



BiOS

A roadside biomass volume calculator

March 9th, 2021

Stu Spencer, Senior Researcher





BiOS App – What is it?

What is it?

- BiOS is a free App, designed for tablets, that calculates available biomass volumes (at roadside), secondary harvest costs and greenhouses gases for a single cutblock.
- This data can be uploaded to the BC Forest Biomass Supply Information System (FBSIS) to display aggregate harvest residual availability.



BiOS App – Why is it needed?

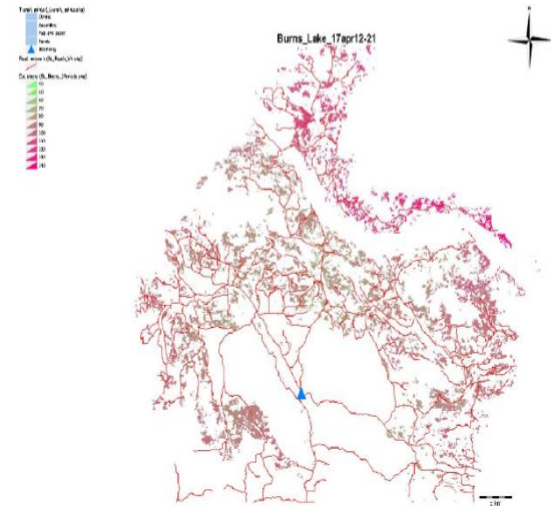
Why is it needed?

- Lack of accurate information on the cost and availability of forest residual biomass is one of the main impediments in developing a sustainable forest bioeconomy for British Columbians.

BiOS App – Why is it needed?

Why is it needed?

- BiOS data can assist secondary harvest operators in their decision-making processes.
- BiOS data, in an aggregated form displayed on the BC FBSIS platform, can assist decision makers de-risk new enterprises that will be dependent on harvest residuals.



BiOS App Walkthrough

Project Info Page

Step 1 – Enter a project name

Step 2 – If the location function is enabled in your tablet, BiOS will determine the coordinates of the cutblock automatically. Coordinates can also be entered manually

Step 3 – Enter the area for the cutblock

Step 4 – Pick option 'Field assessment' or 'Off-site assessment'

Field assessment will share the data with FLNRORD

Off-site assessment will keep the data within your tablet

BiOS

PROJECT INFO SPECIES LOGGING BIOMASS RECOVERY TRANSPORT VISUAL ESTIMATOR MEDIA

Project Name

Location
Latitude Longitude
51.73 -121.35

Area *ha*

Project Type *
 Field assessment Off-site assessment

* Only projects that are located in British Columbia and whose project type is field assessment will be synchronized with ArcGIS Online.

CANCEL NEXT >

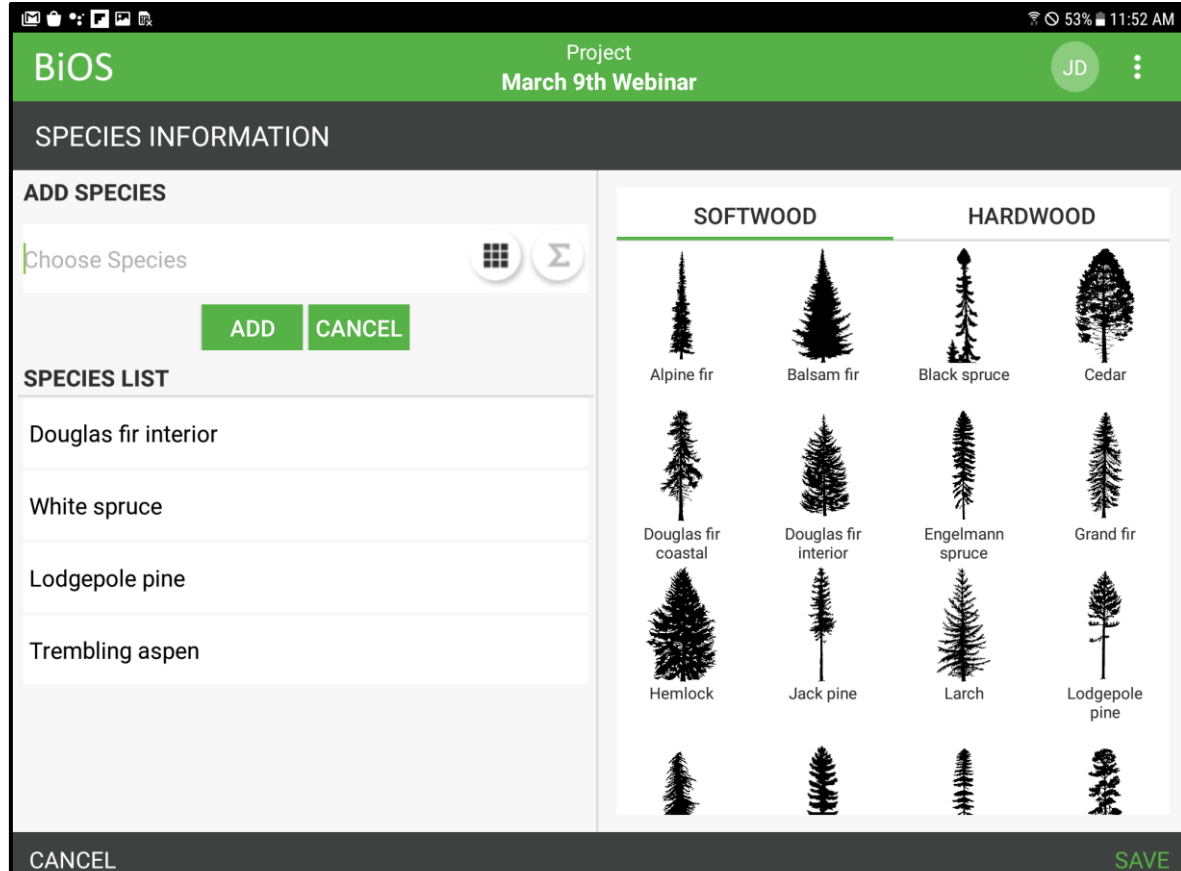
BiOS App Walkthrough

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 App Walkthrough

Species Page

Step 2 – After a species has been chosen, enter data from field collection and cruise compilation:

