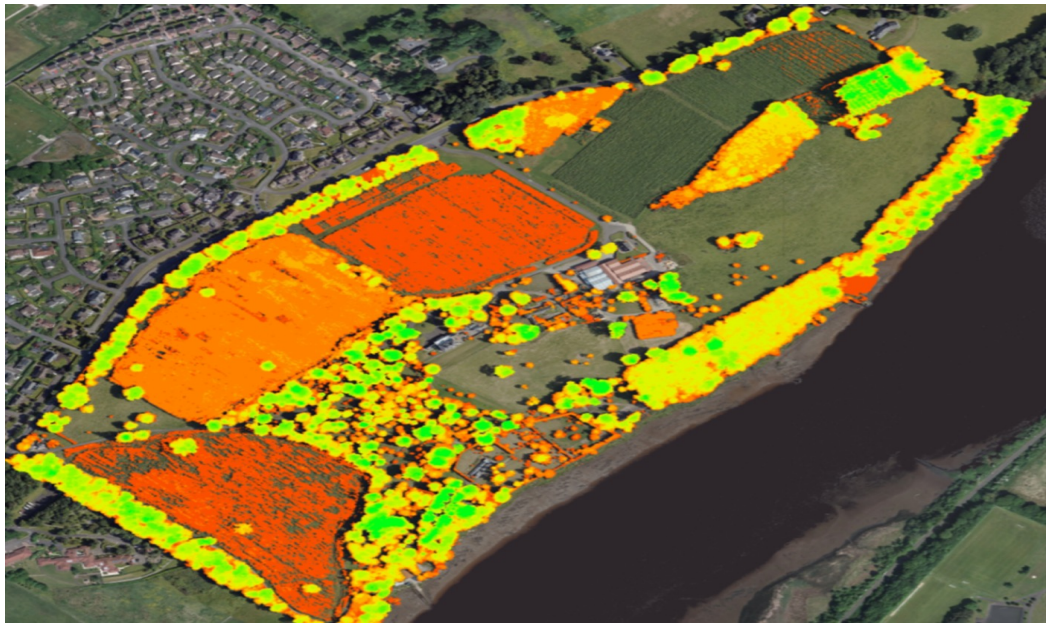
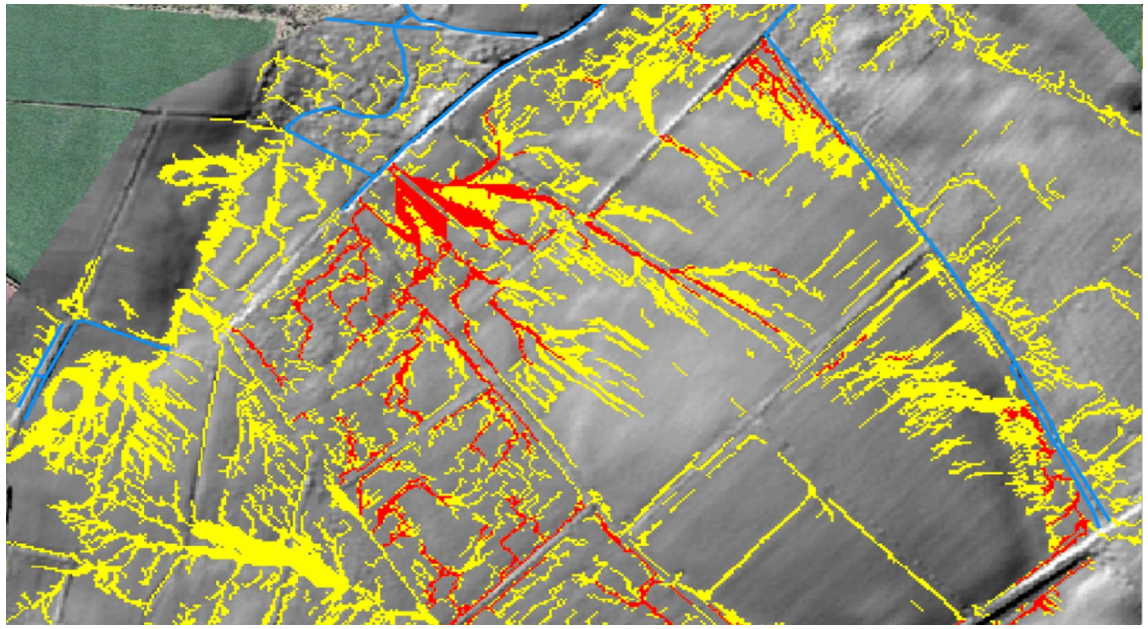
Sustainable Land Management – A New Approach

Technology & Climate Change – The Potential for Impact on Land Value?





Prof. John Gilliland OBE

Professor of Practice, Queens University Belfast; Chair, ARC Zero
Special Advisor, AHDB; Owner, Brook Hall Estate.

22nd March 2024

TEGOVA
The European Group of Valuers' Associations

asaval

The Central Association of Agricultural Valuers

2014, Independent Expert Working Group Set Up

Inclusive of Farmers, Land Owners, NGOs, Policy & Food Chain

Sustainable Agriculture Land Management Strategy Launched, 2016

With Written Support of Farmers Union & NGOs

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Observations

N. Ireland Environmental Performance, 2016

Since 2004 – N balance down 10%; N efficiency up 12%

P balance down 32%; P efficiency up 28.5%

N levels in Water, Good, 15-20mg

But

- 62% of Water Bodies failing Good Quality Status
- 80% of P was entering rivers by “Over Land” flow of excessive rainfall
- The “Tail” of our Phosphate legacy was greater than 50 Years….

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Observations on Farming Production

N. Ireland Farm Efficiencies & Practices, 2016

- Grass Dry Matter Utilisable Yields – Average, 5.1t/ha/yr
  - Top 5%, 16t/ha/yr
- Soil Analysis – Only 2% of acreage analysed on an annual basis
- Soil pH – 64% land below pH 6, ??% land at pH 6.5 (optimal for legumes)
- Soil optimal fertility – 18%
- Land planted in trees – 6%
- Land rented on a 11 month lease (conacre) – 30%

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Recommended - If you can’t Measure you can not Manage….

The use of New Measuring Technologies on all farms, at individual field scale

Aerial LiDAR Survey
at 40 scans per metre

Soil Sampling to one
metre deep

When repeated every 5 yrs. measures actual change, essential for TIER 3

Government Response – A Pilot in Three River Catchments

Plus, “light touch” in N. Ireland wide pilot

Level of Farmer Participation – 73% in Catchments

River Bann – 513 farms, 7,340 fields, 11,547 ha
Colebrooke – 289 farms, 5,059 fields, 13,108 ha
Strule - 289 farms, 4,677 fields, 16,989 ha

Rest of NI. - 522 farms, 12,629 fields, 22,220 ha

Total, 1,613 farms, 63,000 ha, £2.3m of EU & NI Public Funding

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

cafre College of Agriculture, Food & Rural Enterprise

Results from Pilot in Three River Catchments

Including the N. Ireland wide pilot

Behavioural Change Survey by Leeds University

86% - Changed fertiliser type used
80% - Increased lime usage
68% - Changed fertiliser quantity
28% - Changed quantity of slurry imported or exported

"Run off" Risk Maps were particularly useful

ARCZero
ACCELERATING FARMING TOWARDS CARBON NEUTRALITY

An EIP Operational Group - Accelerating Seven N. Irish Farms towards Net Zero

Roger & Hilary Bell *Sheep*
Simon Best *Arable & Beef*
Patrick Casement *Sheep & Sucklers*
John Egerton *Suckler Beef*
John Gilliland *Willow & Dry Stock*
Hugh Harbison *Dairy*
Ian McClelland *Dairy*

