

Final report

Carbon Calculator Phase 2

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Abstract

The MLA Carbon Calculator has been previously developed with Cognizant Servian. The scope of this phase was to upgrade the website with the new animal categories Goat and Feedlot, as well as update the existing methodology with the latest version of the Greenhouse Accounting Framework (GAF) spreadsheets.

Executive summary

Background

Cognizant Servian has been contracted to build a digitalised version of the GAF excel spreadsheets developed by the University of Melbourne. The first phase of the project was focused on the Beef, Sheep and Crop calculators. The scope of this second phase was to upgrade the calculator with new animal categories Goat and Feedlot as well as update existing methodology with the latest version of the GAF spreadsheets. Additionally, a data pipeline has been added to the infrastructure to be able to run some data analytics on the collected carbon calculations.

Objectives

The main objectives were the following features / integration:

- Goat
- Feedlot
- Methodology upgrade
- Management strategy in PDF
- Combining reports
- Correction and bug fixes
- Data pipeline

Methodology

The team operated in an agile manner with a focus on the objective outcomes, with daily and fortnightly meetings ensuring all milestones had been delivered in a timely manner or if necessary, delayed to allow alignments with other third parties involved.

Results/key findings

All milestones have been successfully delivered and the update has been integrated to the production environment.

Benefits to industry

The livestock industry now has access to a digital version of the GAF excel spreadsheet for Goat and Feedlot producers.

Future research and recommendations

Stakeholders should continue to maintain the platform by digitalising more of the GAF excel spreadsheets as well as keeping the methodology up to date with the latest update of the National inventory report.

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1. Background

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2. Objectives

The main objectives were the following feature / integration:

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- Feedlot
- Methodology upgrade
- Management strategy in PDF
- Combine reports
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- Data pipeline

3. Methodology

The team operated in an agile manner with a focus on the objective outcomes, with daily and fortnightly meetings ensuring all milestones have been delivered in a timely manner or if necessary delayed to allow alignment with other third parties involved.

4. Results

All milestones have been successfully delivered and the update has been integrated to the production environment.

4.1 Goat

Calculations now allow for Goat animal types to be added to the livestock inventory, purchased inventory, sale inventory and wool inventory.

4.2 Feedlot

Calculations now allow for Feedlot animal types to be added to the livestock inventory, purchased inventory and sale inventory.

4.3 Update

The methodology has been updated to align with the latest change on SBGAF v2.3 and GGAF v10.9. The following new features have been developed:

- Managements can be added to the PDF
- Reports can be combined between same year calculation
- Various bug fixes and improvements

4.4 Data pipeline

A data pipeline has been setup allowing MLA to query the database through PowerBI.

5. Conclusion

The MLA Carbon Calculator has been updated successfully with the requested new features.

5.1 Key findings

Not relevant.

5.2 Benefits to industry

The livestock industry now has access to a digital version of the GAF excel spreadsheet for Goat & Feedlot producer.

6. Future research and recommendations

Stakeholders should continue to maintain the platform by digitalising more of the GAF excel spreadsheets as well as keeping the methodology up to date with the latest updates of the National inventory report.

7. References

PICC Resources page with GAF Excel spreadsheet link: <https://www.piccc.org.au/resources/Tools>

8. Appendix

Planning and design document



Carbon Calculator P2 Goat & Feedlot update

Planning & Design Document

1st Nov 2023 - Cognizant Servian

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Introduction

MLA as part of their Carbon Neutral by 2030 strategy, is providing more resources and tools to educate producers to move towards carbon neutrality. In partnership with Cognizant Servian, MLA recently launched a web version of the SB/G GAF calculator accessible online.

The scope of this Phase 2 is to update /extend the Carbon Calculator with 2 new types of animal with Feedlot & Goat as well as update the existing Sheep, Beef and Crop to match the latest up to date calculation methodology following the update of the original GAF excel spreadsheets.

MLA has also exposed the desire to retrieve insight from the carbon calculator usage with analytics. The actual carbon calculator is actually storing raw dataset for MyMLA users. An additional goal of this update will be to extract the raw data from the database, transform into a refined format and give access to MLA data analyst.

Project target:

- Add Goat Go-GAF v1.25
- Add FeedLot F-GAF v.3.9
- Upgrade Sheep & Beef SB-GAF 2.2
- Upgrade Grains G-GAF 10.8
- Software Upgrade (See Milestone 2)
- Data extraction & Transformation

This document provides the design and planning of the update.



Feedlot system

1. Feedlot integration design

Feedlot is a widely used technique to feed Beef livestock, emissions are quite different from the Beef grazing technique therefore it will be hosted in MLA Carbon Calculator as a new category alongside Beef, Sheep, Crop and Goat. Producer will be able to identify themselves as a Feedlot producer allowing them to input data separately from the other sections. Reporting will also be split and Feedlot emission will be separated from Beef.

