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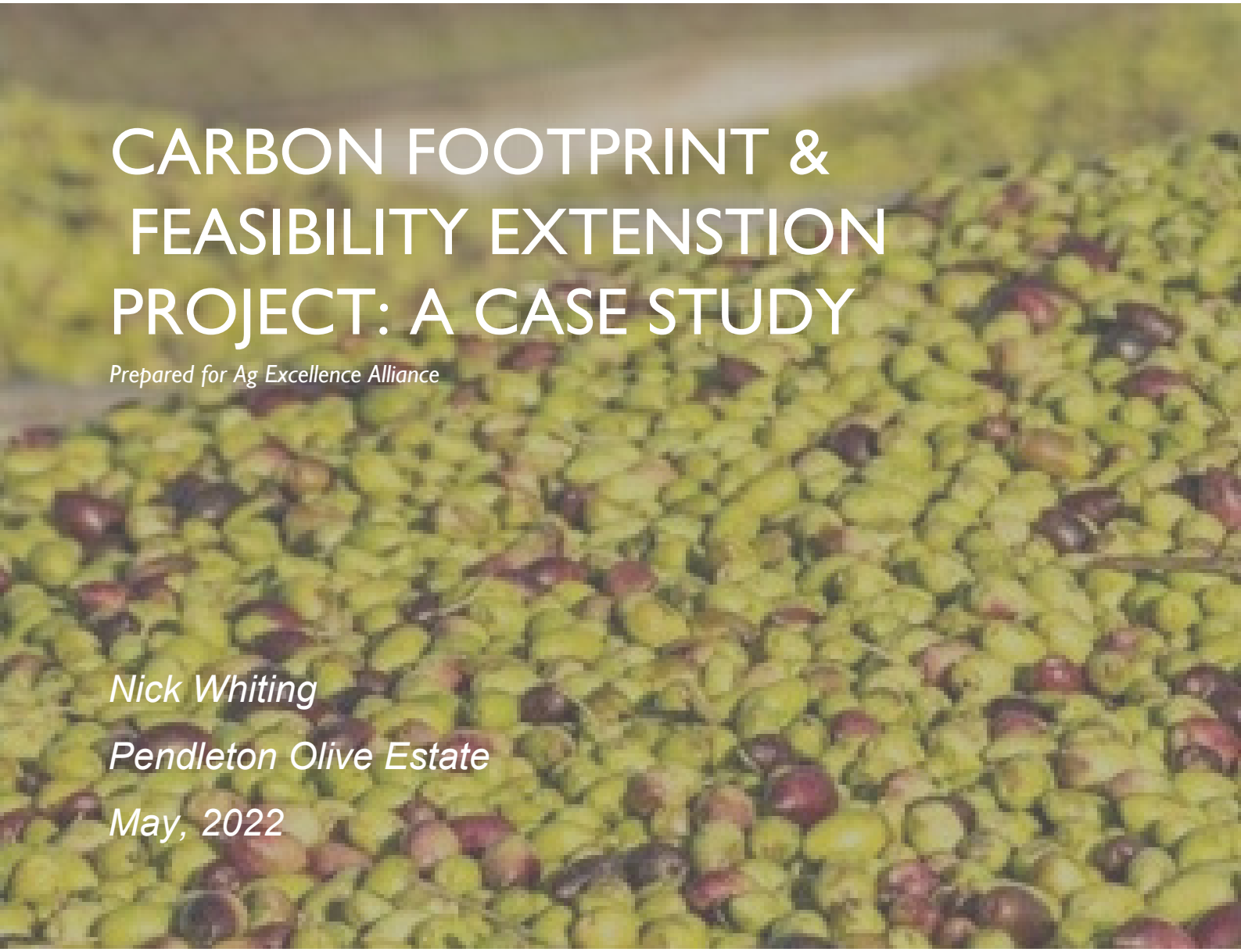

CARBON FOOTPRINT & FEASIBILITY EXTENSTION PROJECT: A CASE STUDY

Prepared for Ag Excellence Alliance

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Pendleton Olive Estate

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AgExcellence ALLIANCE

National Landcare Program

LANDSCAPE SOUTH AUSTRALIA NORTHERN AND YORKE

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Coonalpyn Olives

Coonalpyn Olives is an olive plantation within the Pendleton Olive Estate located in Coonalpyn, South Australia. The farm is run by Nick Whiting and has 190,000 olive trees grown across 500 ha, consisting of eight olive varieties, of which Barnea olives are predominantly grown. They also keep sheep to graze through the groves as a form of weed control.

