LAND USE *for* NET ZERO >>> HUB

Soil Carbon Baselining

Presentations from the workshop run by the LUNZ Topic Advisory Group on Soil Health and Carbon Dynamics (Soil TAG)

25th June 2025

UK Research and Innovation

Department for Environment Food & Rural Affairs

Department for Energy Security & Net Zero

Llywodraeth Cymru Welsh Government

Scottish Government Riaghaltas na h-Alba

DAERA Department of Agriculture, Environment and Rural Affairs
An Roinn Talmhaíochta, Comhshaoil agus Gnóthaí Tuaithe
Depairtment o' Fairmin, Environment an' Kintra Matthers
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Contents

Introduction

Soil carbon baselining raises as many questions as answers from stakeholders motivated by different but overlapping objectives:

- From **corporates** to feed into their carbon inventories and to quantify the impact of their interventions
- From **governments** to see the direction of travel for one of the pillars of the environment – and for which targets are in place
- From **landowners** engaging in carbon and nature markets
- And from farmers looking to understand the state of their most important asset.

This workshop heard case studies from a range of organisations working at different scales, using different technologies and methodologies and for different outcomes, who have had to answer some or all of these question as they develop their own soil carbon baselining initiatives. The presenters shared:

- The technologies, protocols, or sampling regimes used
- Their overall baselining approach
- The scale and investment level
- Their key motivation and intended outcome — be it soil stock change tracking, corporate reporting, or readiness for carbon market participation
- And what they learnt along the way…

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Presentation 1:

A Practitioner's Perspective

Helaina Black, Agricarbon

Agricarbon

UK Research and Innovation

Scottish Government
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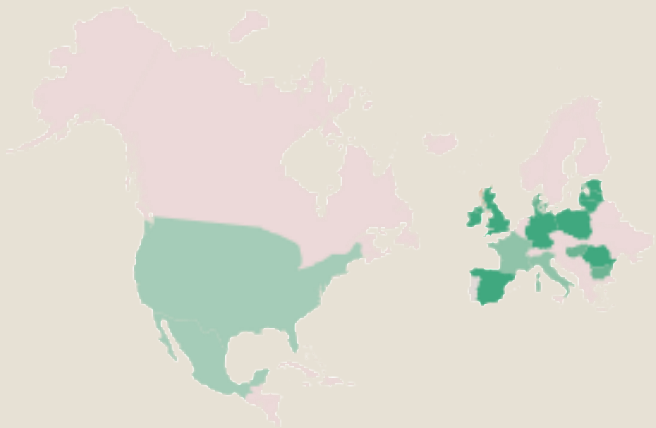
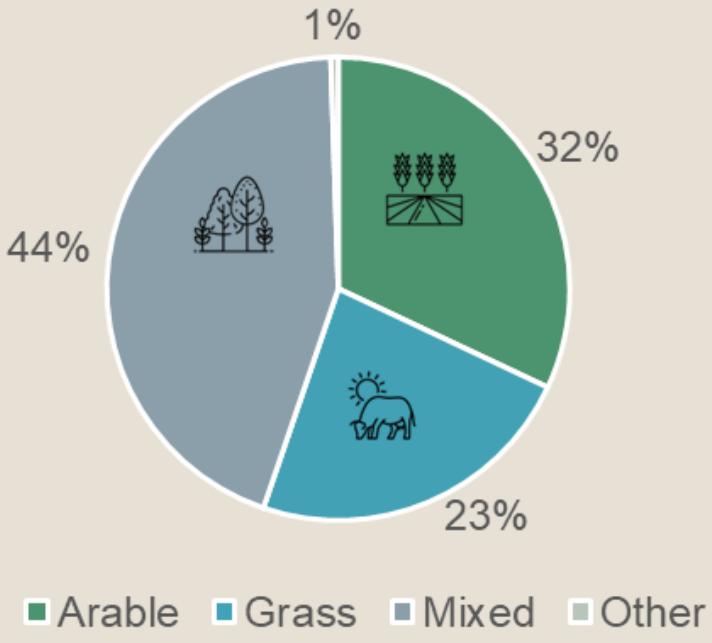
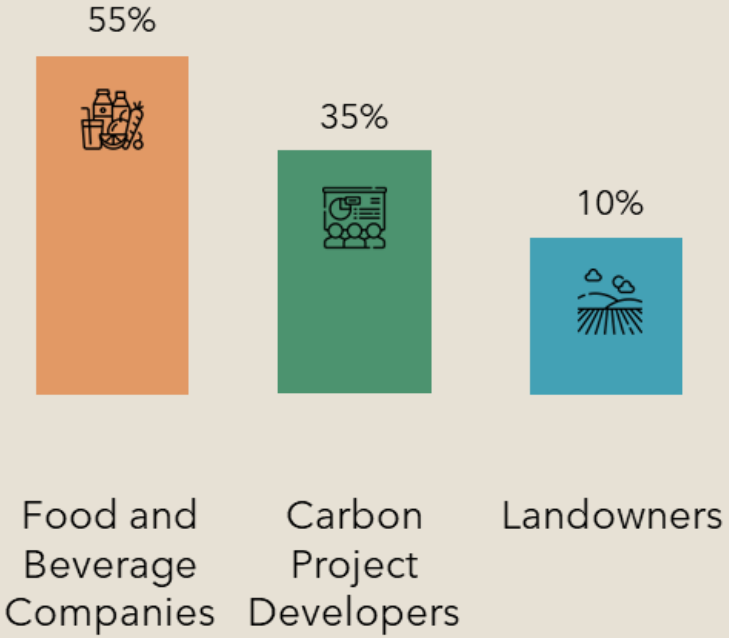
Baselining soil C projects



>200,000 Sampling points
>25,000 Fields
18+ Countries





Since 2021, >500,000 soil samples analysed for soil C stocks
SOC% + FF bulk density (+ soil mass)

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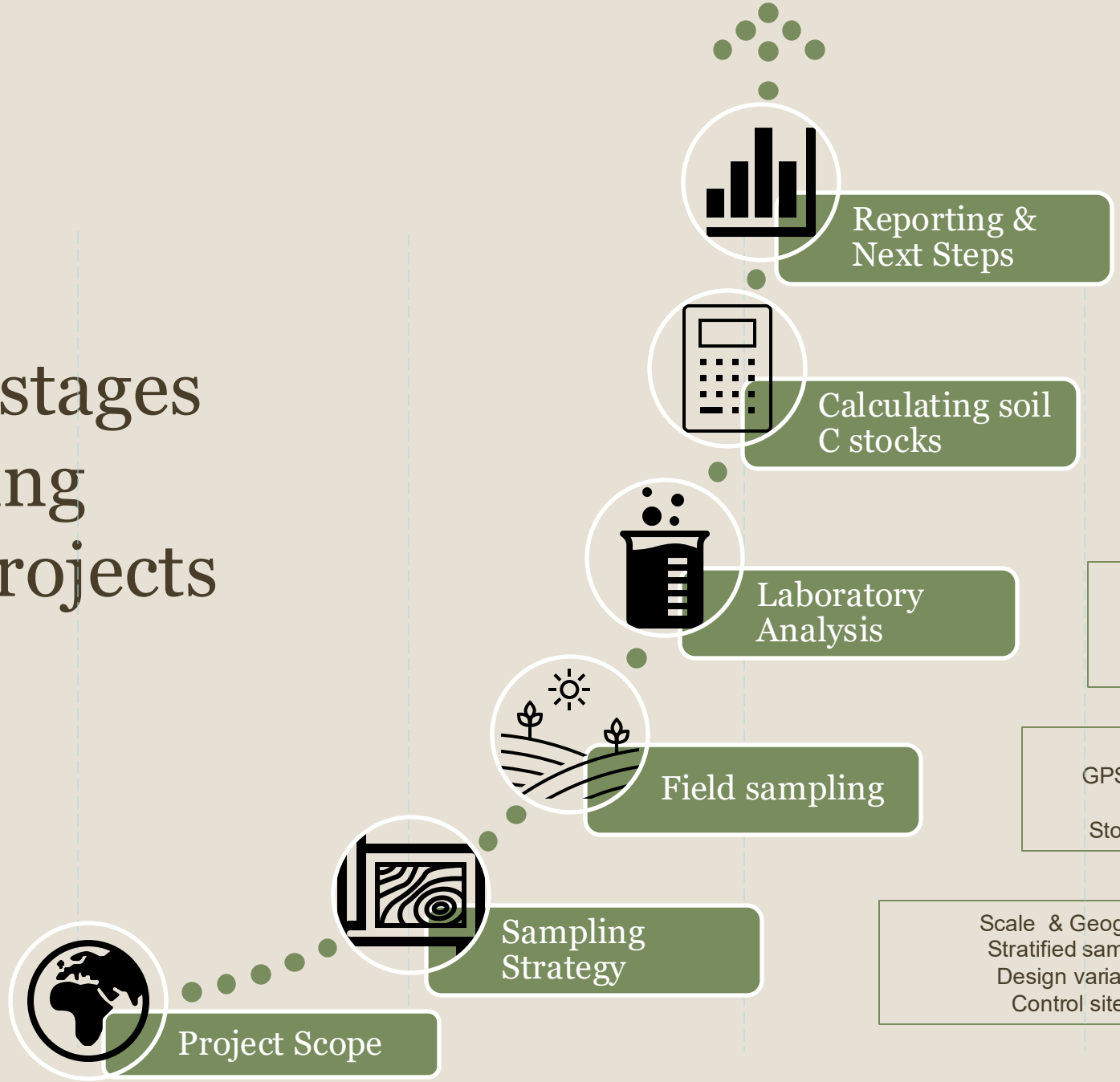
Typical stages Baselining Soil C Projects



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Project Scope

	regenerate outcomes	firstmilk The Regenerative Co-op	NATTERGAL	ARCZero
Scale:	Farm cohorts: mixed farming systems	Dairy farming: farm to regions	Field-Farm : rewilding	Farm-level: soil C removals
Purpose:	Carbon Credits (offsetting & insetting)	Net Zero + First4Milk sustainability program	Carbon Credits (offsetting & insetting)	Net Zero Farm Enterprise (insetting)
Standards/ Methodology:	Verra VM0042	GHG LS&R + LCA Calculator	Wilder Carbon (BNG)	LCA Calculator (GHG LS&R / EU CRCF?)
Third parties:	Understanding Ag	FCT University of Leeds Nestle	Arup	Devenish Agrecalc
Geography:	UK	UK	UK	UK

