Northern Farming Conference 2023

Tomorrow's farming, today

Wednesday 1st November

NORTHERN FARMING CONFERENCE

ArmstrongWatson® Accountants, Business & Financial Advisers

CLA

HSBC

NORTH EAST GRAINS

Hexham and Northern Marts

WOMBLE BOND DICKINSON

youngsRPS

Chairman's Welcome **Andrew Robinson** Head of Agriculture, Armstrong Watson

10:10 **Janet Hughes** Defra's Director for the Future Farming and Countryside Programme

10:35 **Martin Hanson** Head of Agriculture at HSBC

10:50 **Joe Stanley** Head of Training & Partnerships, GWCT Allerton Project

11:15 **Panel Question Session chaired by The Rt Hon Lord Benyon**

11:55 **Andrew Meredith** Farmers Weekly Editor

12:25 **Peter Illman** Tesco's Sustainable Farming Manager

Afternoon Chair **Samantha Charlton** Head of Engagement AHDB

13:50 **Professor John Gilliland OBE** Special Adviser to the AHDB

14:20 **Caroline Grindrod** Roots of Nature Consultancy, Wilderculture, Primal Meats

14:50 **Andrew Ward MBE** Farmers Weekly Farming Champion & Arable Farmer of the Year, Founder of Forage Aid

15:20 **Final Questions chaired by Samantha Charlton**

Andrew Robinson

Chairman & Head of Agriculture,
Armstrong Watson

Janet Hughes

Defra's Director for the Future Farming and Countryside Programme

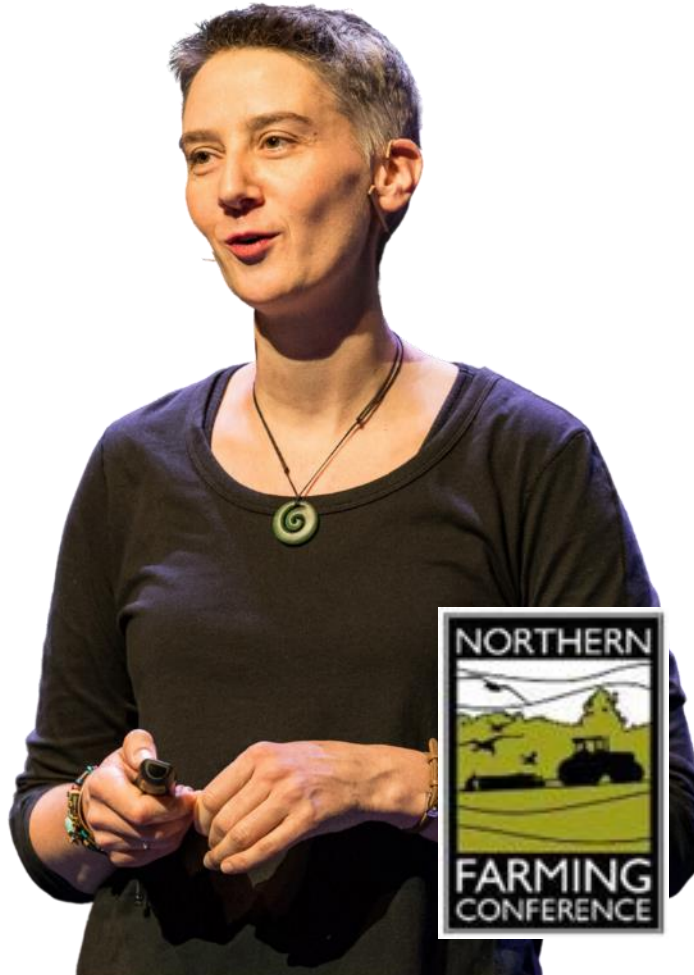
Janet Hughes

Defra's Director for
the Future Farming and Countryside Programme

Janet is the director of the future farming and countryside programme for Defra – the programme responsible for taking England out of the Common Agricultural Policy.

Defra is phasing out agricultural subsidies and introducing new environmental land management schemes to pay farmers to take care of the natural environment alongside food production including reducing climate emissions, storing carbon and mitigating the impacts of climate change.

The programme is also funding investment in farm productivity, innovation, research and development, and reforming farming regulation to make it fair, proportionate and effective.



Martin Hanson

Head of Agriculture at HSBC

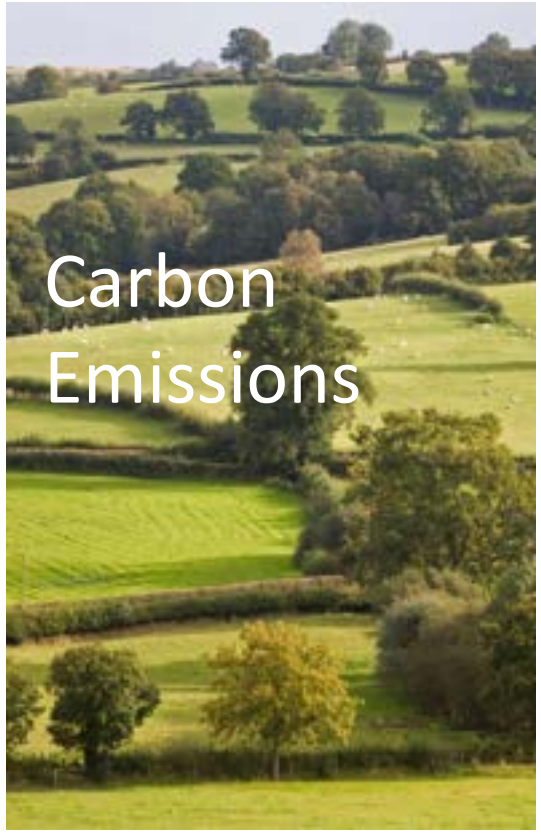
HSBC UK Agriculture

November 2023

Martin Hanson Head of UK Agriculture

HSBC UK

Public



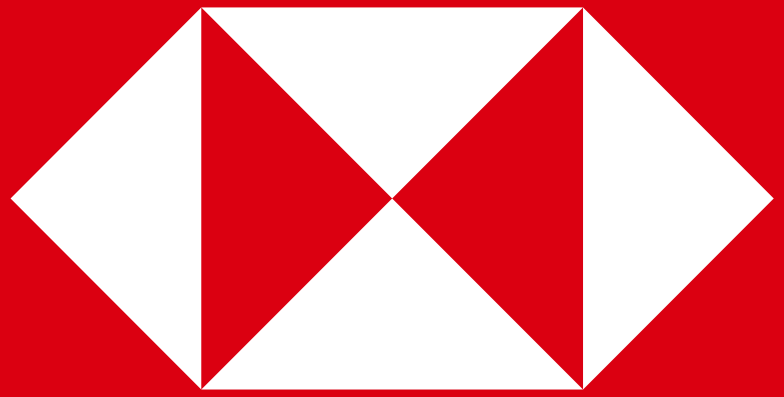
Arable
Arable farms could take advantage of a number of practices to reduce emissions, including optimising artificial fertiliser usage, reducing fuel usage, minimising soil disturbance and use of cover crops.

Enterprise	Unit	Top 25%	Mean	Lower 25%
Winter Wheat – feed	(kg CO2e/kg)	0.29	0.34	0.39
Spring Barley – malting	(kg CO2e/kg)	0.29	0.33	0.37

- ❑ Looking Forward
- ❑ Consider the risks and opportunity
- ❑ Think commercially
- ❑ Formulate a plan
- ❑ Act

Understand ‘risk’ so that we can provide finance to support successful farming

Change brings new risk and new opportunity



Joe Stanley ARAgS

Head of Training & Partnerships,
GWCT Allerton Project

@AllertonProject

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It's p**s wet – what can we do about it?

Northern Farming Conference

1st November 2023

Joe Stanley, ARAgS

HEAD OF TRAINING & PARTNERSHIPS

www.allertontrust.org.uk

Aims

Allerton Research & Educational Trust

- To combine **productive** farming with wildlife conservation
- To **research** the interaction between farming, wildlife conservation, resource management & the environment
- To **disseminate** the results for the benefit of farmers, policy makers & others
- C.150 published research papers

