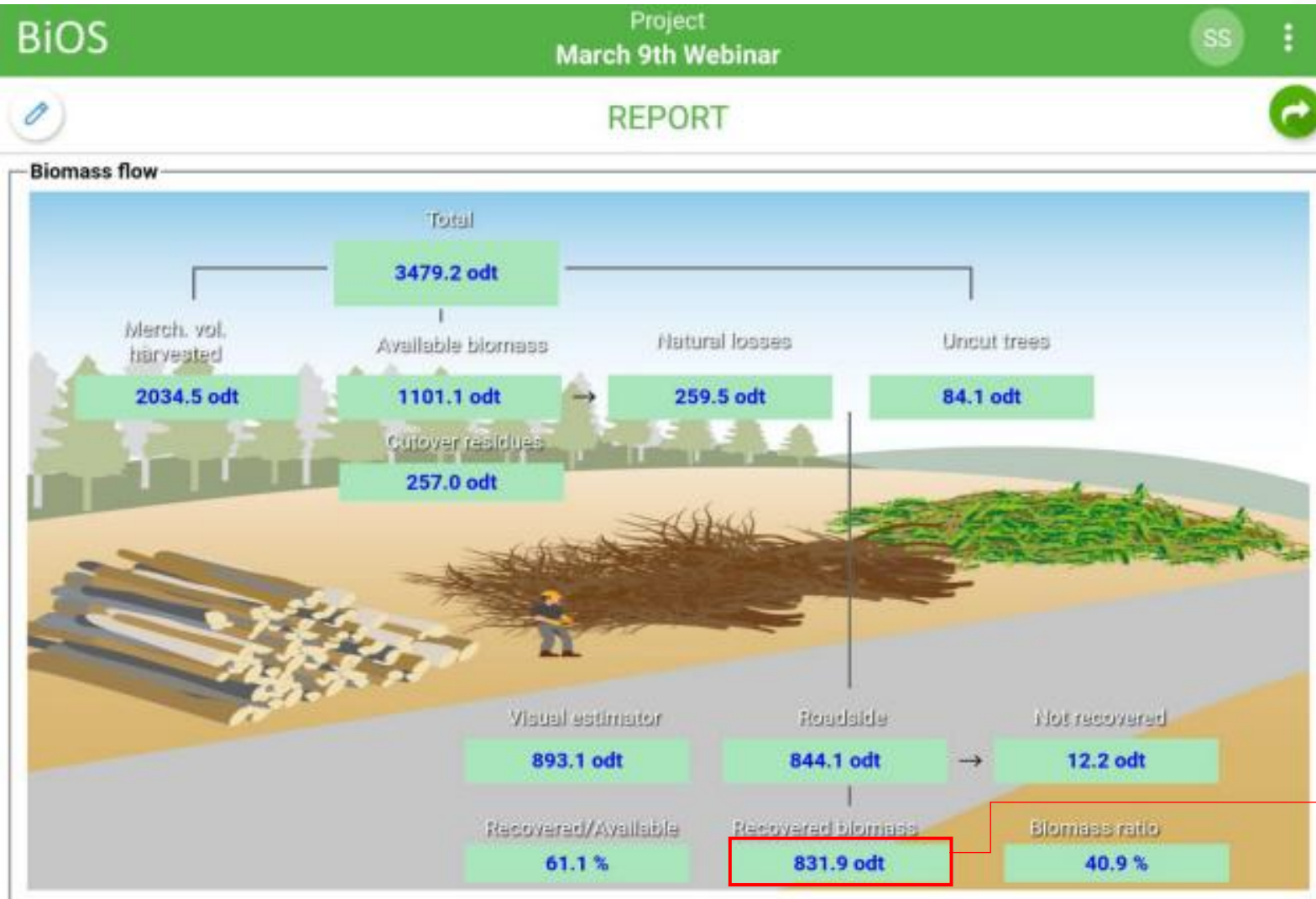
Natural losses = *not measurable*

Uncut trees = retention patches

Roadside = debris pile weights (chipped + pile footprints)

Not recovered = pile footprints

Validation Specifics



Total = Gross merchantable volume

Merch. Vol. harvested = Scale report volumes

Available biomass = CWD transects and debris pile weights (chipped + pile footprint)