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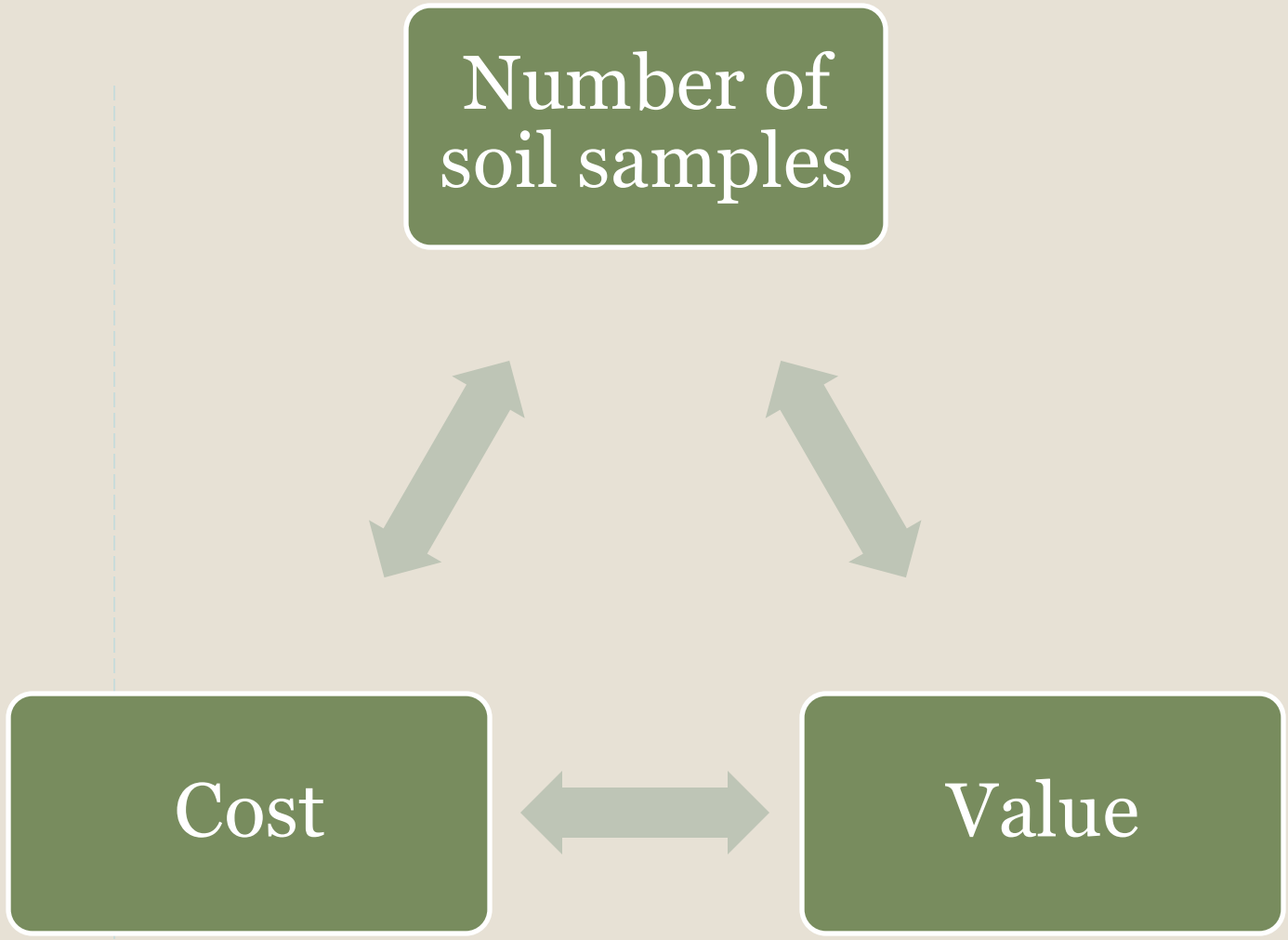
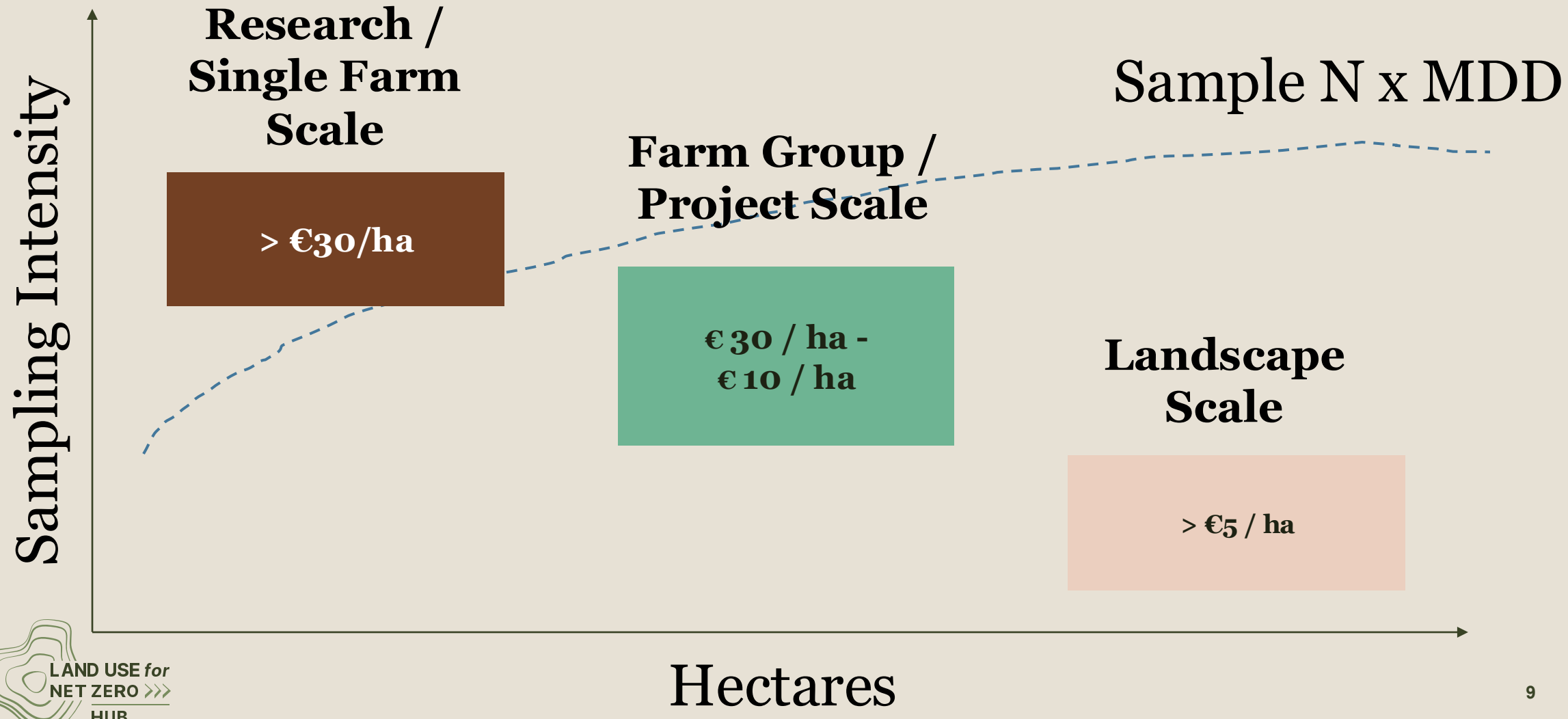
Project Scope



How much does it cost - measurement



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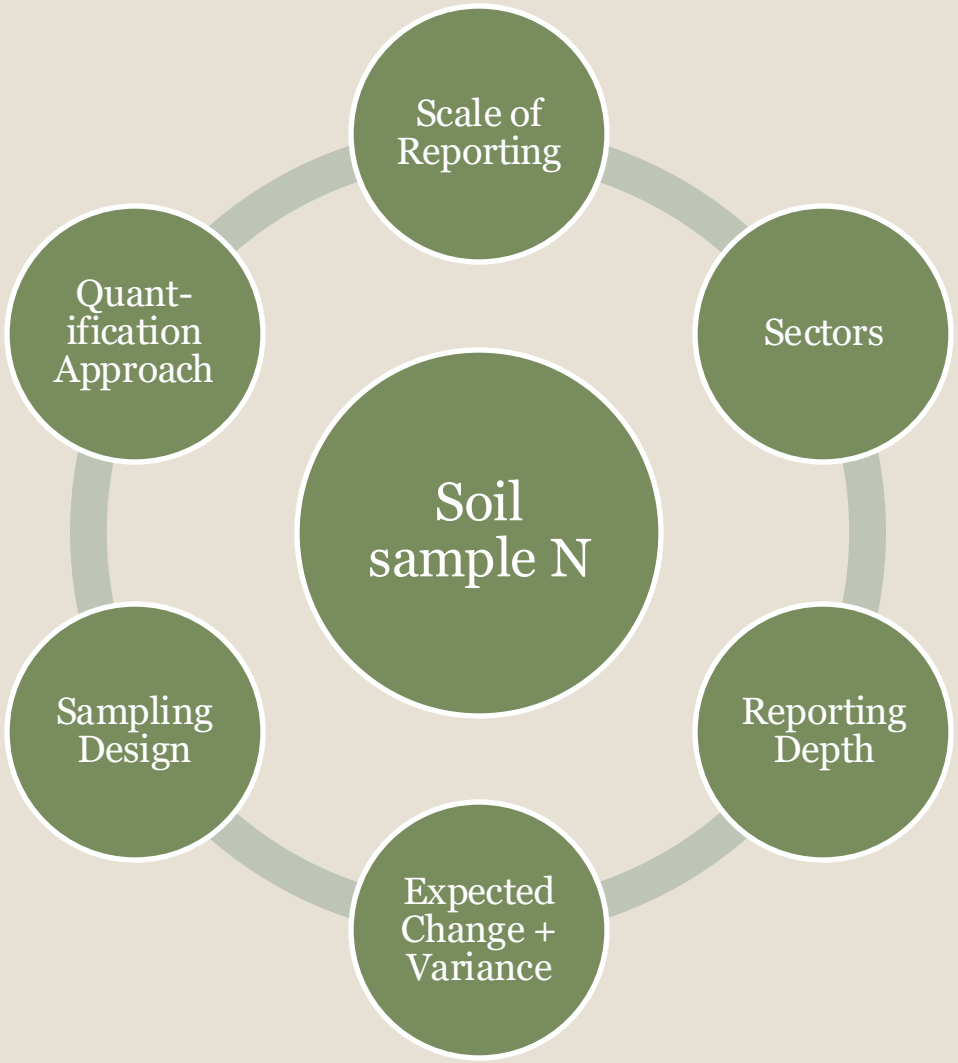
Project Scope



Project Scope

VALUE

Uncertainty deductions

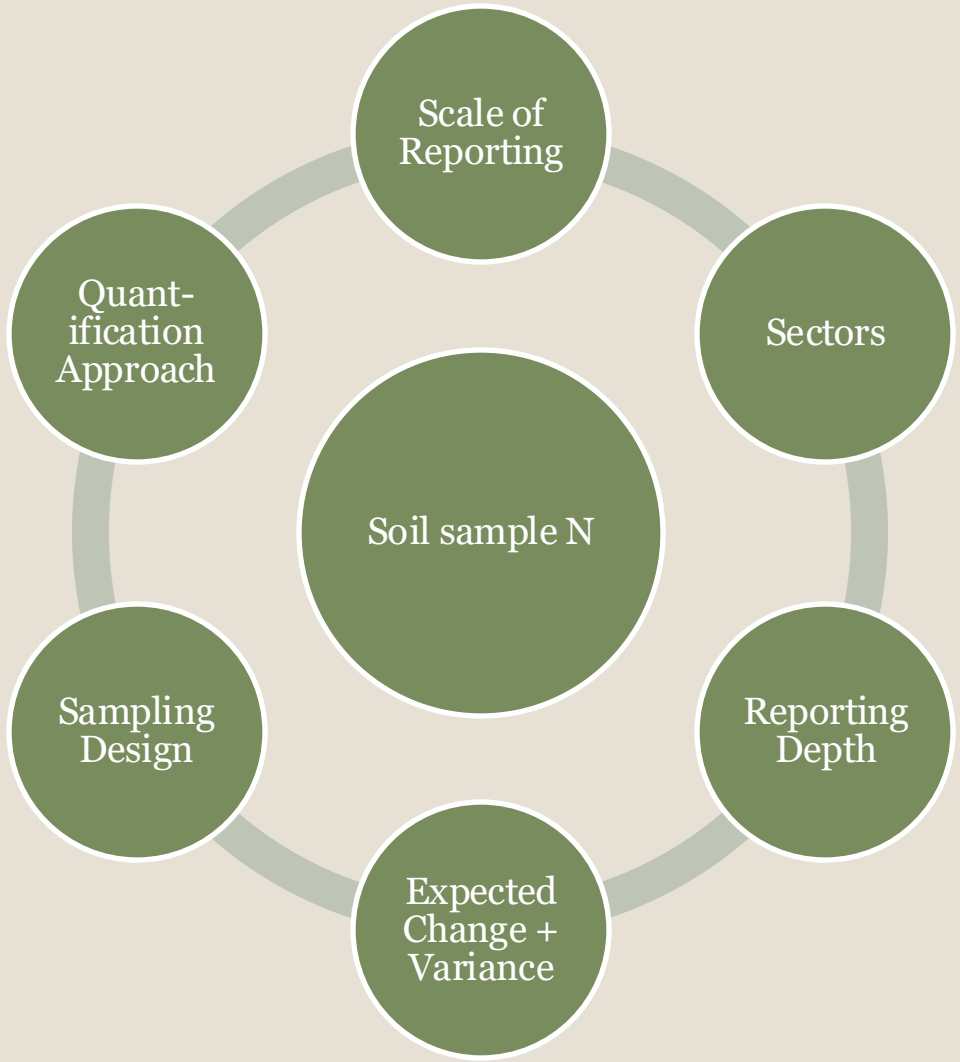
Model-measure
Measure-remeasure
(Measure-model-remeasure)

Remeasurement intervals

Space-for-Time

BAU Controls

Optimised sampling designs
Pre-existing data
Pre-sampling



Plots - Field
Farm – Cohort - Region
Programme

Arable – Pasture
Crop type(s)
Rotations
Churn

0-30 only
2 depths : 0-30/30-60
Multiple depths
ESM vs Fixed depth
Below ‘management layer’?