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

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

rural Development Programme

AgriSearch NI
Driving Excellence & Innovation

BIRNIE CONSULTANCY

DEVENISH™
Beyond Nutrition

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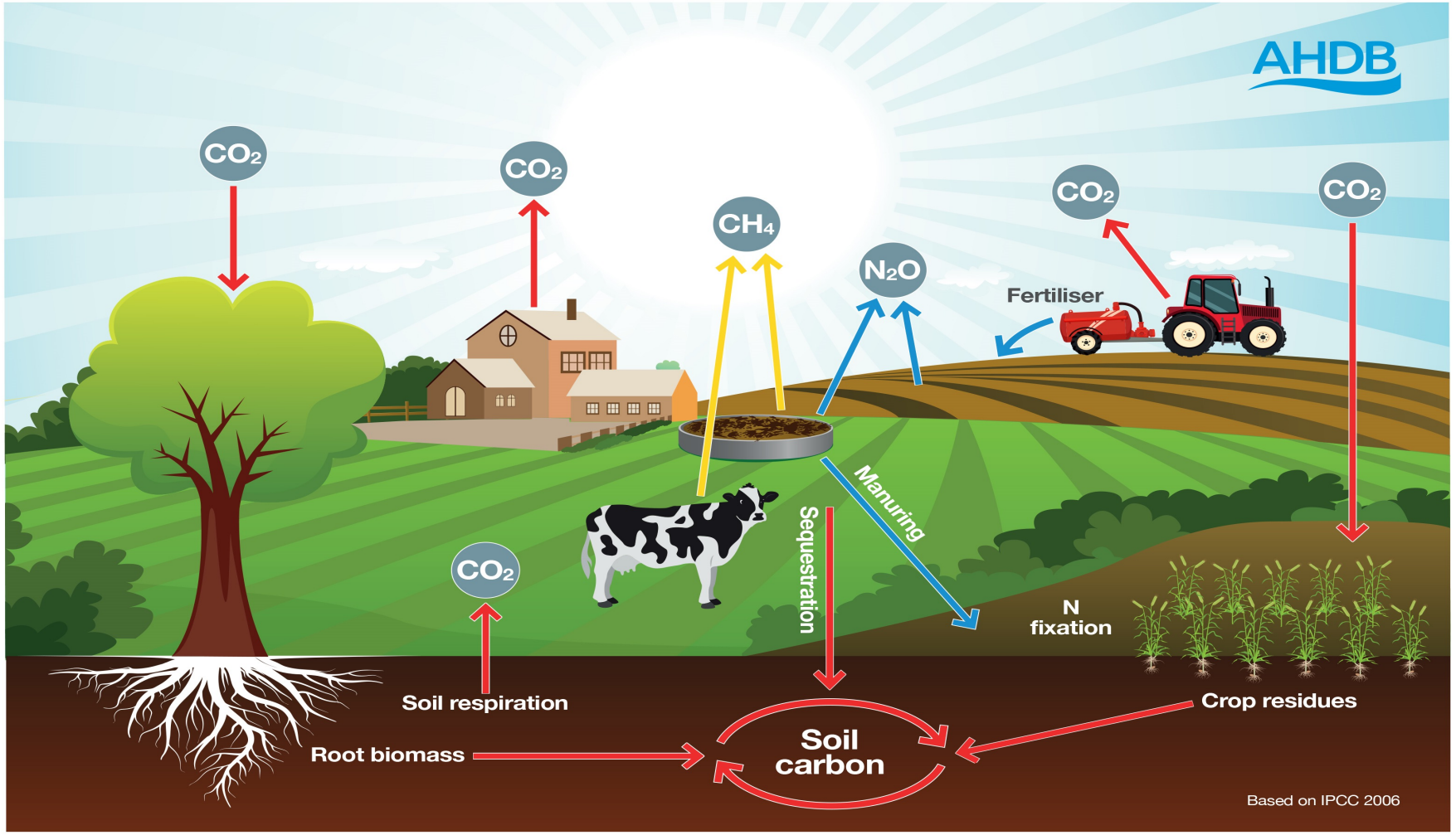
“Net Zero:” Sum of Emissions equals Sum of Sequestration

Adjusted for any fossil fuel CO2 emissions displaced by Renewables
& for any methane emissions reduced by waste management



It is not about Zero Emissions……

ARCZero
ACCELERATING FARMING TOWARDS CARBON NEUTRALITY

Where did we start…… We Learnt our Numbers…..

Baselined & Benchmarked…..

ARCZero
ACCELERATING FARMING TOWARDS CARBON NEUTRALITY

Where did we start…… We Learnt our Numbers…..

Baselined & Benchmarked…..

- GHG Emissions
- Carbon Sequestration
- Carbon Stocks in Soil
- Carbon Stocks in Trees
- Net Carbon Position
- Behavioural Change
- Delivering other Natural Capital

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Net Carbon as a Percentage of Gross Emissions

Using agrecalc TIER 1 Sequestration Module

2021 Agrecalc Analysis	Enterprises	Gross Emissions t CO2-e/yr	Gross Sequestration t CO2-e/yr	Net Emissions t CO2-e/yr	% Reduction
Ian McClelland	Dairy	1,101	309	792	28%
Hugh Harbinson	Dairy	2,009	549	1,459	27%
John Egerton	Beef & Sheep	1,475	444	1,031	30%
Roger & Hilary Bell	Sheep with Beef	754	456	298	60%
Simon Best	Arable with Beef	1,799	738	1,061	41%
Patrick Casement & Trevor Butler	Beef & Sheep	492	548	-56	111%
John Gilliland	Willows with Dry Cows	151	156	-4	103%

No two farms are the same…..

Some farms will find the journey easier than others……

Some farms are beyond Net Zero already…..

agrecalc

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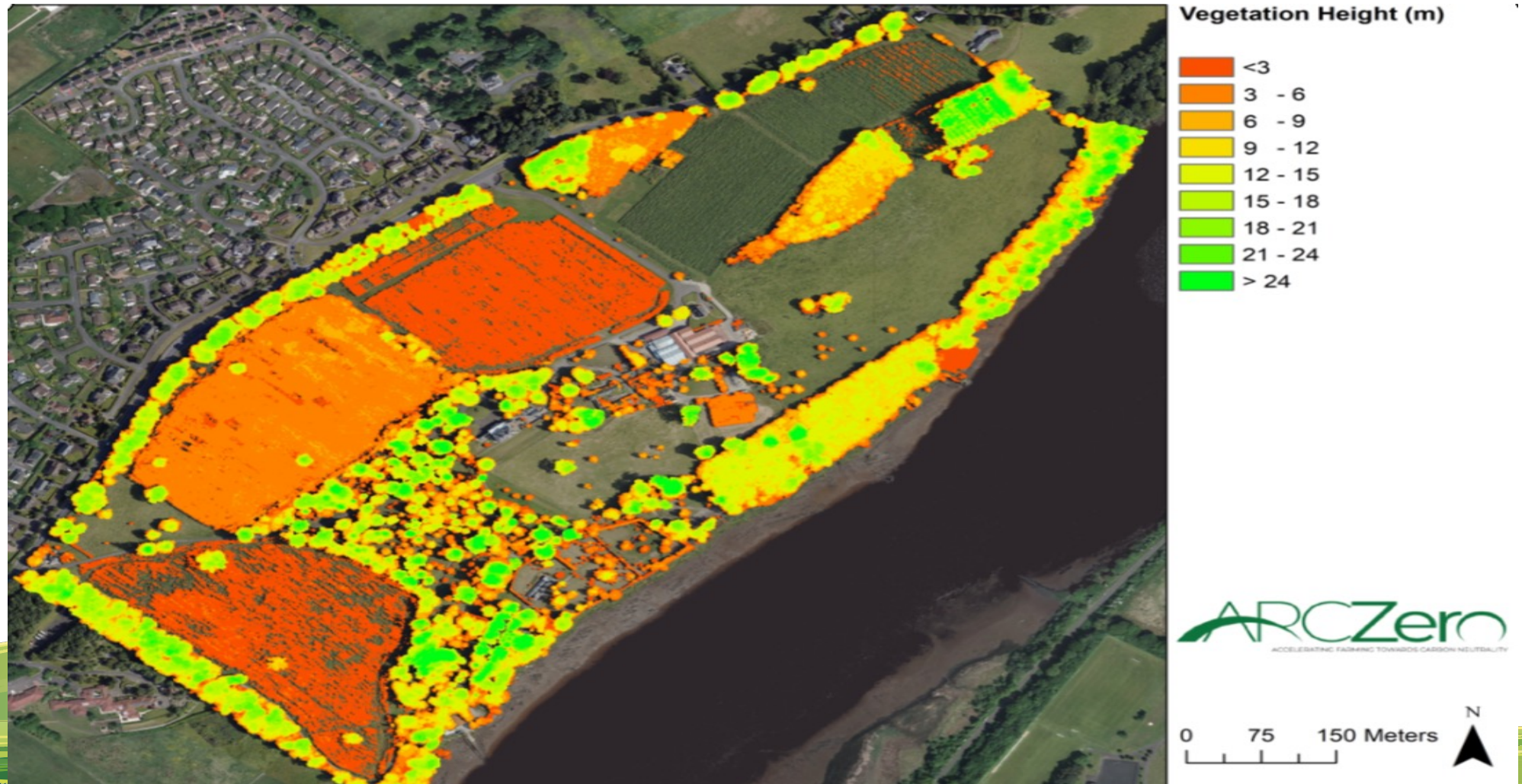
Measuring Carbon in Trees & Hedges