Cutover residues = CWD transects

Natural losses = *not measurable*

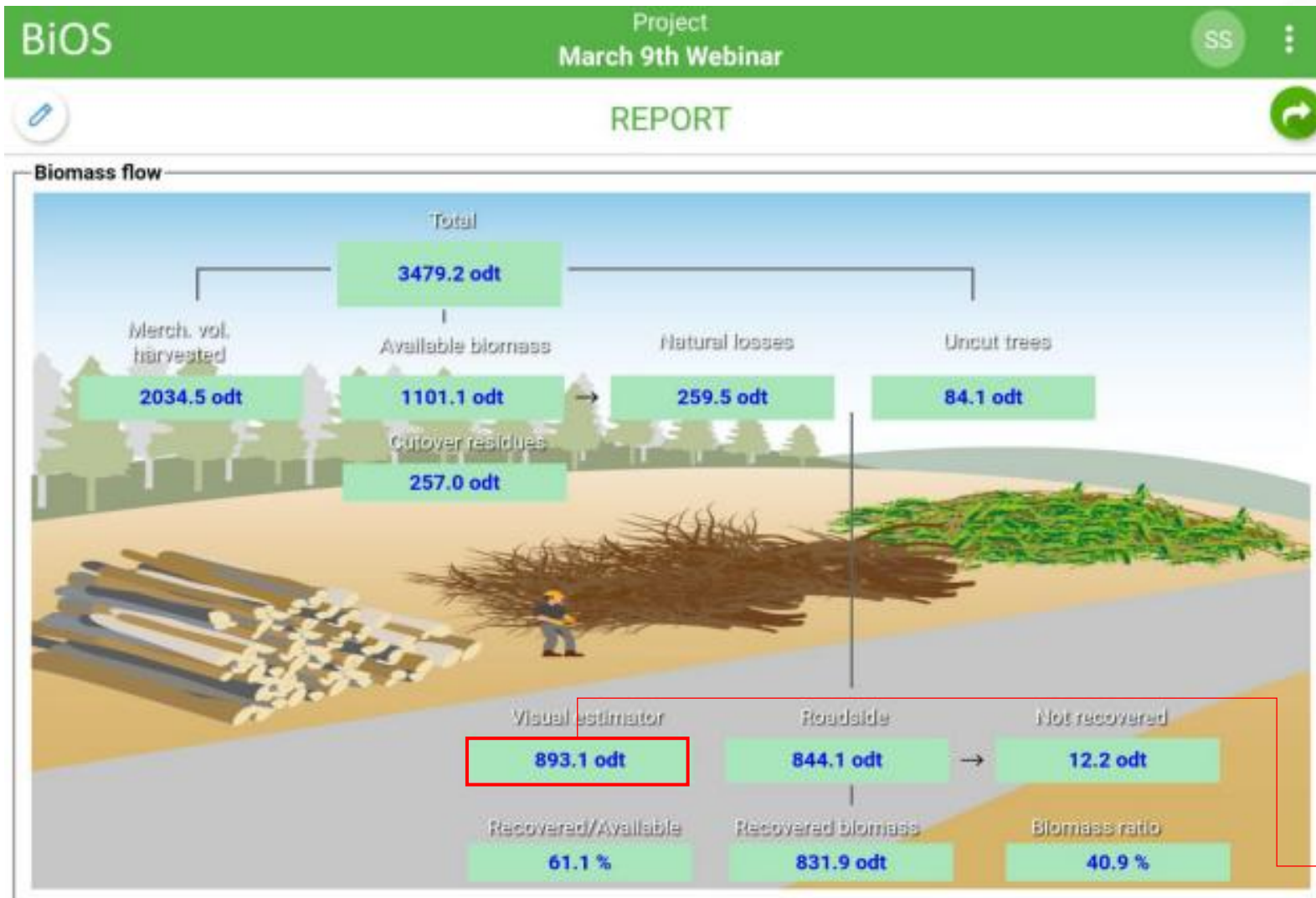
Uncut trees = retention patches

Roadside = debris pile weights (chipped + pile footprints)

Not recovered = pile footprints

Recovered biomass = chipped

Validation Specifics



Total = Gross merchantable volume

Merch. Vol. harvested = Scale report volumes

Available biomass = CWD transects and debris pile weights (chipped + pile footprint)

Cutover residues = CWD transects

Natural losses = *not measurable*

Uncut trees = retention patches

Roadside = debris pile weights (chipped + pile footprints)

