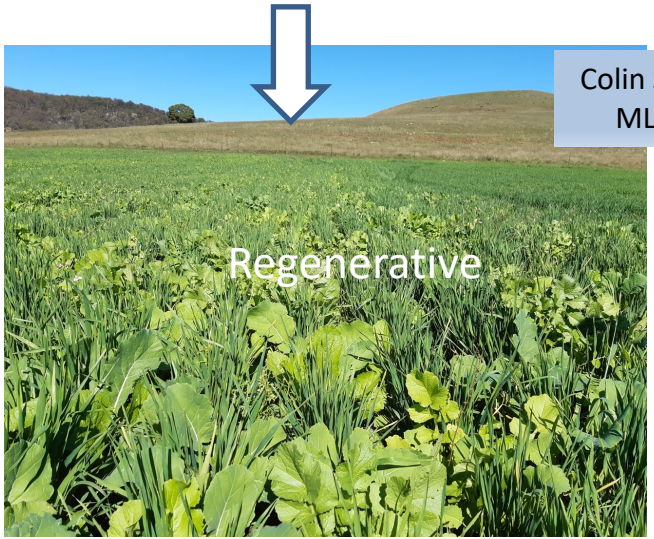
Elmore - 2020

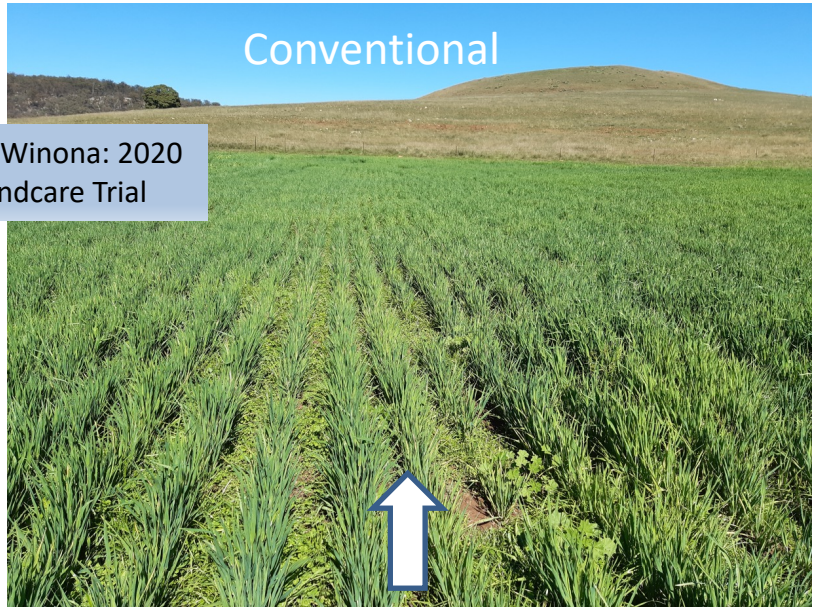
AFTER

Case Study: Paired trial – Mudgee, NSW

Cost of Multi-species crop $183 /ha
(6 Seed types and fertiliser)



Colin Seis – Winona: 2020
MLA / Landcare Trial



Cost of barley crop - $140 /ha
(1 Seed type and fertiliser)

Paired trial: Weight Gain/Profit

228 Merino lambs – 57 days

Weight gain per day – 149 grams

Weight gain -57 days – 8.5 kg
Lamb price/kg dressed - $7

4.75 kg x $7 = $33.25 / lamb

Gross /ha = $1263.35
Minus cost of sowing crop- $140/ha

Profit/ha $1123.50

228 Merino lambs – 57 days

Weight gain per day – 300 grams

Weight gain -57 days- 17 kg
Lamb price/kg dressed $7

8.5 kg x $7 = $59.50/lamb

Gross /ha = $2261
Minus cost of sowing crop $183/ha

Profit/ha $2078

Change in Soil Nutrients

Cover Crop Plant	C:N	Focus
Ideal microbial diet	24:1	Soil repair
Cereal rye*	80:1	High biomass
Annual vetch	11:1	Excellent stock feed; fixes large amount of N, releases soil phosphorus, beneficial insects (flowers)
Daikon (tillage raddish)*	19:1	Biological subsoil aeration
Clover	21:1	
Forage brassica*	12:1	High protein, very digestible, helps control weeds
Annual ryegrass	20:1	

- *helps chemically control weeds, shading & competition

Single species crop (A)

- Carbon – 15%
- Total Nitrogen -21%
- Phosphorus (Colwell)+ 62%
- Calcium – 3%
- Magnesium – 8%

Multi-species crop (B)

- Carbon + 21%
- Total Nitrogen +16%
- Phosphorus *(Colwell)+* 125%
- Calcium +13%
- Magnesium + 3%

+36% swing

Evaluation of investment

With the inclusion of soil carbon, the gross margin (p.a.) resulting from a multi-species cover crop is 3 times the control (single species cereal) and an even greater margin over tired minimal species pastures.

This approach (Trial B) is the fastest means of building soil carbon in an extremely profitable production model.