MDD
Evidence for practice changes
Current baseline / Soil potential

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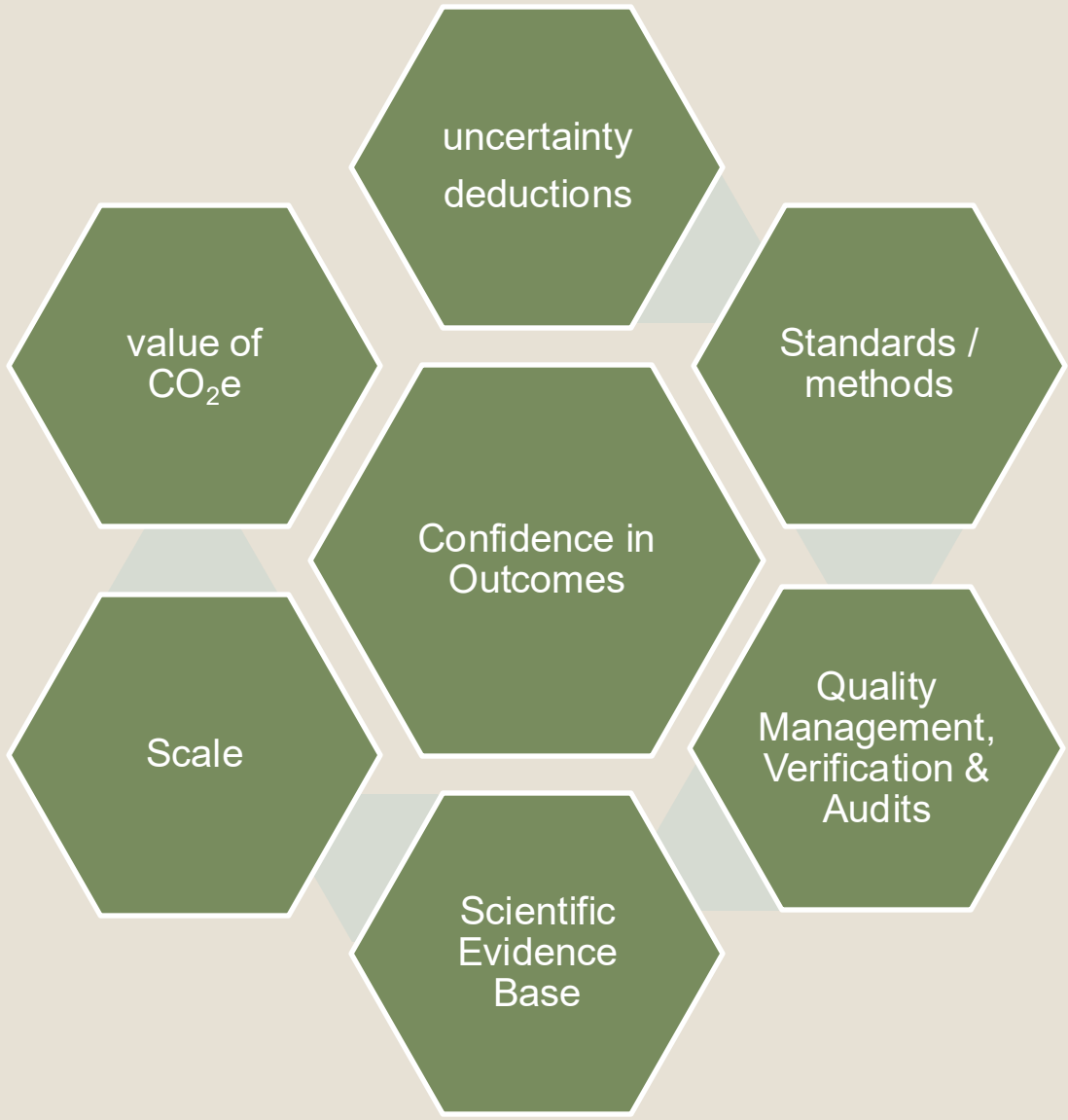
Project Scope



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Presentation 2:

Soil Carbon Monitoring: The story so far…

Tom White, Yeo Valley

UK Research and Innovation

Scottish Government
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Department for Environment Food & Rural Affairs

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Intro to Yeo Valley Food and farming business

YVP makes c33% of all UK's retail yogurts*

Yeo Valley Organic is UK's largest organic brand & 41st biggest FMCG brand

Working with, and supporting, ~100 organic dairy farms

Growing our own non-organic regenerative dairy farming pool (NBDG)

Run a farmer-to-farmer best practice programme for regenerative farming

Our own 2000ac Farm in North Somerset


Tom White, Yeo Valley

LAND USE for NET ZERO HUB

Our Purpose and Vision

To

Nurture & Nourish People & Planet

by

Making Great Food the Right Way. Forever.

Our Aims:

How can we help make a difference?

As a food and farming business we are driven to show that there is an affordable and scalable way to produce natural healthy foods that sustains and values life whilst helping to reverse climate change.

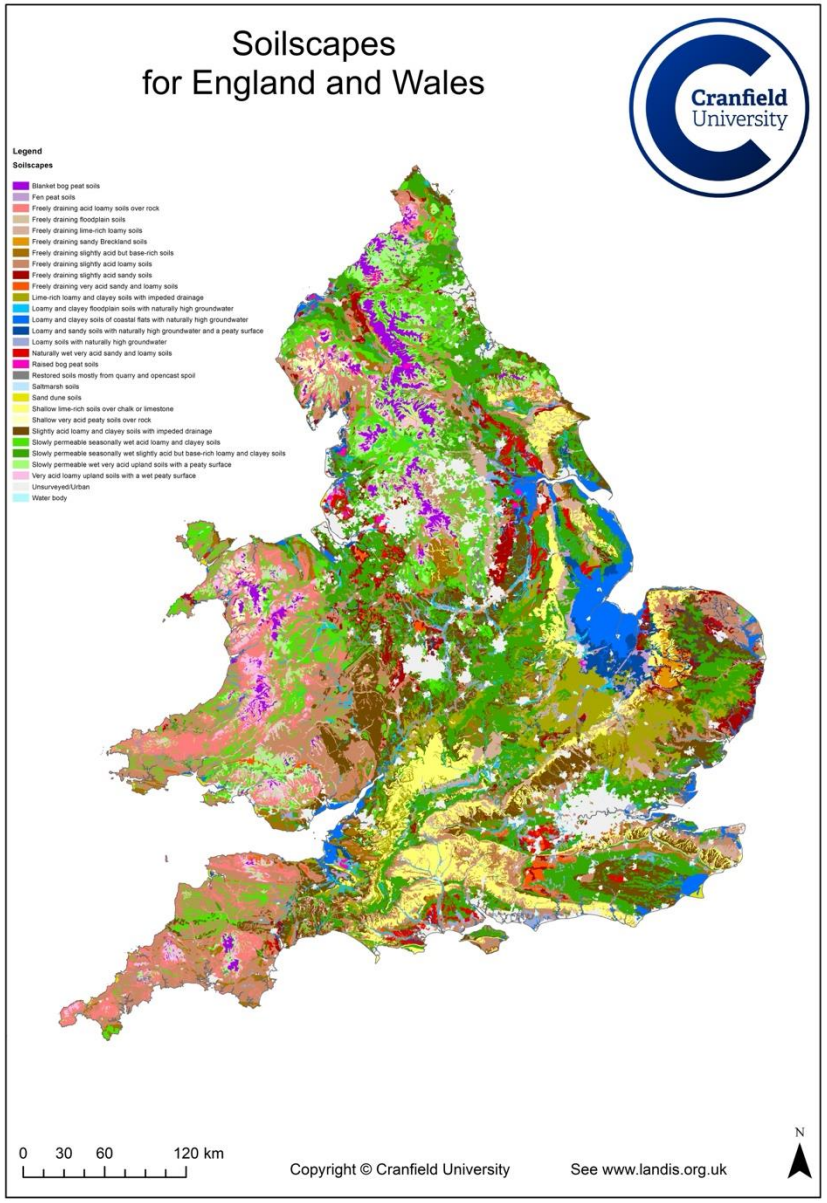



Background:

2015 - 2018 started to look at Soil Organic Matter as a key soil metric for the first time and understand how this might contribute to farm carbon footprints.

Started to understand the difficulty of measuring and monitoring in the UK.

Alongside growing interest Regenerative agriculture and the farming practices which might influence soil health and soil carbon.



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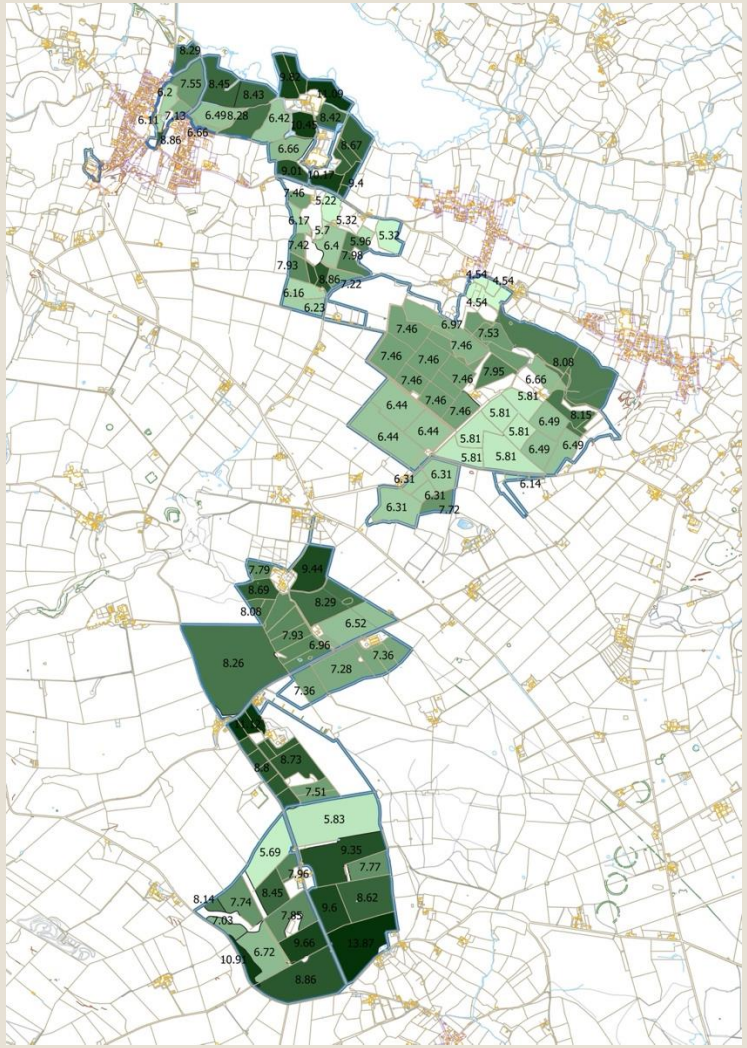
Sampling on our own farms:



Methodology:

- 2000-acre organic farm
- Extensive manual auger testing to 60cm of min 15 points in every field through walking a W.
- Samples aggregated by field at 3 depths (0-10cm, 10-30cm, 30-60cm)
- Aggregated samples tested for each field depth manual measurement and soil mapping
- Measure: Measure approach to demonstrate sequestration of Regenerative Organic farming

Findings:

- 375,000t of carbon in stock (CO2e)
- Significant variation between fields and land use types (range of 4.5-13.87 soil organic matter which is used to calculate the CO2e of the soil carbon levels) showing the potential of this farm to sequester a significant amount of carbon.