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The Allerton vision

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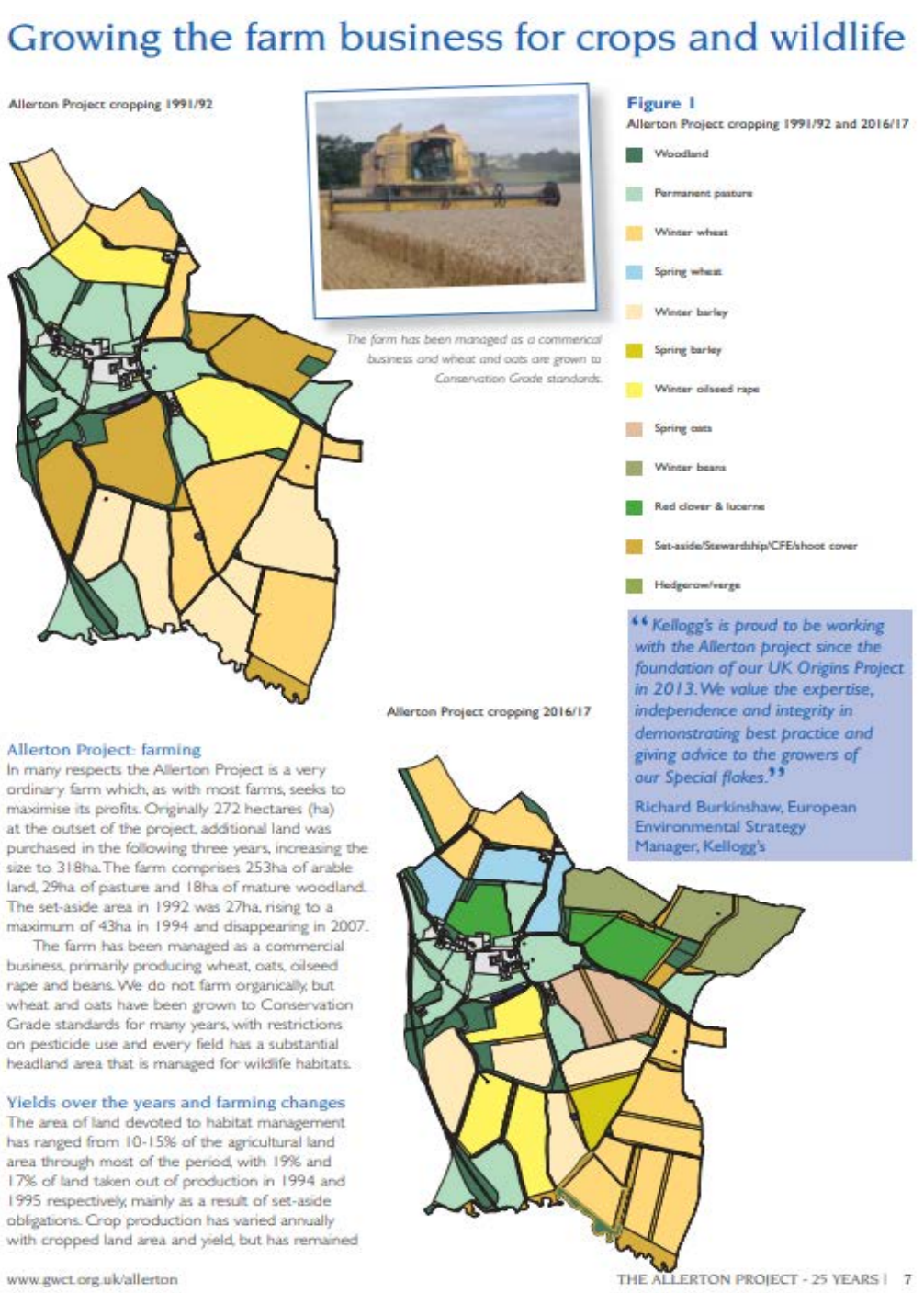
1992 vs today

- 1992
  - Plough-based
  - Basic set-aside
  - Simple rotation + permanent grass
  - Hedges

- Today
  - Direct-drill/min-till
  - Agri-environment schemes
  - Complex rotation + permanent/temporary grass
  - Hedges & edges, in-field options
  - Forestry & agroforestry
  - Bigger & more hedges!



Growing the farm business for crops and wildlife

Allerton Project cropping 1991/92

The farm has been managed as a commercial business and wheat and oats are grown to Conservation Grade standards.

Figure 1
Allerton Project cropping 1991/92 and 2016/17

Woodland
Permanent pasture
Winter wheat
Spring wheat
Winter barley
Spring barley
Winter oilseed rape
Spring oats
Winter beans
Red clover & lucerne
Set-aside/Stewardship/CFE/shoot cover
Hedgerow/verge

"Kellogg's is proud to be working with the Allerton project since the foundation of our UK Origins Project in 2013. We value the expertise, independence and integrity in demonstrating best practice and giving advice to the growers of our Special flakes."

Richard Burkinshaw, European Environmental Strategy Manager, Kellogg's

Allerton Project cropping 2016/17

Allerton Project: farming

In many respects the Allerton Project is a very ordinary farm which, as with most farms, seeks to maximise its profits. Originally 272 hectares (ha) at the outset of the project, additional land was purchased in the following three years, increasing the size to 318ha. The farm comprises 253ha of arable land, 29ha of pasture and 18ha of mature woodland. The set-aside area in 1992 was 27ha, rising to a maximum of 43ha in 1994 and disappearing in 2007.

The farm has been managed as a commercial business, primarily producing wheat, oats, oilseed rape and beans. We do not farm organically, but wheat and oats have been grown to Conservation Grade standards for many years, with restrictions on pesticide use and every field has a substantial headland area that is managed for wildlife habitats.

Yields over the years and farming changes

The area of land devoted to habitat management has ranged from 10-15% of the agricultural land area through most of the period, with 19% and 17% of land taken out of production in 1994 and 1995 respectively, mainly as a result of set-aside obligations. Crop production has varied annually with cropped land area and yield, but has remained

www.gwct.org.uk/allerton

THE ALLERTON PROJECT - 25 YEARS | 7

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Soil erosion

- Soil is a finite resource
- 40% of global soils are degraded; 90% could be by 2050 (UN FAO, 2022)
- 12m ha productive soil 'degraded' every year (area size of Greece, or 1% of total)
- 24bn tonnes topsoil lost per year
- Soil production c. 1in/250 years – 1in/800 years (c. 0.1-1.9t/ha/year) (Montgomery, *Dirt)*
- Erosion on arable/overgrazed land 100-1000x natural rates (UN FAO)

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Factors influencing soil erosion

- Weather
- Soil type
- Topography
- Crop selection & rotations
- Cultivations type & direction
- Drainage
- Soil cover
- Soil Organic Matter (SOM)

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Drainage

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Rotations

High risk crops

- Late sown winter wheat
- Late harvested maize on sloping ground
- Late harvested sugar beet & potatoes
- Root crops on sloping ground
- Grass re-seeds, spring or autumn (where fine seed bed used)
- Overwinter cultivations/no covers

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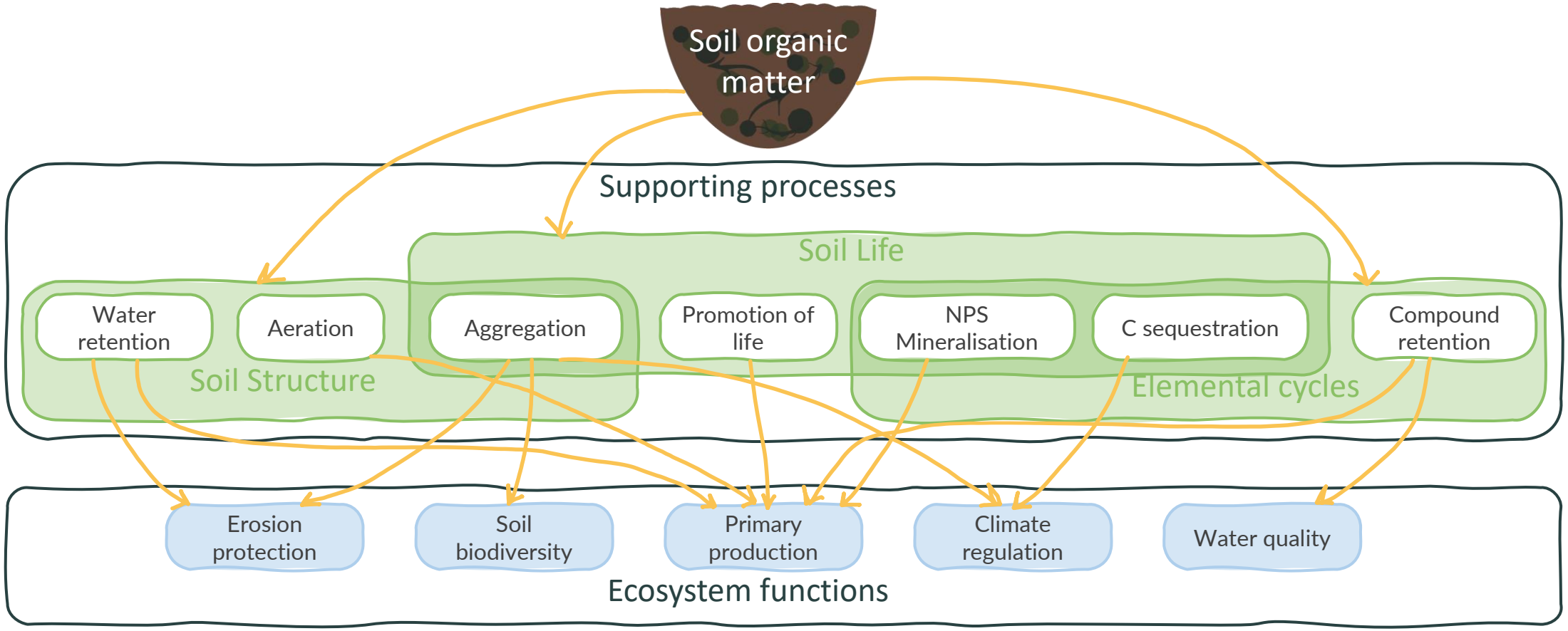
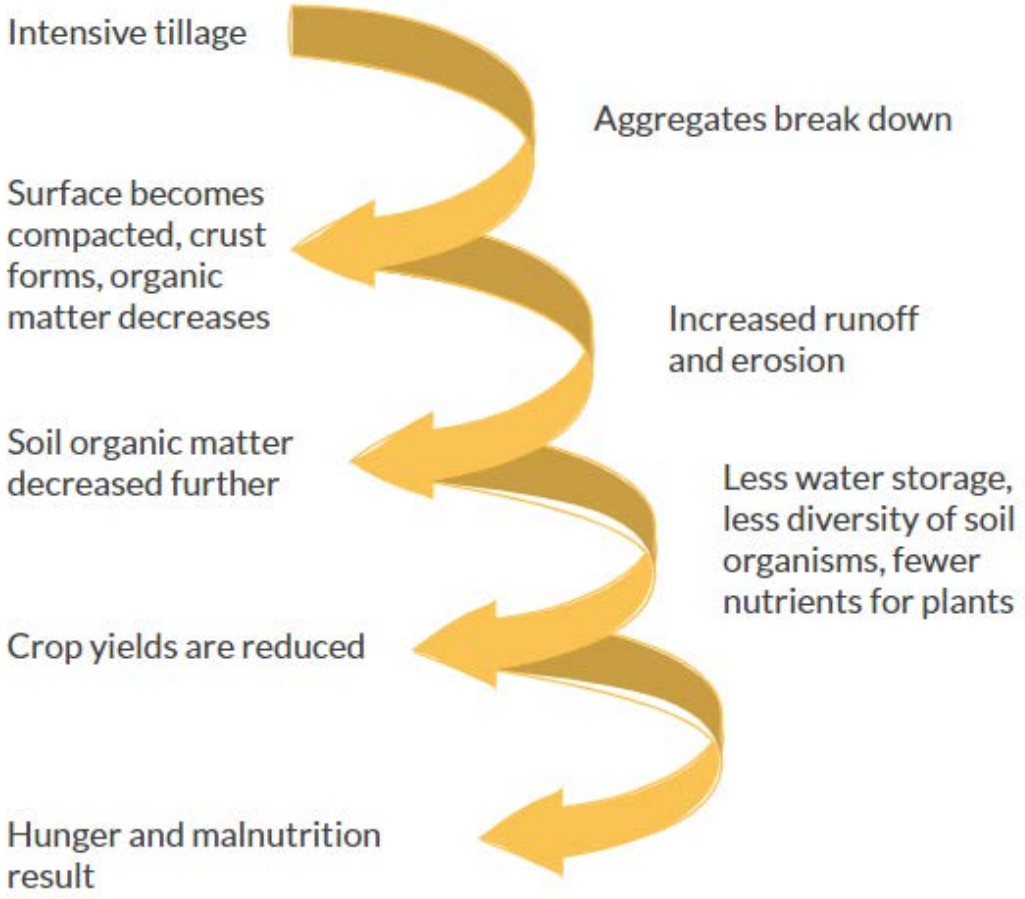
SOM & soil function