1.1 Excel structure

For most of the calculation the Feedlot excel F-GAF structure is similar to the previously SB-GAF with the following section:

- Enteric fermentation
- Manure Management
- Manure direct & indirect & soil
- Atmospheric deposition
- Transport
- Purchased Livestock
- Sale inventory Meat

Property level

- Urea application
- Liming
- Electricity
- Fuel
- Off-farm emissions
- Vegetation

1.2 Data input

Custom data input is necessary for feedlot livestock inventory as it doesn't fit with the existing livestock group structure. Similar UI will be created with the ability to create multiple Feedlot groups containing 3 fixed columns (replacing seasons or months) for Domestic, Export & Japan ox categories inside the feedlot group. Feed composition will also be appended to each feedlot group.

Group 1					
	Domestic	Export	Japan ox	Units	
Livestock Numbers (N)		1000	1000	1000	head
Average length of stay (L)		75	140	250	days
Liveweight (W)		360	490	565	kg/head
Dry matter digestibility (DMD)		81	81	81	%
Crude Protein		13.4	13.4	13.4	%
Dietary net energy concentration		8.4	8.4	8.4	MJ/kg
Nitrogen Retention		20.4	12.7	12.7	% of intake
Proportion of feed components					
	Total grains (inc molasses)	Other concentrates	Grasses	Legumes	
	0.779	0.048	0.138	0.035	
Composition of feed components					
Cellulose	0.070	0.190	0.310	0.360	
Hemicellulose	0.040	0.110	0.310	0.200	
Soluble residue	0.680	0.190	0.210	0.210	
Nitrogen	0.020	0.050	0.026	0.032	

Fig 1. Excel Feedlot input system FGAF v3.9

oat Integration



2. Goat integration design

Goat livestock excel spreadsheet is very similar to the Sheep system, with few simplifications on the calculations and therefore less detail on the input side.

2.1 Excel structure

For most of the calculation the Goat excel Go-GAF structure is similar to the previously SB-GAF with the following section:

- Enteric fermentation
 - Manure Management
 - Urine & Dung
 - Atmospheric deposition
 - Leaching & Runoff
 - Purchased Livestock
 - Sale inventory Meat
 - Sale inventory Wool
- Property level
 - Urea application
 - Liming
 - Electricity
 - Fuel
 - Off-farm emissions
 - Vegetation

2.2 Data input

Producers will be asked to fill only the number of heads per type per property and no liveweight is required with the actual Excel methodology GoGAF v1.25.

No custom input is required for this category.

Edit group: Bucks ✕

Bucks: entire male with at least one permanent incisor tooth in wear or shows evidence of secondary sexual characteristics.

	SUMMER	AUTUMN	WINTER	SPRING	UNITS
Headcount	20	20	20	20	# head

Clear **Save**

Fig 2. UI for Goat input



Data Extract & Transform

3. Data Extraction & Transform

The actual carbon calculator database is actually storing raw dataset (for MyMLA users only). MLA data analyst will get access to this dataset through PowerBI after the creation of a data pipeline that extracts & transforms the current database into a refined format usable by PowerBI.

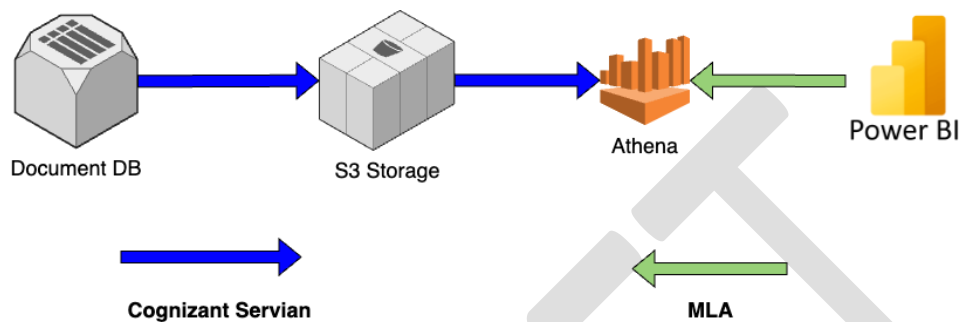


Fig 3. Data pipeline draft

3.1 Data pipeline

After a user reaches the final step of the carbon calculator, step 3 “Result”, the calculation (user input + result) will be saved in S3 storage. A transformation function will then anonymise the data and flatten the data structure to be exposed to PowerBI using AWS Athena. The Power BI data view will then be in live sync with the result served to users, in progress calculations will not show in the data view until the user reaches the result page.