The region has a semi-arid climate with a total annual rainfall of approximately 530 mm p.a. Soil types are mostly characterised as loamy and shallow soils over rubbly or sheet calcrete.

Goals for sustainability

Pendleton Olive Estate's primary interest was to learn more about carbon accounting, to help inform them about their decision making around sustainable and climate friendly olive production.

As their olives are sold under their own brand, Pendleton Olive Estate are seeking to establish that brand as the sustainable choice for consumers. Being aware of the growing consumer demand for carbon neutral or sustainable food choices, Pendleton Olive Estate want to stay ahead of marketing practices. Looking towards the future, Nick sees achieving carbon neutral status or similar sustainability certification as a goal for the business.

"We need to know whether we need to set up programs now instead of getting caught out in a few years time."

Nick Whiting

Carbon Footprint

A carbon footprint allows producers to calculate their current GHG emissions and helps them to 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 tonne of product).

Pendleton Olive Estate is a 1,232ha property located in one of Australia's best olive-

Farm details for Pendleton Olive Estate

Region overview				
State	**Region**		**Electricity source**	
South Australia	South east		State grid	
Native vegetation, soil and climate				
Species/type of tree	**Soil type**	**Annual rainfall (mm)**	**Area of trees (ha)**	**Age of trees (yrs)**
Mixed species (Environmental Plantings)	Duplex Soils	530	950	2

Crop data					
Olive tree age (yrs)	**Olive trees per ha**	**Area sown (ha)**	**Area with midrow cover crop (ha)**	**Irrigation (ML/ha)**	**Crop yield (t/ha)**
16	380	500	0	1.83	4.50

Purchased inputs				
N fertiliser (t N)	**N manure/ compost (t N)**	**Lime (t)**	**Herbicide/pesticide (L)**	**Other fertiliser (t)**
0	0	0	1873	10.0

Sheep data					
Number of head	**Number of sales**	**Average live weight of lambs sold (kg)**	**Lambing rate (%)**	**Average wool shorn (kg/hd)**	**Wool yield (kg/yr)**
610	300	55	100	6.9	1135

Fuel and gas			
Irrigation pump fuel/diesel usage (L)	**General diesel usage (L)**	**Petrol (L)**	**Electricity (kWh)**
110,000	56,500	9,700	5,500