Ecosystem functions of a soil organic matter and the processes supporting them



Adapted from source: 'Eco-functionality of organic matter in soils', Hoffland et al, 2020

The ‘devil’s spiral’



The downward spiral of soil degradation. Modified from Topp et al.

Reduced tillage

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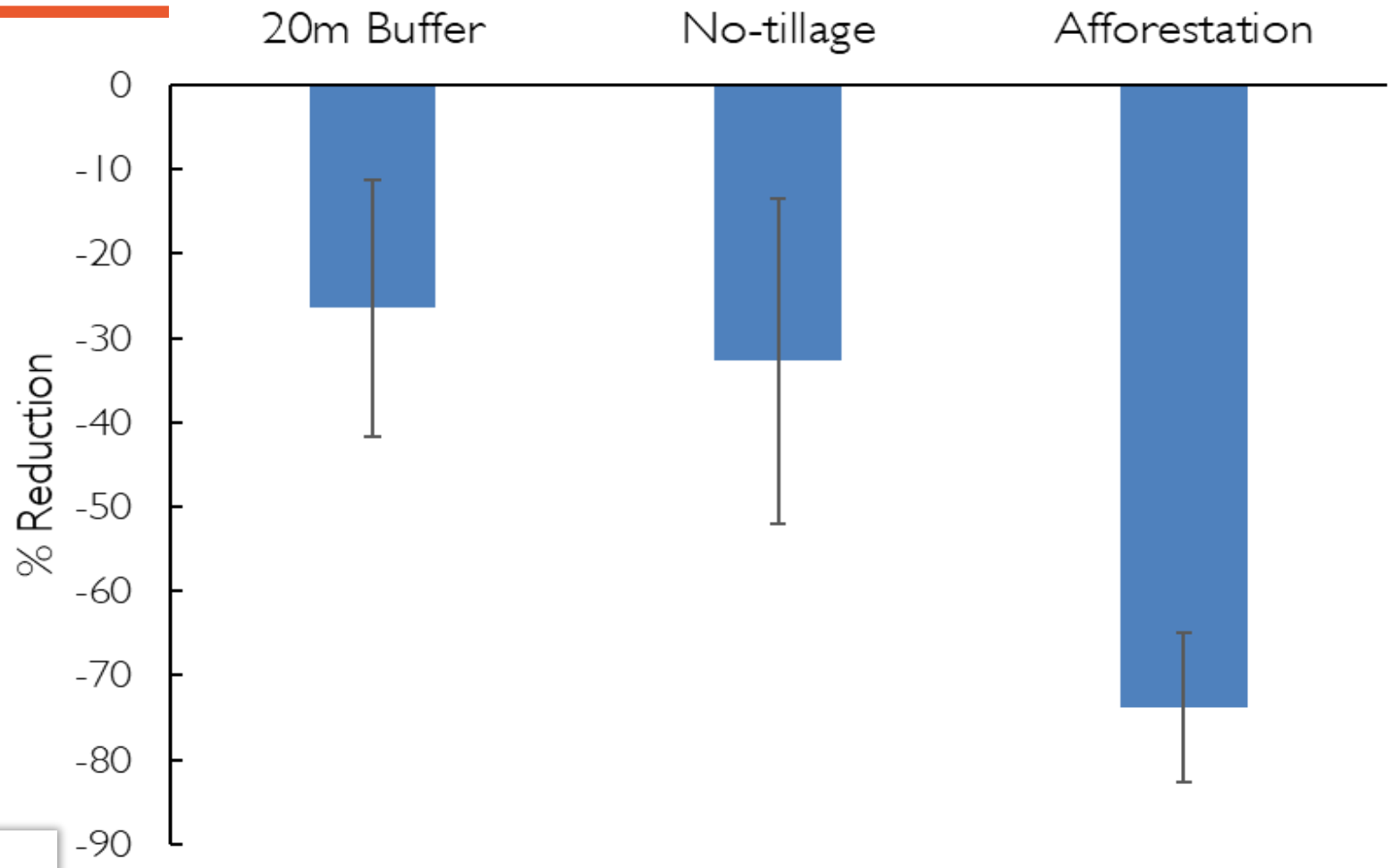
Reducing sediment loss to water



