ARCZero

ACCELERATING FARMING TOWARDS CARBON NEUTRALITY

THE ROAD TOWARDS NET ZERO FARM WALK SERIES

#1 - Bell Farm, Kells, Co. Antrim - 31.05.22

ARCZERONI.ORG

Department of Agriculture, Environment and Rural Affairs
www.daera-ni.gov.uk

The European Agricultural Fund for Rural Development: Europe investing in rural areas

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Today's farm walk

Stop 1
Introduction to the farm & the ARCZero Project
Roger Bell, ARCZero

Stop 2
Benchmarking Green House Gas Emissions
Michela Tener & Stephen Flanagan, CAFRE

Stop 3
Multi-Species Swards
John Gilliland, ARCZero

Stop 4
Benchmarking Above & Below Ground Carbon
Patrick Casement, ARCZero
& Paul Williams, Queen's University

Stop 5
The Importance of Measurments to Flock Performance & Take Home Messages
Roger Bell & Jonathan Birnie, ARCZero

The journey towards Net Zero

John Gilliland
ARCZero Chair

Whether these are your first tentitive steps, or part of an ongoing journey towards NetZero I want to thank you for taking some valuable time out to join us at the first ARCZero Farm walk.

With the Climate Change bill now law, it's essential that we understand not only what carbon is emitted on farm, but just as importantly how farms capture it too, ensuring a bright future for the next generation.

The recently announced Soil Health & Nutrient Scheme will provide some of the information you'll see here today and will be an essential tool to help every farmer in the country to improve both their environmental and production efficiency. We hope today will help you understand just how powerful having such detailed information at your fingertips can be.

I would like to take this opportunity to thank the speakers from Queen's University and CAFRE who have given up their time to be a part of today's walk. Expertise such as theirs has been invaluable during this project.

ARCZero is a farmer-led European Innovation Project co-funded by the European Agricultural Fund for Rural Development (EAFRD) and the Department of Agriculture, Environment and Rural Affairs (DAERA).

ARCZero Farmers

Roger & Hilary Bell
Co. Antrim

Simon Best
Co. Armagh

Patrick Casement
Co. Antrim

John Egerton
Co. Fermanagh

John Gilliland
Co. Londonderry

Hugh Harbison
Co. Londonderry

Ian McClelland
Co. Down

Welcome to Springmount!

Hilary & Roger Bell
ARCZero Farmers

Welcome to Springmount! It's our great pleasure to welcome you to our sheep farm.

We have a combination of 500 lowland and upland ewes on a rotational grazing system here in Kells, County Antrim on our 78-hectare farm, operating on a rotational and strip grazing system.

Over the last 15 years, the grassland on the farm has been drained, reclaimed and re-seeded to improve grass quality.

To ensure healthy flocks, we record the liveweight gain of all animals on the farm, benchmark every year, operate a veterinary herd/flock health plan and perform soil sampling on the farm annually, using recorded data to make informed management decisions.

We were delighted to be asked to be part of the ARCZero project, helping to give farming a positive message about the carbon being sequestered in our soils, trees and hedgerows which you will hear about today.

Please enjoy your time on our farm, we hope you come away with a great story to tell, and plenty to think about!