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Working with Farm Carbon Toolkit

Initial soil carbon sampling was carried out by FCT soil samplers using manual equipment.

As well as gathering samples for loss on ignition Soil Organic Matter and Bulk Density Soil Health Observations and Nutrient testing was also carried out:

P, K, Mg, pH

Earthworm Counts
VESS
Infiltration
Slake

Roll Out to 25 Organic Farms 2021 - 2023

- 2021 kicked of project to roll out sampling to 25 Organic Farms to increase knowledge and data this work took until 2023 to complete baseline.
- Completed: 1141 fields, 6833 ha (16,800ac) sampled / 11,410 bags of soil! / 17,115 point cores / 3423 holes dug
- 1,394,742 t C. CO_2 equivalent is 4,839,755 t CO_2e
- Some great insights on impacts of interventions such as diverse swards / grazing strategies / organic management.

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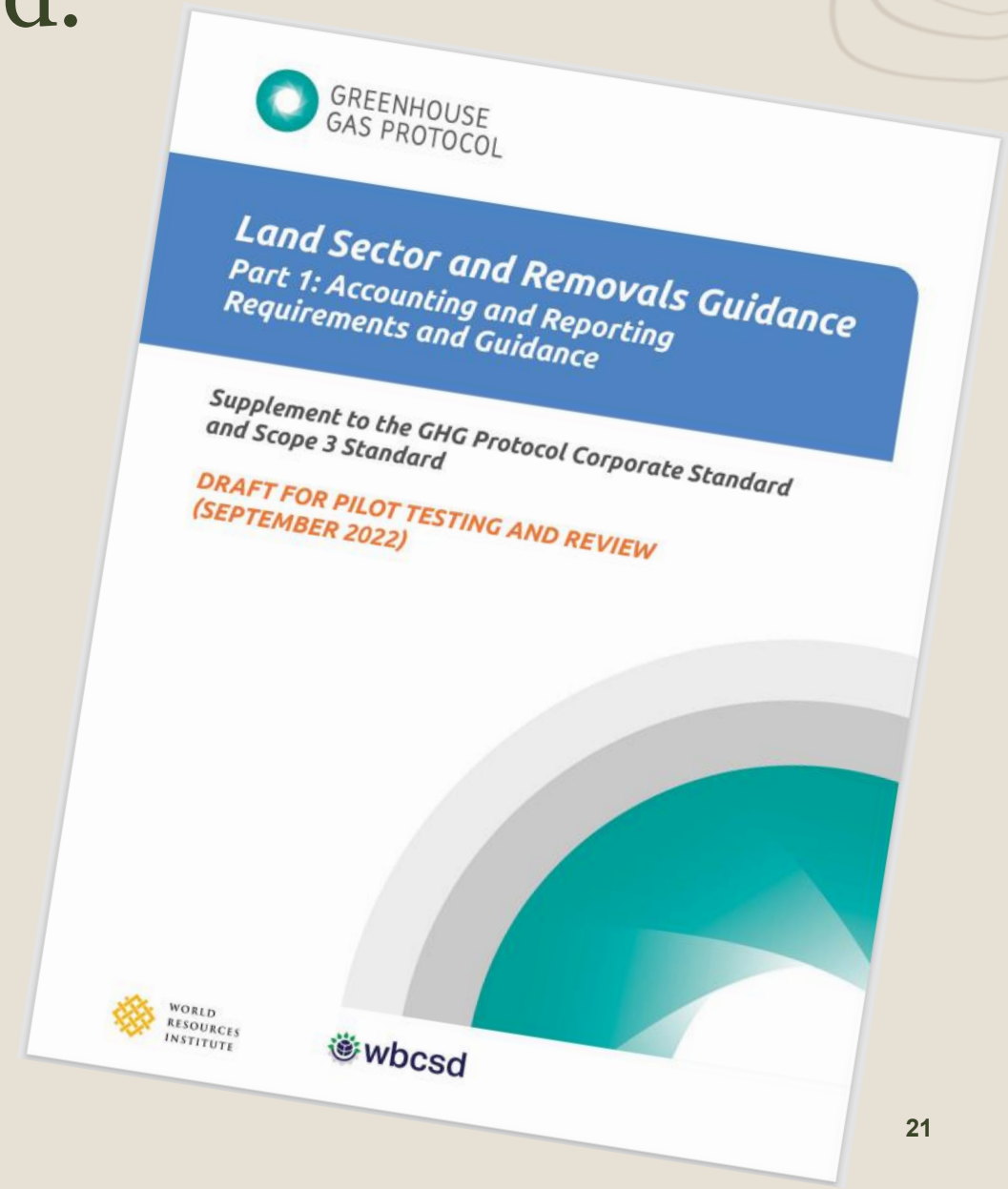
2023 LSRG pilot / draft issued.

In 2023 the Green House Gas protocol Land Sector and Removals Draft is run as a pilot.

This gives for the first time an opening for the inclusion of removals in farm carbon footprints for a scope 3 declaration for supply chains.

There is still much uncertainty on how to measure but very high statistical significance is likely to be required.



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2023/2025 – Yeo Valley Supply Chain Approach

- New farmer groups formed creating long term relationship required for ongoing interaction and data collection
- Knowledge sharing and financial incentive for data sharing and changes to practice based on regenerative agriculture principals and ongoing data analysis.
- Soil Carbon sampling roll out to all farms in supply chain ongoing.
- Farmers carrying out soil health observations.

2025 - Soil Carbon Monitoring for the whole supply chain.

- Working with Agricarbon we have developed an approach which we believe will give us the level of statistical power required to be able to meet the bar set by the LSRG for an eventual inclusion of soil carbon flux within farm footprints.
- Working to 1m depth and at an extremely high sampling rate across stratified farms we aim to achieve below 0.5t mdd annualised.
- This will provide farms very good information to inform management and measure progress from changes made.

What next? This is probably not the end of the story!

- Our current sampling approach will give us fantastic data to support farms and show the risks and opportunities or organic and regenerative farming approaches.
- We will continue to watch the changes to technology and capability for measuring soil carbon in the UK.
- We will continue to try to de-risk our approach and incorporate regulatory changes to our approach. We may be over doing it right now?
- Practical approaches to analysis and modelling will be required to in include removals in farm footprints.

Challenges and thoughts.

- We firmly believe that the benefits to soil and carbon coming from good farming practices should be kept with the food – we are not in favour of selling carbon off farm balance sheets.
- The huge cost of doing high intensity soil sampling is a major challenge.
- There are a huge number of co-benefits to engaging farmers on soil health and organic / regenerative / agroecological farm practices – biodiversity / water / nutrition and health / enjoyment.
- Regulatory uncertainty on how and when we might be able use biogenic carbon fluxes in carbon footprints holds up progress.

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Presentation 3:

Soil Sampling at National Trust

Felicity Roos
National Trust

National Trust

UK Research and Innovation

Scottish Government
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Department for Environment Food & Rural Affairs

Department for Energy Security & Net Zero

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National Trust

Overview

- We look after 250,000ha of land across England, Wales & Northern Ireland
- Most of out land is managed by around 1800 farm tenants, with around 50,000ha in-hand.
- We have committed to Net Zero by 2030, and by 2035 we aim to have created 250,000ha of nature-rich landscape, by working with others on and off our land, where rivers flow clean, all peatland is restored, coastal systems are robust, and landscapes are connected
- The monitoring and evaluation of our land is a large undertaking and historically has involved the use a qualitative indicators. But as part of our new 10-year strategy launched this year we are moving towards the use of more quantitative indicators.

Soil Sampling – National Trust

Approach

- Sampling is done on a largely ad-hoc basis when required for stewardship agreements or as baselining for a project (generally externally funded). Some sampling is done to address a concern or management question.
- We have an internal soil sampling methodology specifying how samples should be collected and data recorded
- All samples are sent to the same lab to try and reduce variability in the data.
- Sampling data is currently stored as an ArcGIS layer. An internal project is currently looking at better ways to manage and store all our nature/geographical data.

Soil Sampling – National Trust

Method

- Samples to be collected from 3x GPS fixed points in a field/sampling area, instead of the ‘walk a W’ approach.
- Sampling is done to 15cm (spade depth) across all sites & land uses
- At each sampling point we record:
  - VESS (Visual Evaluation Soil Structure)
  - Earthworms (Total No.)
  - Lab sample – either NRM’s A218 - Standard Agricultural + SOM%
    or A421 – Carbon Check

Soil Sampling – National Trust

Challenges

- Soil sampling is expensive (labour & lab costs) hence most of our sampling is done in relation to externally funded projects. This influences the scale and granularity of the sampling.
- We would like to set up a strategic national sampling strategy across the NT
- No funders we have worked with recently (private or government) have provided clear guidance on what they want in terms of soil data – soil carbon or soil health – or with what degree of confidence they want monitoring to show change.

In the absence of external guidance/requirements, we have applied our sampling methodology as best fits the budget available.

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Presentation 4:

Soil Carbon Baselining: Why, What is the Context?

John Gilliland
Arc Zero and Northern Ireland's Soil Nutrient Health Scheme

ARCZero
ACCELERATING FARMING TOWARDS CARBON NEUTRALITY

UK Research and Innovation

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Soil Carbon Baselining – Why, What is the Context?

John Gilliland,
Arc Zero and Northern Ireland's
Soil Nutrient Health Scheme

Sustainable Land Management Strategy for NI; ARC Zero; AHDB/QMS (2014)

- Improve Water Quality, Minimise Run Off…
- Improve Productivity, Correct soil pH, Protect Organic Soils

Soil Carbon Baselining – Why, What is the Context?