Using Aerial LiDAR at BROOK HALL Estate & Gardens

A. Higgins 2021 afbi AGRI-FOOD & BIOSCIENCES INSTITUTE



ARCZero
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Measuring Carbon in Trees & Hedges

Using Aerial LiDAR at BROOK HALL Estate & Gardens

A. Higgins 2021

afbi AGRI-FOOD & BIOSCIENCES INSTITUTE

	Brook Hall Estate Totals					
Vegetation type	Hedge Length (km)	AGB (t)	C (t)	BGB* (t)	C (t)	Total C (t)
Hedge 0-4m	0.78	14.92	7.1	2.86	1.3	**8.5**
Hedge 4-7m	0.35	6.36	3.0	1.22	0.6	**3.6**
Hedge 7-10m	0.25	10.32	4.9	1.98	0.9	**5.9**
Hedge >10m	1.00	156.17	74.5	29.99	14.1	**88.6**
Total Hedges	**2.38**	**187.77**	**89.5**	**36.05**	**16.94**	**106.49**
	Canopy Area (ha)					
Single Trees	1.87	494.78	236.0	95.00	44.6	**280.6**
Deciduous Woodland	17	1352.74	645.1	259.73	122.1	**767.2**
Coniferous Woodland	0.09	6.17	2.9	1.27	0.6	**3.5**
Biomass	28.96	337.61	161.0	64.82	30.5	**191.5**
Total	**47.92**	**2,379.07**	**1,134.6**	**456.8**	**214.7**	**1,349.3**

AGB
Above Ground Biomass

BGB
Below Ground Biomass

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ACCELERATING FARMING TOWARDS CARBON NEUTRALITY

Measuring Carbon in the Soil

Stratified for different Land Uses & Land Managements at Brook Hall

Land Category	Total ha	Soil pH	Av. LOI/SOM	No. of Soil Cores	No. of Samples	Av. C. 0-10cm	Av. C. 0-30cm	Av. C/ha	Av. C/Category
<10% Soil Org. Matter, Short Rotation Willow Coppice	34.2ha	pH 6.2	7.60%	55	11	4.20%	3.20%	87.1t	2,978.8t
<10% Soil Org. Matter, Permanent Grass, no slurry/FYM, only grazed	1.4ha	pH 6.3	9.30%	15	3	4.90%	3.10%	87.3t	122.2t
<10% Soil Org. Matter, Decideous Woodland	0.5ha	pH 5.3	9.10%	15	3	5.80%	4.10%	114.7t	57.4t
10-20% Soil Org. Matter, Permanent Grass, no slurry/FYM, only grazed	12.9ha	pH 6.1	13.70%	30	6	5.50%	3.40%	93.7t	1,208.7t
10-20% Soil Org. Matter, Silvopasture, no slurry/FYM	4ha	pH 4.8	14.80%	25	5	5%	2.80%	81.6t	326.4t
10-20% Soil Org. Matter, Decideous Woodland	4.6ha	pH 5.3	13%	25	5	6.90%	4.90%	136t	625.6t
Totals	**57.6ha**			**165 Soil Cores**	**33 C. Samples**			**92.3t/ha**	**5,319.1t of C.**

Soil Carbon at Brook Hall = 5,319 t of C, or 19,468 of CO_2e

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ACCELERATING FARMING TOWARDS CARBON NEUTRALITY

Total Carbon Stocks across ARC Zero farms……

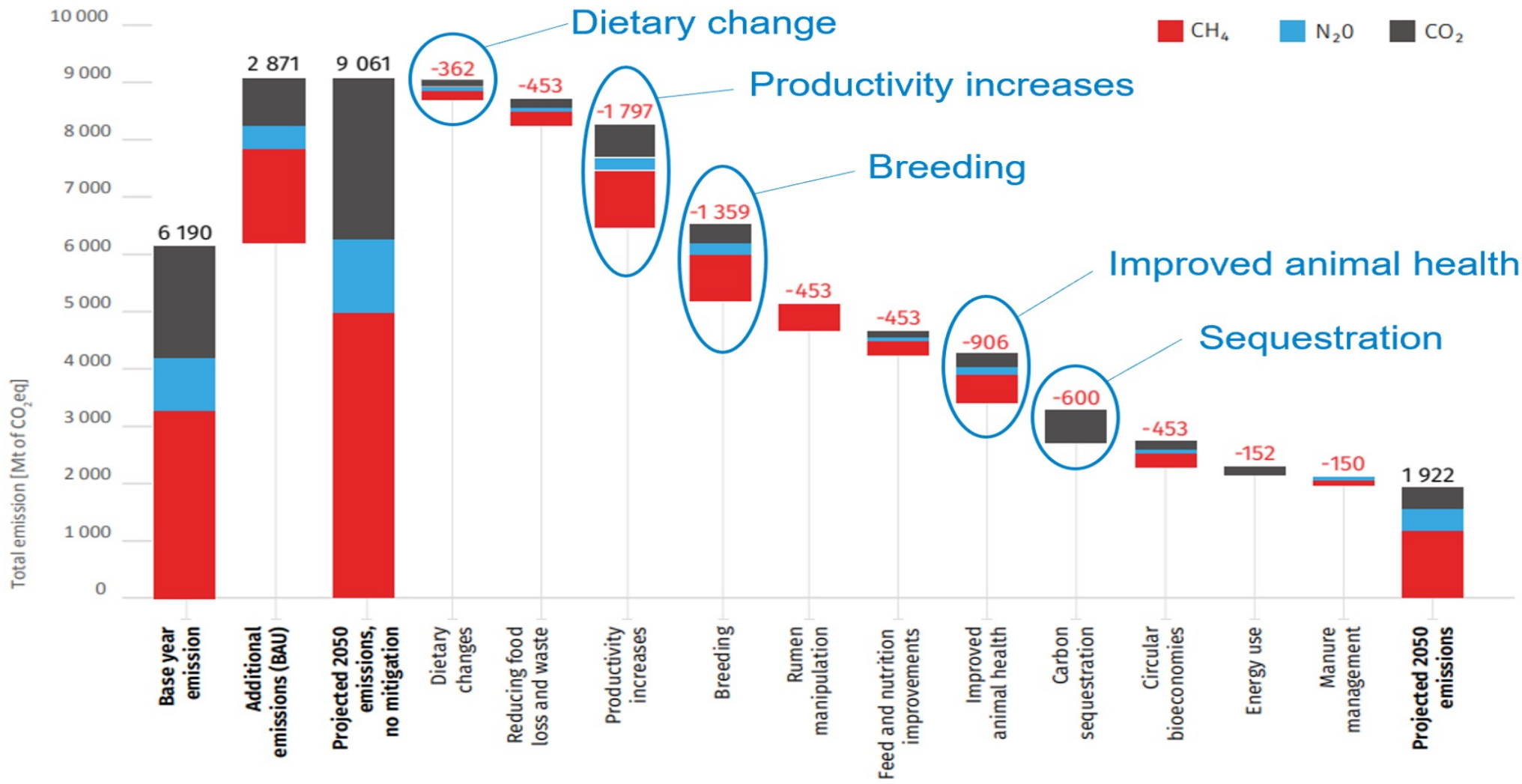
Total ARC Zero CO2e Stocks	Soil Carbon	Tree Carbon	Total Carbon	% C in Soil
Ian McClelland	31,813t	1,310t	33,123t	96%
Hugh Harbison	68,054t	1,969t	70,023t	97%
John Egerton	31,813t	1,310t	33,123t	96%
Roger & Hilary Bell	50,819t	688t	51,507t	98%
Simon Best	237,915t	6,493t	244,407t	97%
Patrick Casement & 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

In 2027, Target 530,000t? Will GHG Inventory or Scope 3 Declarations Recognise?