- Gross merchantable volume per ha
 - Topping diameter
 - Harvest removal %
 - Decay-waste-breakage %
 - Gross merchantable volume per tree – from cruise compilation
- OR**
- Gross merchantable volume per tree – manual calculation from tree height and diameter at breast height

The screenshot shows the BiOS app interface. At the top, the title bar reads "BiOS" and "Project March 9th Webinar". Below the title bar is a navigation menu with tabs: PROJECT INFO, SPECIES (highlighted), LOGGING, BIOMASS RECOVERY, TRANSPORT, VISUAL ESTIMATOR, and MEDIA. The main content area is titled "Update Species" and displays "Douglas fir interior" with a grid icon and a summation symbol. Below this are two buttons: "UPDATE" and "CANCEL". A "SPECIES LIST" section shows "Douglas fir interior" selected. To the right, a form for data entry is visible, with the following fields and values:

Field	Value	Unit
Gross Merchantable Volume per ha	110	m ³ /ha
Topping Diameter	12.1	cm
Harvest Removal	98	%
Decay-waste-breakage	5	%

Below the form, there is a "Calculate value" toggle switch (turned on) and a resulting value of "0.380" with the unit "m³/tree". At the bottom of the screen, there are navigation buttons: "< BACK", "CANCEL", and "NEXT >".

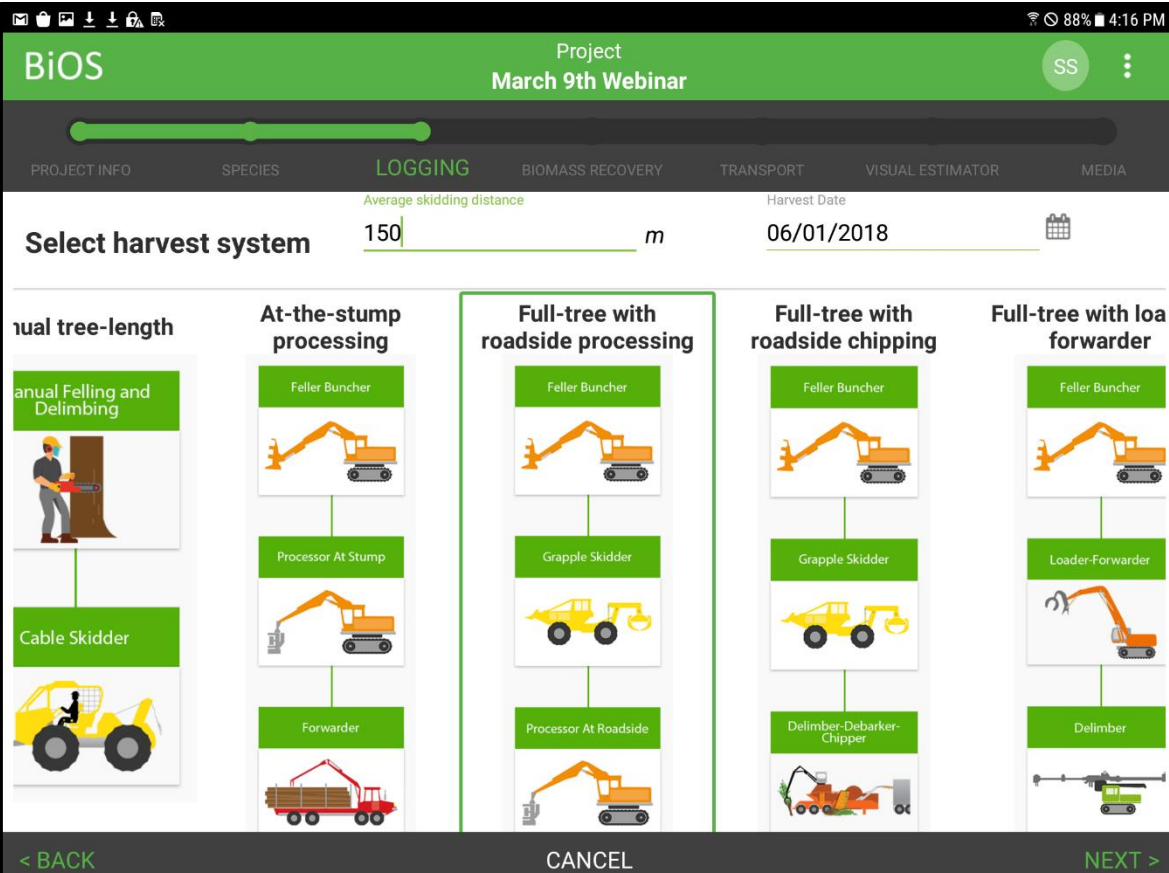
BiOS App Walkthrough

Logging Page

Step 1 – Choose the primary harvest system (7 methods to choose from).

Step 2 – Enter an average ‘skidding distance’.

Step 3 – Enter the harvest date.



BiOS App Walkthrough

Biomass Recovery Page

Step 1 – Choose a secondary harvest method. (Chipping or grinding).

Step 2 – Enter a secondary harvest date.

When you choose your secondary harvest method an edit button will appear.

BiOS is fully populated with default values based on FPInnovations studies but users may wish to refine values to match their own experience.