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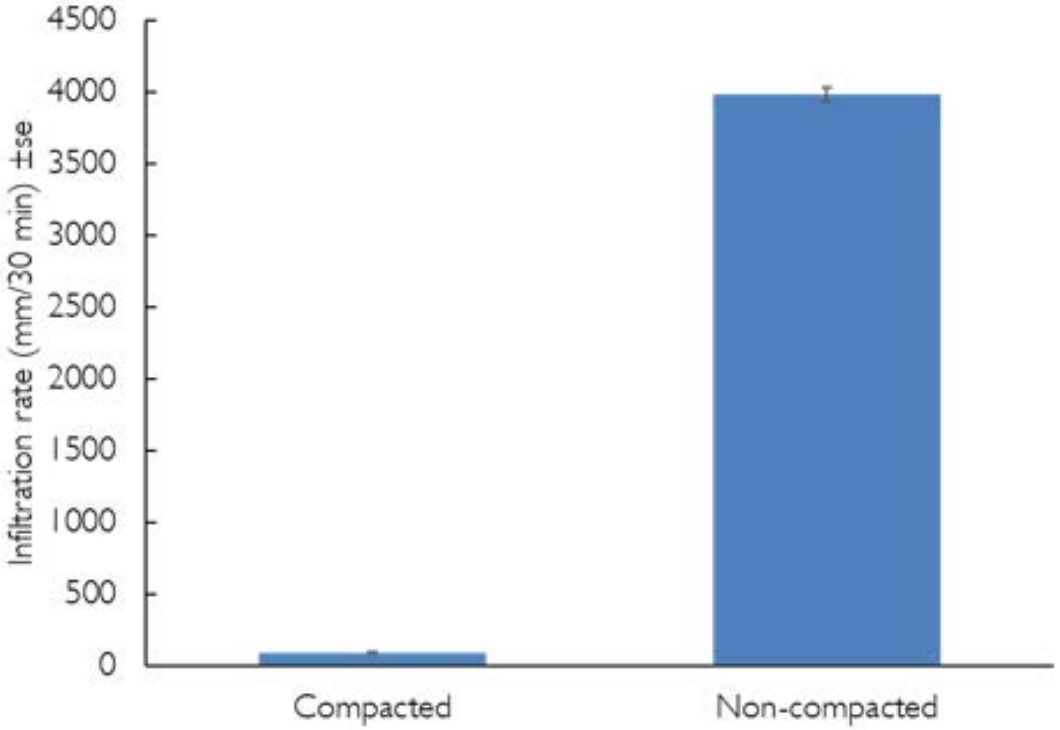
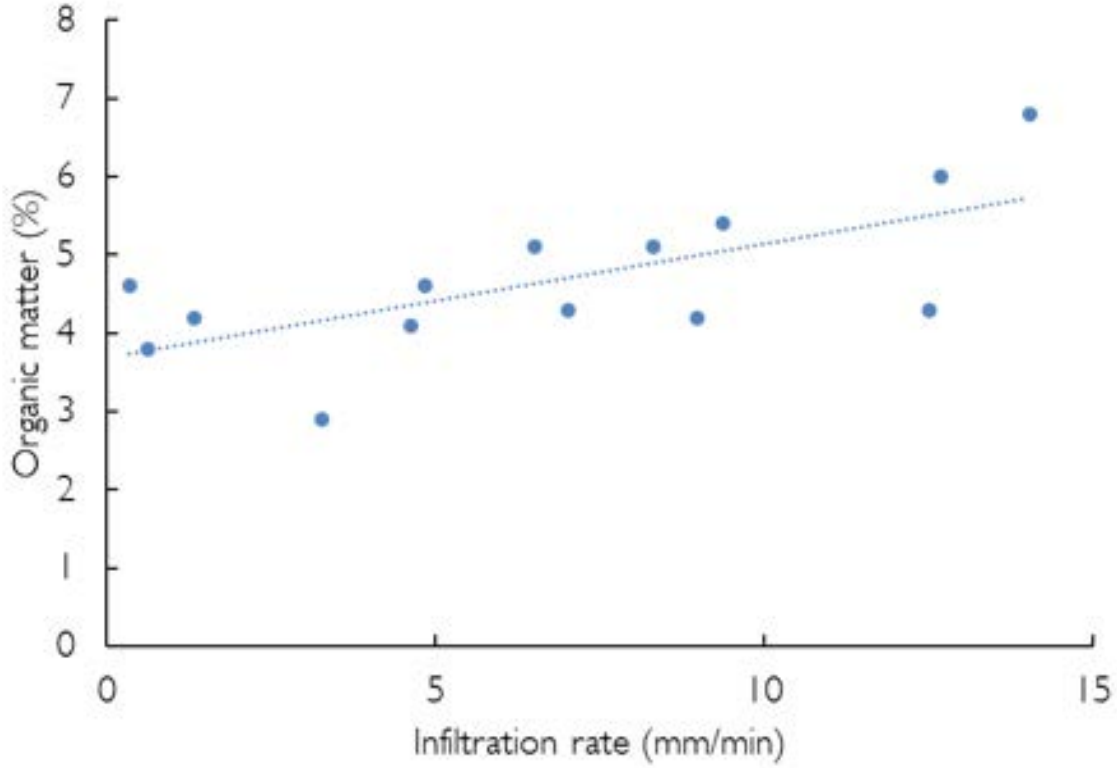
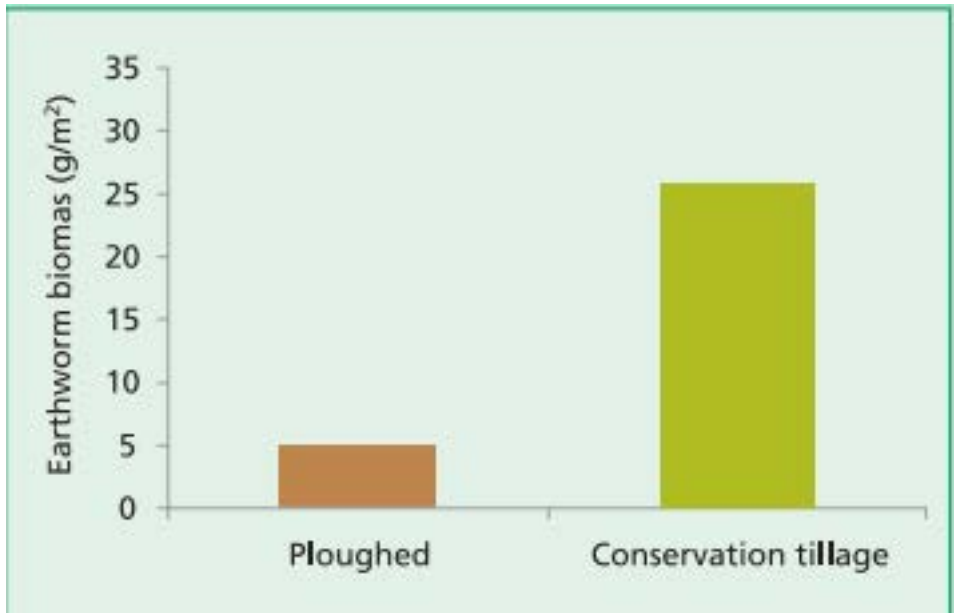
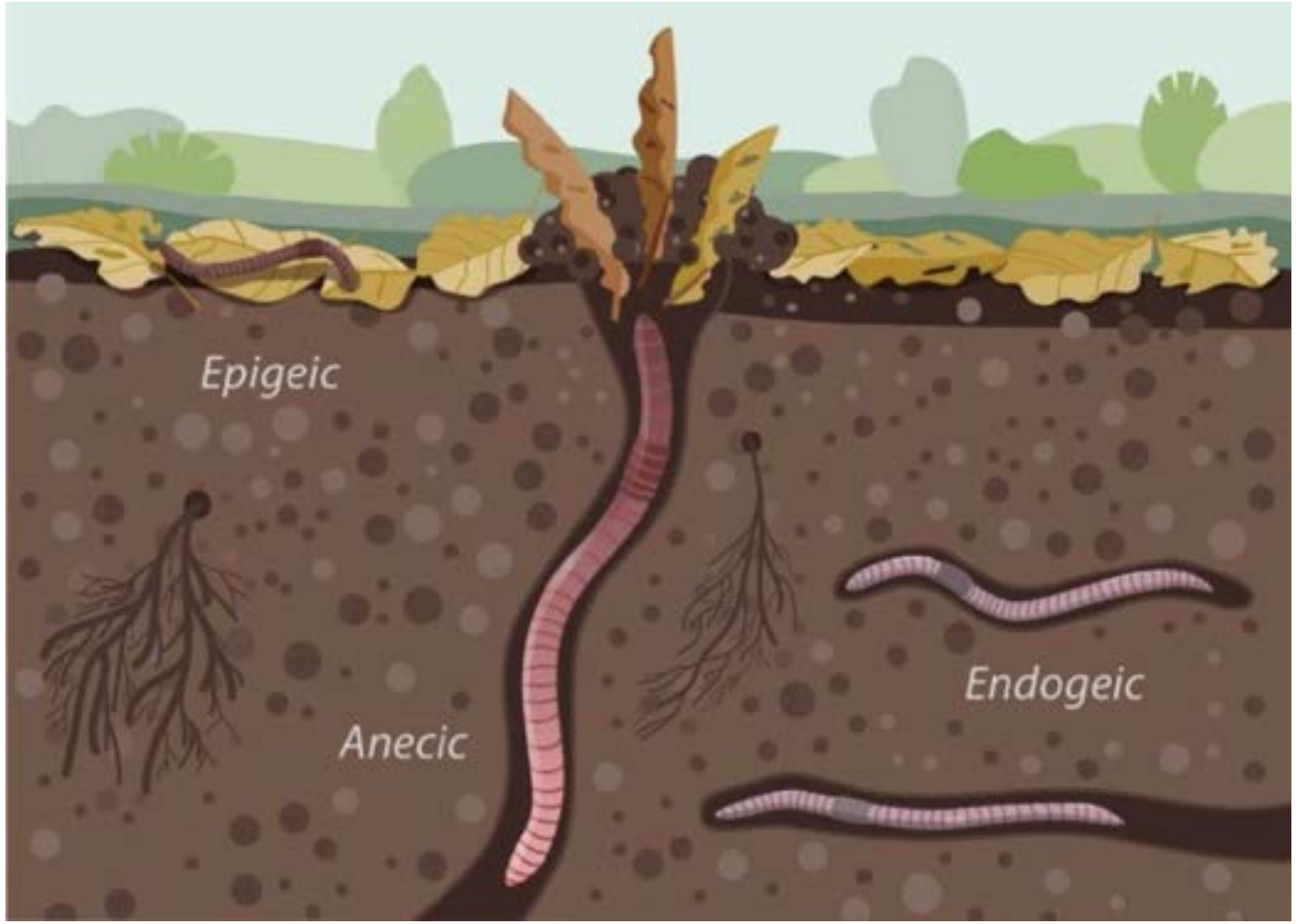
Organic matter & infiltration





Earthworms & tillage





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1% increase in SOM = 200,000l (200t) water/ha!