FAO, Pathway to Lower Emissions

Prioritising & Giving Context to the Change required Globally



Source: UN FAO 2023 Pathways towards lower emissions (fao.org)

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The Resultant Behavioural Change after two years…..

agrecalc

Comparison between 2021 & 2023, gross emission/unit of output

GHG Reduction 2021 to 2023	Enterprises	2021	2023	% Reduction in GHGs
Ian McClelland	Dairy	1.3kg CO2e/kg FPC Milk	1.1kg CO2e/kg FPC Milk	13%
Hugh Harbison	Dairy	1.25kg CO2e/kg FPC Milk	1.2kg CO2e/kg FPC Milk	4%
John Egerton	Beef & Sheep	32.8kg CO2e/kg dwt	25.6kg CO2e/kg dwt	22%
Roger & Hilary Bell	Lamb	22kg CO2e/kg dwt	15.7kg CO2e/kg dwt	28%
Simon Best	Wheat	0.99kg CO2e/kg grain	0.47kg CO2e/kg grain	53%

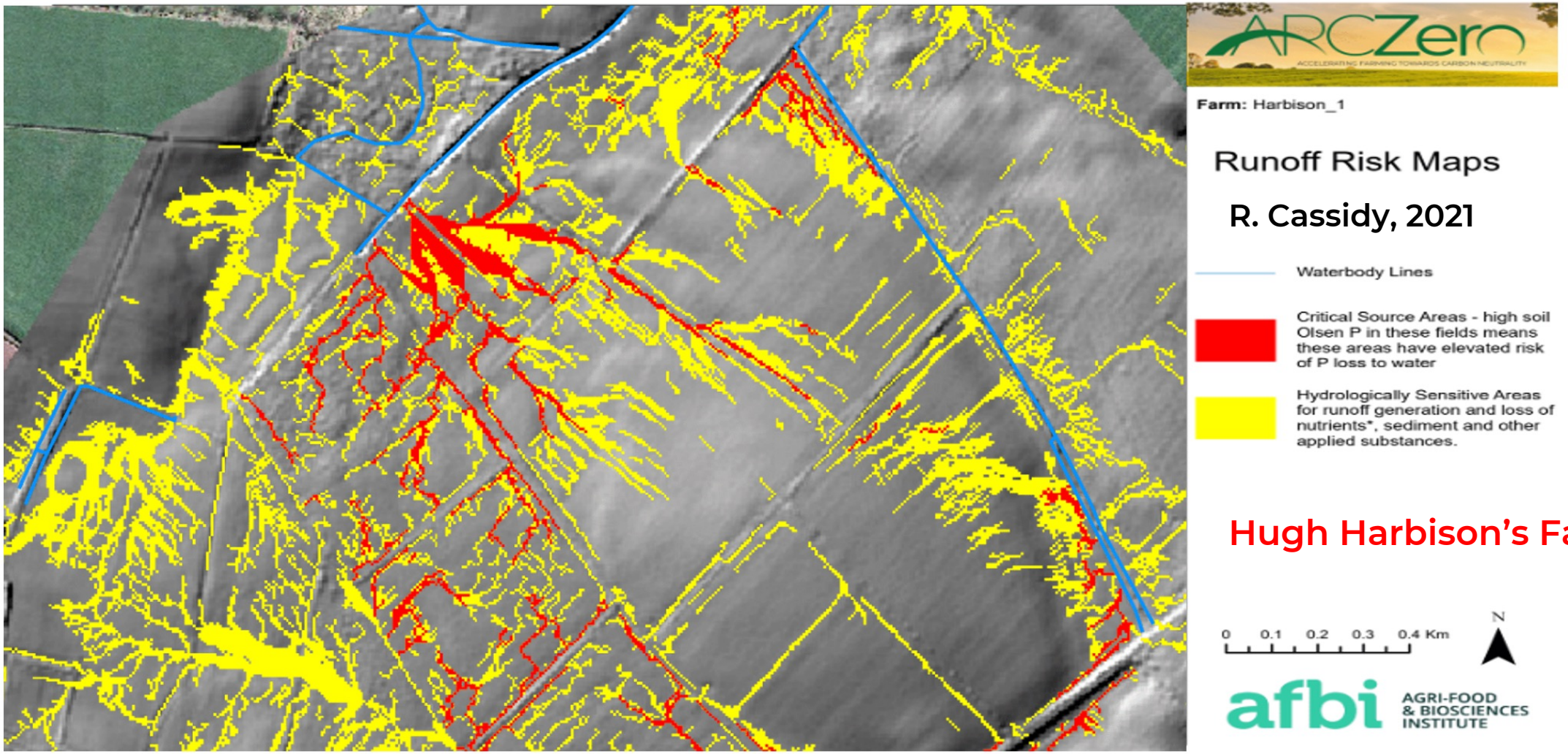
Determining Factors – Price of Fertiliser
- Sowing of legumes
- Health of Livestock
- Weather

agrecalc

ARCZero
ACCELERATING FARMING TOWARDS CARBON NEUTRALITY

Delivering Multiples of Natural Capital, Simultaneously

Using LiDAR & Phosphate Soil Surveys to create “Run Off Risk” Maps



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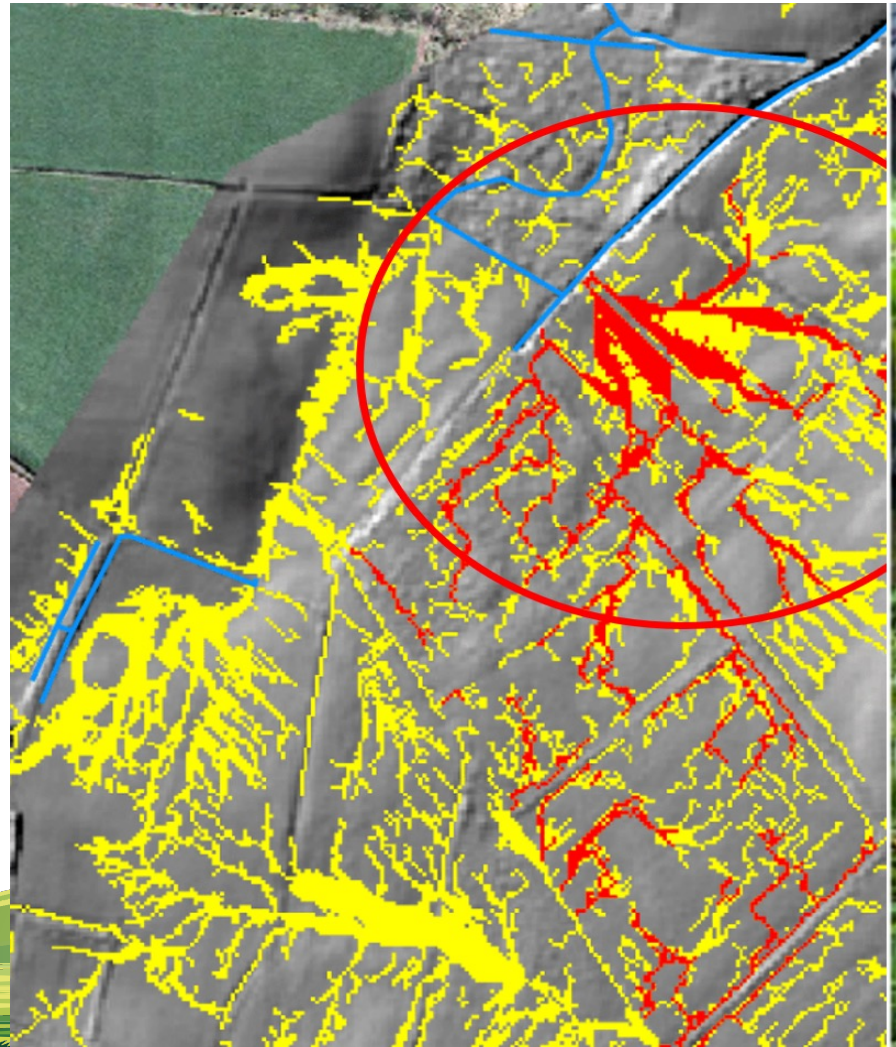
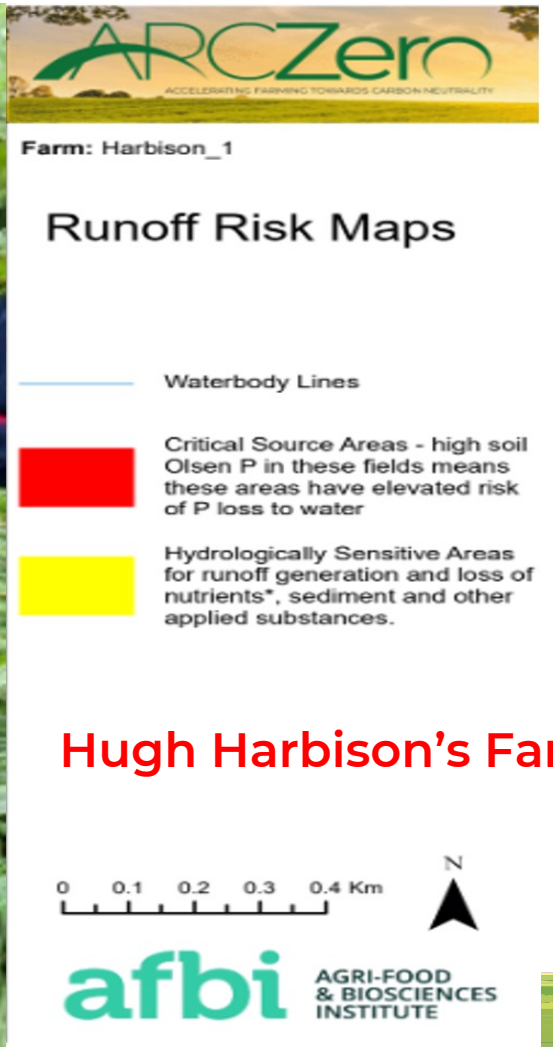
ACCELERATING FARMING TOWARDS CARBON NEUTRALITY