COVER CROP GROSS MARGIN CALCULATOR

Developed by Regenerative Autralian Farmers Pty Ltd, 2021

PARAMETERS	TRIAL A (control)	Trial B (new1)
Area (ha)	6	6
Rainfall	260	260
Paddock name (or ID)	**Barley**	**Multi-species**
Photo point (take 2 weekly)		
Brix reading (sugar levels)		
Penetrometer (depth to achieve 300psi)	Attached	Attached
VSA (refer Shepherd's book)		
A. Cover Crop details (per ha)	expand for detail	
sub-total		
B. Stock Production details	expand for detail	
sub-total		
C. Commercial value (per ha)		
Est. live weight value at start of period ($/kg)	93	119
Live weight value at end of period ($/kg)	123	177
Dressed price ($/kg)	7	7
Additional Revenue ($/head)	29.4	58.1
Gross Revenue ($/ha)	1117.2	2207.8
Estab. Costs ($/ha)	262.5	305.5
sub-total		
Gross Margin ($/ha)	**$ 854.70**	**$ 1,902.30**
With Soil Carbon value (2021 @$30/tCO2e)	$0	$576.00
Total	**$ 854.70**	**$ 2,478.30**

✓

REGENERATIVE AUSTRALIAN FARMERS
PROMOTING HEALTHY SOILS

Part 2 – Carbon Farming

Carbon Farming

- Soil Basics (physical, chemical, biological)
- Soil Testing (strategy, sampling, testing, interpretation)
- Five Principles of Soil Health
- Carbon Farming & Credit Creation
- What market? Am I eligible? What is involved?
- Case studies & the business case for soil carbon

Case Study: Know your starting point

(soil carbon baselining)

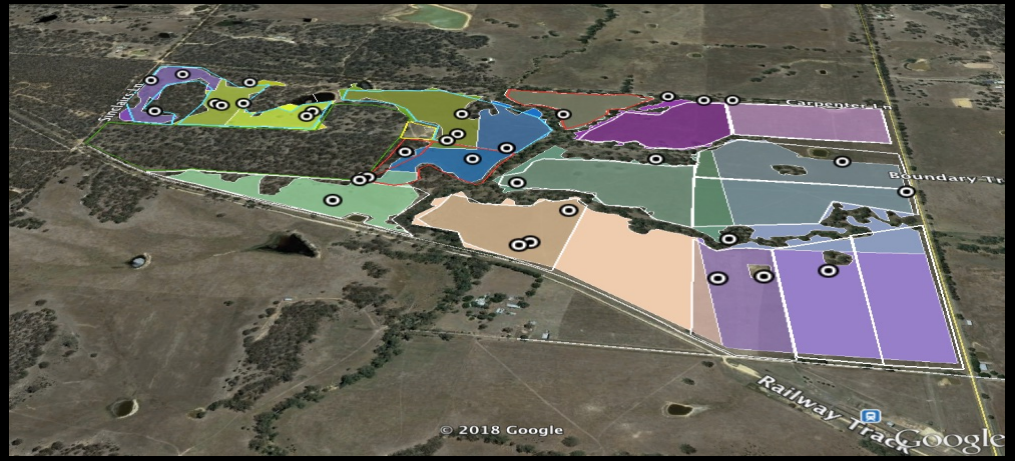
What is my soil carbon level?

How do I find out?

What is possible?

Can I get paid for soil carbon?

What part of my farm?



Soil carbon Report

2021 measurement showed SOC increases:
42% increase for 0-30cm & 35% for 30-100cm horizon

ROUTINE AGRICULTURAL SOIL ANALYSIS REPORT

Job No:	F4748
No of Samples:	2
Date Supplied:	14th November 2016
Supplied by:	Eco2Sys Australia Pty Ltd