John Gilliland,
Arc Zero and Northern Ireland's
Soil Nutrient Health Scheme

Sustainable Land Management Strategy for NI; ARC Zero; AHDB/QMS (2014)

- Improve Water Quality, Minimise Run Off…
- Improve Productivity, Correct soil pH, Protect Organic Soils
- Capture the benefits of increasing root diversity & architecture in regenerative farming
- Improve the Resilience of Soils to our ever-increasing Extreme Weather Events
- Articulate the Role of Land Managers as Custodians of Carbon
- Create Evidence to Smarten the LULUCF National GHG Inventory & LSRG/Scope 3
- Understand better the consequence of Long-Term Land Use Change

N. Ireland Sustainable Land Management Strategy

John Gilliland,
Arc Zero and Northern Ireland's
Soil Nutrient Health Scheme

Launched October 2016

- If you can't measure accurately, how can you manage properly...
- Improve Water Quality… Run Off Risks Maps…
- Mine Surplus Phosphate, improve Grass Utilisation
- Improve Soil pH, Protect Organic Soils
- Baseline Soil Organic Matter across the whole of N. Ireland…

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N. Ireland Sustainable Land Management Strategy

John Gilliland,
Arc Zero and Northern Ireland's
Soil Nutrient Health Scheme

Launched October 2016

- If you can't measure accurately, how can you manage properly….
- Improve Water Quality…. Run Off Risks Maps….
- Mine Surplus Phosphate, improve Grass Utilisation
- Improve Soil pH, Protect Organic Soils
- Baseline Soil Organic Matter across the whole of N. Ireland….
- **Soil Nutrient Health Scheme launched 2021**
- 25 Cores/field, 7.5cm (grassland), 15cm (arable)

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Explored Impact on SOC of Different Land Use & Land Managements

All land was stratified & sampled in 2ha Land Parcels from previous soil sampling (0-7.5cm) when LOI/SOM was determined

- Loss of ignition (LOI)/soil organic matter (SOM) status:- 0-10%, 10-20%, 20-30%, 30% and greater
- Land use:- grass, arable, woodland
- Whether organic manures are applied:- slurry, FYM, Compost
- In the case of grassland:- is it permanent or rotational grass, is it cut, grazed, or both
- If rotational grass:- predominately perennial rye grass or multispecies
- In the case of woodland:- deciduous, coniferous, short rotation willow, or Silvopasture / agro-forestry

Soil Carbon Sampling Density determined on the following basis:

Five Cores at each sampling point (for both 0-10cm & 0-30cm depths)

- Categories <2ha = 3 Carbon samples & 1 Bulk Density sample
- Categories 2ha to 11ha = 5 Carbon samples & 1 Bulk Density sample
- Categories 11ha to 30ha = 1 Carbon sample every 2ha & 1 Bulk Density every 5 Carbon samples.
- Categories 30ha – 100ha = 1 Carbon sample every 3ha & 1 Bulk Density every 5 Carbon samples.
- Categories >100ha = 1 Carbon sample every 4ha & 1 Bulk Density every 5 Carbon samples.

86 Different Land Categories over seven ARC Zero farms

Soil Texture Classifications were carried out on all samples to 30cm…

A Case Study – Hugh Harbison's farm, July 2021

John Gilliland,
Arc Zero and Northern Ireland's
Soil Nutrient Health Scheme

Working out Total Farm Soil Carbon Stocks

Land Category	Total ha	Av. LOI/SOM	No of soil Cores	No of Samples	Av. C. 0-10cm	Av. C. 0-30cm	Av. C/ha	Av. C/Category	C. 0-30cm Variation	Av. pH
10-20% Soil Org. Matter, Rotational Grass, Slurry, Only Cut	13.7ha	16.10%	35	7	5.80%	4.10%	133t	1,825t	3.1 - 5.1%	6
10-20% Soil Org. Matter, Rotational Grass, Slurry, Cut & Grazed	6.7ha	17.30%	25	5	6.40%	4.80%	153t	1,032t	3.8 - 5.3%	6.2
10-20% Soil Org. Matter, Rotational Grass, Slurry, Only Grazed	30.9ha	17.20%	50	10	7.70%	5.20%	162t	4,998t	4.4 - 5.3%	6.4
10-20% Soil Org. Matter, Permanent Grass, Slurry, Only Grazed	2.2ha	17.90%	15	3	5.50%	4.70%	159t	346t	4.0 - 6.1%	6.7
20-30% Soil Org. Matter, Rotational Grass, Slurry, Only Cut	4.2ha	21.10%	15	3	7.60%	4.40%	144t	605t	2.6 - 5.9%	5.8
20-30% Soil Org. Matter, Permanent Grass, No Slurry, Only Grazed	2.2ha	21.20%	15	3	10.50%	5.70%	168t	370t	5.1 - 6.7%	6
20-30% Soil Org. Matter, Rotational Grass, Slurry, Cut & Grazed	1.6ha	23.10%	15	3	15.40%	9.40%	247t	395t	5.7 - 15.8%	6.2
20-30% Soil Org. Matter, Rotational Grass, Slurry, Only Grazed	32.7ha	22.60%	60	12	8.80%	6%	183t	5,984t	3.4 - 9.8%	6.3
>30% Soil Org. Matter, Rotational Grass, Slurry, Only Grazed	7.7ha	40%	25	5	16.90%	13.90%	344t	2,649t	7.2 - 23.2%	6.4
10-20% Soil Org. Matter, Decideous Woodland	1.5ha	15.70%	15	3	8.20%	6%	167t	228t	3.6 - 10.7%	6.1
20-30% Soil Org. Matter, Scrubland	0.8ha	21.60%	15	3	10.30%	8.80%	210t	162t	7.9 - 9.6%	5.9
Sampling Density, 1 composite sample per 1.8ha or 2.7 cores/ha	**104ha**		**285 Soil Cores**	**57 C. Samples**			**179t/ha**	**18,594t of C.**		

Total Soil Carbon 18,594t of C

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ARCZero
ACCELERATING FARMING TOWARDS CARBON NEUTRALITY

Total Carbon Stocks across the 7 ARC Zero farms……

Measured to 30cm, with Tree Carbon estimated from LiDAR Survey

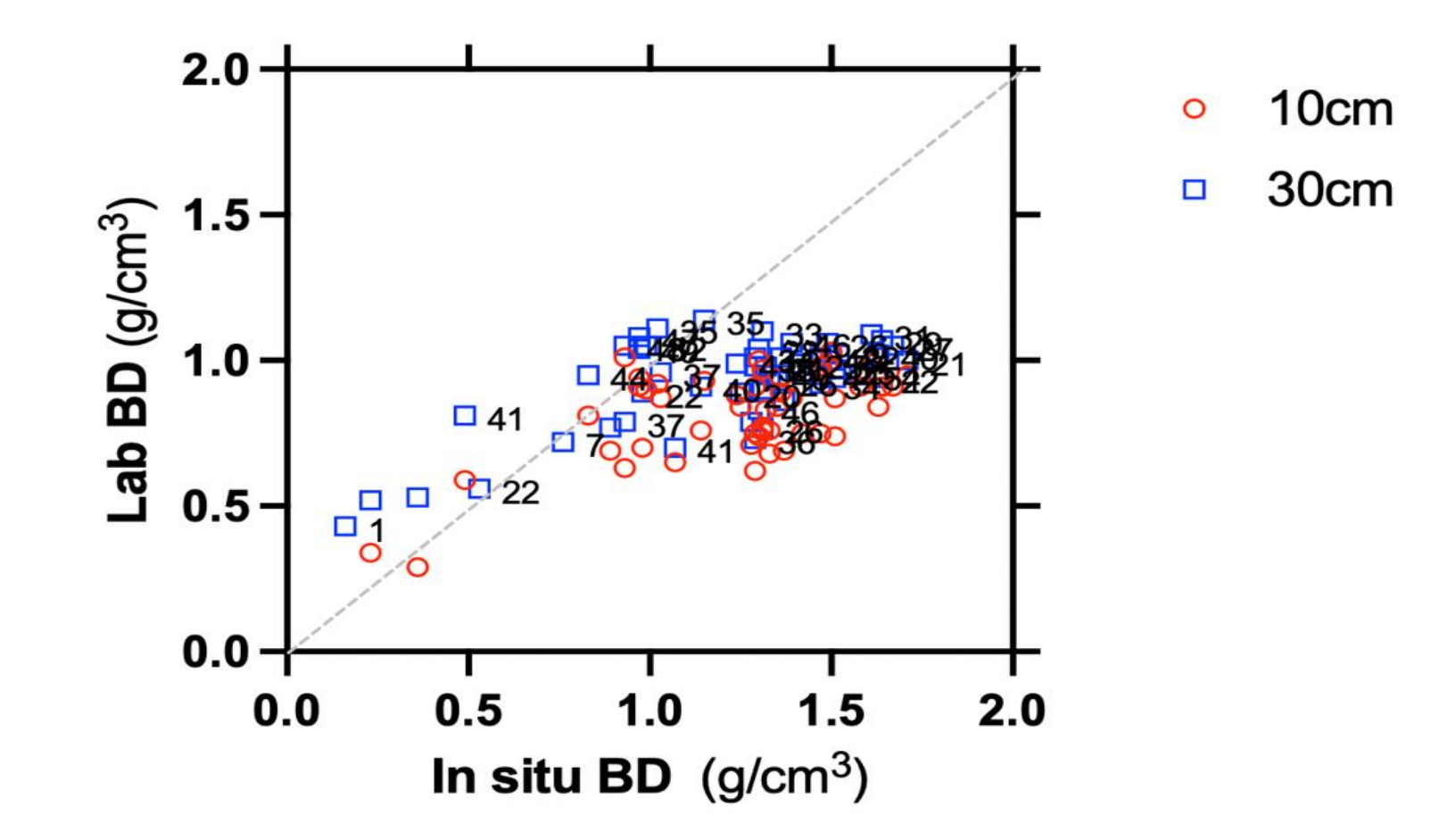
Total ARC Zero CO2e Stocks	Soil Carbon	Tree Carbon	Total Carbon	% C in Soil
Ian McClelland	31,813t	1,310t	33,123t	96%
Hugh Harbison	68,054t	1,969t	70,023t	97%
John Egerton	31,813t	1,310t	33,123t	96%
Roger & Hilary Bell	50,819t	688t	51,507t	98%
Simon Best	237,915t	6,493t	244,407t	97%
Patrick Casement & Trevor Butler	54,556t	4,022t	58,578t	93%
John Gilliland	19,468t	4,937t	24,405t	80%
		Total	515,166t	

ARC Zero farms manage 515,166t of CO2e, 97% is within the Soil

Health Warning.....

John Gilliland,
Arc Zero and Northern Ireland's
Soil Nutrient Health Scheme

Bulk Density Variance between NRM's in lab method & in field method (P. Williams 2021)

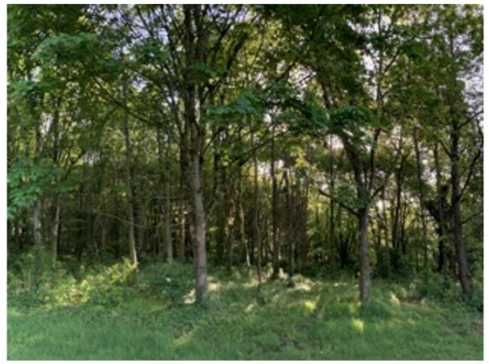


John Gilliland,
Arc Zero and Northern Ireland's
Soil Nutrient Health Scheme

Comparing Consequences of Long-Term Land Uses on SOC

Sampling to C Horizon, or 1 metre to see impact of different plant diversities
Selected AgriCarbon (R. Buffara, WUR 2023)

WILLOWS (28 YEARS)



WOODLAND (30 YEARS)

PERMANENT GRASSLAND
(200 YEARS)

SILVOPASTURE (120 YEARS)

WOODLAND (250 YEARS)