Delivering Multiples of Natural Capital, Simultaneously

Multi Species Pastures – Water Infiltration, Biodiversity, Carbon Sequestration





Hugh Harbison's Farm

COMPARING DIFFERENT LAND USES

Willow SRC (28 Yrs. Old)

Permanent Pastureland (200 Yrs. Old)

Silvopasture (120 Yrs. Old)

D. Woodland (30 Yrs. Old)

D. Woodland (250 Yrs. Old)

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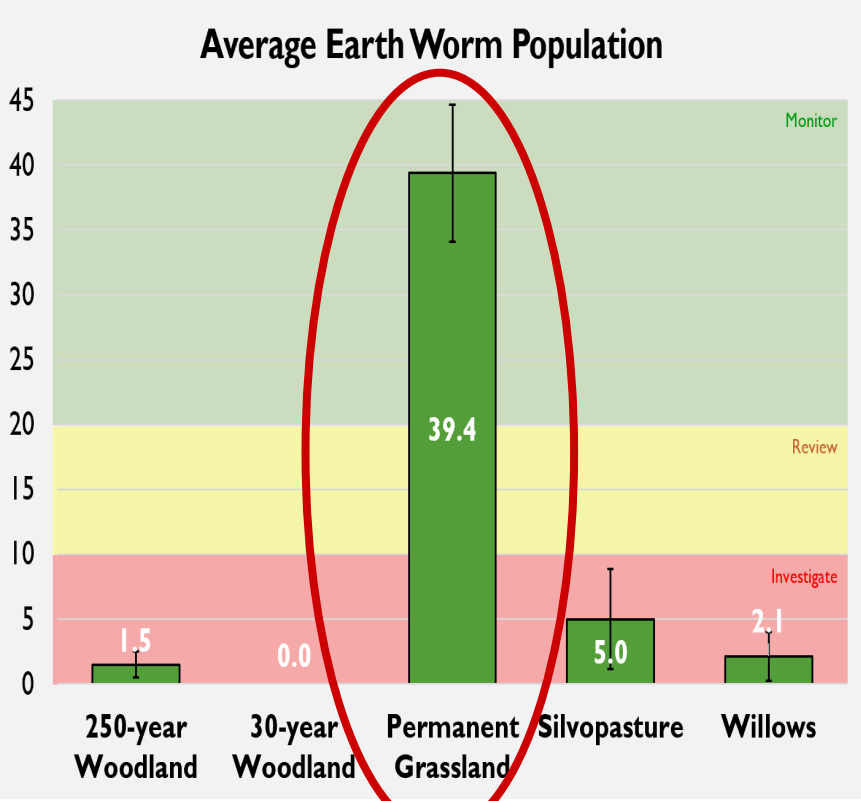
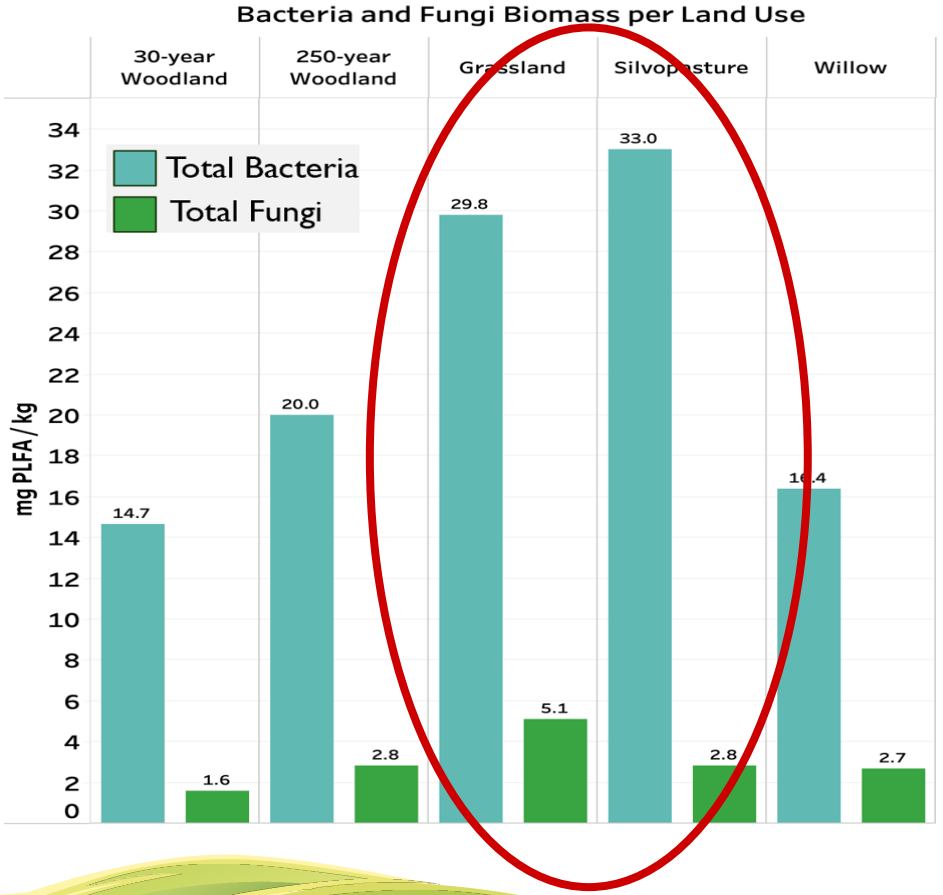
R. Buffara, WUR, 2023

ARCZero
ACCELERATING FARMING TOWARDS CARBON NEUTRALITY

Delivering Multiple Public Goods Simultaneously

Role of Livestock Faeces…. In Increasing Soil Biodiversity……





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R. Buffara, WUR, 2023

ARCZero
ACCELERATING FARMING TOWARDS CARBON NEUTRALITY

Delivering Multiple Public Goods Simultaneously

The Importance of Increasing Biodiversity Under the Soil…. 3 New Papers….