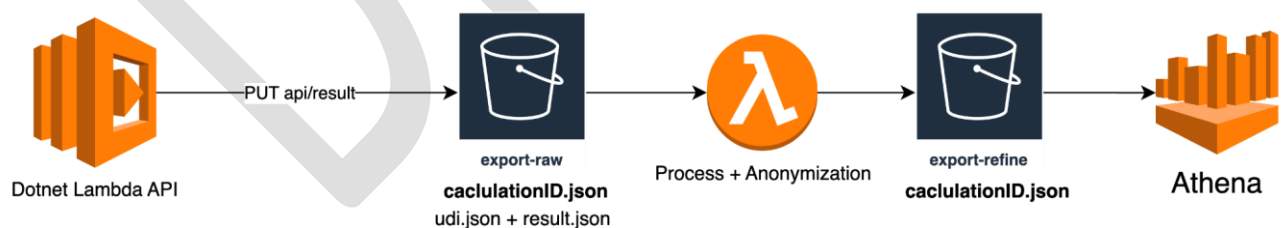


Fig 4. Data pipeline detail

Source code for the lambda function is stored in the GAF-tool-etl repository on MLA bitbucket.

4. Software upgrade

New versions of SB and G GAF have been released, an upgrade of the methodology for those categories will be done at the same time as releasing Goat & Feedlot.

SB Upgrade 2.2

Excel Upload SB-GAF 2.2 / G-GAF 10.8

Multiple entries under the classes of livestock

Data Input 'Soil organic carbon testing results'

Data Input '% of property with remnant vegetation'

Merge multiple calculation together in one report in PDF

Interactive management strategy in PDF

DRAFT



AIA - API Integration

5. AIA API Integration (Optional)

Agriculture Innovation Australia AIA in partnership with MLA and Richard Eckard, creator of the Excel GAF tool, are digitizing all GAF Calculators. MLA Carbon Calculator will transition to using AIA Emissions Calculators API.

5.1 Data input alignment

MLA Carbon calculator and AIA Emissions calculator are very similar in terms of data structure as they have been designed based on the same GAF tool. However, it will still be needed to align the inputs stored in the Carbon calculator to the inputs expected by the AIA API. There are two possible approaches to achieve this.

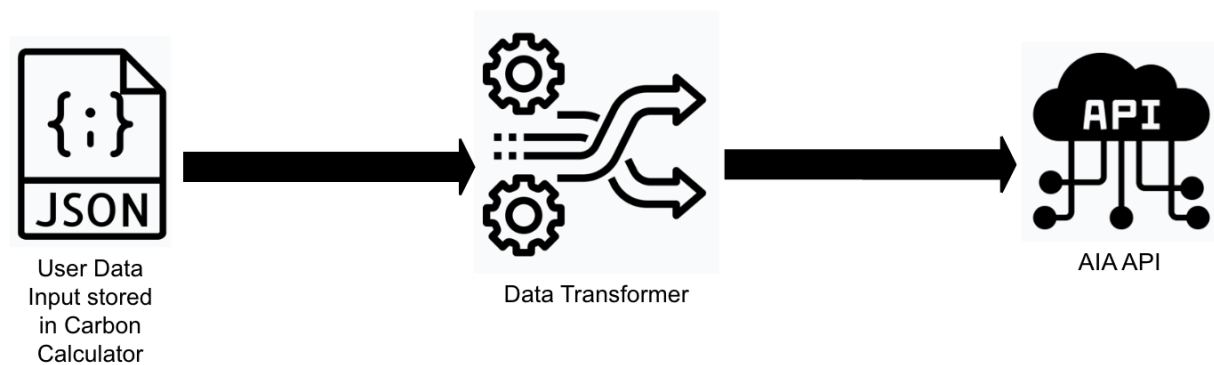
1. Refactor the components in the Carbon calculator so that inputs are stored in the exact format expected by AIA API.
2. Leave the components in the Carbon Calculator unchanged, but transform the inputs to the format expected by AIA API at the time of making the API request.

Approach 01 will require a higher effort compared to approach 02 and we will have to separately address the Excel reading logic since we will need to restructure that as well.

Approach 02 will require a lesser effort compared to approach 01 and there will be no need to change the Excel reading logic.

Input type	Inputs (Carbon Calculator)
beef sheep goat feedlot	<ul style="list-style-type: none"> - property information - livestock data <ul style="list-style-type: none"> - livestock inventory - purchase inventory - sale inventory - savannah burning - energy <ul style="list-style-type: none"> - electricity - petrol - diesel - vegetation - off farm usage <ul style="list-style-type: none"> - grain - cotton seed - hay - mineral supplementation - glyphosate - herbicides/pesticides - limestone - superphosphate - fertiliser - transport (feedlot only)

crop	<ul style="list-style-type: none"> - property information - energy <ul style="list-style-type: none"> - electricity - petrol - diesel - vegetation - off farm usage <ul style="list-style-type: none"> - grain - cotton seed - hay - mineral supplementation - glyphosate - herbicides/pesticides - limestone - superphosphate - fertiliser - crop plantations
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5.2 Result alignment

The result returned from the AIA API will be different to what is expected by the carbon calculator. Hence, the UI components of the carbon calculator will have to be refactored to consume the new result format.

5.3 Existing Calculation conversion

Conversion of calculations pre-existing in the database will be executed to fit the newest input structure.