

Gometra Farm Carbon Audit Report BRN: 115206

**For the year ending
Dec 2018**

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Introduction to resource efficiency

The amount of GHG emissions produced on farm in a year can be determined using a carbon calculator. This measure of emissions is known as a carbon footprint, also referred to as a carbon audit or resource use efficiency audit.

The three main greenhouse gases produced from agriculture include:

- Carbon dioxide (CO₂), produced by burning fossil fuels such as coal, oil and diesel to produce energy and disposal of waste.
- Methane (CH₄), produced as a natural by-product of animal digestion and from organic manure.
- Nitrous oxide (N₂O) which is released during the application of inorganic and organic fertiliser to the soil, from urine deposition by grazing animals, cultivations of soils and changes in land use and vegetation.

Agri Calc (carbon calculator) has been used to estimate the type, source and extent of GHG emissions produced at Gometra. Any emissions that arise after outputs have left the farm are not included in the calculation

Calculated emissions are displayed in terms of CO₂e (CO₂ equivalents) as an emissions intensity (i.e. CO₂e per unit of output), commonly known as a carbon footprint. Presenting emissions in this way allows comparisons to be made with other farms or enterprises and allows farm production to be taken into account.

Farms with a low carbon footprint are generally the most efficient. AgRE Calc© benchmarks carbon footprint results against similar enterprises; this process highlights areas where improvements could potentially be made helping to reduce emissions and improve efficiency of the farm business.

Introduction to the farm business

This carbon audit report has been prepared for Mr Roc Sandford, Gometra Farm

Average number of livestock (averaged over 12 month period)	
Ewes	227
Hoggs	115
Gimmers	110
Lambs	160

Area of Land Utilised	
Rough Grazing	355.65ha
Improved Grazing	45.11ha
Woodland	1.51

- No purchased feed, bedding, fertiliser
- BF lambs sold store at 27.5Kg
- Ewe lambs kept as replacements
- Farm electricity 100% from solar
- 2018 was an exceptional year with very poor weather, which greatly reduced lambing % across Argyll and Lochaber, however lambing figures remained high for Gometra

Carbon footprint results

Total farm emissions and output

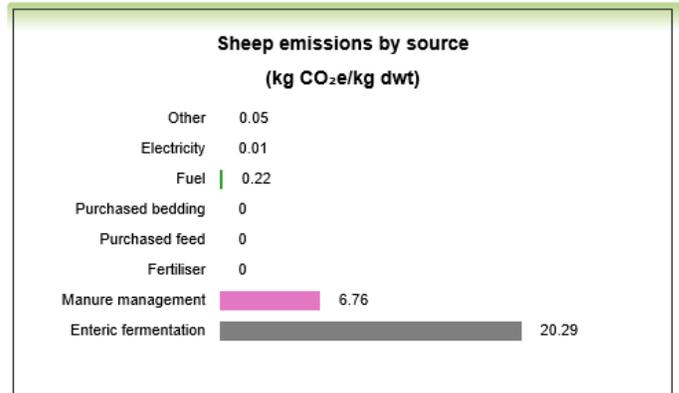
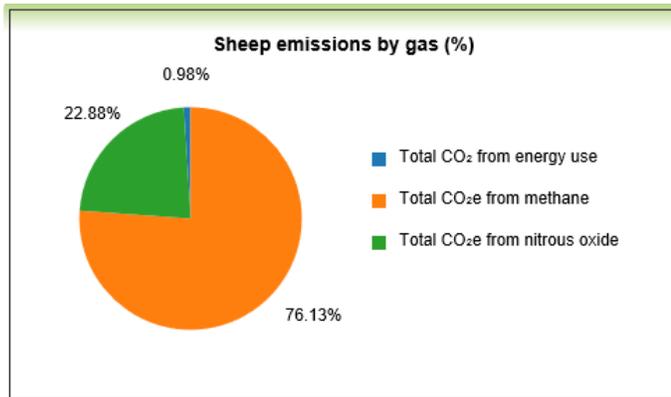
Gometra's carbon footprint for the year ending December 2018 was 25.52kgCO₂e per kg of output, Table 1.

Table 1. Total emissions and the farm carbon footprint

	Year end month and year
Total farm emissions (kg CO ₂ e)	147037
Farm carbon footprint, excluding forestry (kg CO ₂ e / kg output)	25.51
Woodland sequestration (kg CO ₂ e)	16,444
Net farm output* (kg)	5762
Farm carbon footprint, including sequestration (kg CO ₂ e / kg output)	25.52

- The above information can be found in the results – resource use and emissions section in AgRE Calc©)

Whole Farm Emissions (Sheep only)



- 100% of emissions come from the sheep.
- 76.13% of the total sheep emissions is in the form of Methane.
- Methane emissions are mainly caused by digestion of feed (enteric fermentation) and production of manure. There is no purchased feed or forage, so these emissions will be 100% from the natural digestion of improved pasture and rough grazing.
- Nitrous oxide emissions for Gometra are mainly caused by urine deposition from grazing animals, as there is no fertiliser application on farm.
- Fuel use represents a very small proportion of the total emissions.