LAND USE for NET ZERO HUB

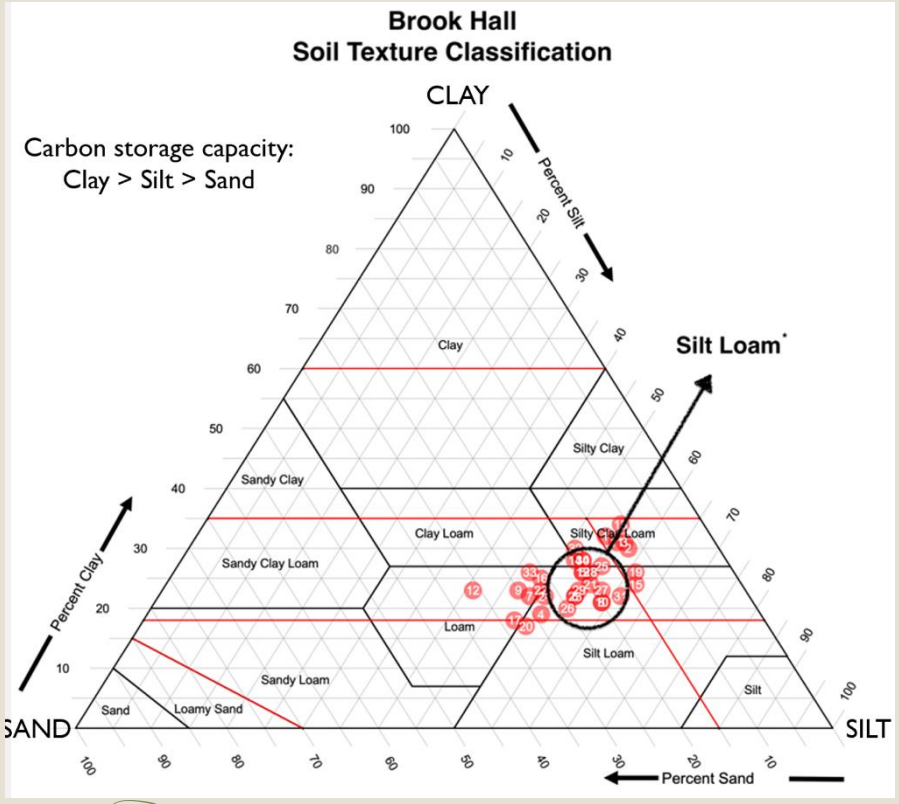
BROOK HALL
Estate & Gardens

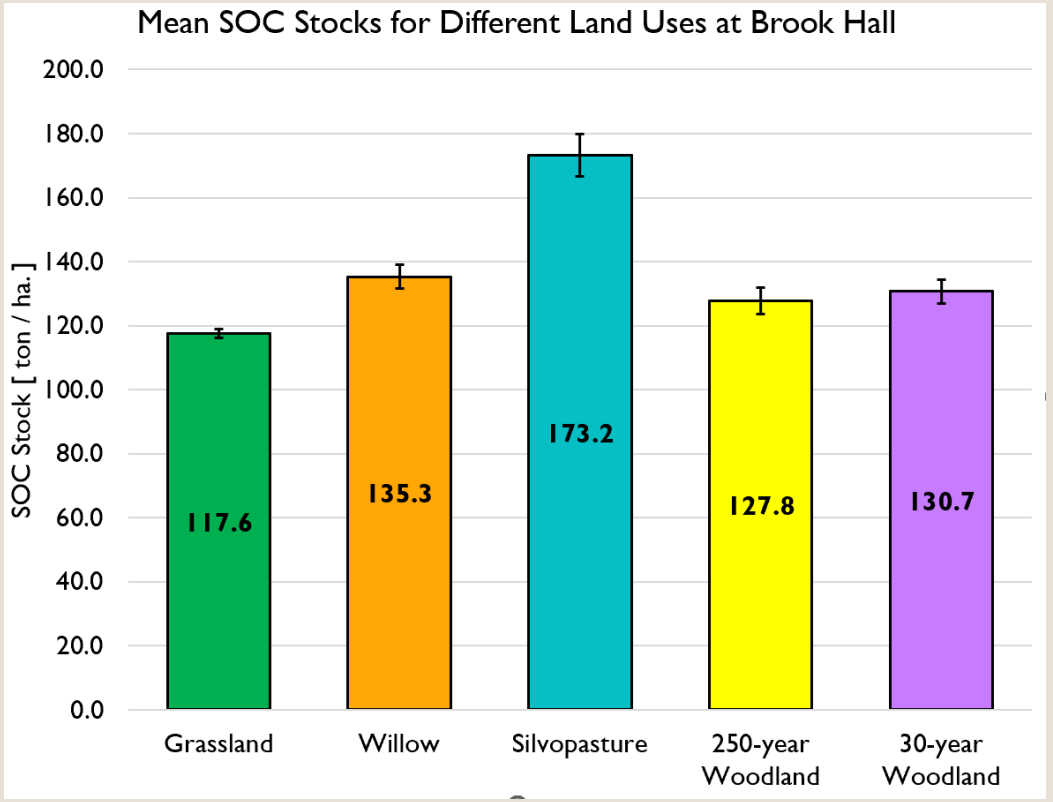
ARCZero
ACCELERATING FARMING TOWARDS CARBON NEUTRALITY

Comparing Consequences of Long-Term Land Uses on SOC

John Gilliland,
Arc Zero and Northern Ireland's Soil Nutrient Health Scheme

Understanding the Role of Soil Texture & the need to have it measured (R. Buffara, WUR, 2023)





Total cores:180
Total samples: 565
Each core stratified by depth and analyzed at each interval
Sampling density: 17.6 samples / ha.

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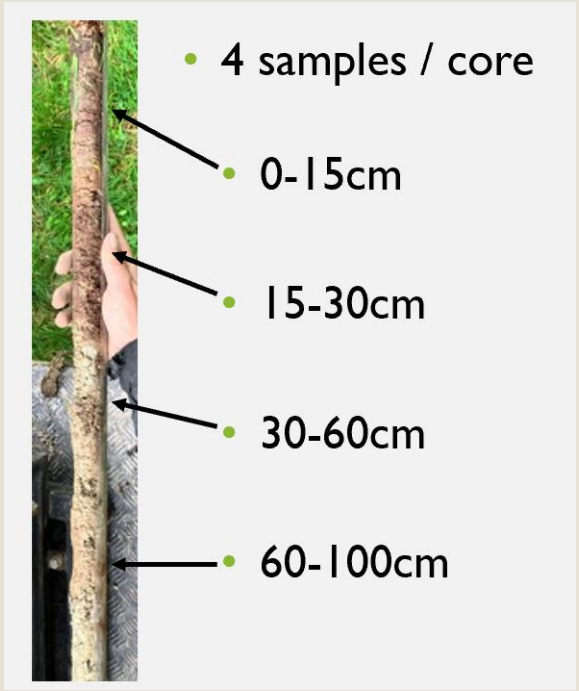
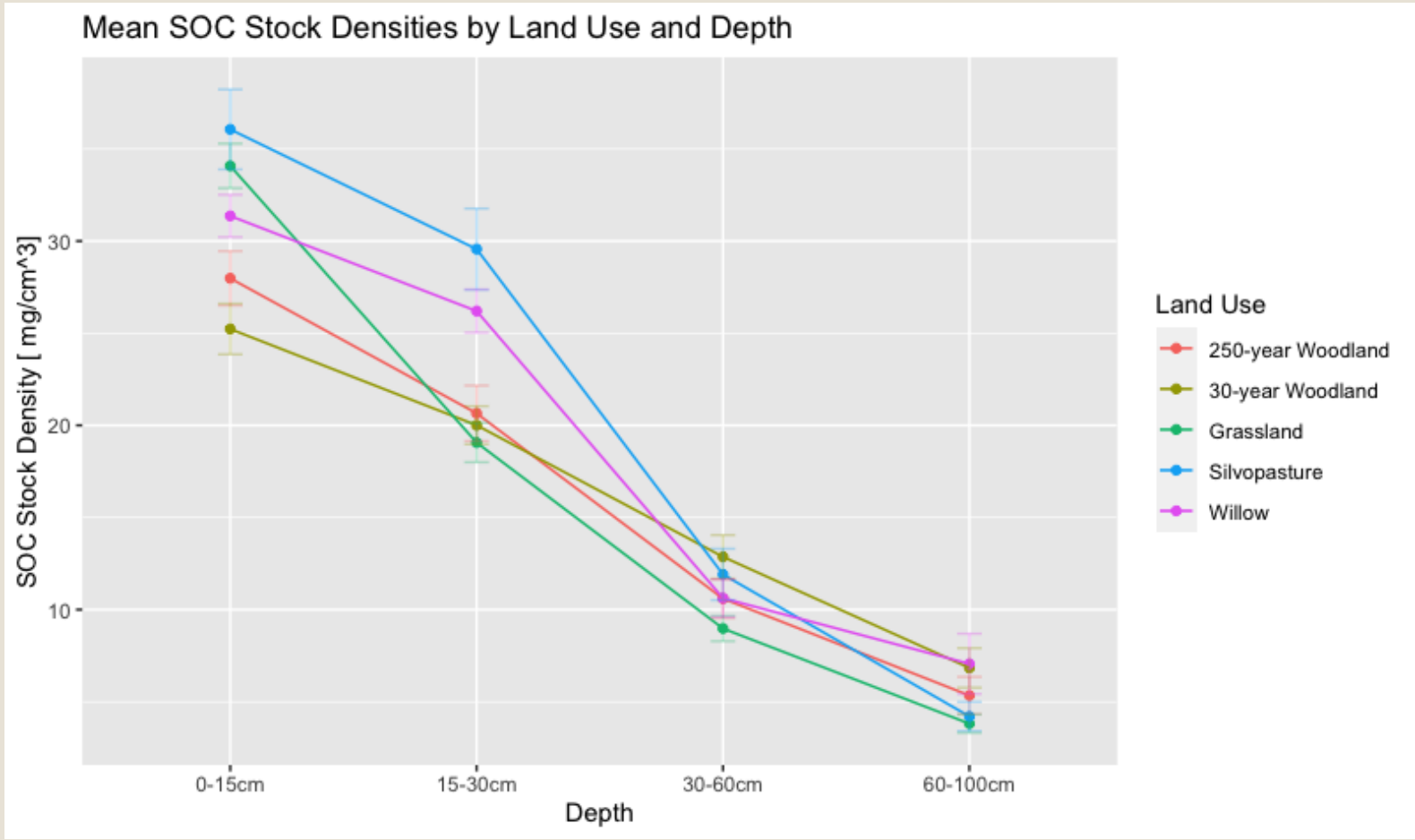
Comparing Consequences of Long-Term Land Uses on SOC

John Gilliland,
Arc Zero and Northern Ireland's Soil Nutrient Health Scheme

The benefit of measuring stratified soil depth layers (R. Buffara, WUR, 2023)





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BROOK HALL Estate & Gardens

ARCZero ACCELERATING FARMING TOWARDS CARBON NEUTRALITY

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Presentation 5:

Environmental Baselining Pilot

John Gilliland
Agriculture and Horticulture Development Board (AHDB)

AHDB

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Department for Environment Food & Rural Affairs

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Environment Baselining Pilot

Collating data to empower individual farmers and strengthen an entire industry

John Gilliland,
Agriculture and Horticulture Development Board (AHDB)

Scotland	35
England	125
Wales	10
Total	**170**

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Agriculture and Horticulture Development Board (AHDB)

This isn't just a pilot; it's a movement to redefine

How famers are recognised for delivering both food and environmental goods

The scale and potential of natural carbon stocks and sequestration

The environmental impact of UK agriculture and progress to net zero

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What is being measured?

