Australian Government
Department of Agriculture, Water and the Environment

Future Drought Fund

Government of South Australia

CARBON FOOTPRINT & FEASIBILITY EXTENSTION PROJECT: A CASE STUDY

Prepared for Ag Excellence Alliance

Jarred Tilley
Greenwith Farms
May, 2022

This project is part of the Farm Business Resilience Program and is jointly funded through the Australian Government's Future Drought Fund and the Government of South Australia.
It is supported by funding through the Australian Government's National Landcare Program, the Department for Environment and Water, the Northern and Yorke Landscape Board, and Ag Excellence Alliance.

AgExcellence ALLIANCE

National Landcare Program

LANDSCAPE SOUTH AUSTRALIA NORTHERN AND YORKE

LANDSCAPE SOUTH AUSTRALIA MURRAYLANDS AND RIVERLAND

INTEGRITY AG & Environment

Greenwith Farms

Greenwith Farms is operated by Jarred Tilley and his brother Leith Tilley, in South Australia's Mid-North region. Jarred operates a mixed enterprise, with 3500 Merino ewes joined to Merino and Suffolk rams and broadacre cropping across over 2800ha of land. Jarred's mixed cropping enterprise occupies 2000ha of wheat, barley, canola, beans and export hay.

The region is associated with hot and dry summers and mild temperatures in the winter, with total annual rainfall of 405mm p.a. Soil types are characterised by red and brown loamy soils.

Goals for sustainability

Greenwith Farms identifies one of its major concerns as limited market access in the future. Rather than be restricted by this limitation, Jarred saw this as a great opportunity to see where the farm's biggest emission sources were.

Jarred says their most important goal is to be 'sustainably viable'. To remain sustainable and to maintain market access for their produce in the future. Climate change presents a major challenge that must be faced by the company successfully. Jarred feels it should be the goal of all businesses to be carbon neutral.

"One of the major concerns for sustainability for us is limited market access in the future."

Jarred Tilley

Carbon Footprint

A carbon footprint allows producers to calculate their current GHG emissions and helps them understand the main drivers of emissions. Carbon accounting is completed through modelled calculations based on farm inputs, to estimate emissions and carbon storage. Emissions are defined into three scopes: Scope 1: (direct GHG emissions from an enterprise), Scope 2: (GHG emissions from purchased electricity), and Scope 3: (emissions associated with purchased inputs and transport).

A carbon footprint examines the combined impact of total emissions produced across a property, and is also commonly reported as 'emissions intensity', which is the emissions per unit of product (e.g. kg of CO_2-e per kg of liveweight). This is a measure to contextualise efficiency of production with GHG emissions.

Greenwith Farms occupies over 2000ha of wheat, barley, canola, beans and export hay

Farm details

Region overview				
State	**Region**		**Electricity source**	
South Australia	Mid North		State Grid	
Native vegetation, soil and climate				
Species/type of tree	**Soil type**	**Annual rainfall (mm)**	**Area of trees (ha)**	**Age of trees (yrs)**
Environmental Plantings	Loamy soils	405	10	5
Crop data				
Total area sown (ha)		**Crops and yield (t/ha)**		
1,100		Wheat (3.3), barley (3.5), pulses (3.0), oilseed (1.8)		
Sheep data				
Number of head	**Number of sales**	**Average live weight of lambs sold (kg)**	**Lambing rate (%)**	**Wool yield (kg/yr)**
7539	4150	45	103	37535
Purchased inputs				
N fertiliser (t N)	**Other fertiliser use (kg/ha)**	**Herbicide/ pesticide (L)**	**Diesel and fuel use (L)**	**Electricity (kWh)**
159	280	6600	31000	18500