Project
March 9th Webinar

PROJECT INFO SPECIES LOGGING **BIOMASS RECOVERY** TRANSPORT VISUAL ESTIMATOR MEDIA

COMMINUTION

Roadside chipper 600 kW (800 hp)

Horizontal grinder 600 kW (800 hp) **EDIT...**

Horizontal grinder 820 kW (1100 hp)

RECOVERY DATE

March 2021

Sun	Mon	Tue	Wed	Thu	Fri	Sat
28	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31	1	2	3
4	5	6	7	8	9	10

< BACK CANCEL NEXT >

BiOS App Walkthrough

Biomass Recovery Page Edit feature

The edit feature allows the user to change many variables in order to match the secondary harvest operation:

- Productivity and utilization
- Shift features
- Operator rates
- Fuel consumption and cost
- Recoverability of fibre

The screenshot shows the BiOS app interface for editing a project. The top bar is green and contains the text "BiOS" on the left, "Project March 9th Webinar" in the center, and a user profile icon on the right. Below the bar, the title "HORIZONTAL GRINDER 600 KW (800 HP)" is displayed. The main content area is divided into several sections:

- Summary:** Cost of this phase: 16.97 \$/odt, Hourly cost: 427.61 \$/PMH, Annual production: 55440 odt.
- Productivity:** Calculated productivity: 25.2 odt/PMH. A toggle switch is turned on, and a text input field contains "25.2" odt/PMH.
- Recovery technical efficiency:** 90 %.
- Effective efficiency (with pre-piler):** 100%.
- Cost:** Hours per shift: 12 h, Shifts per day: 1, Days per year: 250, Operators hourly rate: 40 \$/hour.
- Utilization rate:** 70 %.
- Fuel cost:** 1.15 \$/L.
- Fuel consumption:** 135 L/PMH.
- Profit:** 10 %.

At the bottom of the screen, there are two buttons: "CANCEL" on the left and "SAVE" on the right.

BiOS App Walkthrough

Transport Page

Step 1 – Choose a truck configuration (3 types).

Step 2 – Enter a destination. If delivery point is not available in list or your tablet is not connected to the internet, you may enter distance into cycle time calculator manually.

When you choose your secondary harvest method an edit button will appear.

BiOS is fully populated with default values based on FPInnovations studies but users may wish to refine values to match their own experience.

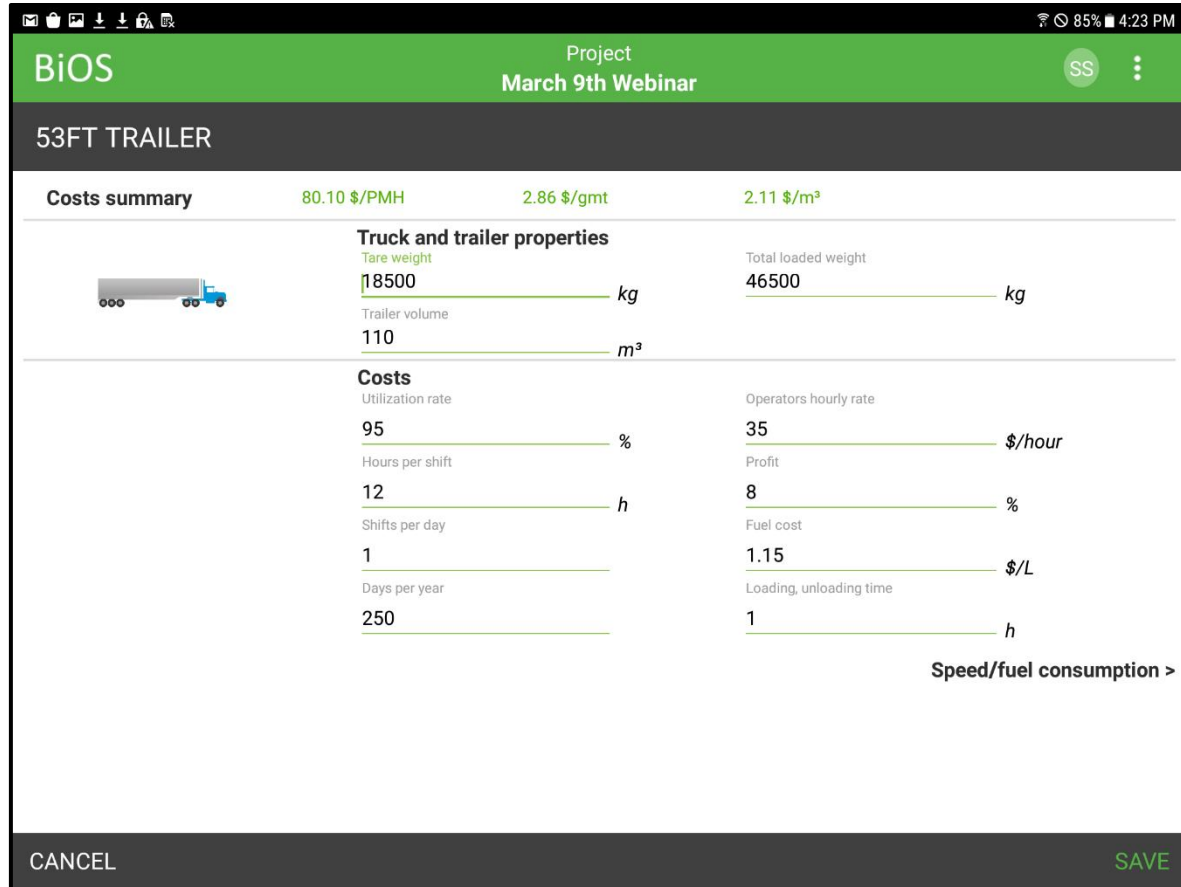
The screenshot displays the BiOS app interface for the 'Transport' page. At the top, the app title 'BiOS' and project information 'Project March 9th Webinar' are visible. A progress bar indicates the current step. The navigation menu includes 'PROJECT INFO', 'SPECIES', 'LOGGING', 'BIOMASS RECOVERY', 'TRANSPORT' (highlighted), 'VISUAL ESTIMATOR', and 'MEDIA'. The main content area is divided into two columns. The left column, titled 'TRUCK CONFIGURATION', lists three options: '53ft trailer' (highlighted with a green box and an 'EDIT...' button), 'B-train', and 'Bin'. The right column, titled 'DESTINATION', shows '100 Mile Lumber (West Fraser Timber Co Ltd)' selected, with '100 Mile House' and 'OSB Board' as alternatives. Below this is the 'DISTANCE CALCULATION' section, which has 'User-Defined' selected over 'Automatic *'. It features three input fields: 'Operational' (value 1), 'Primary' (value 3), and 'Public' (value 15), all in kilometers. A note at the bottom states '* Requires internet connection'. The bottom navigation bar contains '< BACK', 'CANCEL', and 'NEXT >'.