Not recovered = pile footprints

Recovered biomass = chipped

Visual estimator = apparent volumes from UAV imagery

Validation Specifics



Update Species

Douglas fir interior

UPDATE CANCEL

SPECIES LIST

Douglas fir interior

Gross Merchantable Volume per ha
110 m³/ha

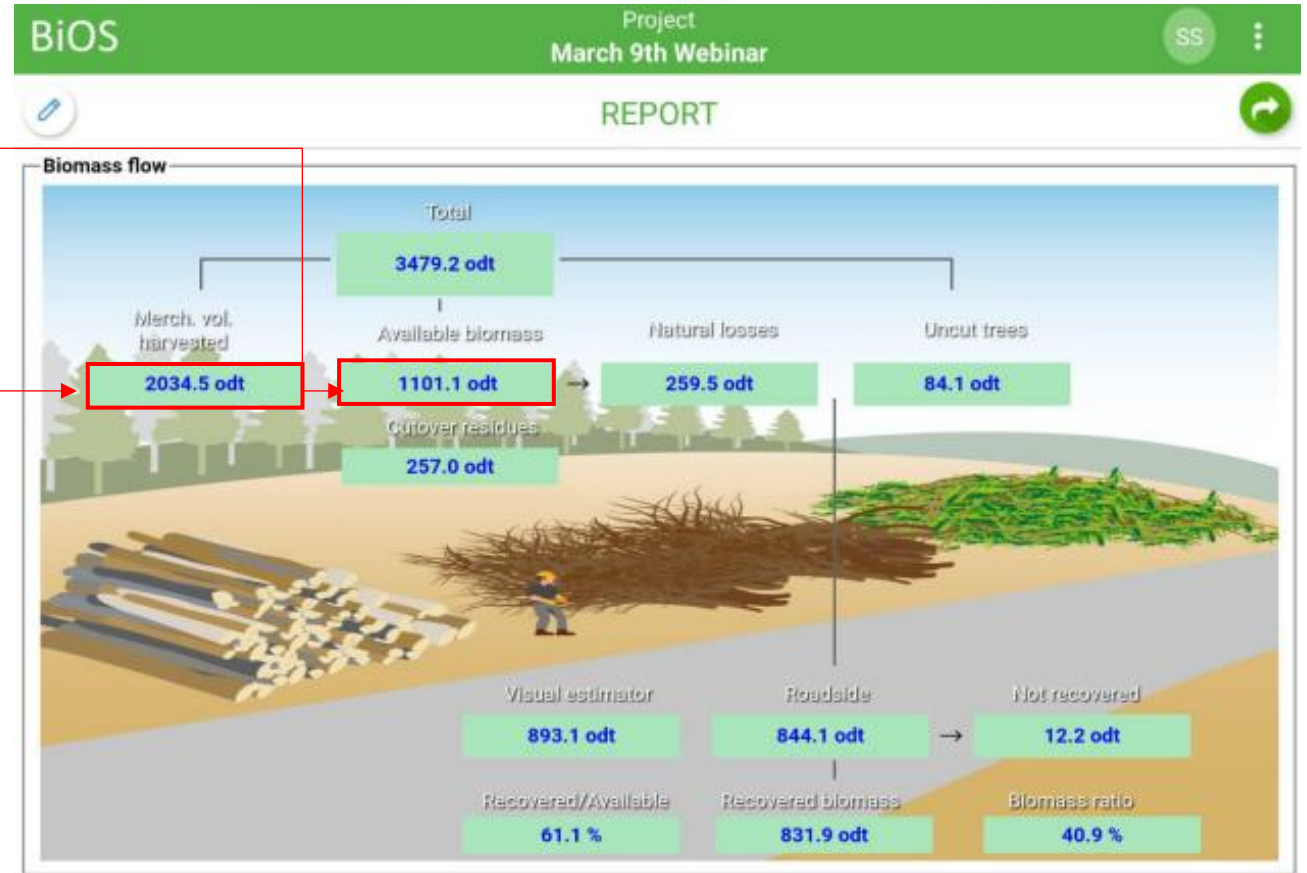
Topping Diameter
12.1 cm

Harvest Removal
98 %

Decay-waste-breakage
5 %

Calculate value

Gross Merchantable Volume per Tree