John Gilliland,
Agriculture and Horticulture Development Board (AHDB)

Net Carbon calculation

GHG emissions and sequestration

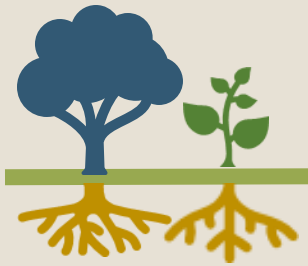
LiDAR scanning

Analysis and interpretation of LiDAR data

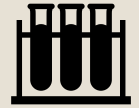
Above ground carbon stocks

Surface run-off risk

Habitat connections



Soil sampling



Satellite/new technology vs. actual

Soil carbon stocks

Soil nutrients

Soil biology

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Agriculture and Horticulture Development Board (AHDB)

Soil sampling

Stratification of sampling by soil types and land use

Farmed land sampling – 4 depths of soil per core

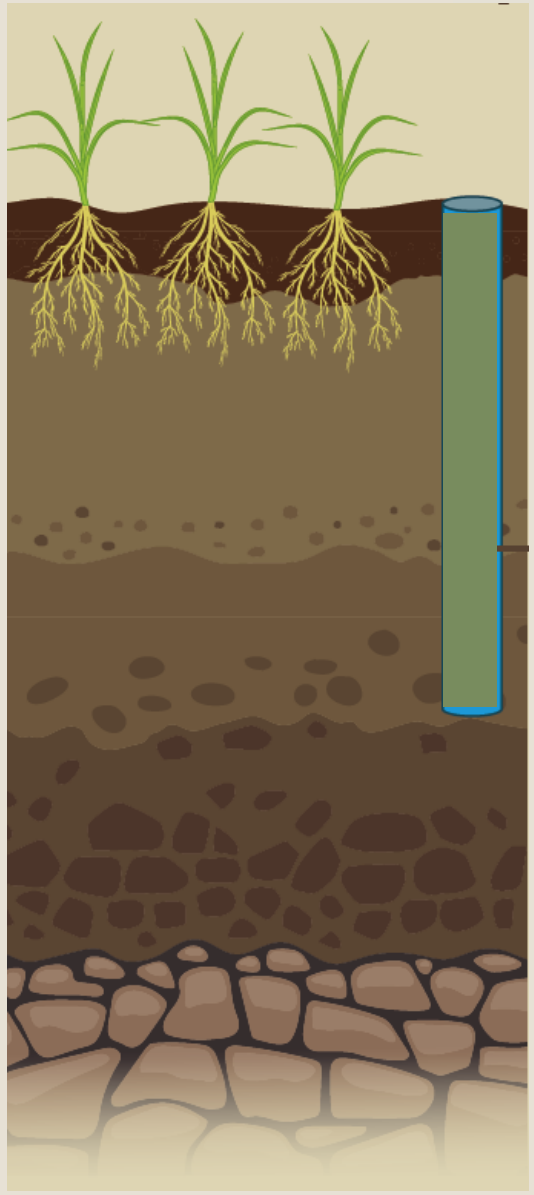
Woodland (>1ha) or where access limited – 0-15, 15-30, 30-60cm

Sampling intensity for farmed land and woodland 1.25 – 1.65 cores per ha

Moorland sampling intensity 0.5 cores per ha

Soil nutrients, pH and texture assessed at 0-15cm (one composite sample per field)

Sampling to be carried out Jan – Oct 2025



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Carbon audit and consultancy

John Gilliland,
Agriculture and Horticulture Development Board (AHDB)

- Years 1, 3, 5 = carbon audit and action plan (Yr 1 & 3)
- May - September
- Consultants allocated to each farm to help do this
- Will review wider data from soils and LIDAR where available

Other elements

John Gilliland,
Agriculture and Horticulture Development Board (AHDB)

- **Behaviour change -** Understanding of the drivers/motivation and challenges/ barriers for change
- **Soil biology** – planning approach to this work and how it sits alongside other national projects
- Potential of **remote sensing** to assess soil carbon levels

John Gilliland,
Agriculture and Horticulture Development Board (AHDB)

In Conclusion - Soil Carbon Baselining, Why, What is the Context?

These Questions must be answered before you decide how you construct the baseline…

- Improve Water Quality, Minimise Run Off…?
- Improve Productivity, Correct soil pH, Protect Organic Soils?
- Capture the benefits of increasing root diversity & architecture in regenerative farming?
- Improve the Resilience of Soils to our ever-increasing Extreme Weather Events?
- Articulate the Role of Land Managers as Custodians of Carbon?
- Create Evidence to Smarten the LULUCF National GHG Inventory & LSRG/Scope 3?
- Understand better the consequence of Long-Term Land Use Change?

John Gilliland,
Agriculture and Horticulture Development Board (AHDB)

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- Understand better the consequence of Long-Term Land Use Change?

If you can not measure accurately…. You can not manage properly…..

john.gilliland@brookhall.org

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Photo: Lloyd Russell

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Presentation 6:

Baselining soil health prior to regenerative transition: a SW UK example

UNIVERSITY OF PLYMOUTH

William Blake
University of Plymouth

UK Research and Innovation

Scottish Government
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William Blake, University of Plymouth

Our objective

To demonstrate direction of travel following implementation of regenerative practice [supporting landowner agri-business narrative] and, in parallel …
… to lay the foundations for a living lab supporting future agri-research and postgraduate training (esp. agri-tech R&D for farmer-led data acquisition)

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Technical Approach

HISTORIC DATA

Interview with landowner to obtain crop cover/residue/ amendment (organic & inorganic)/grazing/tillage information from last 5 years.

CONTEMPORARY DATA

LAND USE

What are the current/planned land uses? Identify '**Intervention Areas**' (IAs).

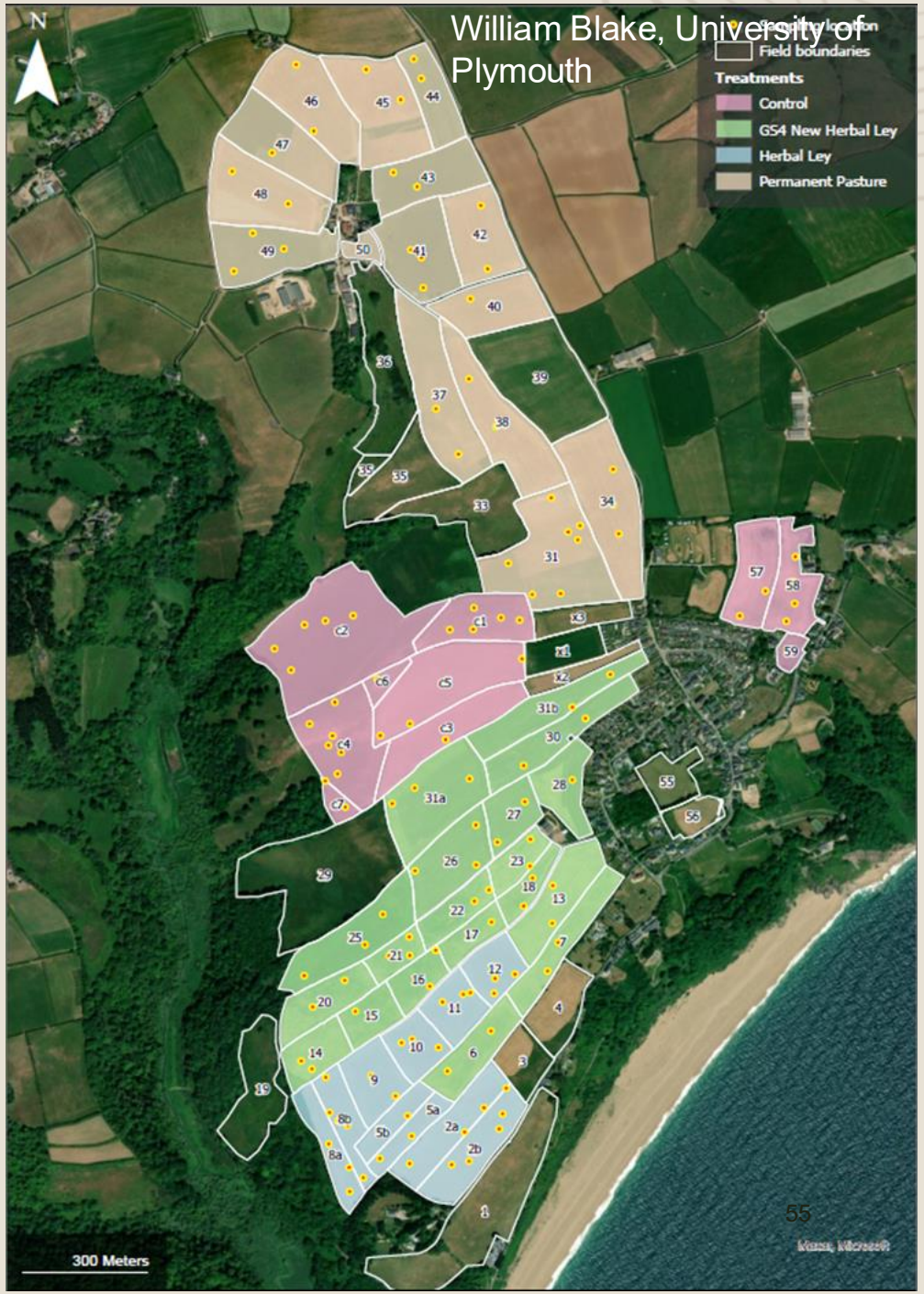
SAMPLE DEPTH

0-10 cm to capture short-term changes.
0-30 cm to comply with IPCC recommendations.

(NB bulk density 0-5 cm, 5-10 cm, 10-15 cm, & 25-30 and aggregate stability & K_{sat} 0- 10 cm)

TIMEFRAME

Spring sampling; re-sampling to be conducted during the same season every four/five years.



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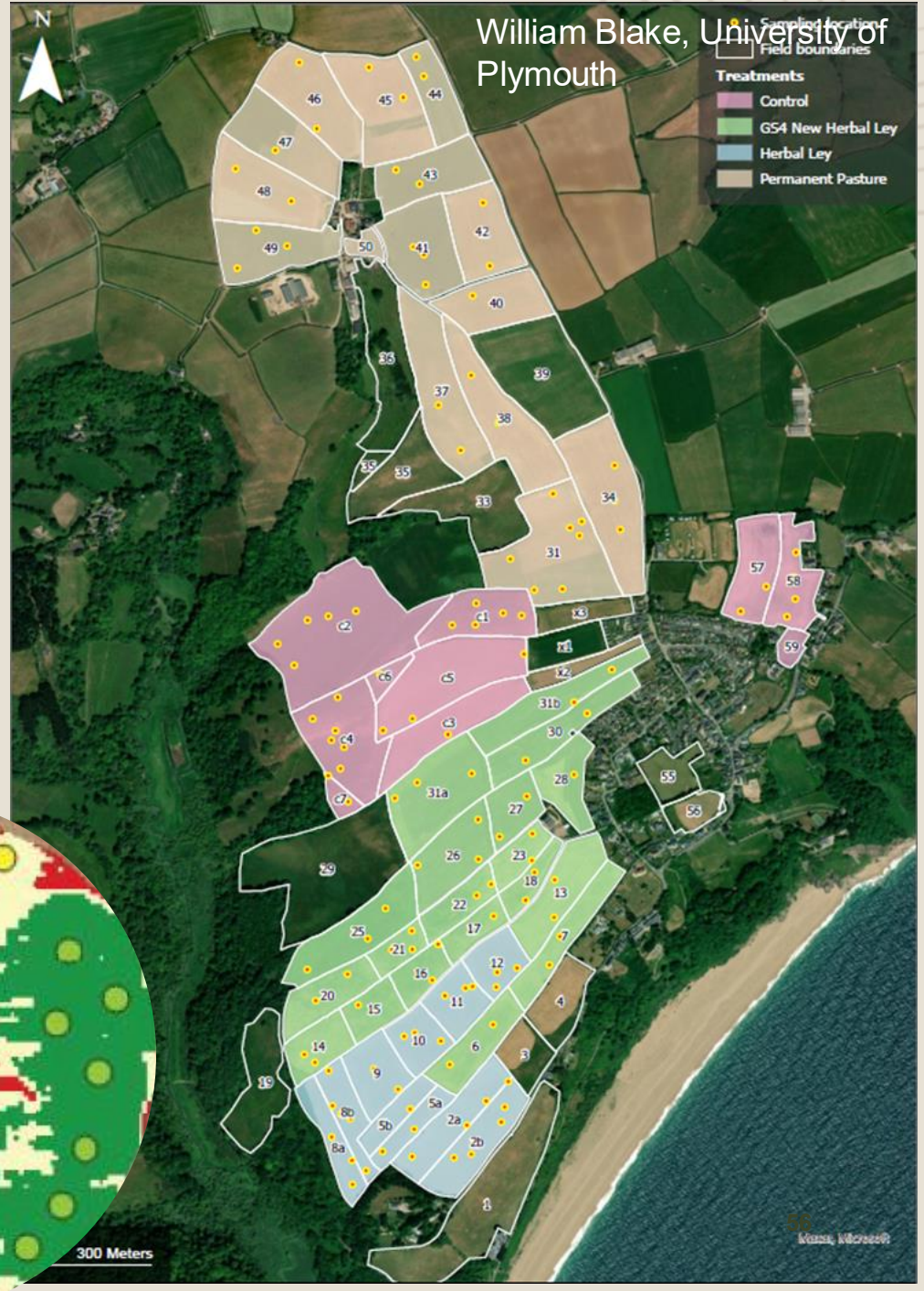
Sample design