BiOS App Walkthrough

Transport Page - Truck and Trailer Edit feature

The truck and trailer properties edit feature allows the user to change many variables in order to match the truck configuration used by the operation:

- Tare and max loaded weight
- Trailer volume
- Utilization
- Shift features
- Operator rates
- Fuel consumption and cost
- Loading and unloading times



BiOS Project
March 9th Webinar

53FT TRAILER

Costs summary 80.10 \$/PMH 2.86 \$/gmt 2.11 \$/m³

Truck and trailer properties

Tare weight 18500 kg

Trailer volume 110 m³

Total loaded weight 46500 kg

Costs

Utilization rate 95 %

Hours per shift 12 h

Shifts per day 1

Days per year 250

Operators hourly rate 35 \$/hour

Profit 8 %

Fuel cost 1.15 \$/L

Loading, unloading time 1 h

Speed/fuel consumption >

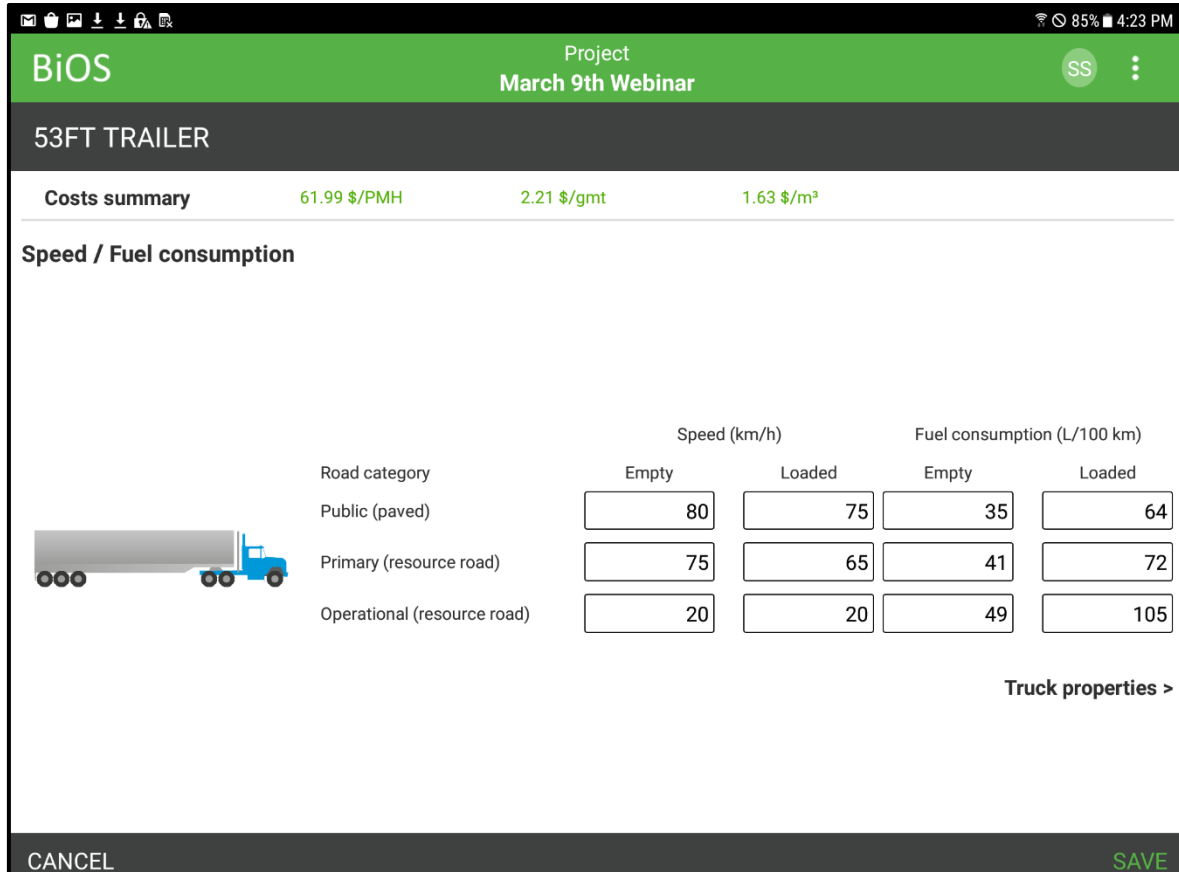
CANCEL SAVE

BiOS App Walkthrough

Transport Page – Speed / Fuel Edit feature

The speed/fuel consumption edit feature allows the user to change many variables in order to better match the speeds and fuel consumptions experienced by the operation:

- Loaded and empty road speeds for 3 different road types
- Loaded and empty fuel consumption for 3 different road types



The screenshot shows the BiOS app interface for a 53FT TRAILER. The top bar is green with the text "BiOS" and "Project March 9th Webinar". Below this, the title "53FT TRAILER" is displayed. A "Costs summary" section shows three values: 61.99 \$/PMH, 2.21 \$/gmt, and 1.63 \$/m³. The main section is titled "Speed / Fuel consumption" and features a table with a truck icon on the left. The table has columns for "Road category", "Speed (km/h)" (subdivided into "Empty" and "Loaded"), and "Fuel consumption (L/100 km)" (subdivided into "Empty" and "Loaded"). The rows represent "Public (paved)", "Primary (resource road)", and "Operational (resource road)". A "Truck properties >" link is located at the bottom right of the table area. At the very bottom of the screen, there are "CANCEL" and "SAVE" buttons.