78 hectare farm

500 lowland and upland ewes

Rotational grazing system

Grasscheck Farm

Technology Innovation Farm

Multi-Species Swards for Beef & Sheep EIP Farmers

The ARCZero Team

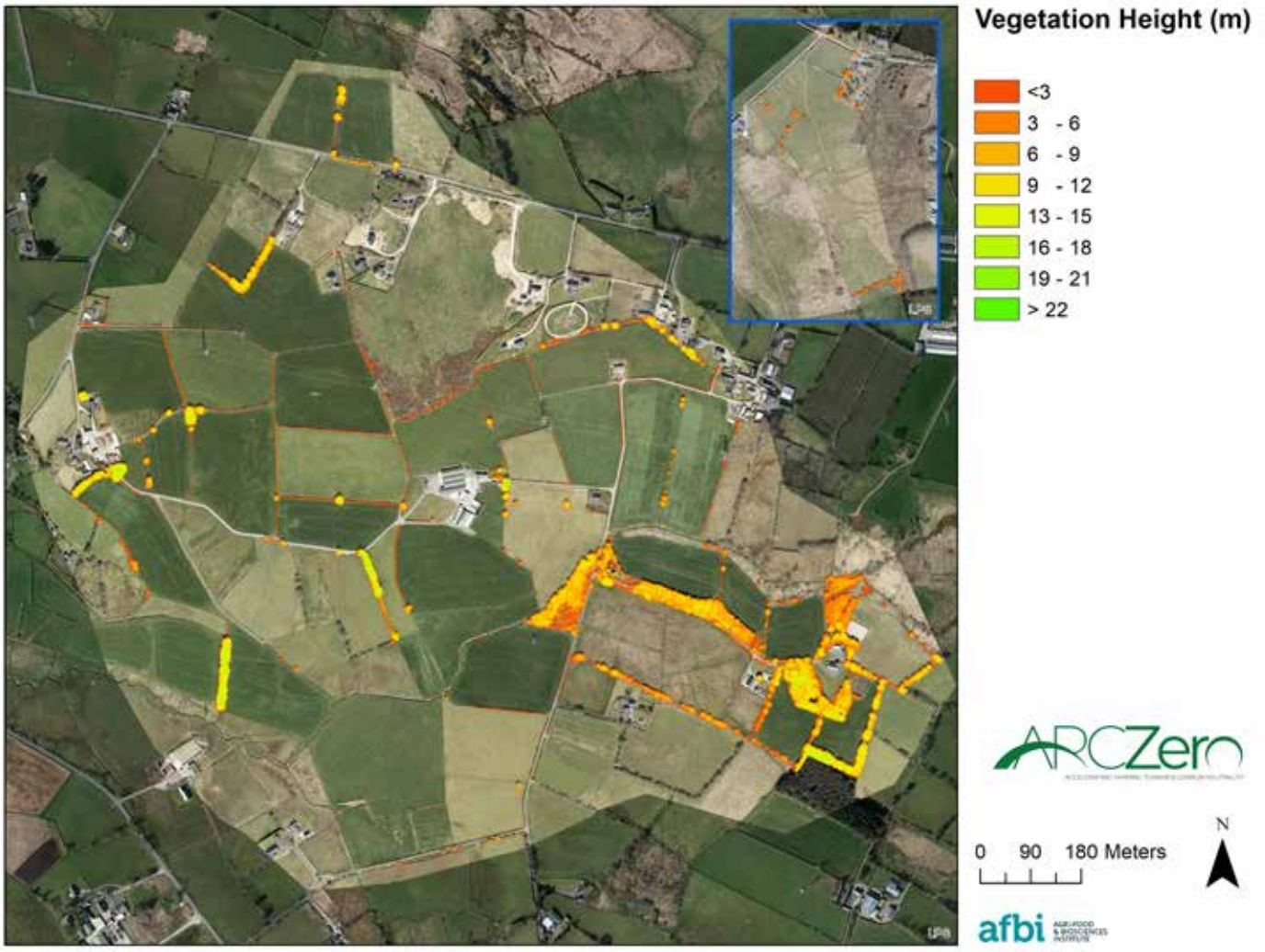
ARCZero: the journey so far

Accelerating Ruminant Carbon Zero (ARCZero) is a farmer led European Innovation Partnership project.

The project is led by John Gilliland of Brook Hall Estate and of Devenish Nutrition, alongside six other N. Ireland farms. Partners include Agrisearch, Birnie Consultants, Devenish and Queens University Belfast, supported by AFBI, CAFRE, NRM, RPS and SRUC

ARCZero is designed to accelerate the pathway to carbon zero farming by measuring and managing carbon flows at individual farm level, and empowering farmers to make positive change.

The project aims to deliver actual individual net farm GHG footprints, carbon stocks and their potential for annual carbon sequestration, enterprise specific life-cycle analysis (LCA) calculators, and a whole farm carbon balance sheet through the precise measurement of the on-farm carbon



Aerial Lidar coverage of Springmount.

stocks within soils, trees and hedges. The project is designed to enable participating farmers to change practice to accelerate their farm's progress to carbon zero by bringing transparency to their current footprint.

To date, the project has conducted two sets of soil sampling for each farm, the first to obtain information on pH (in water, 1:2.5 volume ratio of soil to water), Phosphorus (Olsen) (1:20 volume ratio of soil to sodium bicarbonate), Potassium (1:5 volume ratio of soil to ammonium acetate or ammonium nitrate), Magnesium (1:5 volume ratio of soil to ammonium acetate or ammonium nitrate) and Organic Matter by Loss on Ignition (LOI).

The second sampling was a Soil Carbon Audit, sampled to 10cm with information on Bulk Density, Inoragic Carbon, Total Carbon, Total Nitrogen, C:N Ratio, Organic Matter, Soil Organic Carbon, Active Carbon (mg/kg) and Active Carbon (% of SOC). Alongside soil sampling, a full LiDAR survey was conduted with leaf off the trees, from which carbon stocks of all the trees and hedgerows on each from was calculated. Using SRUC's 'AgReCalc' tool, this allowed a full carbon balance sheet for each farm to be divised from both the inputs and outputs.