The age of extinction

More than half of Earth's species live in the soil, study finds

Soil estimated to be home to 90% of world's fungi, 85% of plants and more than 50% of bacteria, making it the world's most species-rich habitat

National Academy of Science, Aug 23

Cessation of grazing causes biodiversity loss and homogenization of soil food webs

Maarten Schrama[1,2], Casper W. Quist[3,4], G. Arjen de Groot[5], Ellen Cieraad[1,6], Deborah Ashworth[2], Ivo Laros[5], Lars Hestbjerg Hansen[7,8], Jonathan Leff[9,10], Noah Fierer[9,10] and Richard D. Bardgett[2] Oct 2023

agronomy

MDPI

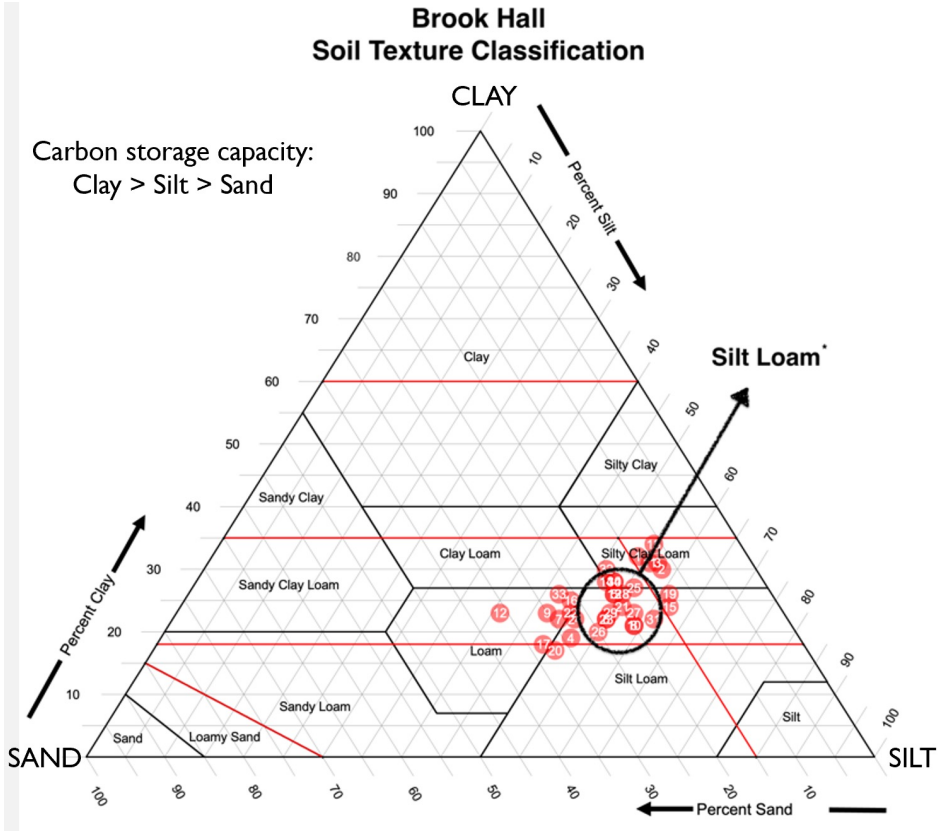
Review

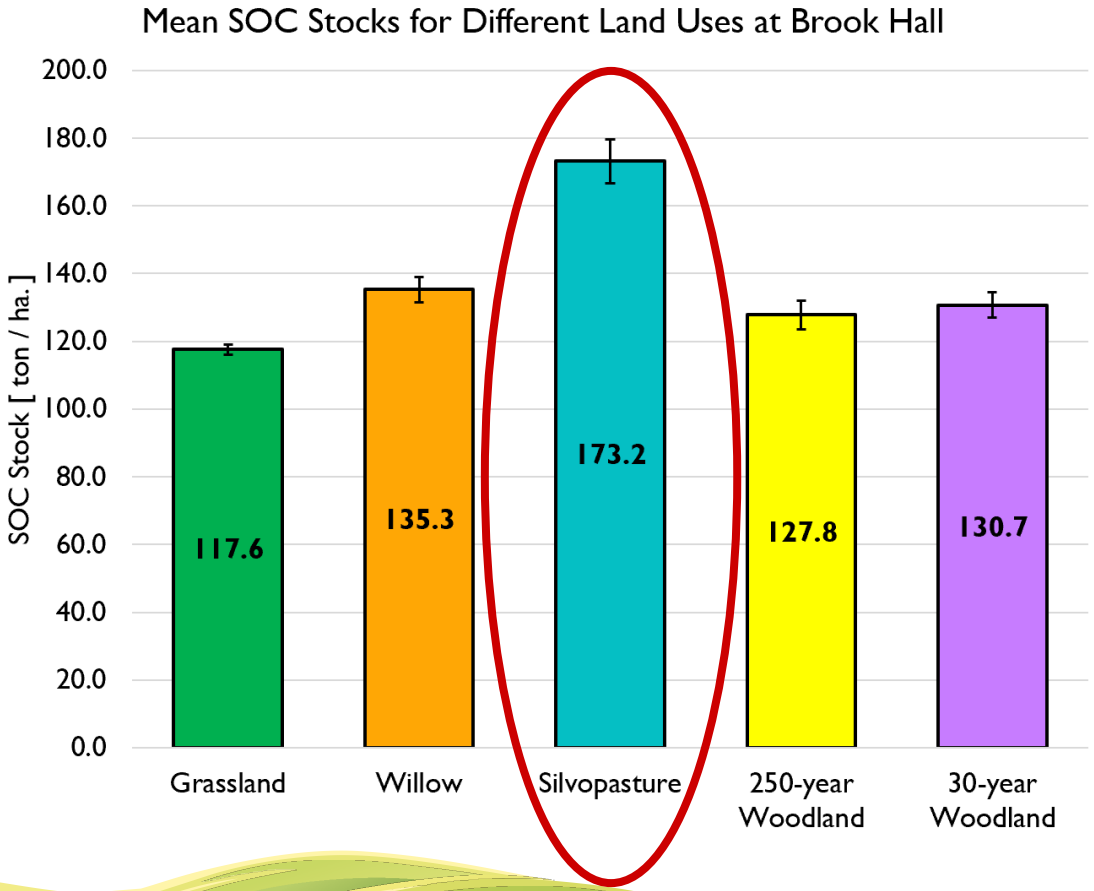
The Effects of Manure Application and Herbivore Excreta on Plant and Soil Properties of Temperate Grasslands—A Review

Arne Brummerloh [1,*] and Katrin Kuka [2] Dec 2023

Role of different Land Uses in building Soil Organic Carbon

Role of Diverse Root Architecture…. Monocultures' Root Structure Struggling…





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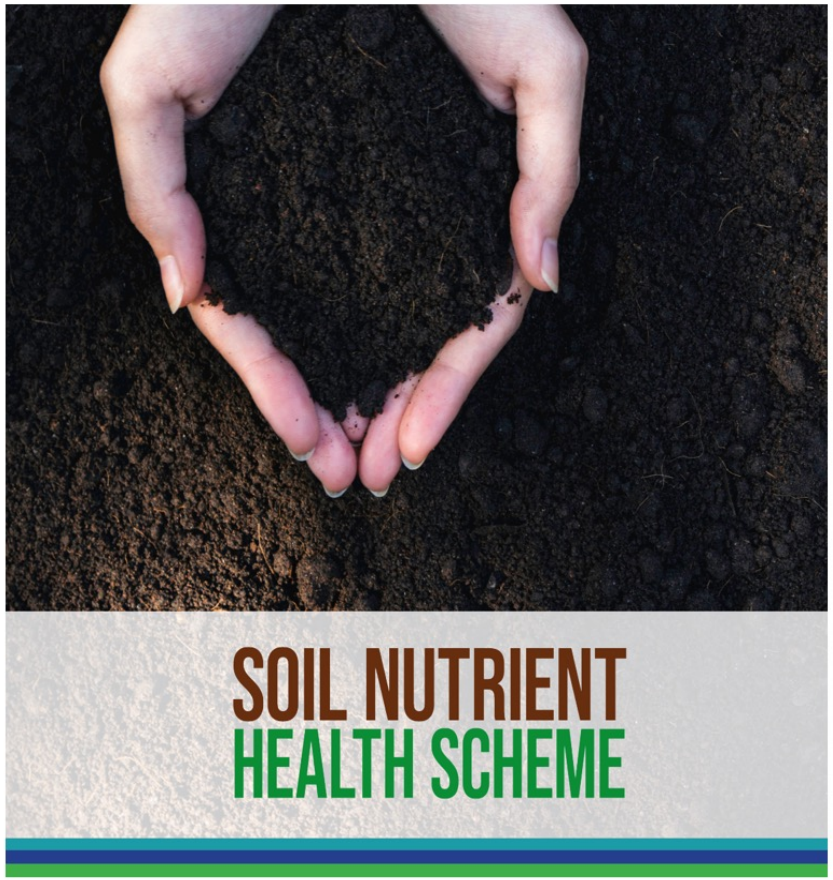
R. Buffara, WUR, 2023

Is this Ambition Possible at a Regional Level……



- £38m N. Ireland Scheme to base line every field, tree & hedge
- Carried out over four years, one Zone per year
- Online training, empowering farmers with their own Data
- Output - Soil Fertility, Carbon Stocks & Run off Risk Maps
- Opened May 2022, plan to repeat every five years
- 92% Farmer uptake in Zone One (25% of N. Ireland)
- Soil Nutrient Health Scheme | Agri-Food and Biosciences Institute (afbini.gov.uk)