0.380 m³/tree



Validation Specifics



PROJECT INFO SPECIES LOGGING BIOMASS RECOVERY TRANSPORT VISUAL ESTIMATOR MEDIA

Update Species

Douglas fir interior

UPDATE CANCEL

SPECIES LIST

Douglas fir interior

Gross Merchantable Volume per ha: 110 m³/ha

Topping Diameter: 12.1 cm

Harvest Removal: 98 %

Decay-waste-breakage: 5 %

Calculate value

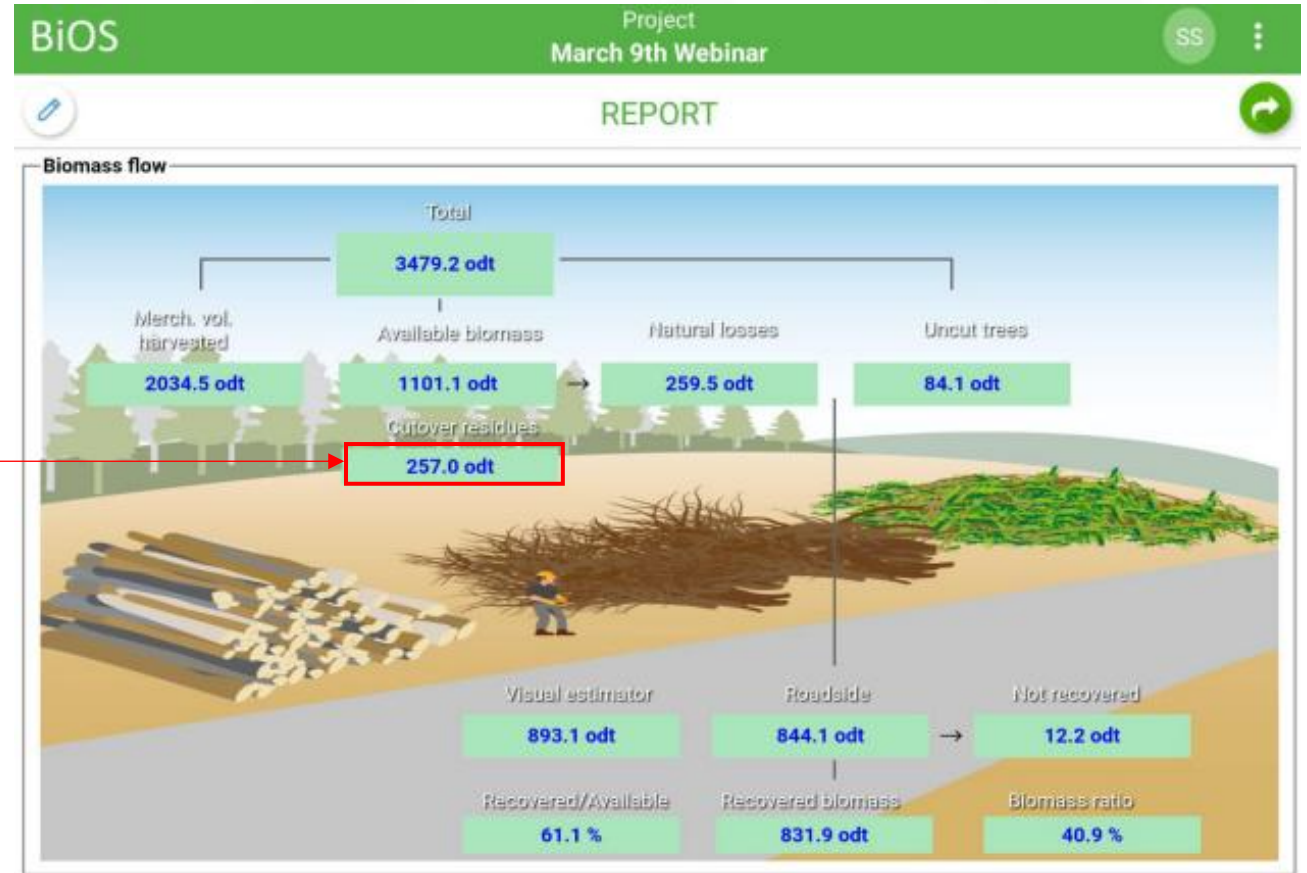
Gross Merchantable Volume per Tree: 0.380 m³/tree