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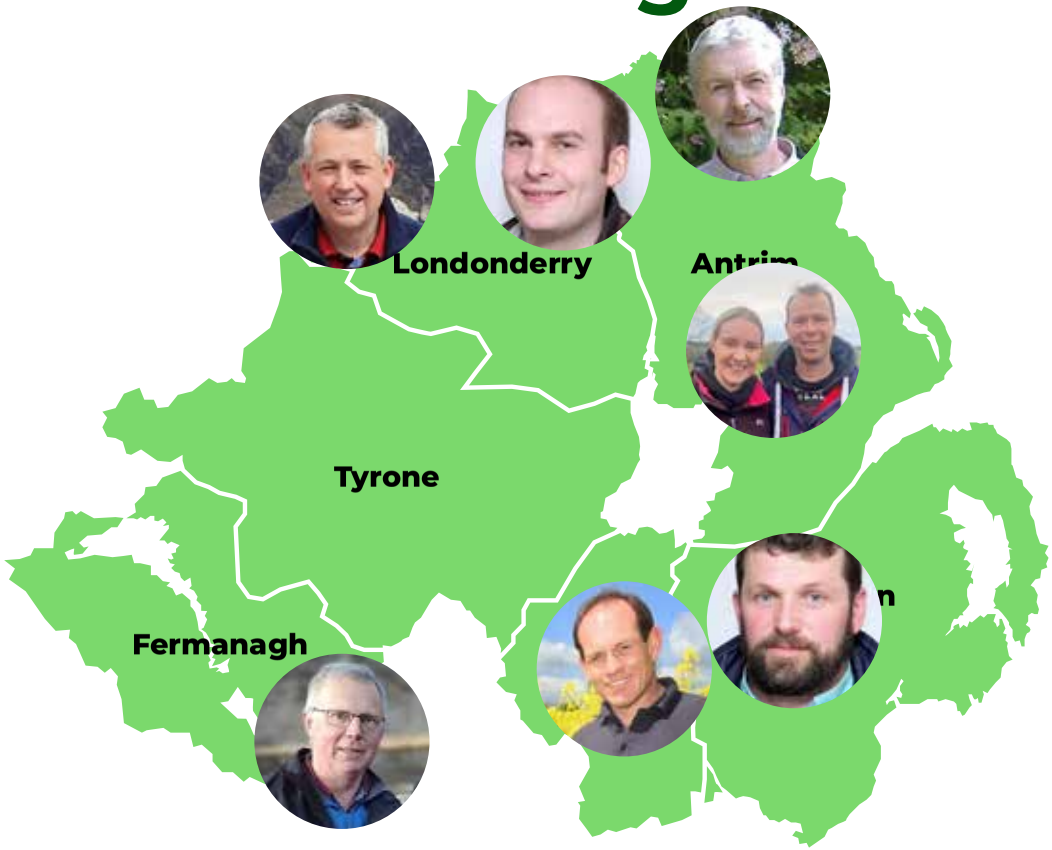
Accelerating 7 NI Farms towards Net Zero



Roger & Hilary Bell *Sheep*

Simon Best *Arable & Beef*

Patrick Casement *Sheep & Dry Stock*

John Egerton *Suckler Beef*

John Gilliland *Willow & Dry Stock*

Hugh Harbison *Dairy*

Ian McClelland *Dairy*

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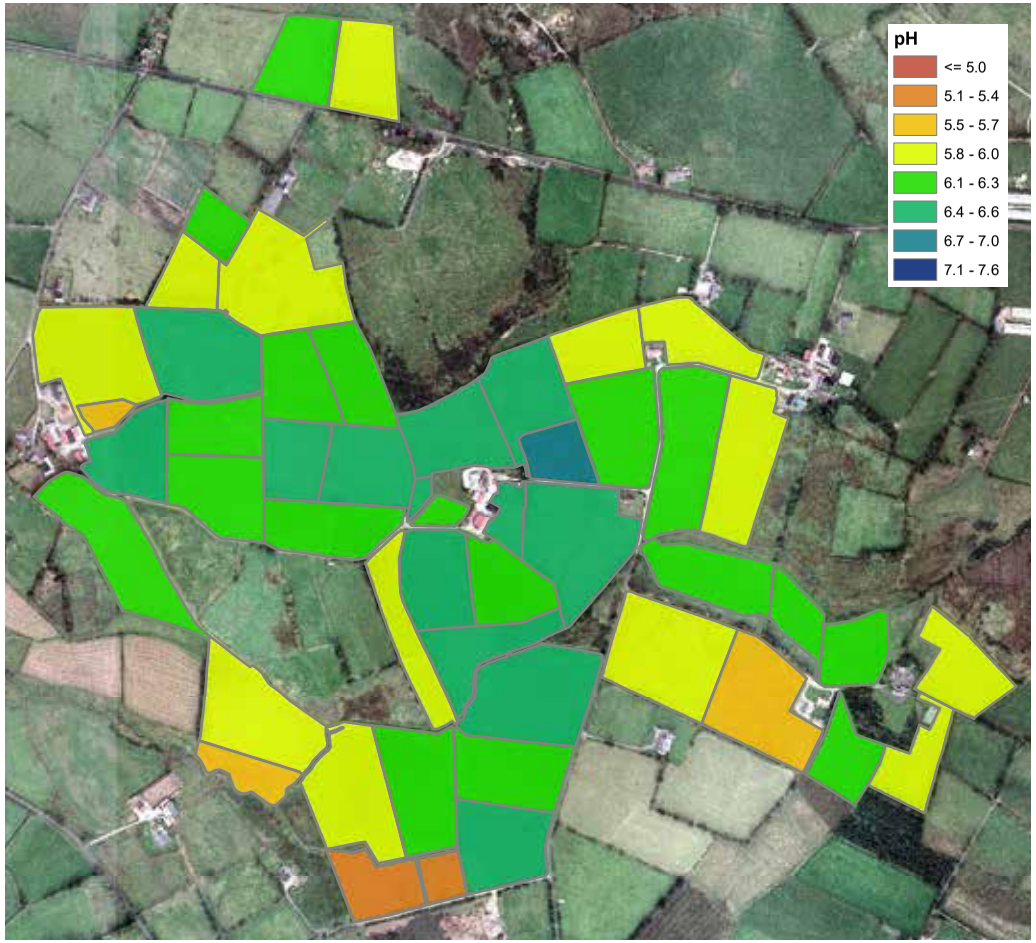
Welcome to the Bell's Farm