Method	Nutrient		Units	Sample ID:	Sample 1 CEA01_Comp03_UL	Sample 2 CEA02_Comp03_UL	Heavy Soil	Medium Soil	Light Soil	Sandy Soil
				Crop:	N/G	N/G				
				Client:	D. Belfield	D. Belfield	e.g Clay	e.g Clay Loam	e.g Loam	e.g Loamy Sand
					F4748/5	F4748/11	Indicative guidelines only- refer Note 6			
	Morgan 1	Calcium	Ca	mg/kg	188	179	1150	750	375	175
		Magnesium	Mg		60	50	160	105	60	25
		Potassium	K		68	53	113	75	60	50
		Phosphorus	P		1.3	0.7	15	12	10	5.0
	Bray1 Colwell Bray2	Phosphorus	P	mg/kg	19	1.7	45[note 8]	30[note 8]	24[note 8]	20[note 8]
					11	10	80	50	45	35
					111	10	90[note 8]	60[note 8]	48[note 8]	40[note 8]
	KCl	Nitrate Nitrogen	N	mg/kg	5.7	10	15	13	10	10
		Ammonium Nitrogen			7.9	6.3	20	18	15	
		Sulfur	S		22	6.5	10.0	8.0	8.0	
	1:5 Water	pH		units	5.46	5.39	6.5	6.5	6.3	
		Conductivity		dS/m	0.047	0.039	0.200	0.150	0.120	
	Calculation	Estimated Organic Matter		% OM	1.7	1.6	>5.5	>4.5	>3.5	
	Ammonium Acetate + Calculations	Calcium	Ca	cmol+/Kg	1.56	1.45	15.6	10.8	5.0	
				kg/ha	702	652	6250	4300	2000	
				mg/kg	313	291	3125	2150	1000	
		Magnesium	Mg	cmol+/Kg	0.70	0.55	2.4	1.7	1.2	
				kg/ha	191	151	580	400	290	
				mg/kg	85	67	290	200	145	
		Potassium	K	cmol+/Kg	0.36	0.26	0.60	0.50	0.40	
				kg/ha	313	224	470	380	300	
				mg/kg	140	100	235	190	150	
		Sodium	Na	cmol+/Kg	0.09	0.06	0.3	0.26	0.22	
				kg/ha	49	29	138	120	101	
				mg/kg	22	13	69	60	51	
	KCl	Aluminium	Al	cmol+/Kg	0.16	0.20	0.6	5	0.5	
				kg/ha	32	39	108	90	81	
				mg/kg	14	18	54	45	41	
	Acidity Titration	Hydrogen	H^+	cmol+/Kg	1.45	1.07	0.6	5	0.5	
				kg/ha	33	24	12	10	9	
				mg/kg	15	11	6	5	5	
	Calculation	Effective Cation Exchange Capacity (ECEC)		cmol+/Kg	4.33	3.58	20	14	7	
	Base Saturation Calculations	Calcium	Ca	%	36.1	40.5	77	76	69	
		Magnesium	Mg		16.2	15.5	12	12	16	
		Potassium	K		8.3	7.2	3	4	5	
		Sodium - ESP	Na		2.2	1.6	2	2	3	
		Aluminium	Al		3.6	5.5	7	7	7	
		Hydrogen	H^+		33.6	29.8				
	Calculation	Calcium / Magnesium Ratio		ratio	2.2	2.6	6.4	6.3	4.3	
	DTPA	Zinc	Zn	mg/kg	2.9	1.0	6.0	5.0	4.0	
		Manganese	Mn		22	39	25	22	18	
		Iron	Fe		404	368	25	22	18	
		Copper	Cu		0.9	0.8	2.4	2.0	1.6	
	$CaCl_2$	Boron	B	mg/kg	0.20	0.27	2.0	1.7	1.4	
		Silicon	Si		38	46	50	45	40	
	LECO IR Analyser	Total Carbon	C	%	0.95	0.94	>3.1	>2.6	>2.0	
		Total Nitrogen	N	%	0.09	0.08	>0.30	>0.25	>0.20	
	Calculation	Carbon/ Nitrogen Ratio		ratio	10.3	11.5	10-12	10-12	10-12	
		Basic Texture			Loam	Loam	..	..	..	
		Basic Colour			Brownish	Brownish	..	..	..	
	Calculation	Chloride Estimate		equiv. ppm	30	25	..	..	..	

RESULTS OF SOIL ANALYSIS

12 samples supplied by Eco2Sys Australia Pty Ltd on the 14th October, 2016 - Lab Job No. F4748
Analysis requested by Deane Belfield.

SAMPLE ID	Job No.	Gravimetric water content on the air dry soil (g water/g oven-dry mass)	Air Dry Mass l (g)	Gravel Content (g)	Gravel Content (%)	Other Conten (%)	Total Organic Carbo (% C)
	Method			Stones and Organic Matter > 2mm	Stones and Organic Matter > 2mm	Soil and Organic Matter < 2mm	LECO CNS2000 Analyser
CEA01_Comp01_UL	F4748/1	0.02	2839	1.2	0.0	100.0	1.08
CEA01_Comp01_DL	F4748/2	0.01	7623	1.5	0.0	100.0	0.22
CEA01_Comp02_UL	F4748/3	0.01	2852	22	0.8	99.2	1.15
CEA01_Comp02_DL	F4748/4	0.01	7503	1.4	0.0	100.0	0.26
CEA01_Comp03_UL	F4748/5	0.02	2826	2.8	0.1	99.9	0.93
CEA01_Comp03_DL	F4748/6	0.01	7476	16	0.2	99.8	0.21
CEA02_Comp01_UL	F4748/7	0.04	1990	238	12.0	88.0	1.14
CEA02_Comp01_DL	F4748/8	0.01	4345	1,014	23.3	76.7	0.28
CEA02_Comp02_UL	F4748/9	0.01	2003	179	9.0	91.0	0.93
CEA02_Comp02_DL	F4748/10	0.01	4696	1,377	29.3	70.7	0.24
CEA02_Comp03_UL	F4748/11	0.02	1957	68	3.5	96.5	0.86
CEA02_Comp03_DL	F4748/12	0.01	4806	854	17.8	82.2	0.20

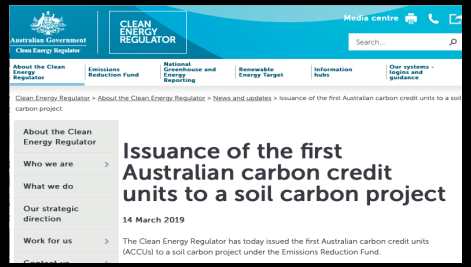
Notes:

1. Results as dry weight DW - soils were dried at 40°C prior to sieving at 2mm then crushing.
2. Testing conducted according to the Carbon Farming Initiative Soil Sampling and Analysis Method and Gudelines June 2014
3. Methods from Rayment and Lyons, 2011. Soil Chemical Methods - Australasia.
4. Large aggregates were crushed with a mortar and pestle before drying
5. The <2mm fraction was sub-sampled by manual coning and quartering
6. Crushed soils were pretreated with acid prior to Carbon analysis on the LECO CNS2000 Analyser.
7. Carbon results are reported on an oven dried basis (105° C)
8. Previously based on the CSIRO National Soil Carbon Research Program 2011 methodologies and protocols

How does the Carbon Market work?