- Approx. 1,500m³ soil/ha (depth 6in)
- 1500 x bulk density of 1330kg/m³ = approx. 2,000 tonnes soil/ha
- If 1ha soil = 2,000t then 1% OM = 20t/ha
- If OM holds 10x its weight in water = extra 200t water/ha

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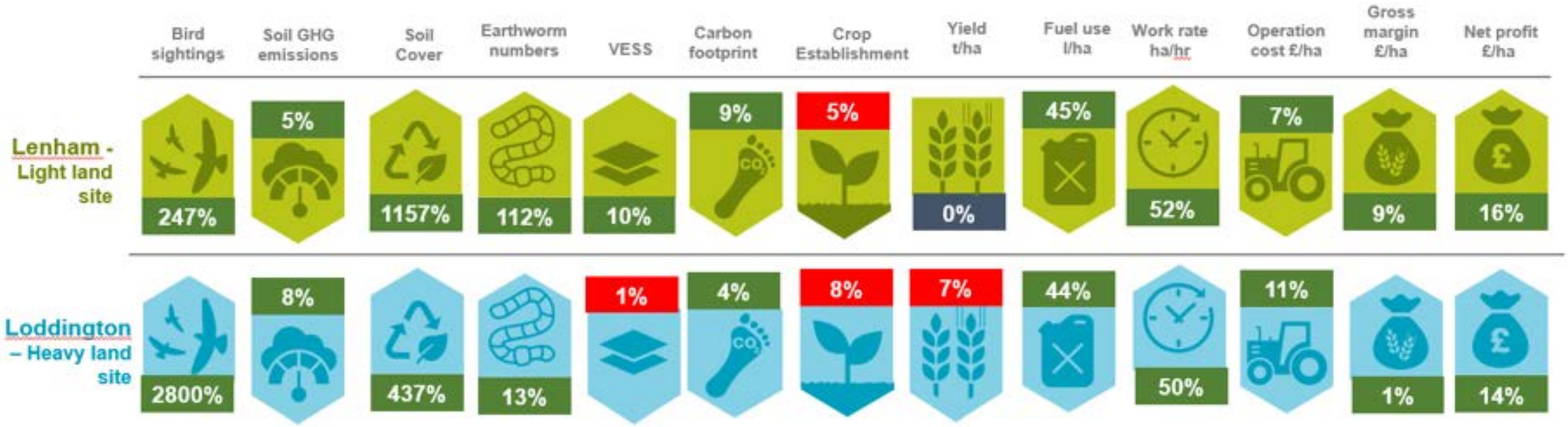
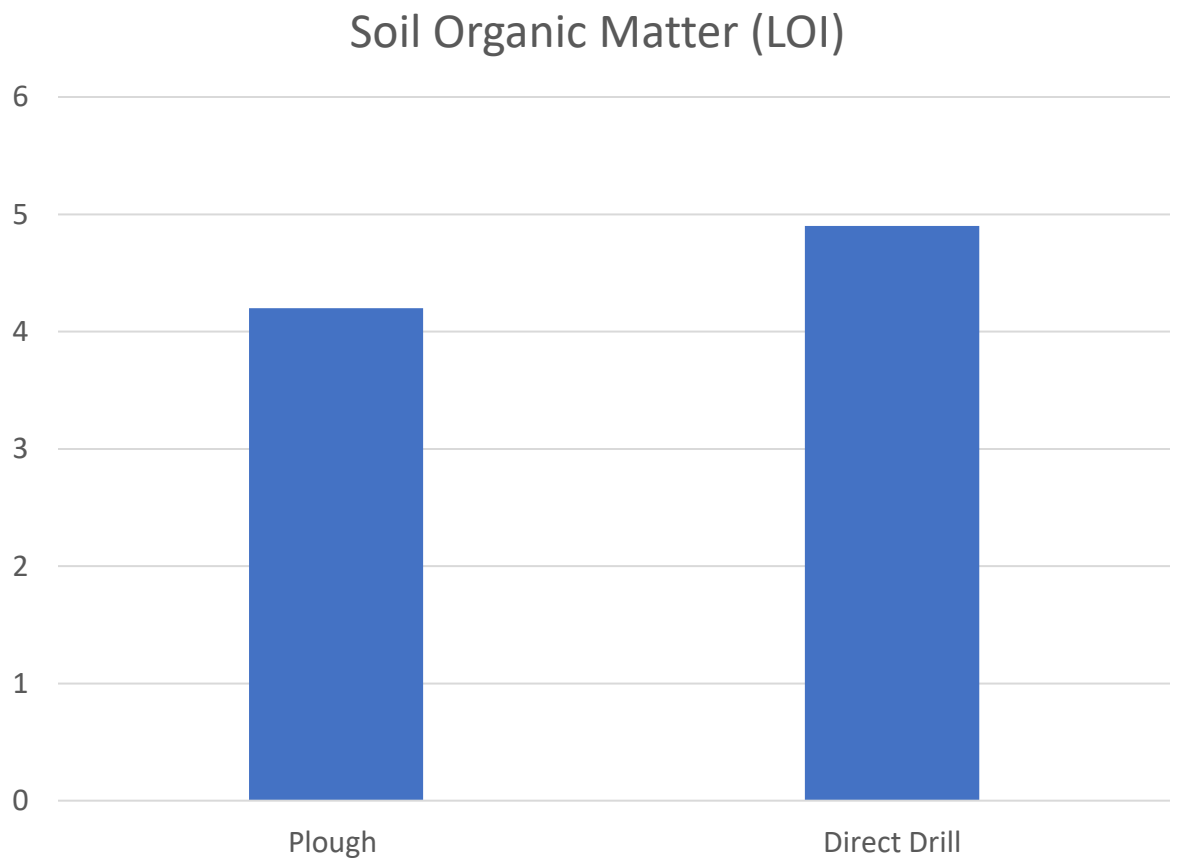
‘Conservation’ Agriculture: 5-year results



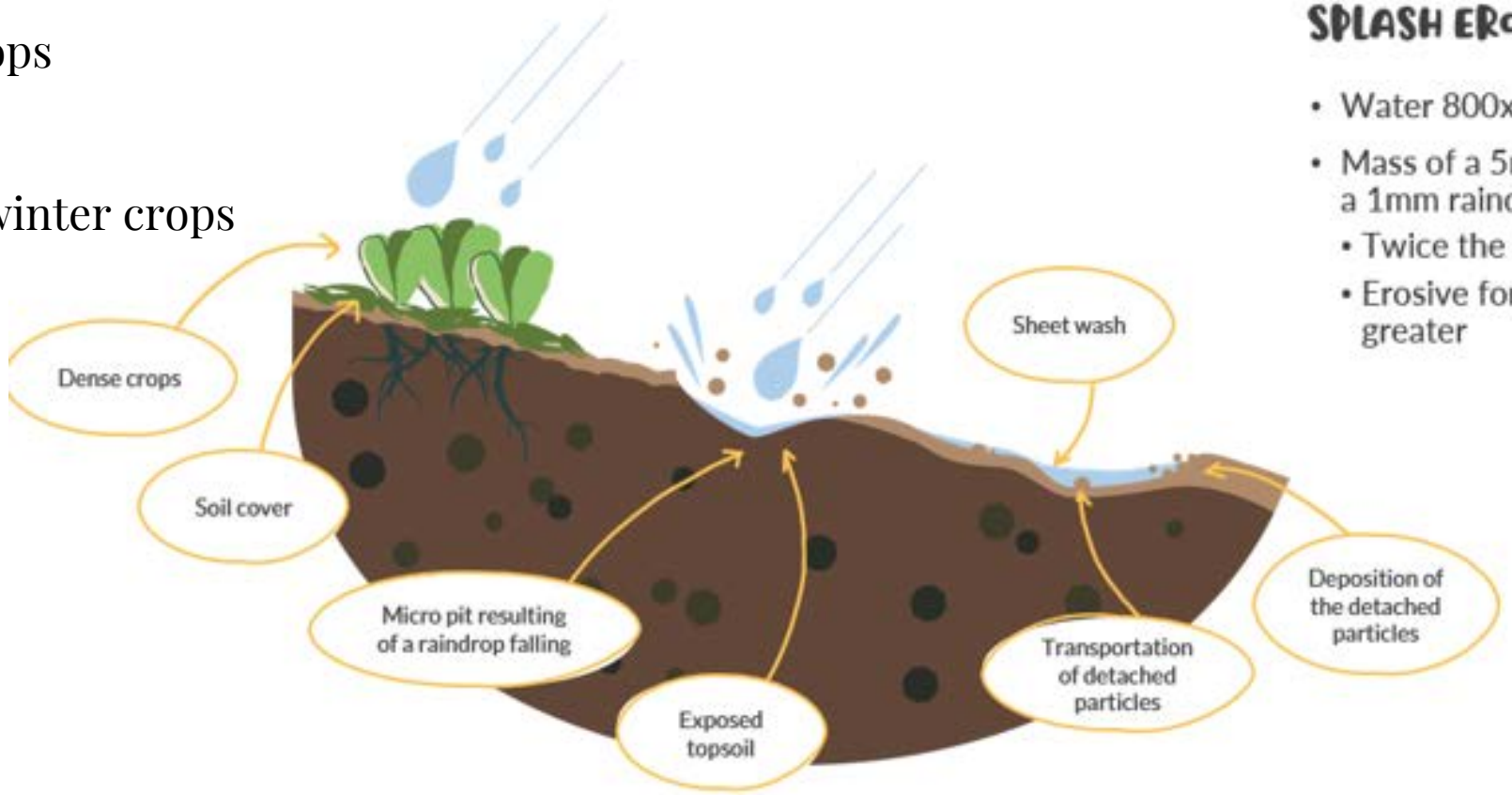
SOM (long-term direct drill vs plough)



The importance of soil cover

‘Soil armour’

- Cover/catch crops
- Crop residues
- Mulches
- Earlier drilled winter crops



SPLASH EROSION

- Water 800x heavier than air
- Mass of a 5mm raindrop 125x that of a 1mm raindrop
  - Twice the terminal speed
  - Erosive force on impact 500x greater

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Soil armour

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Buffers & barriers

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Tramline management

Table 2: Results of mitigation trials at Old Hattons (OH) and at Rosemaund (RM) for the second winter of monitoring. Data are aggregate over-winter yields. NT = no tramline, T = tramline, DT = disrupted tramline, OT = offset tramline