- **78 hectare farm run by Roger & Hilary Bell**
- **500 lowland and upland ewes**
- **Rotational grazing system**
- **Grasscheck Farm**
- **Technology Innovation Farm**
- **Multi-Species Swards for Beef & Sheep EIP Farmer**

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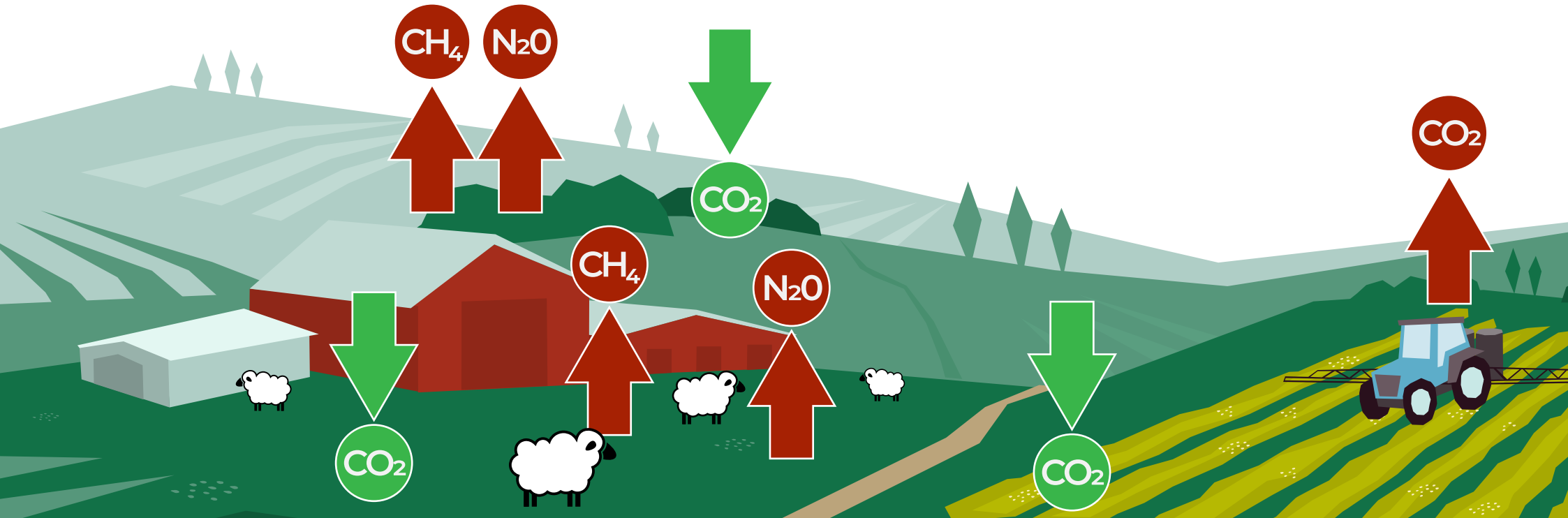
Carbon Farming

If you can't measure, how can you manage?

Gross Annual GHG Emissions
Less **Gross Annual Carbon Sequestration**
= Net Farm Carbon

Using "Net" not "Gross" Emissions to get a complete picture of carbon footprint



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Carbon Footprinting as a managment tool

Springmount Case Study

" A Carbon Footprint is the total greenhouse gas emissions caused by an individual, organisation, service or product, withina given year, expressed as carbon dioxide equivalent, $C0_2e$"
Carbon Trust

Why is it important?