What is a carbon market?
Carbon markets turn emission reductions and removals into tradeable assets. These credits are generated from emission reduction projects (a solar farm or forest conservation easement, for example) or pollution allowances allocated by government cap-and-trade systems.

Australian carbon market - relates to the production and buying and selling of Australian carbon credit units (ACCUs) under the CFI. These units (or credits) are generated primarily from land restoration projects that re-establish native vegetation in the landscape and in turn remove carbon dioxide from the atmosphere, however ……



BUT there are other non-Government markets (private, VCS, and more)

Examples of achieving healthier soils, raising Soil Organic Carbon (SOC) in range of 0.1% -0.4% Annually and improving GM profit.

"Our GRDC Water Use Efficiency in Wheat is consistently around 12 kg/ha.mm. District mean ave. is 9.9 kg/ha"

Tim O'Halloran
Balranald NSW

"I invest 10% of income in new technologies to improve farm profits"
"It is really important we have Healthy Soils"

Brian & Sandra Wilson, Lismore Vic
'Briandra' Demonstration Farm
www.soilsforlife.org.au

Typical Light Sand, Low Carbon

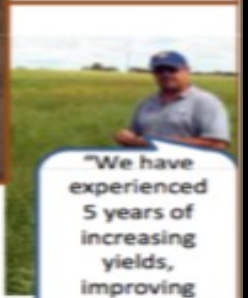
12 Years
BioLogic Farming Systems

"Our soils are much improved – so are my returns as my fertiliser inputs are much lower, production is higher"

David Clayfield, Mt Gambier SA
'Clover Estate' Demonstration Farm www.soilsforlife.org.au

"Our trials demonstrate our yields have increased, costs are down. Crop establishment in our Non Wetting Sand is progressively improving"

Barry Atze
Pinnaroo SA



"We have experienced 5 years of increasing yields, improving salt affected soils"

Kevin Roberts
Cooke Plains SA

How well does your soil retain water

General co-benefits:

- improved soil structure properties, soil biological diversity, plant nutrient availability and quality
- resilience and food security
- reduced demand for synthetic chemical inputs and costs
- reduced input costs

Improving water quality

Water Infiltration Table:
Increasing levels of soil organic carbon
Source: Understanding Soil Health and Watershed Function

Hydrology - water quality co-benefits:

- improved water infiltration & water holding capacity, with increased rainfall efficacy
- improved drought resistance and resilience
- reduced erosion and nutrient run-off

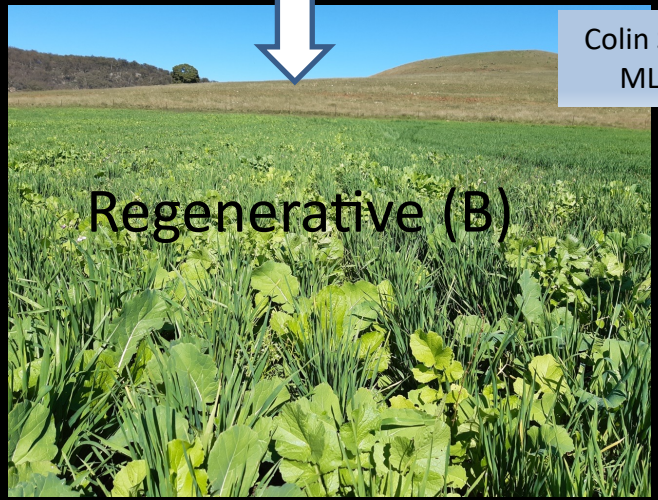
Case Study #3: Soil Organic Carbon Project

Sheep grazing (57 days, 2020)