Emissions summary

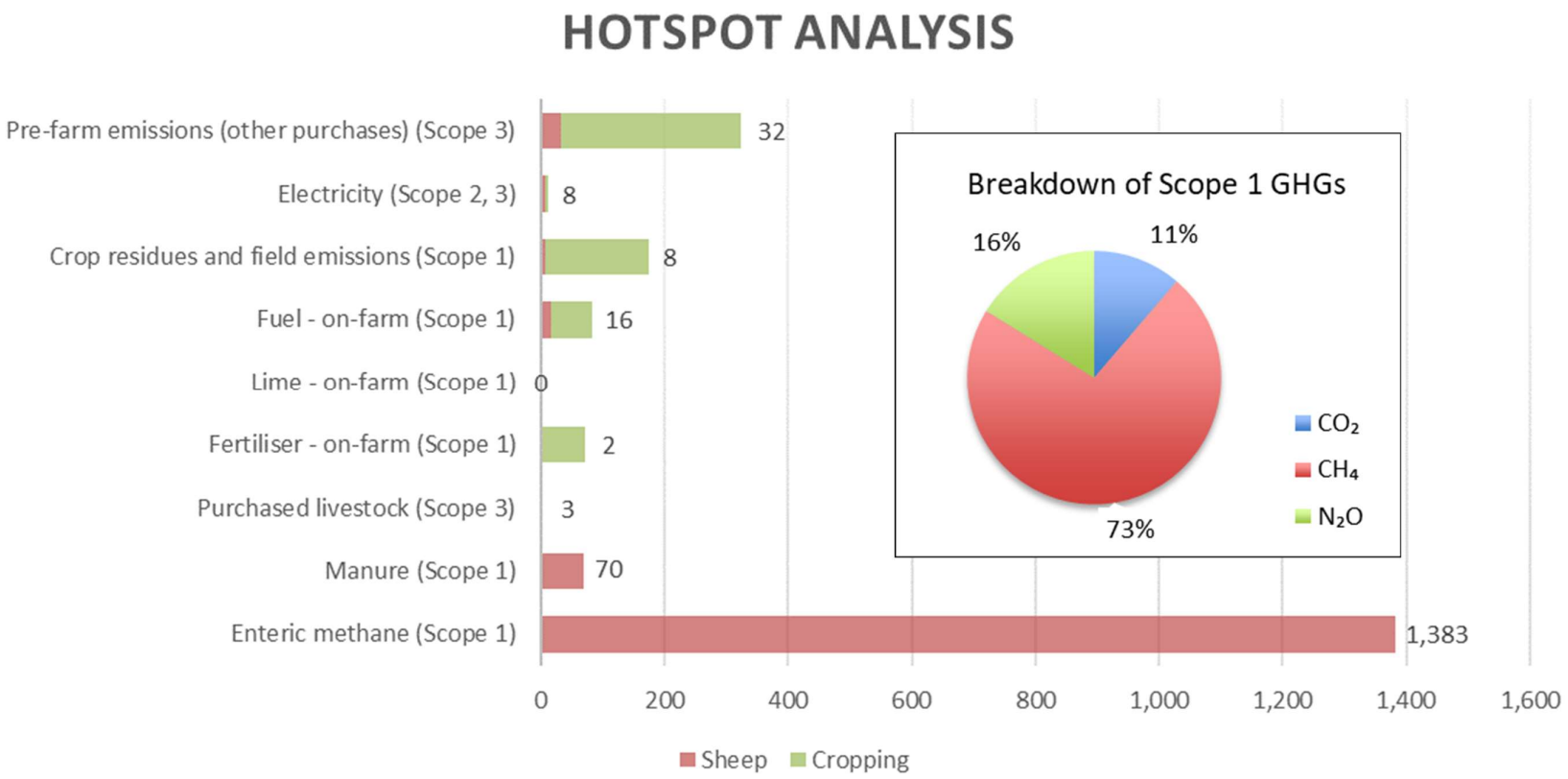
The emissions intensities for grains were all within the expected ranges for these crops, driven by low inputs relative to yield. The emissions intensities for sheep meat and wool (for a stable flock) were in the mid-range for a southern region. This reflects an efficient production system with relatively high turnoff weights, wool yield, and reproductive efficiency. Jarred had accounted for tree plantings across 10ha, planted over the last 5 years, reducing his net farm emissions by 21 t CO_2-e.