> Understanding of GHG emissions
> Farm business sustainability
> Market food products
> Slow the rate of climate change

Farm: 21.99
kg/C02e/kg DW

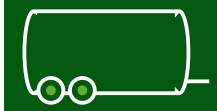
Average 30.70
kg/C02e/kg DW

Sources of Emissions by %

Enteric Fermentation 36%

Purchased Feed 2%

Fertiliser 39%



Manure Management 15%

Other 2%

Fuel 3%

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Springmount moving Towards Net Zero

Mitigation tools

Genomics & Genetic Selection

Feed Additives

Slurry Additives & Amendments

Renewable Energy

Alternative Fuel Vehicles

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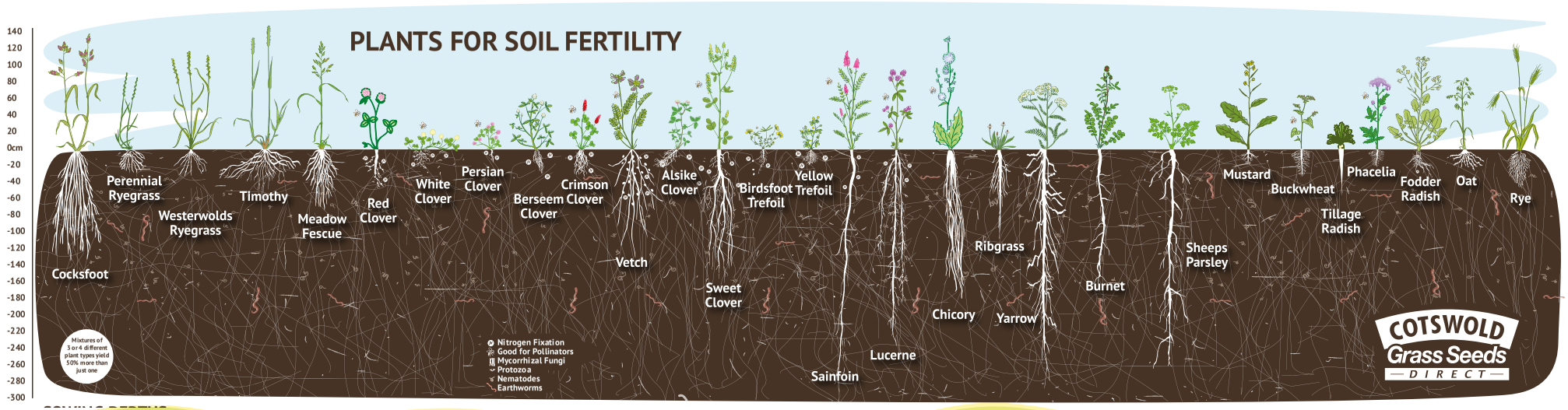
Multi-Species Swards

for Beef and Sheep EIP Project

Learnings so far:

- Each farm is unique – a specific MSS seed mix to suit each farm
- Swards established in the spring have coped well in the dry weather
- Some seed mixes have faired better than others
- Weeds will be a feature - different management perspective needed
- Establishment of MSS is not simple –patience required
- The group has been invaluable for farmer support during the establishment process
- Significant research gaps still exist



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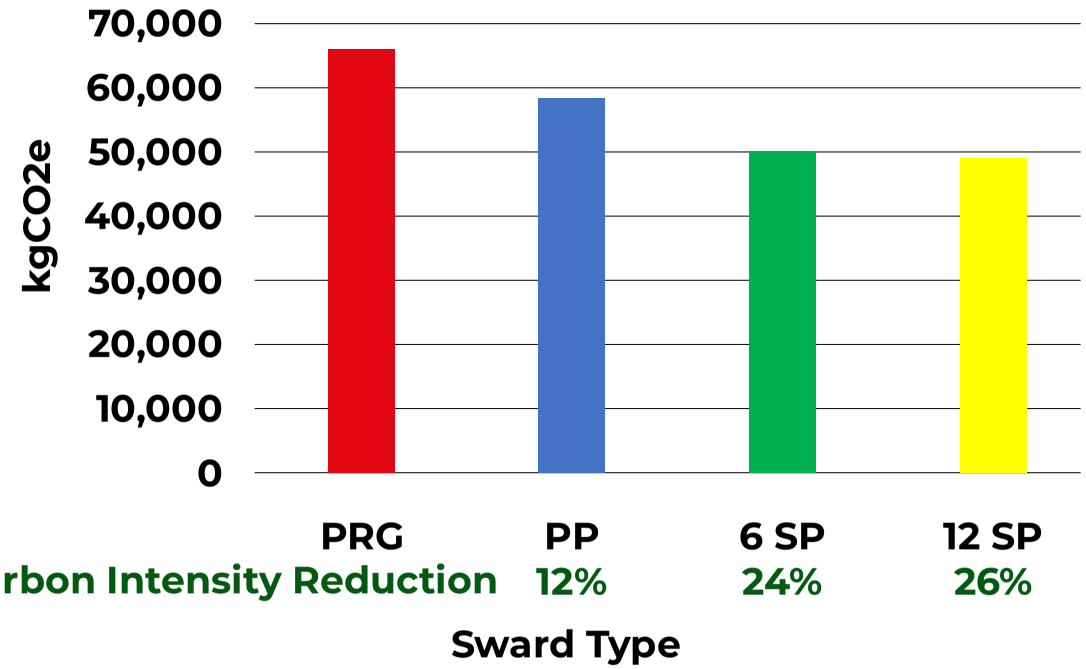
Delivering Multiple Goods