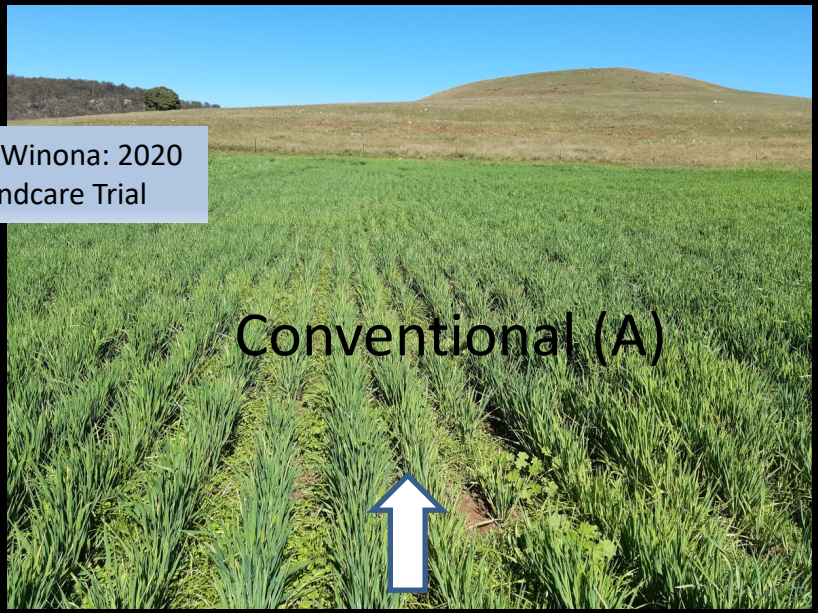
CONVENTIONAL

Cost of Multi-species crop $183 /ha
(6 Seed types and fertiliser)

REGENERATIVE



Colin Seis – Winona: 2020
MLA / Landcare Trial



Cost of barley crop - $140 /ha
(1 Seed type and fertiliser)

Comparative trial

Increased soil carbon = $

MLA/Landcare funded trial - to measure $value of multi-species cover crop (productivity & soil carbon)

- With the inclusion of soil carbon, the gross margin (p.a.) resulting from a multi-species cover crop (grazing lambs) is 3 times the control (single species cereal) and an even greater margin over tired minimal species pastures.

- This approach (Trial B) is the fastest means of building soil carbon in an extremely profitable production model.

COVER CROP GROSS MARGIN CALCULATOR

Developed by Regenerative Autralian Farmers Pty Ltd, 2021

PARAMETERS	TRIAL A (control)	Trial B (new1)
Area (ha)	6	6
Rainfall	260	260
Paddock name (or ID)	**Barley**	**Multi-species**
Photo point (take 2 weekly)		
Brix reading (sugar levels)		
Penetrometer (depth to achieve 300psi)	Attached	Attached
VSA (refer Shepherd's book)		
A. Cover Crop details (per ha)	expand for detail	
sub-total		
B. Stock Production details	expand for detail	
sub-total		
C. Commercial value (per ha)		
Est. live weight value at start of period ($/kg)	93	119
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Total	**$ 854.70**	**$ 2,478.30**

Impact Soil Nutrients

Cover Crop Plant	C:N	Focus
Ideal microbial diet	24:1	Soil repair
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- *helps chemically control weeds, shading & competition

Single species crop (A)

- Carbon – 15%
- Total Nitrogen -21%
- Phosphorus (Colwell)+ 62%
- Calcium – 3%
- Magnesium – 8%

Multi-species crop (B)

- Carbon + 21%
- Total Nitrogen +16%
- Phosphorus *(Colwell)+* 125%
- Calcium +13%
- Magnesium + 3%