Road category	Speed (km/h)		Fuel consumption (L/100 km)	
	Empty	Loaded	Empty	Loaded
Public (paved)	80	75	35	64
Primary (resource road)	75	65	41	72
Operational (resource road)	20	20	49	105

[Truck properties >](#)

CANCEL SAVE

BiOS App Walkthrough

Visual Estimator Page - Pile definitions

The visual estimator is a tool that calculates the total volume within a single or group of piles.

Step 1 – Add a pile.

Step 2 – Pick a pile shape.

Step 3 – Enter pile dimensions (height, length, width)

Step 4 – Choose a bulking factor (4 to choose from, or user defined value)

The screenshot displays the BiOS app interface for the 'Project March 9th Webinar'. The 'VISUAL ESTIMATOR' tab is active, showing 'PILE DEFINITIONS' and 'PILE FOOTPRINTS (MAP LAYERS)'. The 'PILE DEFINITIONS' section includes an 'ADD PILE' button and a list of three piles. The 'PILE SHAPE' section shows three options: CONE, WINDROW, and ORIENTED. The 'BULKING FACTOR' section allows selecting a bulking factor (Loose slash (20%) is selected) or entering a custom value (0). The 'PILE MEASUREMENTS' section shows dimensions for three piles.

Pile #	Apparent volume: m ³	Estimated dry weight: odt
Pile #1	49.9	4.3
Pile #2	39.5	3.4
Pile #3	239.9	20.6

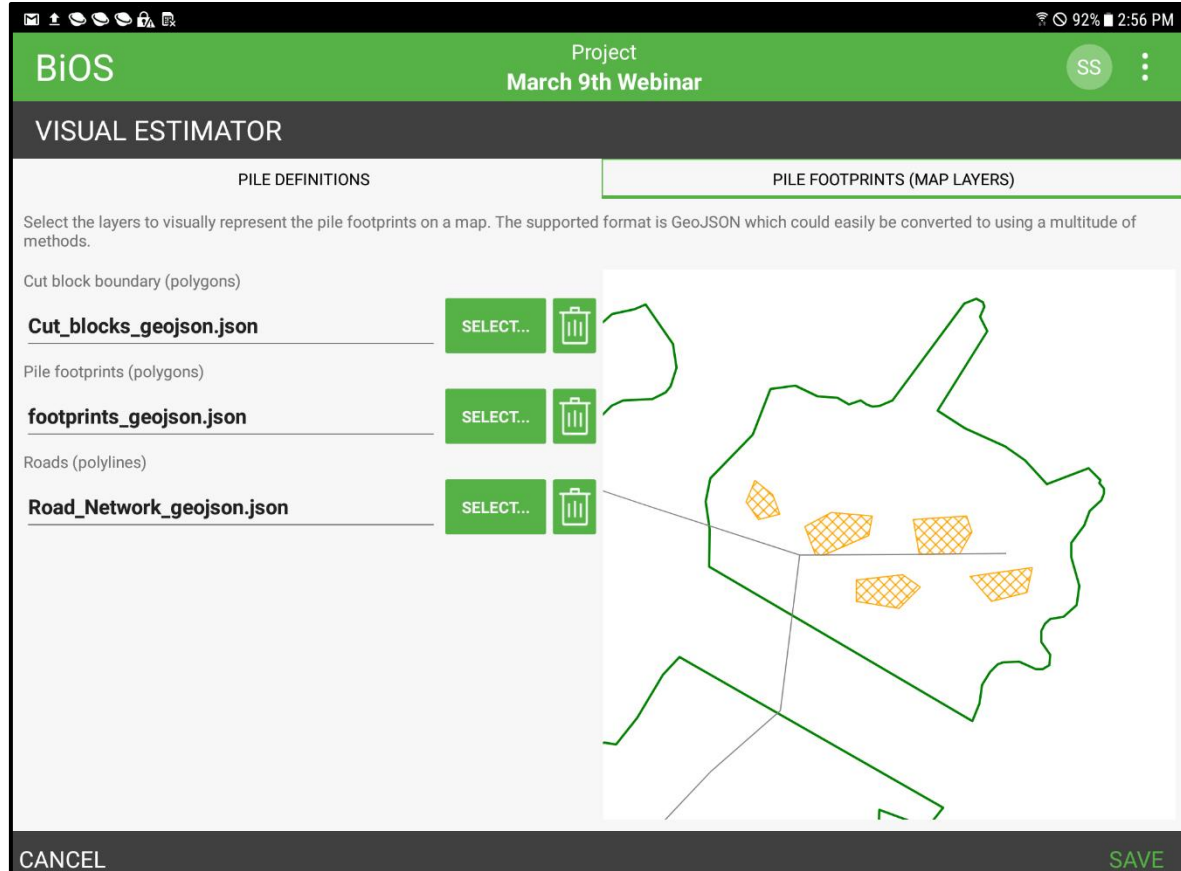
Measurement	Value	Unit
Height #1	1.6	m
Height #2	0	m
Height #3	0	m
Length #1	30.6	m
Width #1	9.8	m
Width #2	0	m
Width #3	0	m

BiOS App Walkthrough

Visual Estimator Page – Pile footprints

A new feature to BiOS is the ability to import spatial data for the cutblock boundaries, the road network and the pile footprints.