by switching to Multispecies Swards

Carbon Intensity of Beef & Lamp per Sward Type



HEARTLAND
ONE HEALTH FROM SOIL TO SOCIETY

- 65% Reduction in Nitrogen
- 20% Improvement in ADWG
- 300% Increase in earthworms
- 14 times faster water infiltration of soil

A 26% reduction in GHG intensity per kg of meat, without recognition of increases in soil carbon...

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JOIN US AT OUR NEXT FARM WALKS!

Simon Best, Poyntzpass
Friday 17th June 2022

John Egerton, Rosslea
Tuesday 21st June 2022

To book your place or find our more information go to

arczeroni.org

Multi-Species Swards for Beef & Sheep Farm Walk

Paul & Frank Turley's on Monday 13th June (3pm & 7pm).

Book your place at agrisearch.org

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Measuring Carbon in Soils

On Site Soil Sampling

Marking GPS Position

Auguring to 30cm

Collecting the Soil Sample

Lab Measurement

SOC + Bulk Density + Texture

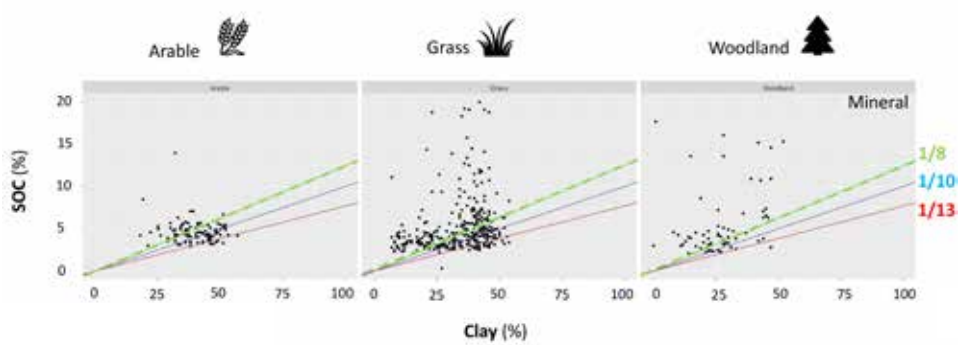
TOC = TC - TIC OM = TO C/0.58

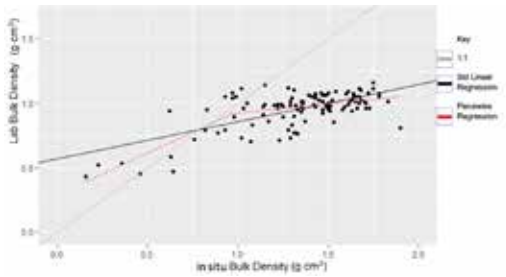
C. Stock

$$BD = \frac{\textit{Dry Matter Weight of Soil Core}}{\textit{Volume of Core}}$$

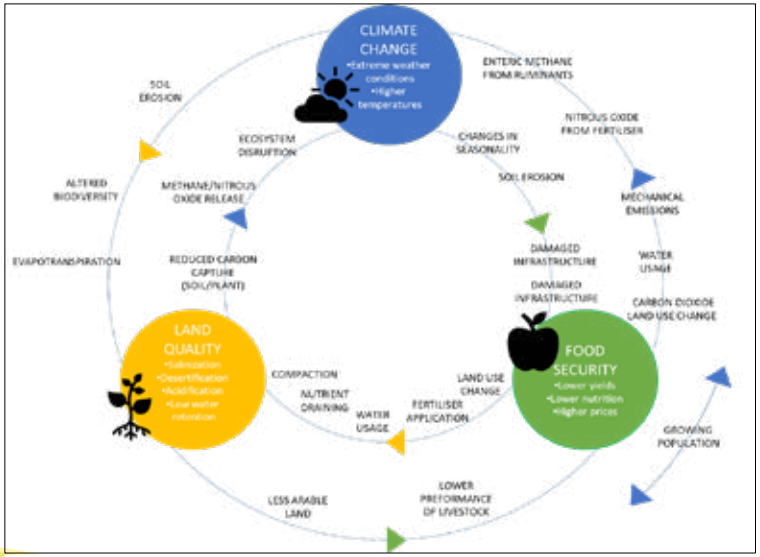
*Stock = SOC * Depth * Bulk Density*

SOC/clay





Benefits



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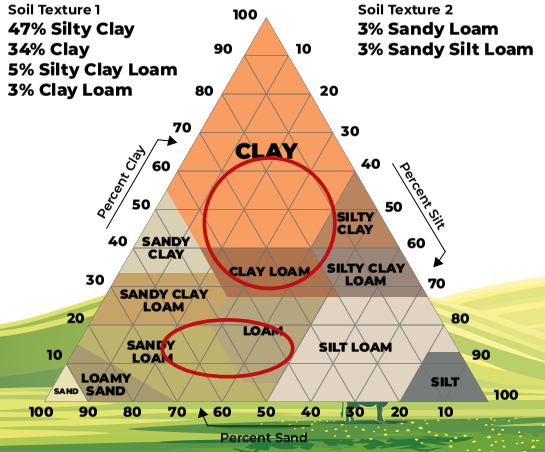
Total Farm Carbon Stocks

Working out Total of Soil Carbon, per land category

Land Category	Total ha	Av. LOI/SOM	No of Soil Cores	No of Samples	Av. C. 0-10cm	Av. C. 0-30cm
10-20% Soil Org. Matter, Permanent Grass, No Slurry/FYM, Only Grazed	0.3ha	12.40%	15	3	9.80%	6.40%
10-20% Soil Org. Matter, Permanent Grass, YFM/Compost, Only Grazzed	3.2ha	16.30%	30	6	8.50%	5.60%
10-20% Soil Org. Matter, Permanent Grass, Slurry/FYM, Cut & Grazed	17ha	18.50%	45	9	7.90%	5.40%