As stated above in the results, the farm has a total net carbon footprint of 22.66kg CO₂e per kg of output. This is very low for a disadvantaged hill flock carrying approximately 337 ewes/gimmers. Comparison farms would normally have a carbon footprint in the region of 40 - 50KgCO₂e per kg of output.

The reason for this low carbon footprint is obvious. The farm does not buy any purchased feed/forage or hay, thus has none of the associated methane emissions.

The lambing percentage is higher than average at 92%, so the flock is arguably operating at full capacity. The average store lamb sale weight of 27.5Kg is slightly below average for this type of farm (typical range 27Kg-33Kg for this farm type), however this is likely associated with the low input costs.

Production is therefore limited by flock size. An increase in flock size, while maintaining the same lambing/technical performance, would increase the Total Farm emissions, but would result in a lower amount of emissions per Kg output.

In summary the low level of input (feed/forage/bedding), combined with good lambing/rearing performance, results in a total carbon footprint which is extremely low.

Carbon footprint benchmarking

Gometra carbon footprint results have been benchmarked against the average carbon footprint for similar farms and the Opportunity Level (High, Medium or Low) of the likelihood for improvement has been calculated. **The full report can be found in the AgRE Reports in AgRE Calc©)**

Table 2 shows that that the total Carbon footprint of Gometra (not including forestry) is much lower than average. **Table 3** clearly shows that for Gometra sheep, when compared against other farms the opportunity for improvement is **Low** in all areas. As stated earlier, the main reason for this is the low level of farm inputs (feed/forage/bedding) and good lambing performance.

Table 2. Enterprise carbon footprints and benchmarks

	Gometra	Average*
Sheep (kg CO ₂ e / kg dwt)	25.52	44.23

Table 3. Source of emissions and opportunity level for improvement per enterprise

Source	Gometra Sheep
Enteric fermentation	Low
Manure management	Low
Fertiliser	Low
Purchased feed	Low
Purchased bedding	Low
Fuel	Low
Electricity	Low
Other*	Low

**crop residues, lime, external transport and waste*

Performance and farm management practices

Following a further review of the emission results, farm performance and discussions with Gometra Farm about farm management practices the following was identified.

Sheep

- Lambing percentage is above average due to small flock and good management at lambing, however ~40 lambs have been lost due to sea eagle predation.
- Store lamb weight is below average, due to Extensive hill system.
- Output is limited by flock size

Fertiliser, grassland and feed

- No fertiliser or feed used
- Grassland is fed from deposition from grazing sheep. Emissions are low

Energy and renewables

- Electricity is 100% from solar

Woodland

- 1.51ha of existing woodland, which contributes to a reduced carbon footprint

Key performance indicator comparisons can be found in the AgRE reports included at the end of this report.

Mitigation

Mitigation action plan

Suggested actions for Gometra that have the potential to reduce emissions and save costs are summarised below.

Technical advice should always be sought before making any business changes.

Developing renewable energy - Renewable energy production can provide attractive paybacks as well as helping to reduce emissions.		
Action	Example of benefits	Sources of information
Consider woodland Creation	Another 1.51ha of established woodland, would reduce Carbon emissions by another 16,444 kg CO ₂ e. Woodland creation might also provide shelter to sheep, which might help to improve technical performance. The woodland creation scheme is currently available and provides planting costs and financial payments for 5 years. Native woodland would probably be the most suitable option if the site is suitable, as commercial timber would require good access for harvest. Deer fencing would also be eligible and	https://www.ruralpayments.org/publicsite/futures/topics/all-schemes/forestry-grant-scheme/ It would be recommended to speak to a forestry consultant when considering this type of investment. Details of approved consultants can be found in the scheme guidance.

	could be designed in such a way as to improve management of sheep.	
Consider an increase in Flock size	This will increase total emissions produced from the farm, but will result in a lower carbon foot print per Kg output produced. Increasing flock size would need to have zero effect on existing lamb sale weights, lambing performance and zero effect on the amount of feed purchased.	It would be recommended to speak to an agricultural consultant when considering this type of change. Considerations, should include <ul style="list-style-type: none"> • Impact on available grazing forage from increase in flock size. Contact: Farm advisory service (FAS) https://www.fas.scot/ Or SAC Consulting Oban 01631565074

Full AgRE Report

Below is a full summary of the resource efficiency and performance of Gometra compared to Similar enterprises.