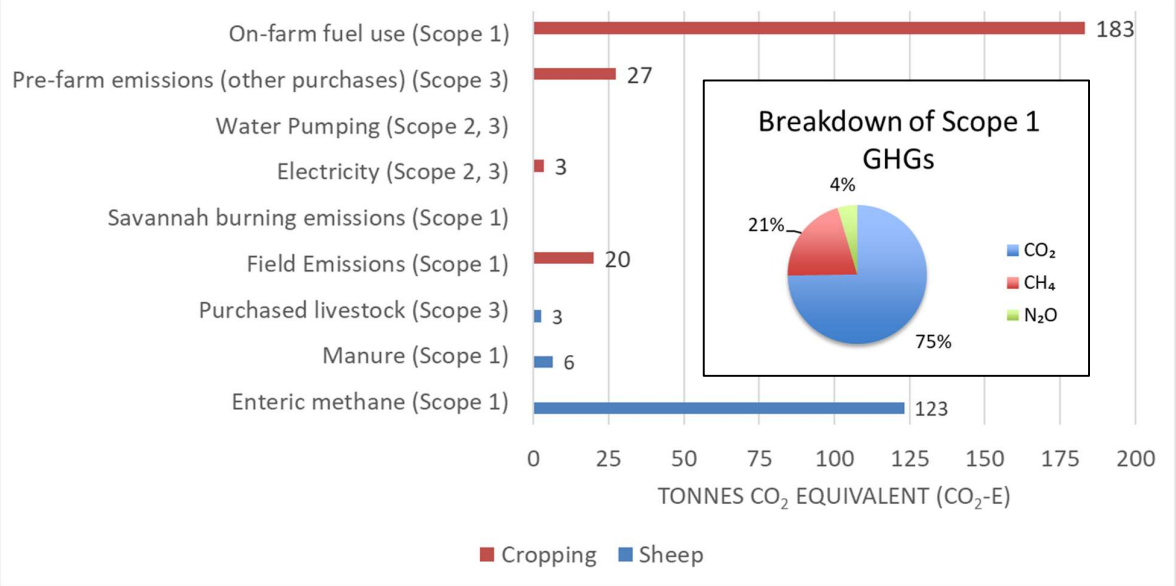
Emissions Summary

Olives are generally a low input crop, with modest amounts of fertiliser. Most of the inputs for Pendleton Olive Estate were fuel for farm operations and irrigation. Emissions from sheep were also quite substantial for the enterprise. The emissions intensity of sheep meat and wool at Pendleton Olive Estate were in the low-mid range compared to other sheep productions assessed internally.

Emissions summary for Pendleton Olive Estate (excluding olive tree sequestration)

	Tonnes CO_2 equivalent (CO_2-e)			
	Sheep	Cropping	Total	
Scope 1 & 2 emissions	139	495	634	
Scope 3 emissions	3	37	40	
Total Emissions	**142**	**532**	**674**	
Carbon sequestration (tree plantings)	NA	-105	-105	
Net Emissions	**142**	**427**	**569**	
Emissions Intensity	**EI (Scopes 1,2,3)**	**EI (Net Farm)**	**Corrected EI***	Estimated error range for EI: ± 20% to ± 40%
Sheep meat (kg CO_2-e / kg LW)	**6.9**	**6.9**	**7.2**	
Wool (kg CO_2-e / kg greasy)	**25.1**	**25.1**	**26.4**	
Olives (kg CO_2-e/t yield)	**236.2**	**189.7**	**NA**	

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



**Corrected emissions intensity figures correct for fluctuations in production output as a result of herd/flock expansion or contraction. This is achieved by adjusting production output to a 'steady state' herd/flock scenario. This figure should be preferentially used when assessing herd/flock emissions intensity.*

Carbon Storage

Some carbon sequestration occurred on farm, partly from native vegetation in areas around the orchard. Carbon sequestered in native trees is typically counted when this is new and permanent. Accounting for carbon in olives is also important. Olives are slow growing, long-lived trees. There are no formal carbon methodologies in Australia that show how to quantify carbon in olives and some accreditation systems don't recognise this as a carbon sequestration source. In the present case study, carbon sequestration was estimated in olive trees at up to 950 tonnes CO_2-e per year, which would be enough to make the farm "carbon negative" if taken into account – i.e. the farm draws 522 tonnes CO_2-e more carbon from the atmosphere than is emitted each year upon inclusion of olive carbon stores.

Opportunities to reduce net emissions

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

- Improved water use efficiency through reducing the amount of energy required for irrigation. (e.g investigating options such as installing a variable speed drive to allow greater control over water flow that suits your requirements and regular maintenance of irrigation systems to ensure further irrigation efficiency).
- Improved fuel efficiency of on-farm vehicles and machinery (e.g. optimising field operations to reduce unnecessary machinery operation)
- Optimising yield to reduce the emissions intensity (e.g. maximising production efficiency).
- Installing a solar system for general farm energy and pumping.

"The carbon accounting process was a bit of an eye opener for me. I was particularly interested in what we could do with our trees."
Nick Whiting

The main avenue available for Pendleton Olive Estate is to reduce emissions from fuel use and Nick is looking to two areas where this can be reduced: tractor operations and irrigation. He is hesitant to turn to solar powered irrigation, due to their current pumping demands, where their irrigation is running 24 hours a day, 6 days a week. In the future when electric or hydrogen tractors become available, this could make a big difference on this farm.

Nick's experience

Nick found obtaining the information for the carbon account to be easier than expected, and that the carbon accounting process was easy to understand and taught him much that he didn't previously know.

With the amount of carbon stored in horticultural trees like olives, the inability to account for this carbon under current national methods was an important takeaway from the workshop for Nick. "I thought we were carbon negative because of the permanent trees", Nick said, noting they don't cut down and replant their olive trees. The difficulty in achieving carbon neutral status stood out to Nick after undergoing the carbon accounting process, knowing that the carbon stored in olive trees cannot yet be accounted for. This may be an opportunity for industry to explore further in future.