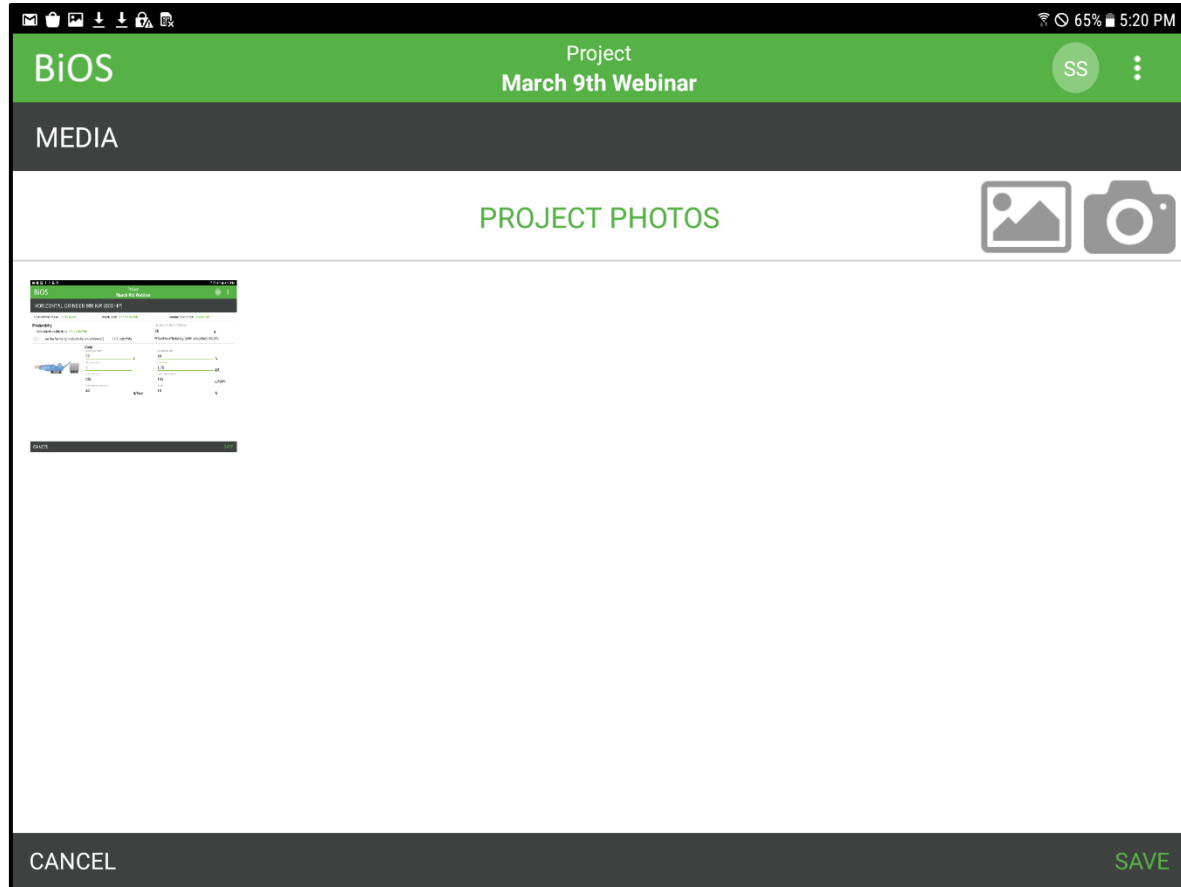
Future updates of this feature will optimistically include the ability to print the map and to calculate the size of the pile footprints.



BiOS App Walkthrough

Media page

The media page allows you take and store photos for the project.



BiOS App Walkthrough

BiOS App Reporting

After all the data entry screens have been completed, BiOS will generate a report.

This report includes biomass recovery (stump to roadside) estimates:

- Recoverable biomass
- Biomass yield (oven dry tonnes per ha)
- Heating values
- Litres of fuel consumed in recovery
- GHG's created

Transportation information is also summarized including:

- Litres of fuel consumed in transport
- GHG's created during transport

The screenshot displays the BiOS app interface. At the top, there's a green header with 'BiOS' on the left, 'Project March 9th Webinar' in the center, and 'SS' and a menu icon on the right. Below the header, there's a 'REPORT' button and a share icon. The main content area shows the report title 'March 9th Webinar' and 'Off-site assessment'. To the right, it lists 'Logging operations: Full-tree with roadside processing' and 'Biomass operations: Pre-piling, Comminution (Horizontal grinder 600 kW (800 hp))'. The report is divided into two sections: 'Biomass recovery' and 'Biomass transport'. The 'Biomass recovery' section includes metrics like Area (28.4 ha), Recovered biomass (831.9 odt), Average moisture content (45.0 %), Biomass yield (29.3 odt/ha), Biomass (odt)/Merchantable (m³) (0.177 odt/m³), Low heating value (10.4 MJ/kg), Fuel consumption (9.3 L/odt), and GHG emissions (CO2eq) (21.2 tonnes). The 'Biomass transport' section includes 'Distance to 100 Mile Lumber (West Fraser Timber Co Ltd) by road category' (19.0 km), Operational (resource road) (1.0 km), Primary (resource road) (3.0 km), Public (paved) (15.0 km), Fuel Consumption (1.5 L/odt), and GHG emissions (CO2eq) (3.5 tonnes). At the bottom right, there's a 'PROJECT LIST >' button.

Biomass recovery	
Area	28.4 ha
Recovered biomass	831.9 odt
Average moisture content	45.0 %
Biomass yield	29.3 odt/ha
Biomass (odt)/Merchantable (m ³)	0.177 odt/m ³
Low heating value	10.4 MJ/kg
Fuel consumption	9.3 L/odt
GHG emissions (CO2eq)	21.2 tonnes

Biomass transport	
Distance to 100 Mile Lumber (West Fraser Timber Co Ltd) by road category	19.0 km
Operational (resource road)	1.0 km
Primary (resource road)	3.0 km
Public (paved)	15.0 km
Fuel Consumption	1.5 L/odt
GHG emissions (CO2eq)	3.5 tonnes

BiOS App Walkthrough

BiOS App Reporting

Recovery (stump to roadside) and transportation (roadside to mill) costs are generated.