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

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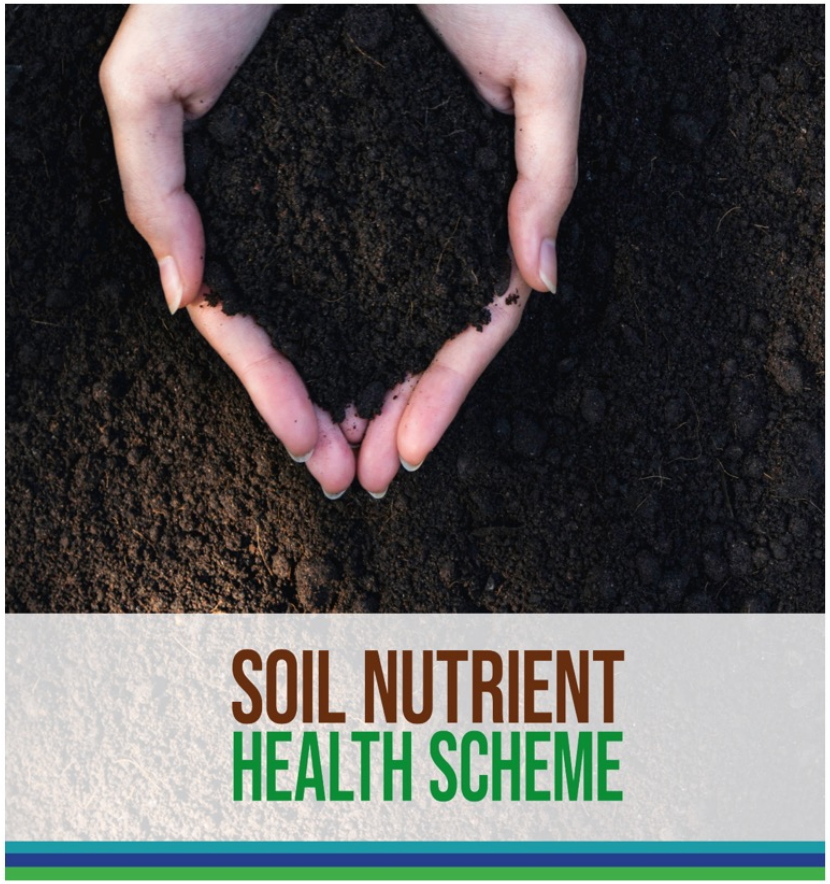

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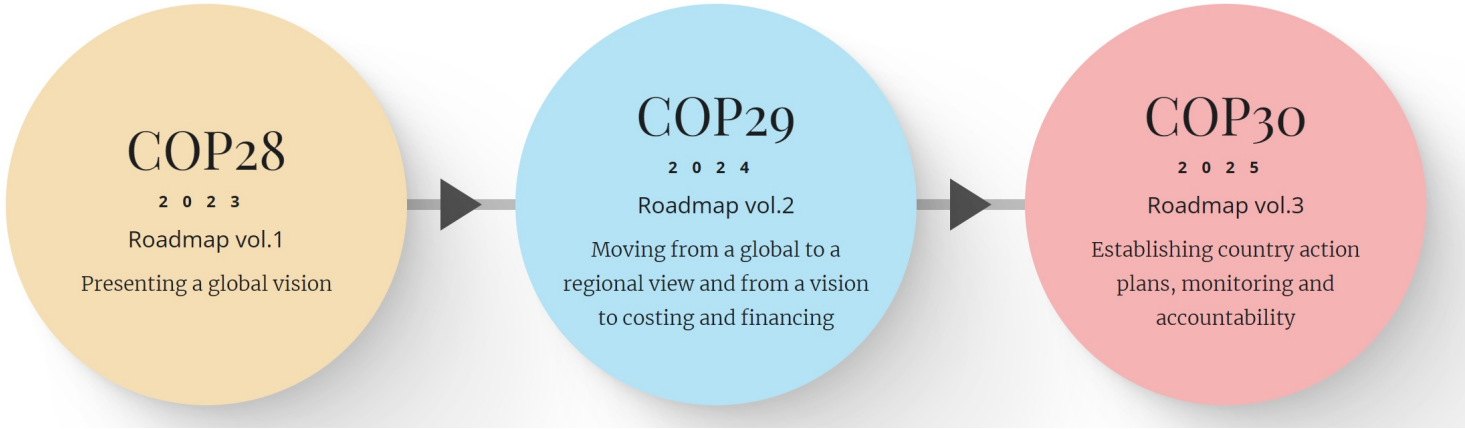
Essential…… Government Recognition……
Measuring, Reporting & Verification is a Public Good

FAO, Achieving Zero Hunger: A Global Road Map, COP 28



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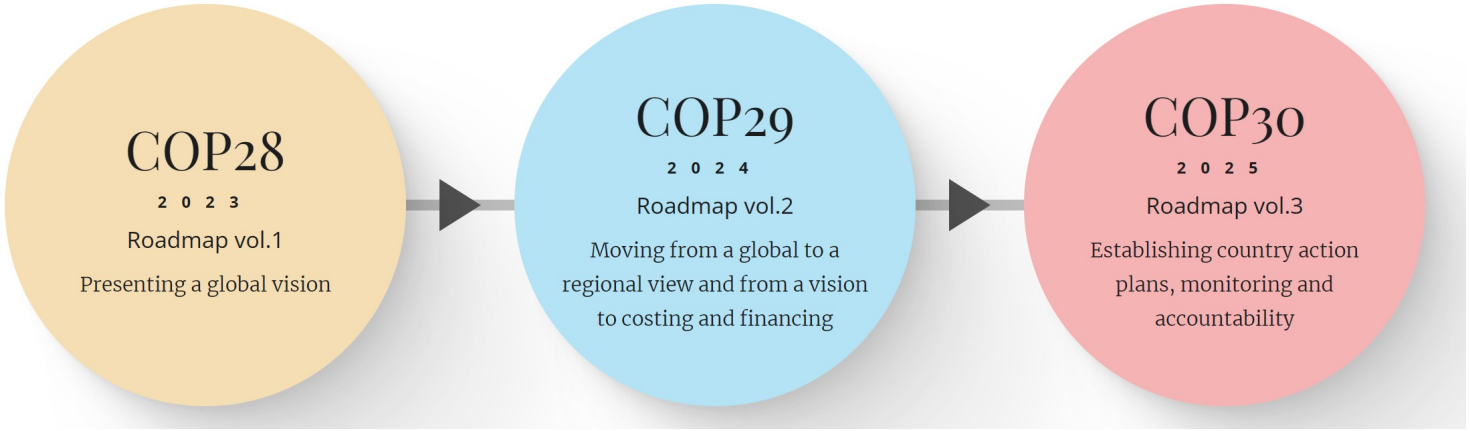

Activity	Target Year	Description
Livestock	2030	Methane Emissions Reduced by 25%, compared to 2020
Livestock	2050	Total Livestock Productivity Growth, 1.7% per year, Globally
Crops	2050	Total Crop Productivity Growth, 1.5% per year, Globally
Crops	2050	Total Crop Productivity Growth, 2.3% per year, Low-income Countries
Enabling Healthy Diets for all	2030	All Countries to update Food Dietary Guidelines & context on Quantity & Dietary Patterns
Enabling Healthy Diets for all	2030	All Countries have Legislation Restricting Food Advertisments targeting Children
Forests & Wetlands	2025	Zero Global Net-Deforestation achieved
Forests & Wetlands	2035	Zero Global Gross-Deforestation achieved
Soil & Water	2030	Achieve Universal & Equitable access to Safe & Affordable Drinking Water for all
Soil & Water	2040	Additional 10 Gega Tonnes of CO2e Sequestered in Crop & Pastureland Soil between 2025 & 2050
Food Loss & Waste	2030	50% Reduction of Global Food Waste at Retail & Consumer levels
Food Loss & Waste	2050	All Food Loss & Waste Integrated into Circular Bioeconomy, or used for Feed & Soil Enhancement