+36% swing

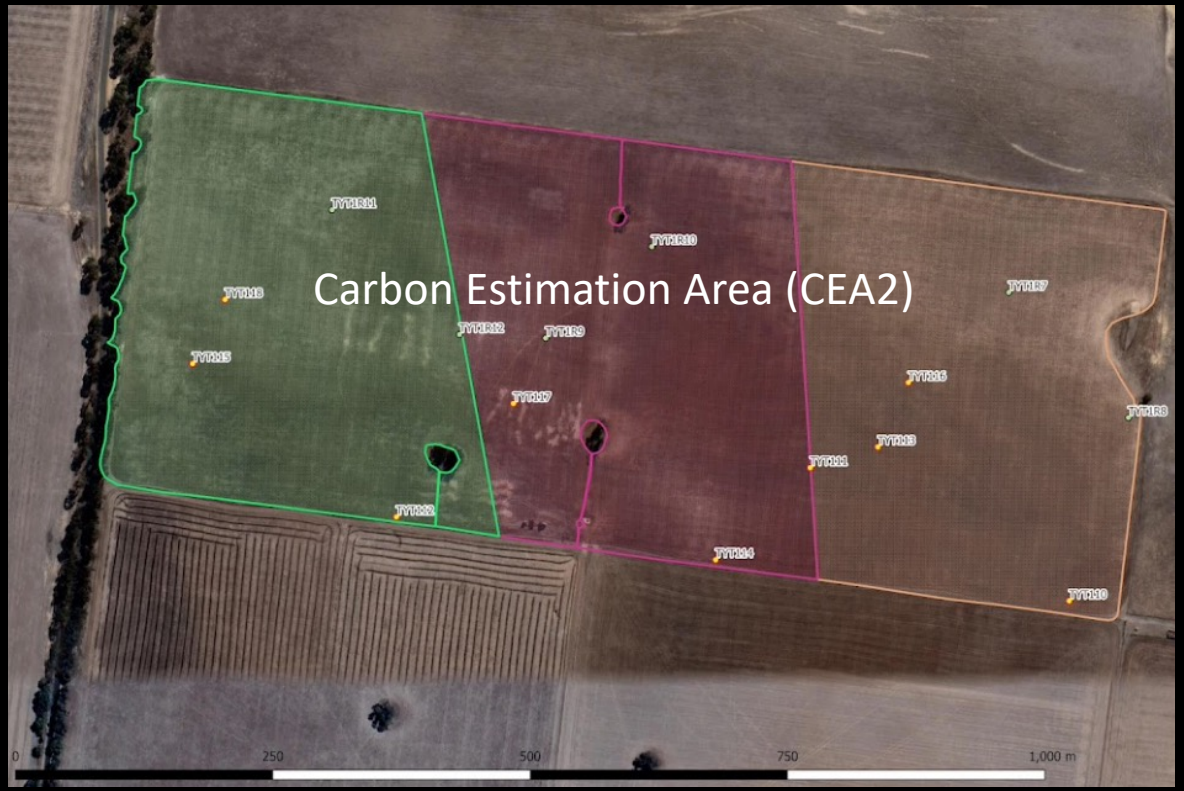
Benefits of Carbon Farming Systems

Improvement in:

- Animal health
- Insect control
- Soil structure
- Nutrient cycling
- Less synthetic fertiliser & chemicals
- Water infiltration
- Soil Carbon > Soil ecosystem
- $ Productivity/income

Regenerative farming is about doing what's right in each environment

Case Study #4: Soil Organic Carbon Project



Wimmera Mallee
Rainfall ~300mm
Farming System: Cropping/Sheep

2017 - Worst paddock
2022 – Almost best paddock

Soil Organic Carbon Change in 5 yrs

SOIL CARBON ANALYSIS REPORT

SAMPLE ID for two carbon project areas (CEA1, CEA2)	Moisture** (%)	Gravimetric water content ** (g water/g oven-dry mass)	Air Dry Mass ** (g)	Oven Dry Equivalent Mass ** (g)	Gravel Content ** (g)	2017 (T0) Total Organic Carbon (% C)	2022 (T1) Total Organic Carbon (% C)
	Carbon Farming Initiative - Measurement of Soil Carbon Sequestration in Agricultural Systems 2018						
T1-CEA1-A-L1	9.29	0.013	1,624	1,603	3.5	0.616	0.82
T1-CEA1-A-L2	18.82	0.031	3,772	3,657	0.3	0.157	0.40
T1-CEA1-B-L1	11.59	0.016	1,641	1,615	4.6	0.910	1.01
T1-CEA1-B-L2	17.49	0.029	3,888	3,780	0.2	0.238	0.87
T1-CEA1-C-L1	12.22	0.014	1,677	1,654	0.2	0.545	0.84
T1-CEA1-C-L2	19.13	0.033	3,647	3,530	31.8	0.173	0.36

CEA1	2017	2022	CHANGE (over 5 years)
AVE UL (0-30cm)	0.691	0.891	22%
AVE DL (30-100cm)	0.19	0.37	49%

T1-CEA2-A-L1	16.12	0.025	1,540	1,503	0.7	0.453	0.79
T1-CEA2-A-L2	19.83	0.039	3,266	3,142	0.1	0.136	0.33
T1-CEA2-B-L1	15.63	0.026	1,528	1,489	1.3	0.586	0.75
T1-CEA2-B-L2	17.83	0.031	3,495	3,390	8.3	0.123	0.32
T1-CEA2-C-L1	10.02	0.011	1,568	1,551	0.6	0.524	0.68
T1-CEA2-C-L2	15.18	0.021	3,624	3,548	2.5	0.152	0.29

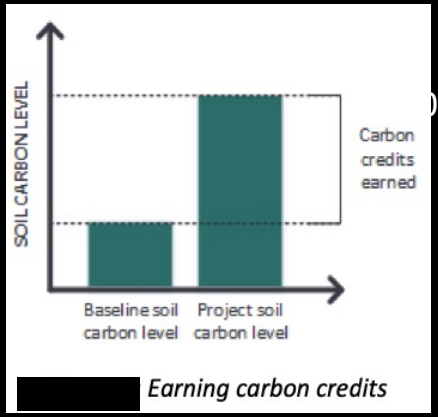
CEA2	2017	2022	CHANGE (over 5 years)
AVE UL (0-30cm)	0.521	0.739	42%
AVE DL (30-100cm)	0.137	0.313	128%

Wimmera Mallee
Rainfall 300mm
Cropping/Sheep

2017 – Worst paddock
2022 – Almost best paddock

Average TOC increase of 16tCO2e/ha/year

$100k+



REGENERATIVE AUSTRALIAN FARMERS
PROMOTING HEALTHY SOILS

Steps to participate in the market

Vegetation	36.92 million tonnes
Landfill and waste	15.48 million tonnes
Savanna burning	3.72 million tonnes
Energy efficiency	1.10 million tonnes
Agriculture	0.84 million tonnes
Industrial fugitives	0.51 million tonnes
Transport	0.36 million tonnes