An analysis of greenhouses gases is generated with a delivered to emitted carbon ratio.

Biomass supply cost

Recovery (stump to roadside)	32.97 \$/odt
Transport (roadside to mill)	9.60 \$/odt
Total	42.57 \$/odt

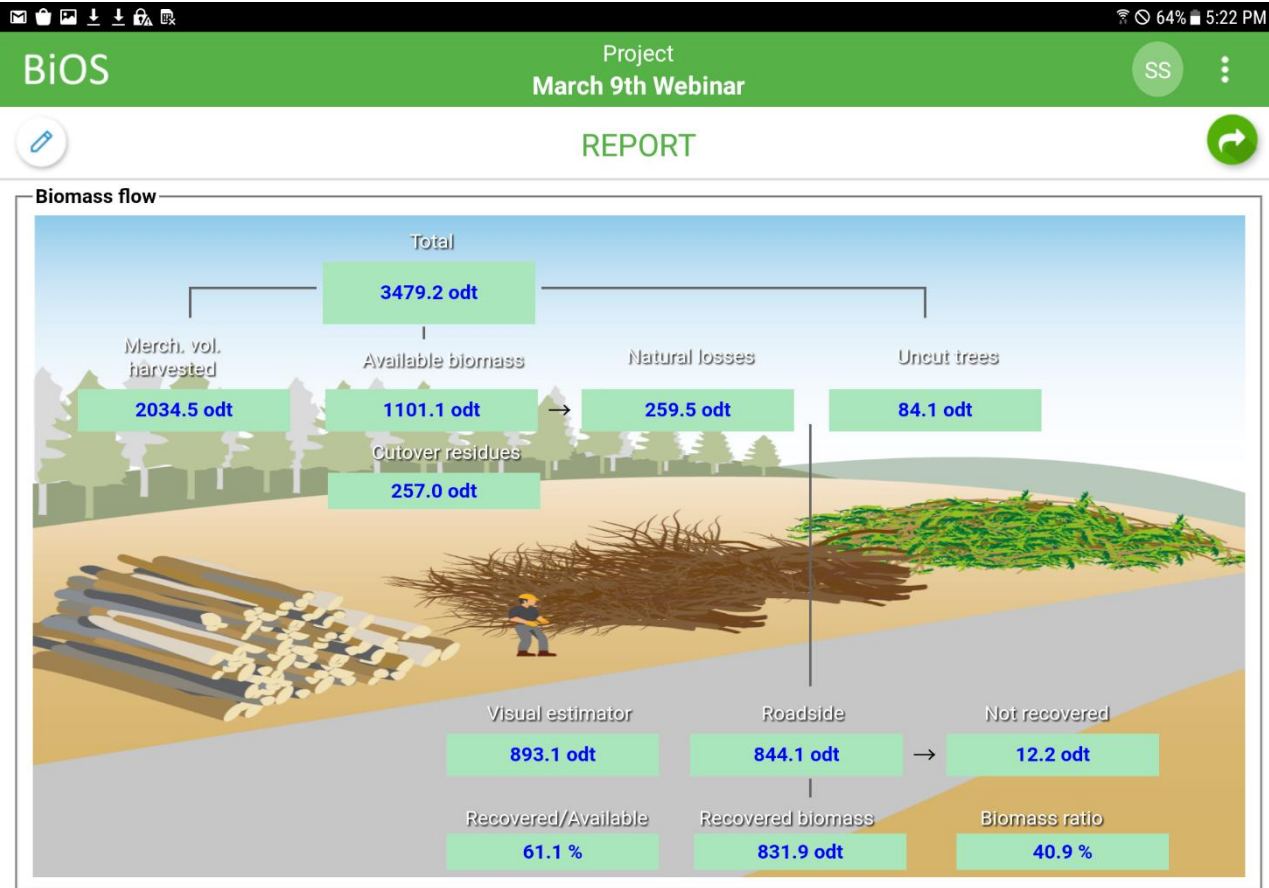
Species breakdown

Species	Carbon delivered (tonnes)	Avoided GHG (tonnes CO2eq)	odt	odt/m ²	odt/ha
Douglas fir interior	266.4	868.6	532.9	0.1587	18.76
White spruce	64.8	211.1	129.5	0.1207	4.56
Lodgepole pine	84.7	276.3	169.5	0.6156	5.97
Trembling aspen	0.0	0.0	0.0	0.0000	0.00
	415.9	1356.0	831.9	0.1768	29.29
Carbon ratio (delivered:emitted)	17:1				

BiOS App Walkthrough

BiOS App Reporting – Flow diagram

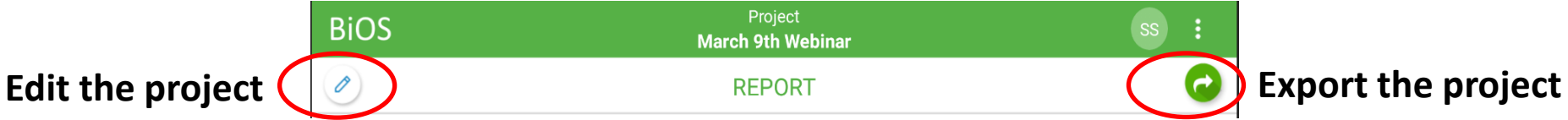
A flow diagram is generated to visually demonstrate the breakdown of residual fibre as it makes its way to roadside.