Emissions summary for Greenwith Farms

	Tonnes CO_2 equivalent (CO_2-e)		
	Sheep	**Cropping**	**Total**
Scope 1 & 2 emissions	1,563	424	1,987
Scope 3 emissions	35	291	327
Total Emissions	**1,598**	**715**	**2,314**
Carbon sequestration (tree plantings)	-10.5	-10.5	-21
Net Emissions	**1,588**	**705**	**2,293**
Emissions Intensity		**Regional average[1,3]**	**Regional average[2]**
Sheep meat (kg CO_2-e / kg LW)	6.3	6.9-8.2	6.2-7.5
Wool (kg CO_2-e / kg greasy)	23.4	23.7-30.0	n/a
Wheat (kg CO_2-e / t yield)	200	254-334	
Barley (kg CO_2-e / t yield)	186	169-261	
Pulses (kg CO_2-e / t yield)	148	194-224	
Oilseeds (kg CO_2-e / t yield)	417	~597	

[1] *Regional average for Merino wool (Wiedemann et al., 2016a),*
[2] *Regional average for crossbred lamb production (Wiedemann et al., 2016b),*
[3] *Regional average for cropping (Simmons et al. 2019).*

Greenwith Farms in the mid-north region of SA, bordering the Bango Wind Farm



A hotspot analysis of Scope 1, 2 & 3 emissions for combined sheep and cropping profiles

"Continued improvements in flock productivity presents the opportunity to lower both net GHG emissions and emissions intensities for sheep meat and wool."
IAE

Opportunities to reduce net emissions

The following management activities have the potential to reduce net GHG emissions:

- Improving nitrogen and water use efficiency.
- Improving fuel efficiency of on-farm vehicles and machinery.
- Optimising field operations to reduce unnecessary machinery operation (e.g. reduce unnecessary cultivation and optimise chemical applications).
- Continued improvements in flock productivity.
- Increasing marking rate, improving pasture quality and supplementary feeding to increase liveweight gains from weaning to sale.

Future tree plantings with higher sequestration species and revegetation present an opportunity to reduce net carbon emissions while providing additional benefits to biodiversity, soil erosion and salinity, and livestock shelter. Management practices that increase soil organic carbon offer opportunities to reduce net carbon emissions and increase productivity, profitability, and sustainability.

"We have always had good shelter but not as many actively growing trees."
Jarred Tilley

Jarred's experience

Jarred found completing his carbon footprint straightforward and informative. The expectation for Greenwith Farms was for fertiliser use to be their biggest contributor to the emissions profile. Surprisingly they found it insignificant compared to methane emissions from sheep.

Greenwith Farms have always been careful in regulating their inputs into the production system by running a robust rotation to keep inputs low. The biggest management tool for this is using an independent agronomist. Jarred also practices harvest weed-seed control options to reduce weed burdens, limiting herbicide application.

What will Greenwith Farm do? Try to improve everything continually. Jarred will look closely at the potential for offsetting carbon by planting trees and look at options for recording what natural regeneration there is.

Wiedemann, S. G., Yan, M.-J., Henry, B. K., Murphy, C. M. (2016a) Resource Use and Greenhouse Gas Emissions from Three Wool Production Regions in Australia. Journal of Cleaner Production 122:121–132l

Wiedemann, S. G., Yan, M.-J., & Murphy, C. M. (2016b). Resource Use and Environmental Impacts from Australian Export Lamb Production: A Life Cycle Assessment. Animal Production Science, 56(7), 1070–1080

Simmons, A. T., Murray, A., Brock, P. M., Grant, T., Cowie, A. L., Eady, S., Sharma, B. (2019). Life cycle inventories for the Australian grains sector. Crop and Pasture Science, 70(7), 575-584