How participating in the Climate Solution Fund works

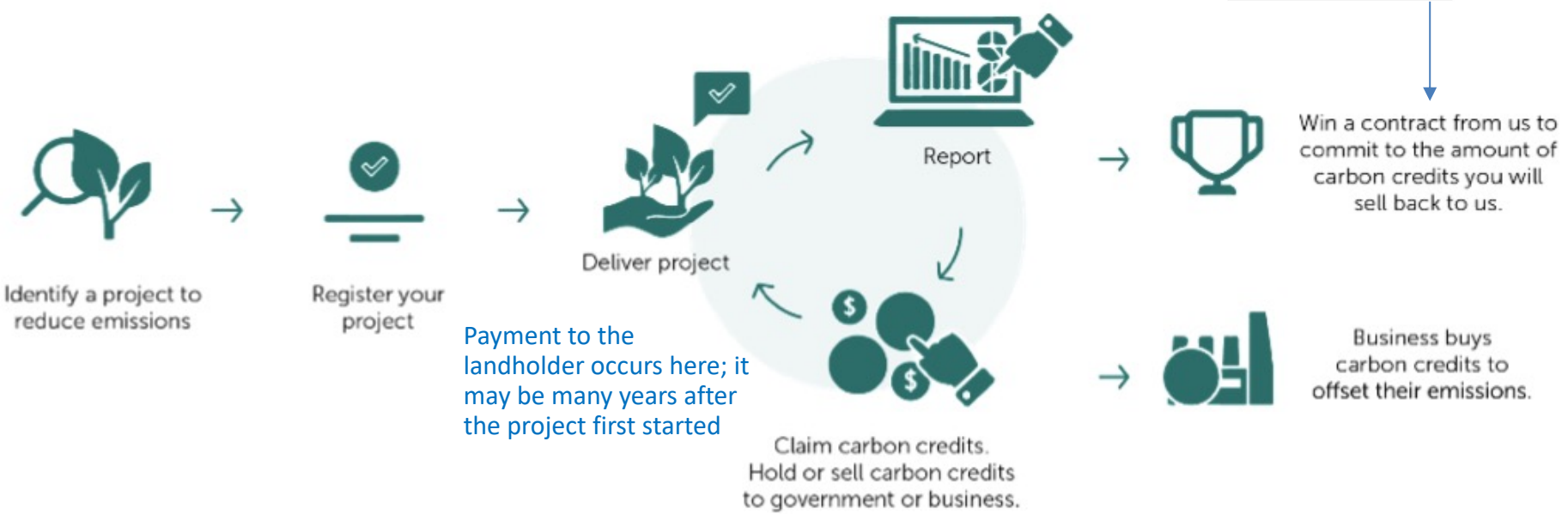
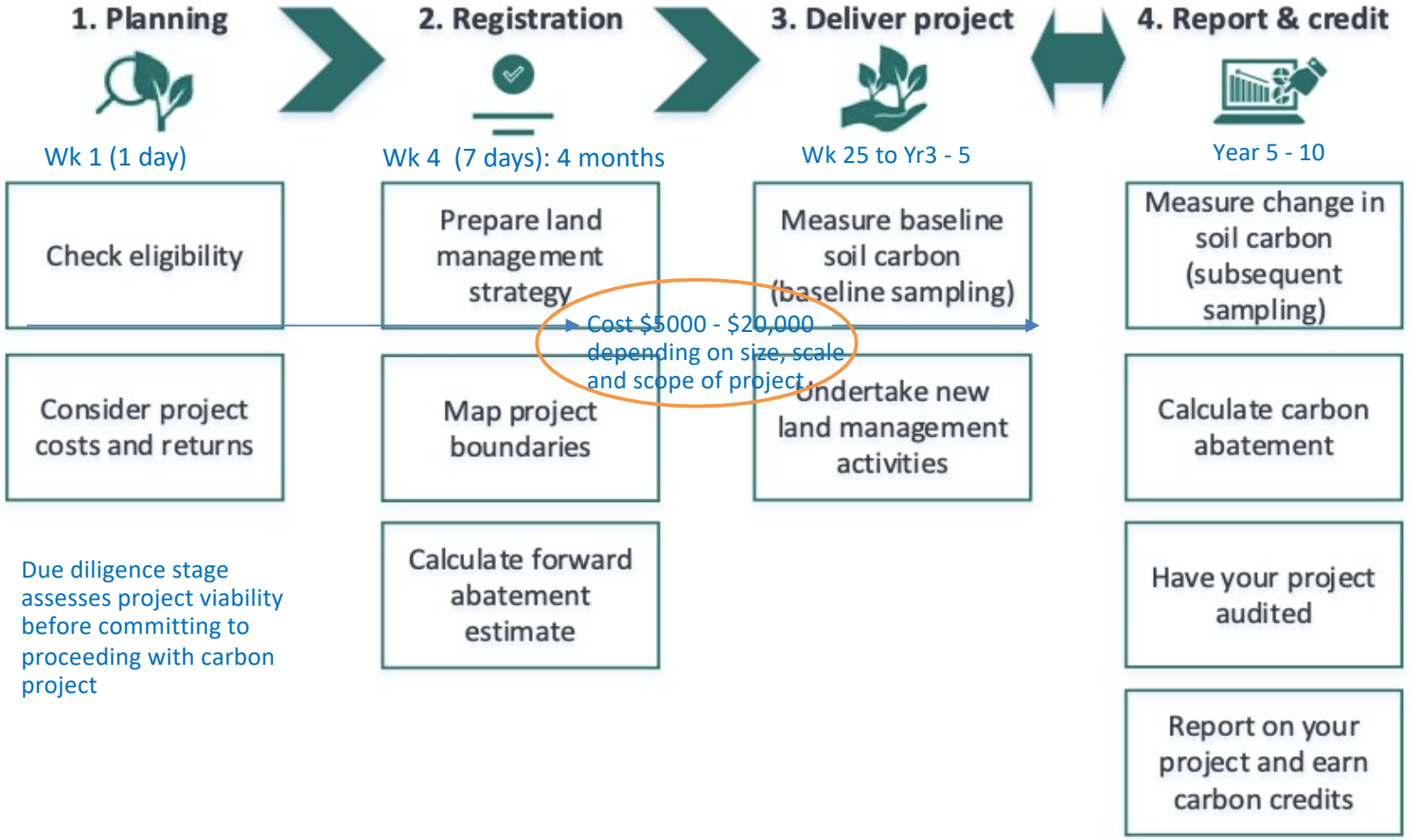