10-20% Soil Org. Matter, Permanent Grass, Slurry/FYM, Only Grazed	5.8ha	17.70%	25	5	10.10%	5.90%
10-20% Soil Org. Matter, Rotational Grass, Slurry/FYM, Only Grazed	5.8ha	16.9%	25	5	8%	5.40%
10-20% Soil Org. Matter, Rotational Multi Species, Slurry/FYM, Only Grazed	4.9ha	16.10%	25	5	8.30%	7.32%
10-20% Soil Org Matter, Rotational Grass, Slurry/FYM, Only Grazed	2.6ha	19.40%	25	5	9%	7.38%
20-30% Soil Org. Matter, Permanent Grass, No Slurry/FYM, Only Grazed	3.9ha	24.60%	25	5	11.40%	9.80%
20-30% Soil Org. Matter, Permanent Grass, FYM/Compost Only Grazed	3.2ha	22.30%	25	5	12.80%	9.10%
20-30% Soil Org. Matter, Permanent Grass, Slurry/FYM, Cut & Grazed	6.9ha	22%	25	5	10.10%	7.60%
20-30% Soil Org. Matter, Permanent Grass, FYM/Compost, Only Grazed	10.8ha	24.40%	25	5	13.70%	9.30%
>30% Soil Org. Matter, Permanent Grass, No Slurry/FYM, Only Grazed	3.3ha	36.10%	25	5	23.40%	16.60%
>30% Soil Org. Matter, Permanent Grass, FYM, Only Grazed	1.2ha	51.10%	15	3	42.40%	26.80%
>30% Soil Org. Matter, Permanent Grass, Slurry/FYM, Cut & Grazed	1.8ha	36.30%	15	3	16.70%	10.70%
>30% Soil Org. Matter, Permanent Grass, Slurry/FYM, Only Grazed	4.2ha	38.30%	10	2	15%	9.10%
>30% Soil Org. Matter, Permanent Grass, Slurry/FYM, Only Grazed	5.3ha	44.10%	15	3	21.30%	9.60%

Soil Texture 1
47% Silty Clay
34% Clay
5% Silty Clay Loam
3% Clay Loam

Soil Texture 2
3% Sandy Loam
3% Sandy Silt Loam



Total Soil Carbon **13,885t of C**

Total Carbon in Trees & Hedges **188t of C**

Total Farm CO2e Stocks **14,073t of C 3.66 = 51,507t of CO2e**

Farmers are Custodians of the Nation's Carbon

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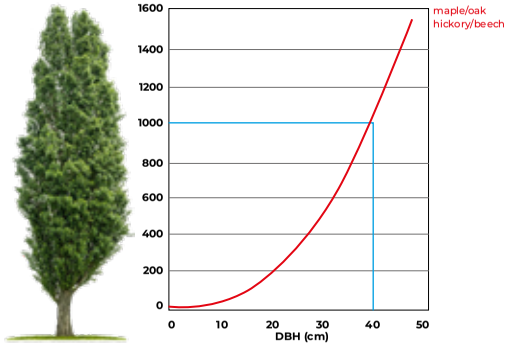
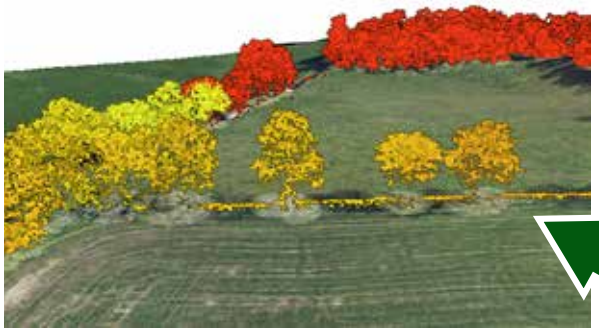
Measuring On-Farm Biomass Carbon Stock