- Guided by FAO GSOC MRV Protocol (2020)
- Sample locations representative of Intervention Areas (AI)
- Topographic:
  - IAs divided into strata based on aspect, elevation, & wetness index (proxy for slope) determined via GIS Lidar DEM
  - 3 strata per IA
  - 30 samples per IA (0-10 cm & 0-30 cm or max possible)
  - 10 samples per stratum (or proportional to strata size) ensuring a minimum of one per field (agri-business need)
- Composite samples: 25 soil cores bulked (ATV drilling rig)
- Georeferenced



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Soil parameters measured ('holistic' – not just carbon)

PHYSICAL

Soil Organic Matter (LOI & DUMAS)

Bulk Density*

Soil Moisture (Gravimetric & Volumetric)*

Soil Texture (Sand, Silt, Clay)

Penetration Resistance*

Aggregate Stability*

Water Infiltration*

CHEMICAL

Soil Organic Carbon (DUMAS)

Total Nitrogen

C:N Ratio

pH

C. E. C.

Macro and Micronutrients

(P, K, Mg, Cu, Fe, Mn, Zn, Ca, B, Mo, Na, S)

BIOLOGICAL

Soil Respiration

Microbial Biomass

Potentially Mineralisable Nitrogen

Total Bacteria

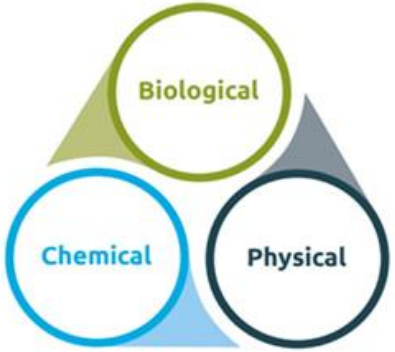
Total Fungi

Fungi/Bacteria Ratio

Hyphal Diameter

MicroBIOMETER (comparison)*

Analysis at Lancrop and *UoP labs



SENSORS

Gamma Spectrometry*

Near Infra-Red Spectroscopy*

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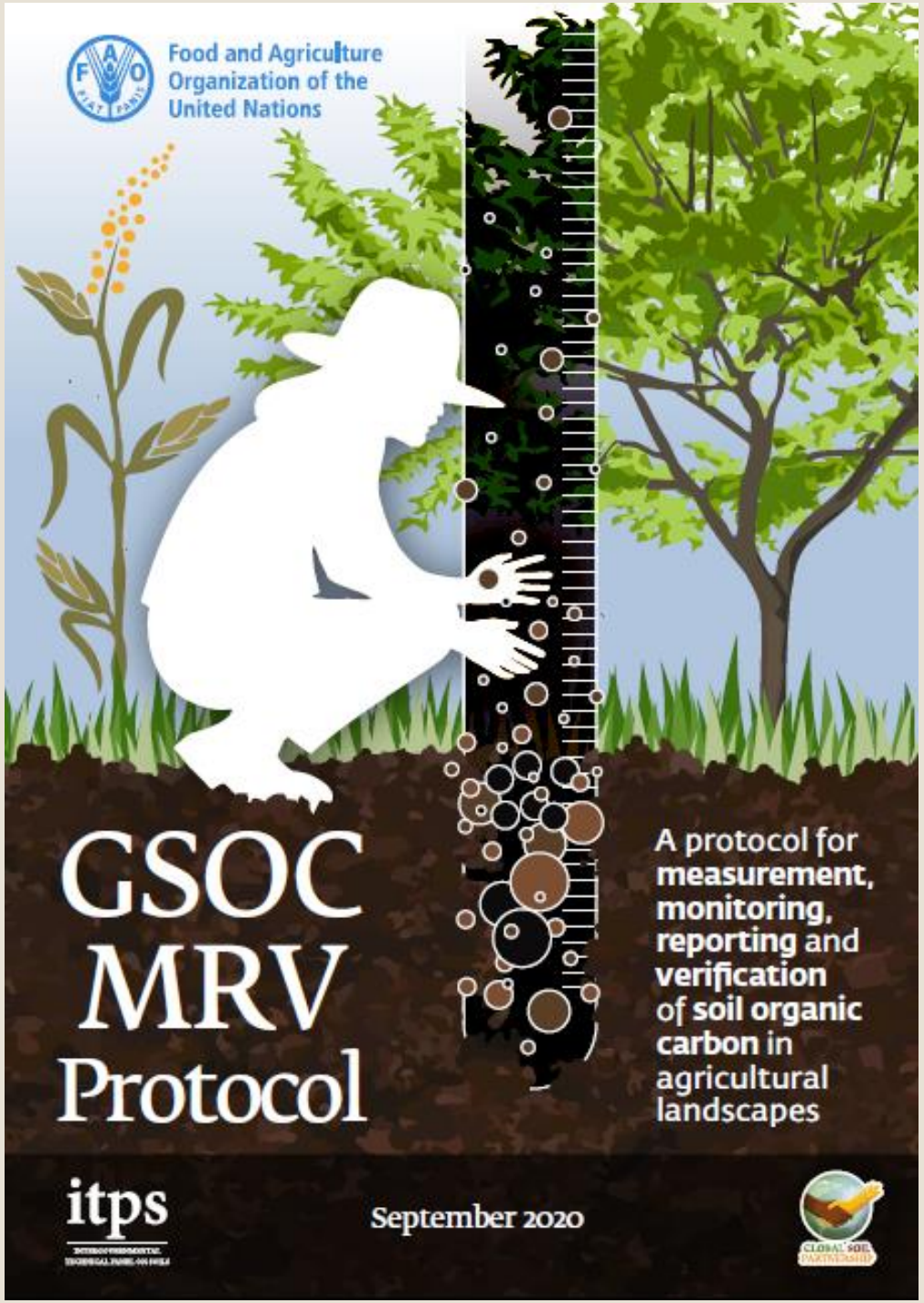
Protocols and standards used



CARBON MANAGEMENT
2022, VOL. 13, NO. 1, 554–580
https://doi.org/10.1080/17583004.2022.2135459

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RESEARCH ARTICLE

OPEN ACCESS Check for updates

What makes an operational farm soil carbon code? Insights from a global comparison of existing soil carbon codes using a structured analytical framework

Helaina I. J. Black[a], Mark S. Reed[b], Helen Kendall[F], Robert Parkhurst[d], Nicola Cannon[e], Pippa J. Chapman[f], Matthew Orman[g], Jenny Phelps[h], Hannah Rudman[b], Sarah Whaley[h], Jagadeesh Yeluripati[i] and Guy Ziv[f]

[a]Ecological Sciences, The James Hutton Institute, Dundee, UK; [b]Thriving Natural Capital Challenge Centre, Department of Rural Economies, Environment & Society, Scotland's Rural College, Edinburgh, UK; [c]Centre for Rural Economy, School of Natural and Environmental Science, Newcastle University, Newcastle Upon-Tyne, UK; [d]Sierra View Solutions, LLC, Sierra Madre, California, USA; [e]Royal Agricultural University, Cirencester, Gloucestershire, UK; [f]School of Geography, University of Leeds, Leeds, UK; [g]Sustainable Soils Alliance, Bristol, UK; [h]Farming and Wildlife Advisory Group, Wellington, Somerset, UK; [i]Information and Computational Science, The James Hutton Institute, Aberdeen, UK

ABSTRACT

Soils have the potential to sequester and store significant amounts of carbon, contributing towards climate change mitigation. Soil carbon markets are emerging to pay farmers for management changes that absorb atmospheric carbon, governed by codes that ensure eligibility, additionality and permanence whilst protecting against leakage and reversals. This paper presents the first global comparative analysis of farmland soil carbon codes, providing new insights into the range of approaches governing this global marketplace. To do this, the paper developed an analytical framework for the systematic comparison of codes which was used to identify commonalities and differences in approaches, methods, administration, commercialisation and operations for 12 publicly available codes from around the world. Codes used a range of mechanisms to manage additionality, uncertainty and risks, baselines, measurement, reporting and verification, auditing, resale of carbon units, bundling and stacking, stakeholder engagement and market integrity. The paper concludes by discussing existing approaches and codes that could be adapted for use in the UK and evaluates the need for an over-arching standard for soil carbon codes in the UK and internationally, to which existing codes and other schemes already generating soil carbon credits could be assessed and benchmarked.

KEYWORDS

Agricultural soils; voluntary carbon market; carbon code; MRV

… Plus, steered and influenced by farmer knowledge and agri-business needs

William Blake, University of Plymouth

Wider SSA discussion points

Are you seeing changing expectations (corporate, policy), that might cause you to change what is being assessed?

- Watching debate on replication and representativeness (in all dimensions) with interest …
- Not one size fits all… approach will in part be led by the questions (sectoral needs) and resource constraints (£ and time)
- *'Is this sample design right?'* versus *'Is this sample design defendable / fit for purpose…?'*

What advice would you give to someone looking to design a baseline measurement today?

- Where sample numbers are limited by logistics and resource, sensor technology can close the gap (when deployed correctly and transparently!)
  [UoP trials in progress – next slide]
- Be aware of agri-business needs – putting 'local' farmer knowledge and practitioner know-how on a level playing field with scientific/research data (role of social science)


Photo: Eva McGrath

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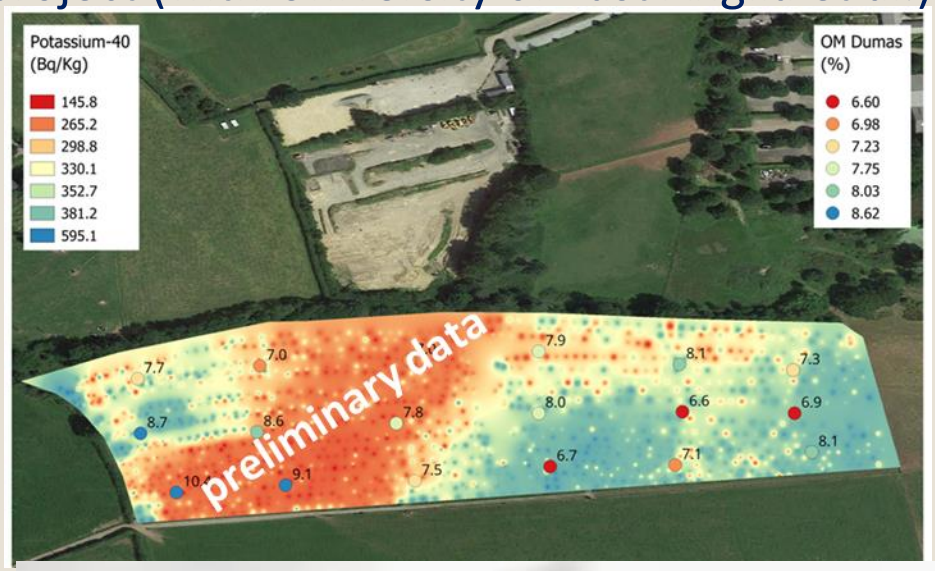
In-situ soil property mapping using portable gamma spectrometry

William Blake, University of Plymouth

Method development and validation in UK (Taylor et al., 2023; Mansfield et al. in prep) within LUNZ OPENLand project (with University of East Anglia et al.)



signal

SOC

https://tyndall.ac.uk/projects/openland/

OpenLAND

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UK Research and Innovation

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End

This slide deck is accompanied by a workshop recording – click here to watch
For more information, questions or comments, please get in touch:
ellen@sustainablesoils.org

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