Figure 1: Climate Solutions Fund project lifecycle

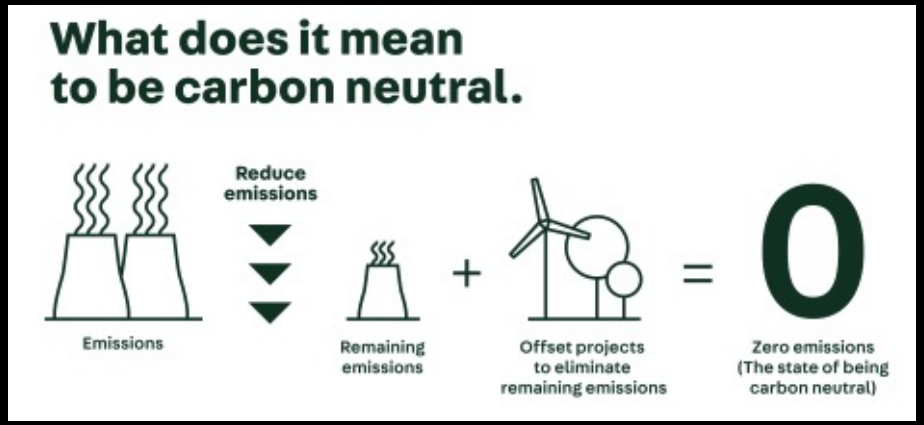


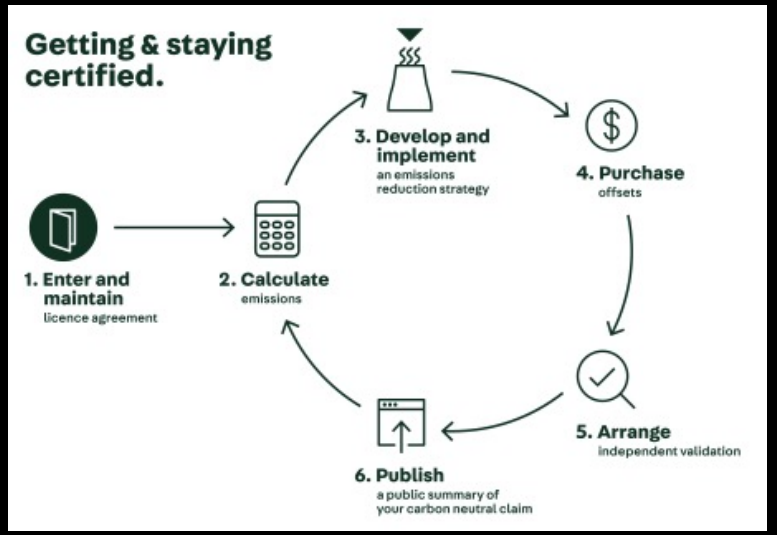
Soil carbon project lifecycle and actions

Carbon Neutral – what and why?

What is does Carbon Neutral mean?

"Climate Active Carbon Neutral Standard for Organisations (Organisations Standard) is a voluntary standard to manage greenhouse gas emissions and achieve carbon neutrality. ... It provides best-practice guidance on how to measure, reduce and report emissions data for the operations of organisations and their products".





What are the benefits of being carbon neutral?

- Future proof your organization
- Meet community expectations
- Stand out from competitors (brand), point of difference
- Enter the carbon neutral supply chain
- Save energy and reduce costs
- Develop carbon management expertise

Wrap Up

- Agriculture is key to both human and planetary health (i.e. the top 150mm skin of planet Earth)
- Adoption of regenerative agriculture principles can offer significant benefits to the way we relate to the planet, feed ourselves and our bank balance
- Soil carbon is the peak indicator of soil health and ultimately human health
- Markets are developing which pay farmers for building carbon in soils & tools now exist to facilitate this (refer next speaker), coupled with biodiversity credits
- Many different approaches for carbon farming depending on the farm enterprise and its vision
- Communities and regions can work together (landholders, local government, businesses, consumers)
- Your LandCare's commitment and support provides a great starting point

MAGIC - "the soil carbon gift horse is alive and well; you get paid for soil carbon but **you get to keep it**"