BIOMASS OPERATIONS

Technical losses at-the-stump: 30 %

Pre-piling

EDIT



Validation Specifics



PROJECT INFO SPECIES LOGGING BIOMASS RECOVERY TRANSPORT VISUAL ESTIMATOR MEDIA

Update Species

Douglas fir interior

UPDATE CANCEL

SPECIES LIST

Douglas fir interior

Gross Merchantable Volume per ha: 110 m³/ha

Topping Diameter: 12.1 cm

Harvest Removal: 98 %

Decay-waste-breakage: 5 %

Calculate value

Gross Merchantable Volume per Tree: 0.380 m³/tree

BIOMASS OPERATIONS

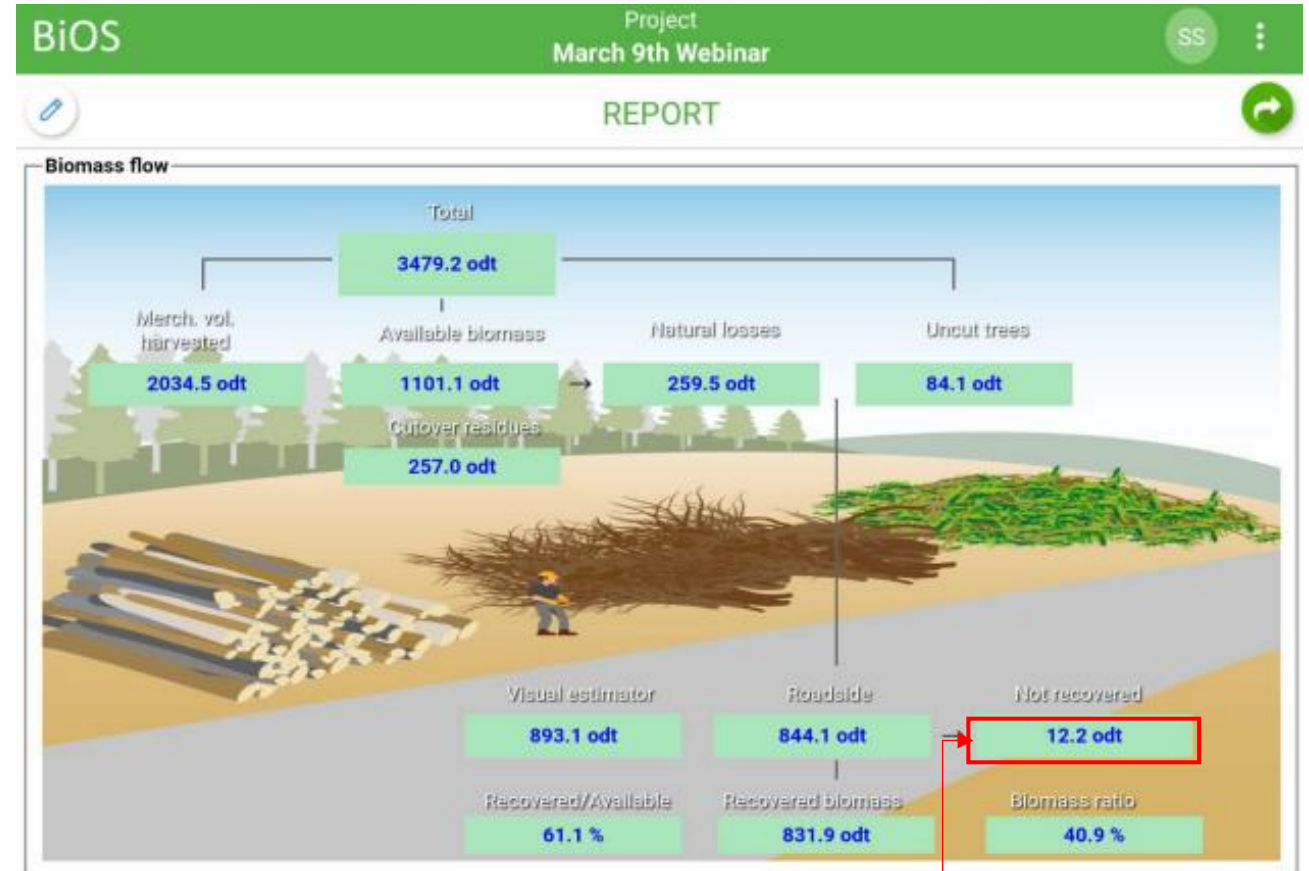
Technical losses at-the-stump: 30 %

Pre-piling

EDIT

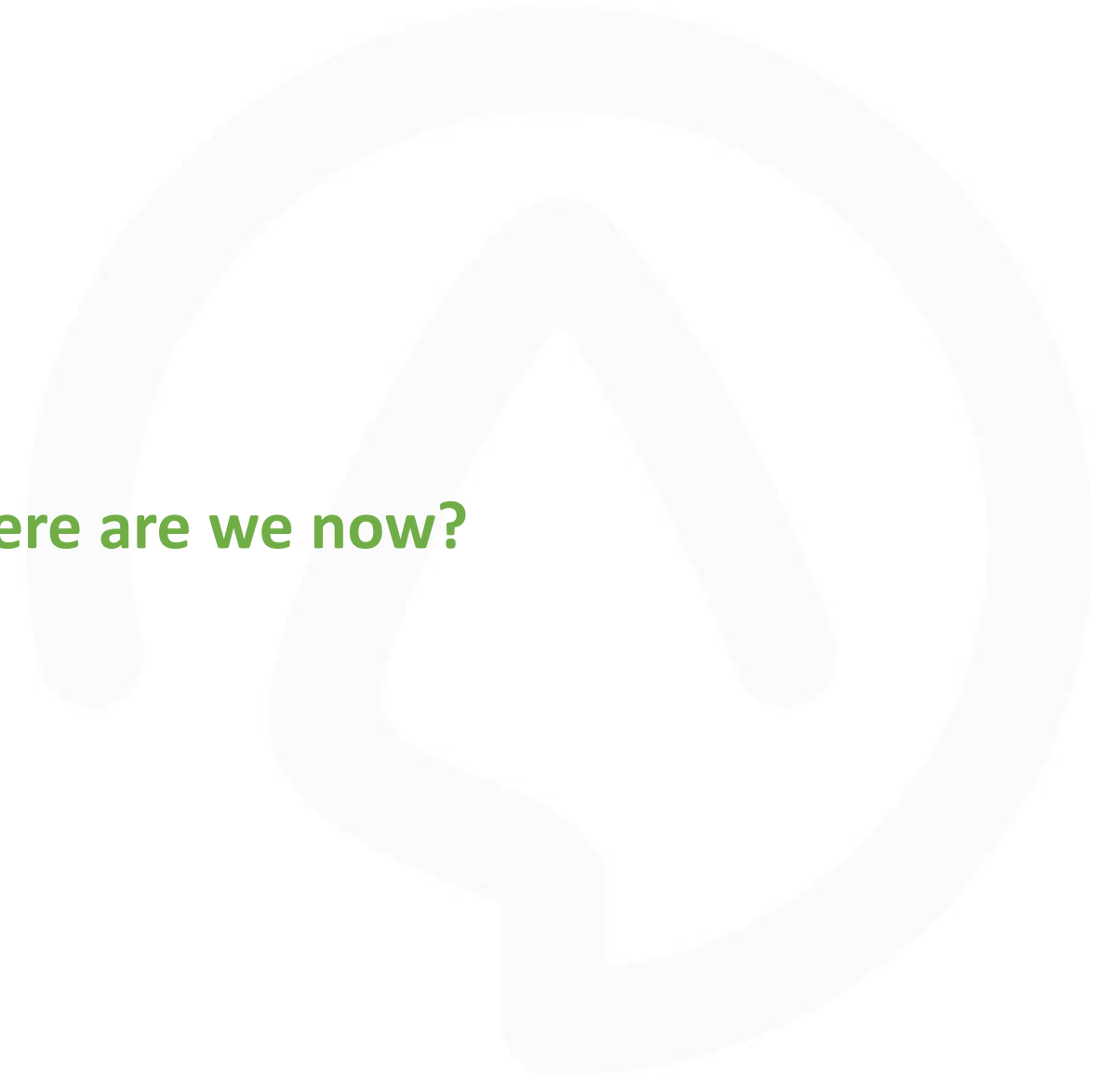
Recovery technical efficiency: 90 %

Effective efficiency (with pre-piler): 100%





BIOS Validations: **Where are we now?**





Current Progress

- The final report is in review
- App updates are underway
- Validations never really *end*
 - The more data the better
 - If grinding operations are planned for 2025, please contact Brianna.Brochez@fpinnovations.ca

GHG pile burning trial





Current Progress

- The final report is in review
- App updates are underway
- Validations never really *end*
 - The more data the better
 - If grinding operations are planned for 2025, please contact Brianna.Brochez@fpinnovations.ca
- GHG emissions factors validation from pile burning
 - Separate project looking at the emissions produced by pile burning
 - Incorporated into the BiOS app to better estimate emission savings when utilizing residual fibre
 - If you are interested in helping us with these, please contact Rebecca.Scheelar@fpinnovations.ca



ANY QUESTIONS?

brianna.brochez@fpinnovations.ca



web.fpinnovations.ca