BiOS App Walkthrough

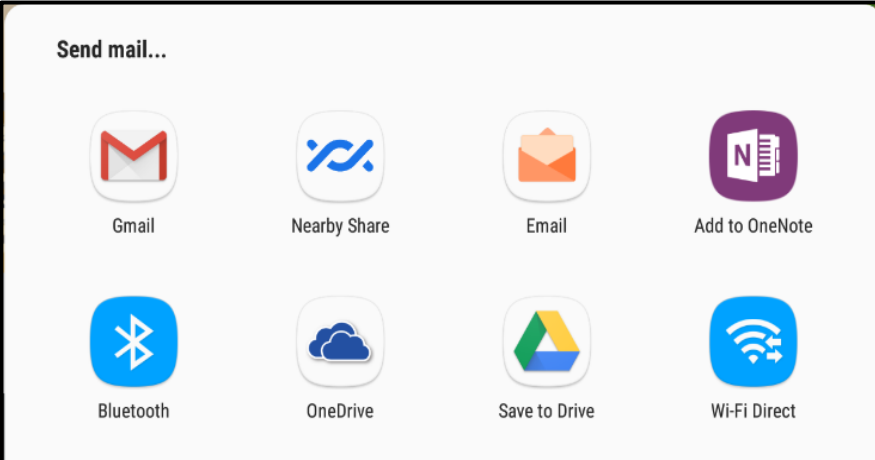
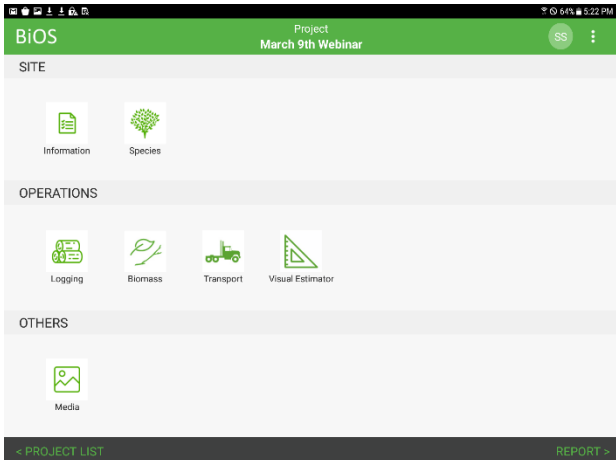
BiOS App Reporting

After the report has been generated, the user has two options; Edit the project or export the report for the project.



The edit button will allow the user to go back through and modify any of the pages or entry field in the app and then generate a new report.

The export button will allow the user to choose the method of export.



BiOS App Walkthrough

BiOS App Reporting



(Stu Spencer)

March 9th Webinar

Logging operations: Full-tree with roadside processing

Off-site assessment

Biomass operations: Pre-piling, Comminution (Horizontal grinder 600 kW (800 hp))

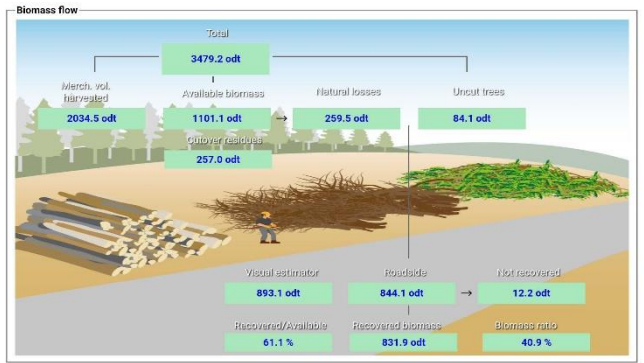
Biomass recovery	
Area	28.4 ha
Recovered biomass	831.9 odt
Average moisture content	45.0 %
Biomass yield	29.3 odt/ha
Biomass (odt)/Merchantable (m ³)	0.177 odt/m ³
Low heating value	10.4 MJ/kg
Fuel consumption	9.3 L/odt
GHG emissions (CO ₂ eq)	21.2 tonnes

Biomass transport	
Distance to 100 Mile Lumber (West Fraser Timber Co Ltd) by road category	19.0 km
Operational (resource road)	1.0 km
Primary (resource road)	3.0 km
Public (paved)	15.0 km
Fuel Consumption	1.5 L/odt
GHG emissions (CO ₂ eq)	3.5 tonnes

Biomass supply cost	
Recovery (stump to roadside)	32.97 \$/odt
Transport (roadside to mill)	9.60 \$/odt
Total	42.57 \$/odt

Species breakdown					
Species	Carbon delivered (tonnes)	Avoided GHG (tonnes CO ₂ eq)	odt	odt/m ²	odt/ha
Douglas fir interior	266.4	868.6	532.9	0.1587	18.76
White spruce	64.8	211.1	129.5	0.1207	4.56
Lodgepole pine	84.7	276.3	169.5	0.6136	5.97
Trembling aspen	0.0	0.0	0.0	0.0000	0.00
	415.9	1356.0	831.9	0.1768	29.29
Carbon ratio (delivered:emitted)	17.1				

The report sent by email looks something like this.



How to get the BiOS App?

New version available May 1st!

Android – Google Play

1. Go to Google Play App on your tablet
2. Type 'FPInnovations' into the search box
3. Choose the 'BiOS' App

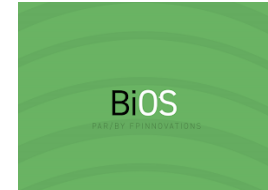
It will have a thumbnail like the graphic below.



Apple – App Store

1. Go to the 'App Store' on your tablet
2. Search 'FPInnovations' in the search function
3. Choose the FPI-BiOS App

It will have two thumbnails like the graphics below.



NEXT STEPS

BiOS is still classified as a Beta application and work is ongoing.

1. Validations in new biogeoclimatic zones (2021-2023)
 - Engelmann Spruce – Subalpine Fir
 - Interior Cedar Hemlock
2. Additional validations in large and diverse zones (2021-2023)
 - Coastal Western Hemlock
 - Interior Douglas-fir
3. Video tutorial series (June 2021)
 - Will direct user step by step through a project in BiOS (FPInnovations – Youtube)



Thank you

Stu Spencer

Senior Researcher

FPInnovations

(778) 828-1216

Stuart.Spencer@fpinnovations.ca