Treatment	Runoff (m^3 ha^{-1})		SS (kg ha^{-1})		TP (kg ha^{-1})	
	OH	RM	OH	RM	OH	RM
NT	27	20	24	21	0.1	0.0
T	153	778	275	4776	0.8	2.9
DT	50	27	72	40	0.2	0.0

- (SS = suspended sediment, TP = phosphate)
- Contour tramlines
- Reduce tillage/more soil residue
- Loosen/disrupt with tines
- Surface residue
- Use GPS/CTF
- Low ground pressure tyres
- Utilise in-field buffers & field margins
- Sediment traps

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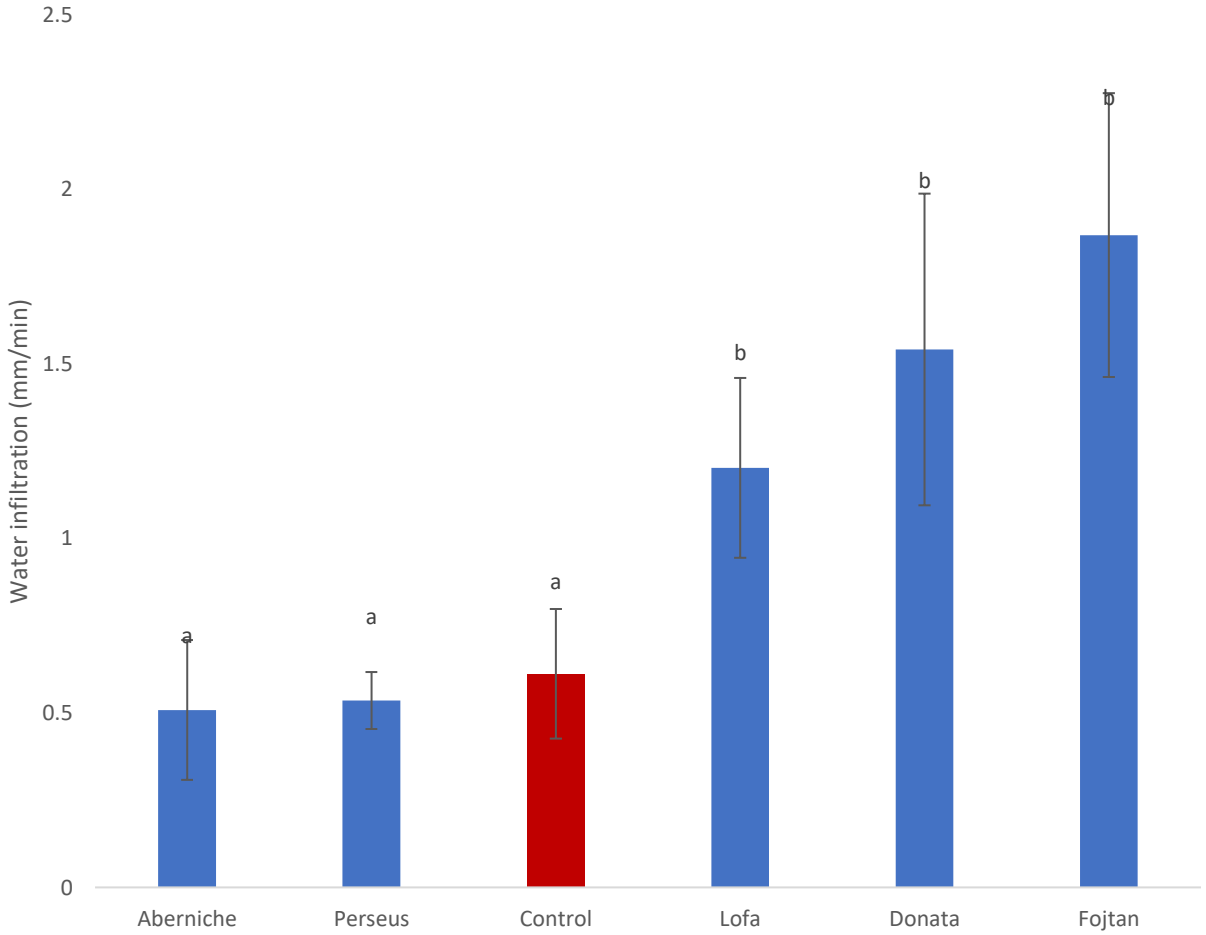
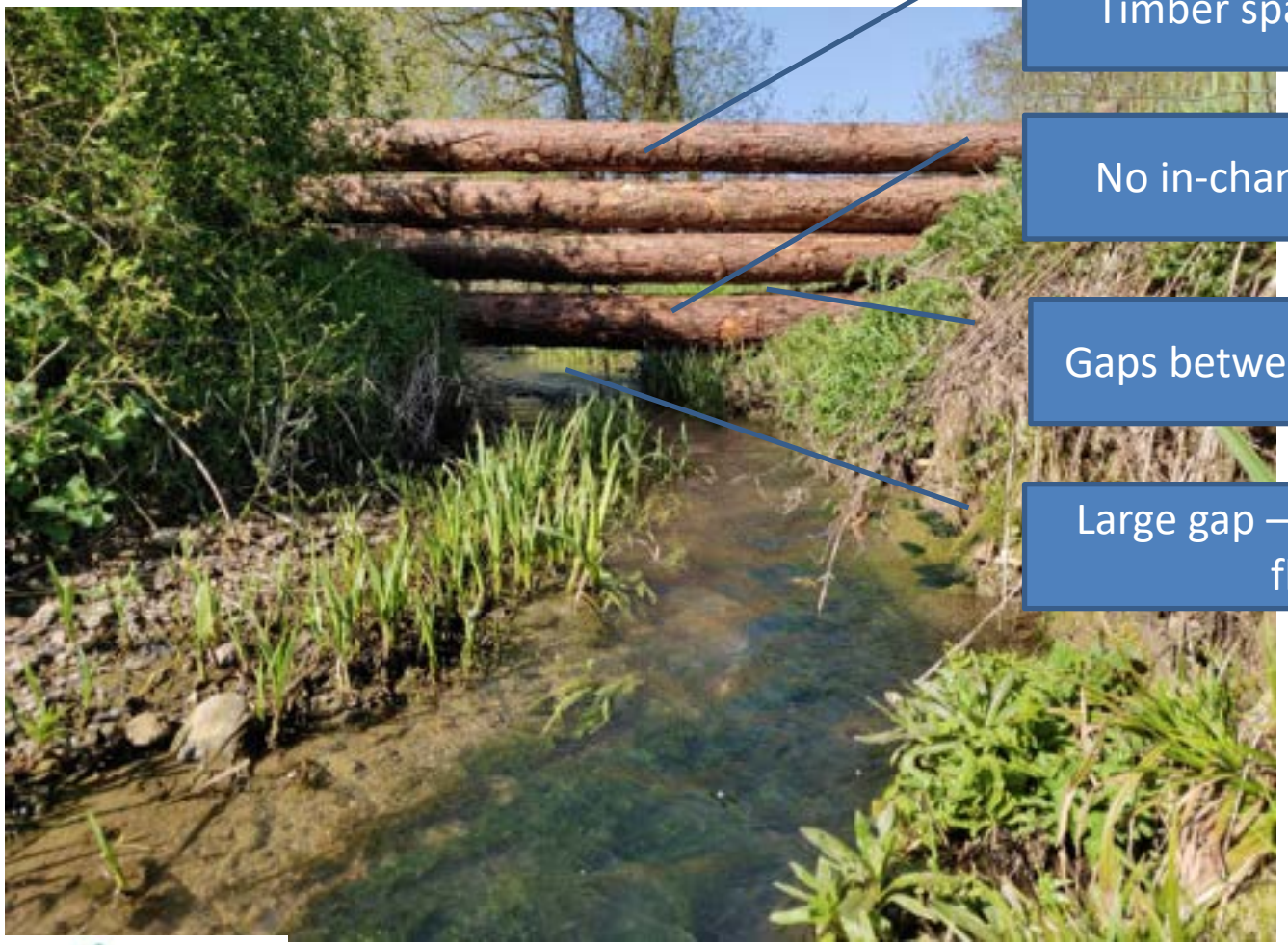
Deep rooting grasses

- Festuloliums & cocksfoot vs ryegrass/clover control
- Festulolium - a natural hybridisation of ryegrass & fescue species, combining the stress resistant genes of fescue with the bulky yield of ryegrass
- Good results in Y1
- Y2 & Y3 – much less difference, probably due to compaction & excessive grazing/cutting
- Sympathetic management required
- Soil organic matter/carbon



Leaky dams



Timber spans channel width

No in-channel support posts

Gaps between lengths of timber

Large gap – above winter base flow level

Freshwater Habitats Trust

University of York

Game & Wildlife Conservation Trust

Thank you & questions?

www.allertontrust.org.uk

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The Rt Hon Lord Richard Benyon

The Rt Hon Lord Benyon was appointed Minister of State at the Department for Environment, Food and Rural Affairs in 2022. (He was previously Parliamentary Under Secretary of State at Defra).

Richard was educated at Bradfield College and the Royal Agricultural College, Cirencester.

Outside of politics, Richard served with the Royal Green Jackets from 1980 to 1985. He is also qualified as a chartered surveyor and ran a business which included farming, forestry and the management of rural and urban housing.