Sector: Sheep
 Enterprise type: Extensive hill ewe flock
 System: Store/finisher (Organic)
 Group:
 Producer:
 Farm: Gometra

Region: Argyll and Bute
 Year calc relates: End Dec 2018
 Reporting date: 2nd Apr 2019
 Report reference: Gometra 2018 Compared to: Sheep Enterprises (system specific) 2015 to 2019 (52) reports

Quick glance enterprise emissions

	* kg CO ₂ e/ kg dwt	Opportunity Level	Comparison
Enteric fermentation	20.29	Low	29.88
Manure management	6.76	Low	10.02
Fertiliser	-	Low	1.44
Purchased feed	-	Low	1.51
Purchased bedding	-	Low	0.01
Fuel	0.22	Low	0.87
Electricity	0.01	Low	0.04
Other	0.05	Low	0.45
Total emissions **	27.33	Low	44.23

Other: crop residues, lime, transport and waste

Physical performance of enterprise

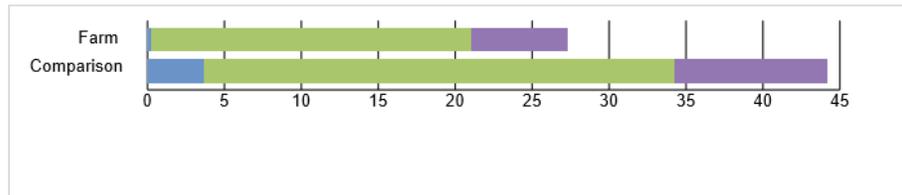
	Value	Comparison
Area of land utilised (ha)	401	1,514
Female breeding stock (no)	337	920
Lamb sale weight (kg lwt/head)	27.50	32.46
Lamb sale weight (kg dwt/head)	12.38	14.63
Wool sales (kg)	800	2,427
Purchased feed use (kg/ewe)	-	63
Homegrown feed use (kg/ewe)	-	102
Mortality (%)	3	6
Lambing percentage (%)	92	100
Ewe cull rate (%)	54	24
Enterprise net output (kgs)	5,762	13,284

Whole farm sustainability indicators

Nitrogen Use	-	kg/ha	Water use	-	litres
Phosphate Use	-	kg/ha	Stocking density	0.32	LU/ha
Potash Use	-	kg/ha	Sequestration	16.44	tCO ₂ e
Waste	-	kg	Renewable energy used	50.00	kWh

Emissions by gas and benchmark comparison

CO₂ : 0.27 kg CO₂e/unit output
 CH₄ : 20.81 kg CO₂e/unit output
 N₂O : 6.25 kg CO₂e/unit output



Improve efficiency and environmental credentials

What does a carbon footprint actually tell you?

There is a strong correlation between efficiency, profitability and low carbon emissions. The lower your carbon footprint the more effective inputs have been at generating saleable product i.e. increased utilisation of costly inputs. Each farm and system have natural limitations but, within this context, the process can identify carbon 'hotspots' on farm and is therefore a steer to improve efficiency and reduce greenhouse gas emissions.

How accurate does the information need to be?

The more accurate the information entered, the more meaningful the output. Where possible on farm records should be used to provide accurate farm-level data.

AgRE report guide

A: Quick glance enterprise emissions The 'opportunity level' (high, medium or low) is the likelihood for improvement gauged against other farms in that sector.

B: Physical performance of enterprise It is much easier to relate to performance indicators, actual sales, feeds and other inputs used. This becomes particularly useful when comparing years and for group comparisons.

C. Whole farm sustainability indicators Sustainability is the ability to deliver a product the customer wants year after year without adversely impacting the environment. Carbon is, however, only one part of the wider sustainability 'formula', some wider indicators are shown in this section.

D. Whole farm emissions by gas and benchmarking comparison Carbon footprinting similar farm types allows a business to benchmark environmental performance against a group average.

E. Potential actions to reduce emissions Examples of practical measures that could reduce emissions are shown below. Technical advice should be sought before making any business changes.

Any questions regarding this report or to discuss other financial and carbon efficiency measures please contact your local SAC Consulting office or the Rural Business Unit.

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* Your carbon footprint is expressed in units of CO₂ equivalents (CO₂e) per unit of output e.g. kg CO₂e per kg dwt of cold carcase. This allows the efficiency of the enterprise to be compared. The main greenhouse gases emitted by agriculture are CH₄ = Methane (Predominantly from animal digestion); N₂O = Nitrous oxide (Predominantly from manure and fertiliser); CO₂ = Carbon dioxide (Predominantly from burning of fossil fuels).

** Total emissions may differ due to rounding. Emissions may be skewed on a year to year basis due to timing of sales therefore results are best monitored over a three year (minimum) period.