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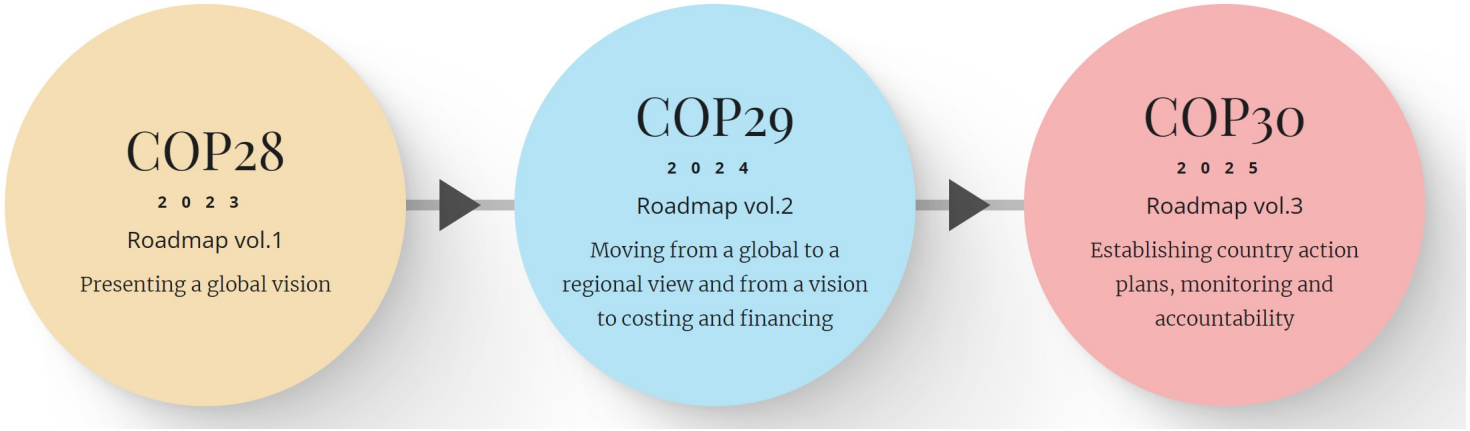

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Australian Clean Air Regulator (2014)

Adjudicates on Australian Carbon Credit Units

ARCHER PASTORAL

AR

1st farm in Australia
only approved in 2023

SOC measured to 1 metre, 7 years apart

New soil carbon credit issuance becomes Australia's largest ever with 94,666 ACCUs

Beef Central, 26/09/2023

Carly and Grant Burnham have become the latest to be issued soil carbon credits, with a record 94,666 Australian Carbon Credit Units. Photo: supplied

The 7th farm Since June 2023

94,666 ACCUs
@
AUS$93/t
=
$8,803,938

As a Result Of Regenerative Farming….

New soil carbon credit issuance becomes Australia's largest ever with 94,666 ACCUs

Beef Central, 26/09/2023

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94,666 ACCUs
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When the Voluntary Carbon Market was AUS$35/t

Closer to home….. EU Parliament Adopts Certification Framework

For Carbon Removals in the Land Based Sector

copa cogeca
european farmers european agri-cooperatives

21/11/23

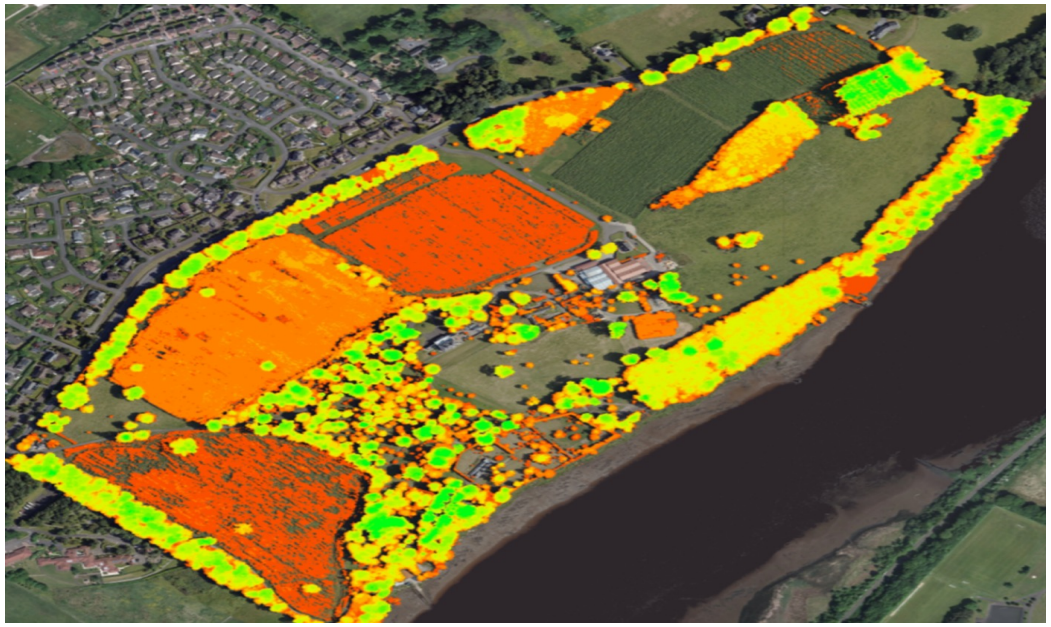
Statement

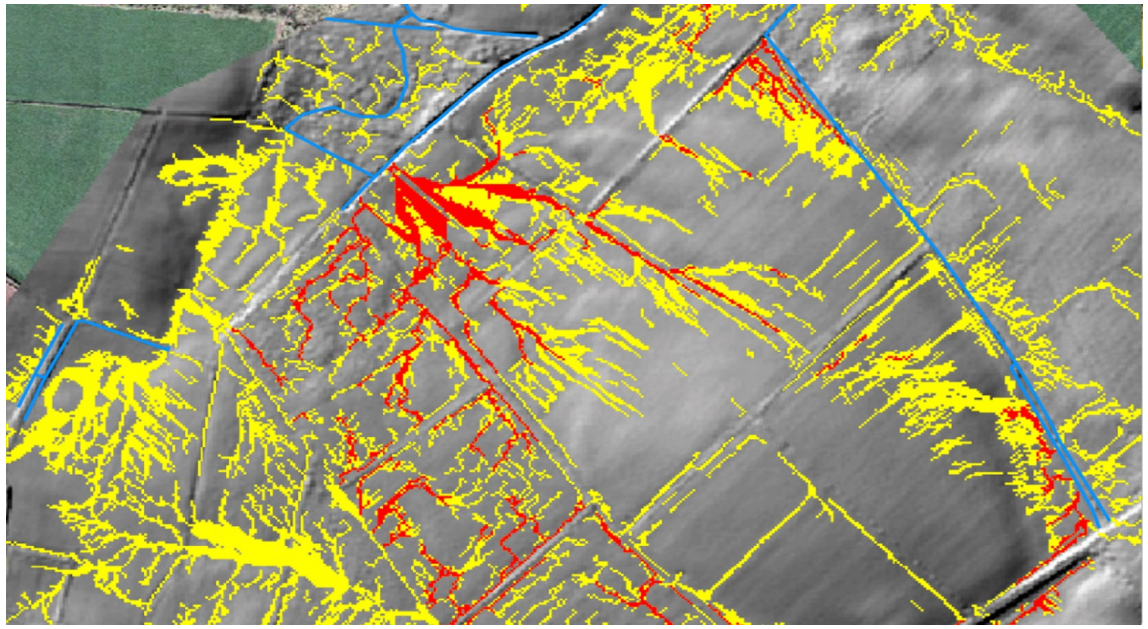
With the adoption today by the European Parliament of its final report on a proposal to establish the first EU-level certification framework for carbon removals, Europe is making great strides in the right direction. As the Council also adopted its negation mandates last week, trilogue negotiations will get underway in the coming weeks, and on the right track.

The EU voluntary carbon framework aims to facilitate and speed up the deployment of high-quality mitigation and adaptation actions in the EU, including those originating from carbon farming practices. The European Parliament acknowledges that carbon farming is not just sequestration of carbon but also emissions' reductions from soil, and enteric and manure fermentation. Copa and Cogeca welcome this step in the right direction, which will enable more farmers to see the benefits of this system.

Sustainable Land Management – A New Approach

Technology & Climate Change – The Potential for Impact on Land Value?





Empowering Land Owners & Farmers “To Know their Numbers”….

Key to Delivering Net Zero & Optimisation of Land Value

john.gilliland@brookhall.org

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ARCZero ACCELERATING FARMING TOWARDS CARBON NEUTRALITY

AHDB

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