Andrew Meredith

Farmers Weekly Editor

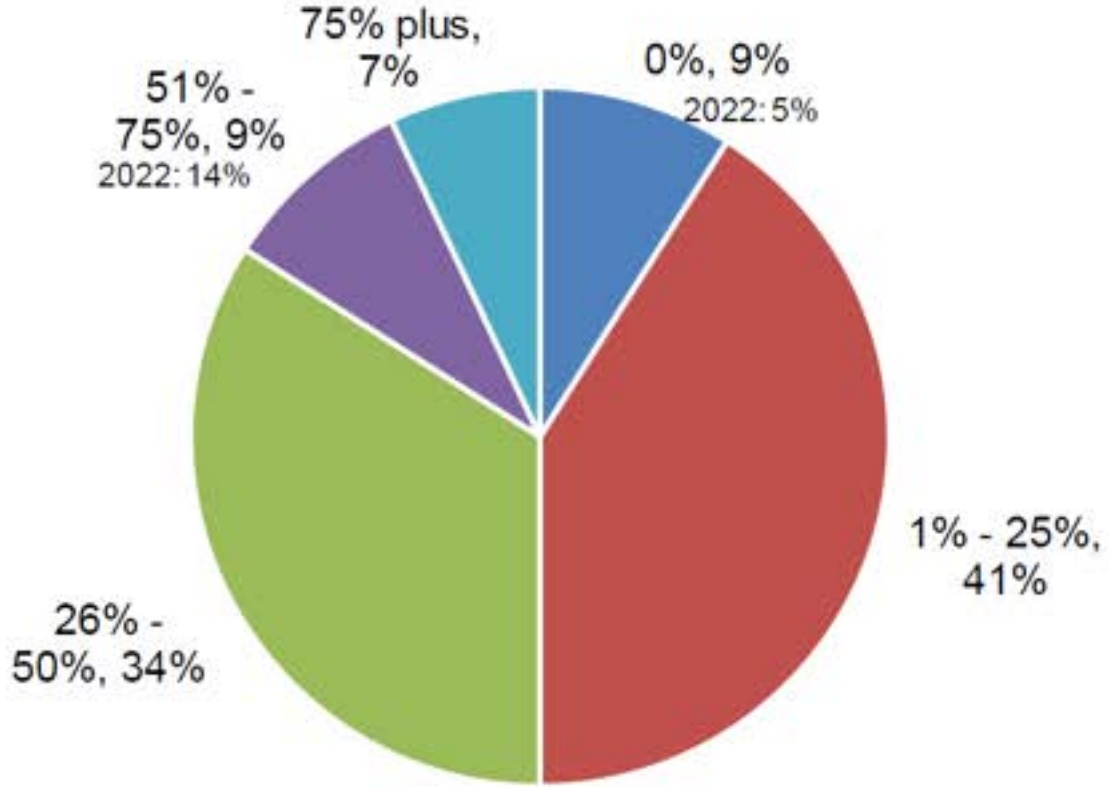
Future of Farm Payments Research 2023

FARMERS WEEKLY

TRANSITION

Macleod Research

The average Basic Payment Scheme payment drops this year to under 30%



Average

Overall		29.3% (2022 31.7%,2021: 36.0%)
		30.0% (2022 31.3%, 2021: 35.8%)
	*	27.4% (2022 37.3%, 2021: 34.3%)
	*	24.0% (2022 23.8%, 2021: 36.7%)

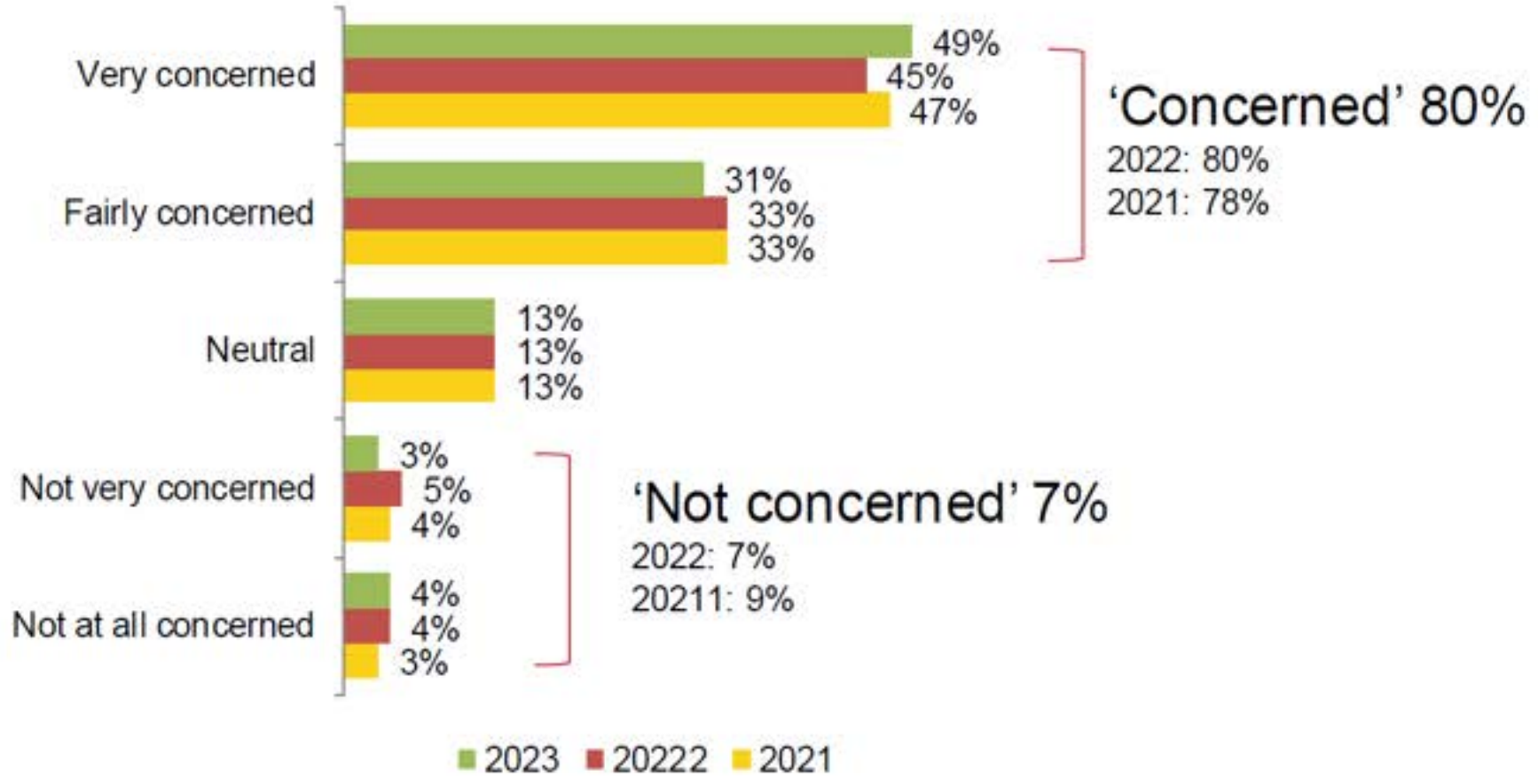
Q *In the last year, what percentage of your farm income did the Basic Payment Scheme payment make up?*

Base: All respondents answering (518)
* Base size low. Exercise care in analysis

4 in 5 remain concerned about replacing the lost income, although 1 in 8 remain neutral about it

FARMERS WEEKLY

TRANSITION



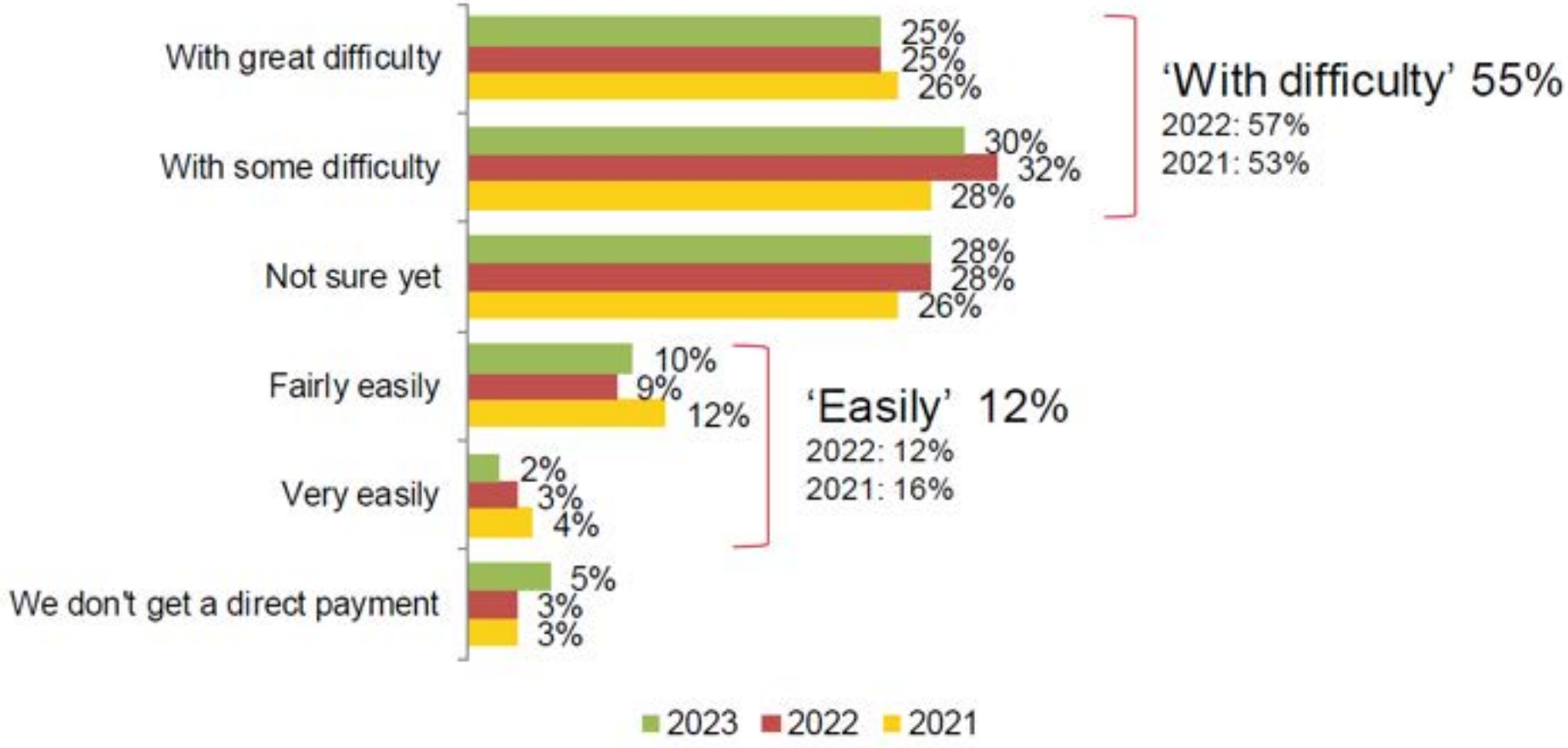
Base: All respondents answering in England (421)