Trees, Hedges & Woodlands





Vegetation Type	Hedge Length (km)	AGB (t)	C (t)	BGB* (t)	C(t)	Total C (t)
Hedge 0-4m	7.24	101.00	48.2	19.39	9.1	57.3
Hedge 4-7m	1.05	20.90	10.0	4.01	1.9	11.9
Hedge 7-10m	0.85	35.41	16.9	6.80	3.2	20.1
Hedge >10m	1.06	84.10	40.1	16.15	7.6	47.7
Total Hedges	**10.20ha**	**241.41t**	**115.1t**	**46.4t**	**21.8t**	**136.9t**
	Canopy Area (ha)					
Single Trees	0.09	2.75	1.3	0.53	0.2	1.6
Deciduous Woodland	1.26	81.26	38.8	15.60	7.3	46.1
Coniferous Woodland	0.13	6.84	3.3	1.41	0.7	3.9
Total	**1.48 ha**	**332.26t**	**158.5t**	**63.8t**	**30t**	**188.4t**

(Alex Higgins, 2021)

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Carbon Life Cycle Assement Report

Benchmarking Sheep Performance Against AgReCalc Average

Quick glance enterprise emissions

	*kg CO2e/ kg dwt	Opportunity Level	Comp -arison
Enteric Fermentation	9.13	Low	17.18
Manure Management	3.19	Low	5.99
Fertiliser	7.40	Medium	4.11
Purchased Feed	0.11	Low	1.51
Purchased Bedding	0.48	Medium	0.10
Fuel	0.69	Low	0.89
Electricity	0.12	Medium	0.04
Other	0.85	Low	0.89
Total Emissions**	**21.99**	**Low**	**30.70**

Physical permormance of enterprise

	Value	Comparison
Area of land utilised (ha)	48	134
Female breeding stock (no)	375	482
Lamb sale weight (kg lwt/head)	46	41.83
Lamb sale weight (kg dwt/head)	20.70	18.97
Wool sales (kg)	1,500	1,240
Purchased feed use (kg/ewe)	8	72
Homegrown feed use (kg/ewe)	1,867	797
Mortality (%)	3	7
Lambing percentage (%)	200	159
Ewe cull rate (%)	33	35
Enterprise net output (kgs)	20,846	14,775

Sheep Output - 41% better than average

GHG Emissions - 28% better than average

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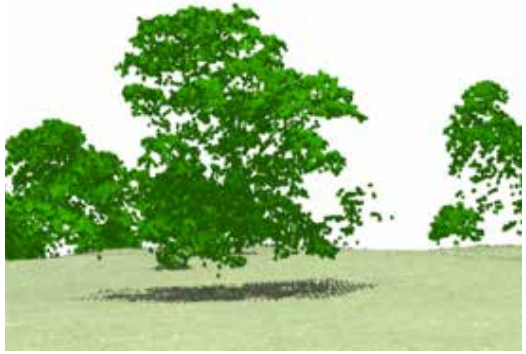
Sustainable Farming

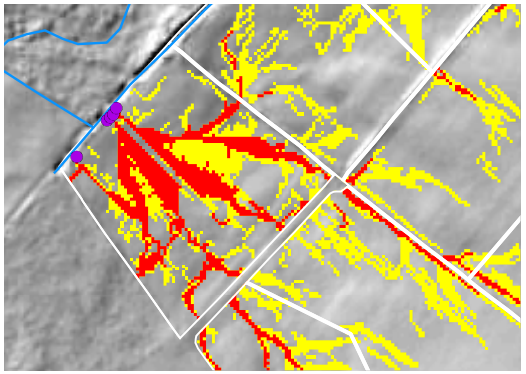
Delivering Multiple Solutions - Not Single Agendas

Producing Nutritious Food & Tackling Malnutrition

Delivering Soil Improvement Both Fertility & Health



Accellerating Carbon Sequestration, Both Above & Below Ground



Improving Water Quality by Reducing Over Land Flow

Optimising Biodiverisity, Especially Below Ground

Generating Profits

Food Futures

DRIVING SUSTAINABILITY

A SMART PLATFORM DESIGNED TO ENHANCE THE SUSTAINABILITY OF THE NORTHERN IRELAND AGRI-FOOD SECTOR

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