Q *How concerned are you about replacing the lost income?*

Seven in eight have no clear idea how their farm business will survive without the direct payment

FARMERS WEEKLY

TRANSITION



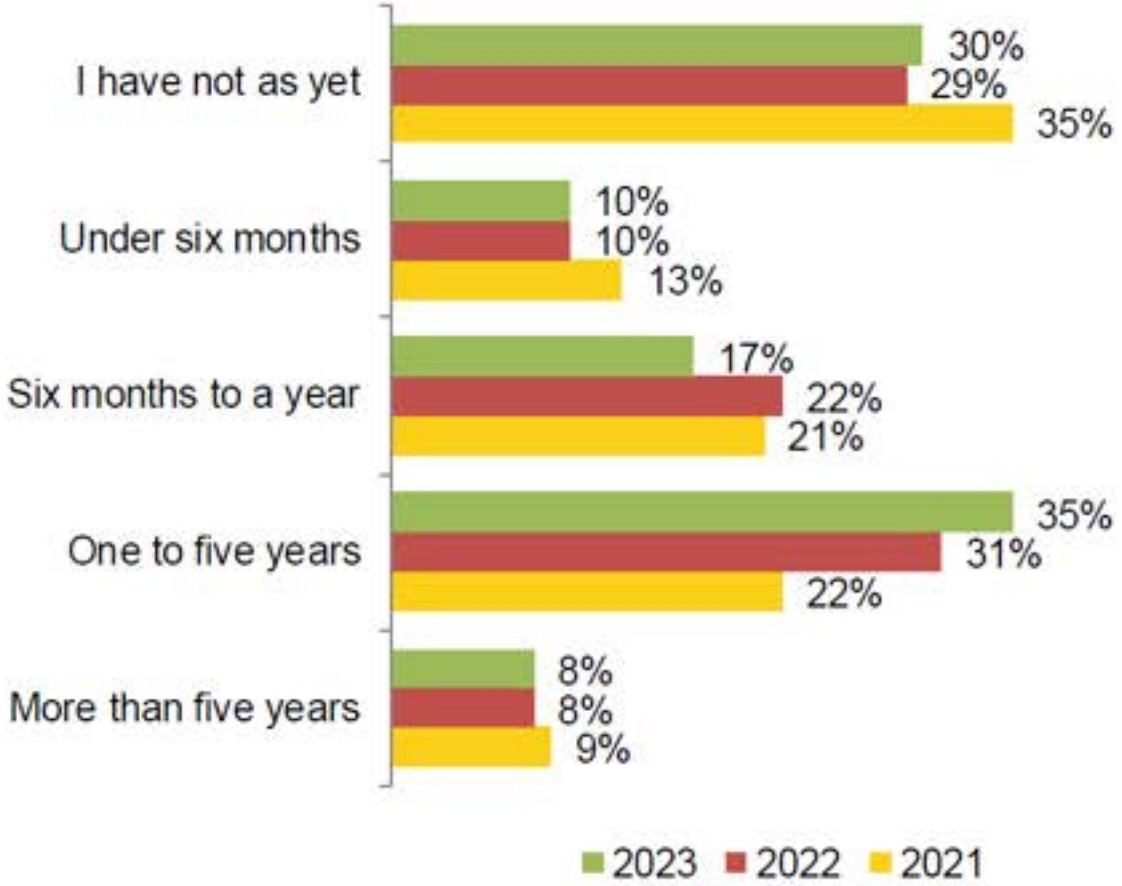
Base: All respondents answering in England (418)

Q *How will or would your business be able to survive* without *the direct payment?*

Seven in ten have started preparing for life without the Basic Payment **(ALL REGIONS RESPONDING)**

FARMERS WEEKLY

TRANSITION



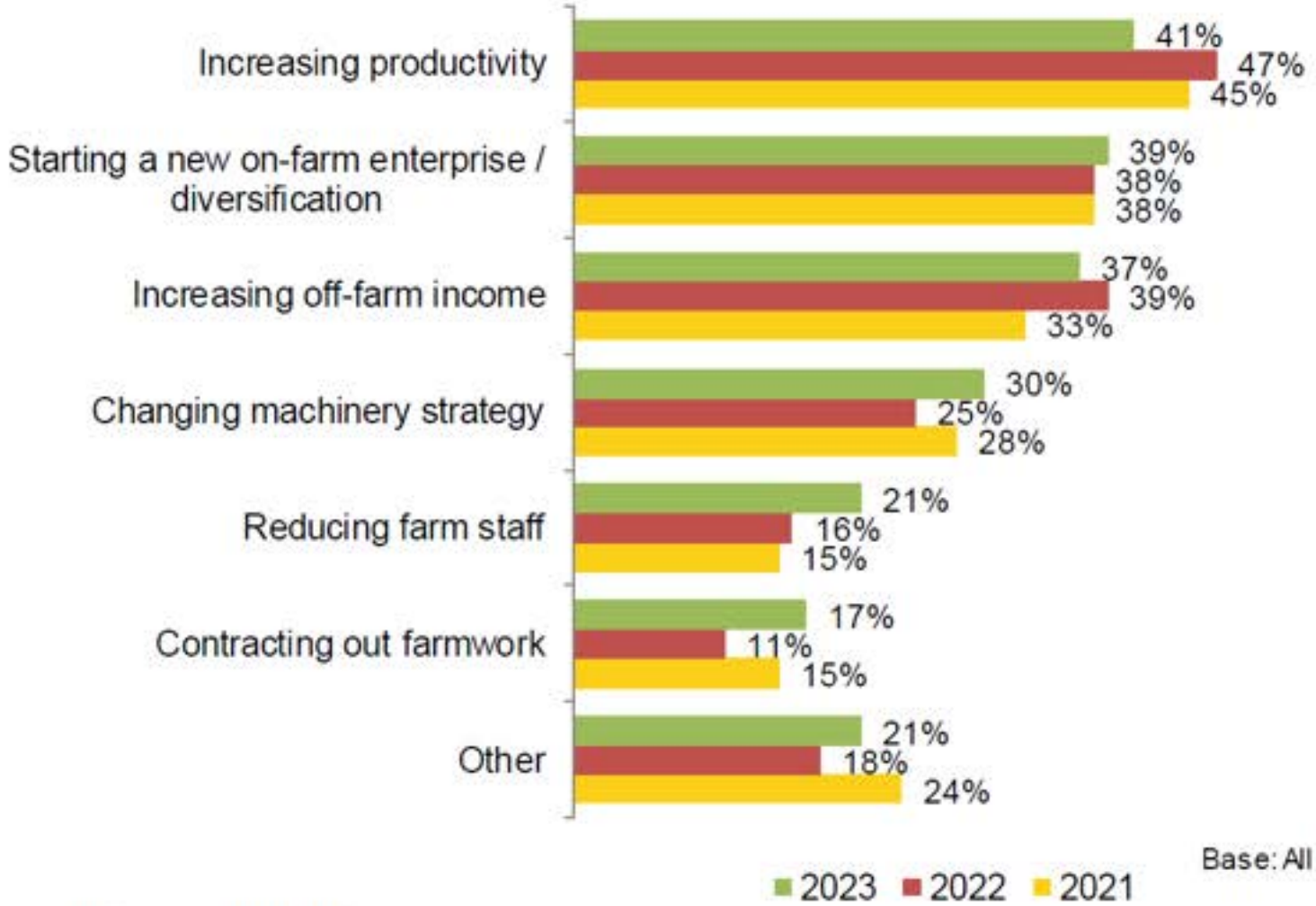
Q *How long have you been preparing your farm business for life without the Basic Payment?*

Base: All respondents answering (505)

Those who are preparing continue to most likely be increasing productivity although fewer are doing so since last year

FARMERS WEEKLY

TRANSITION



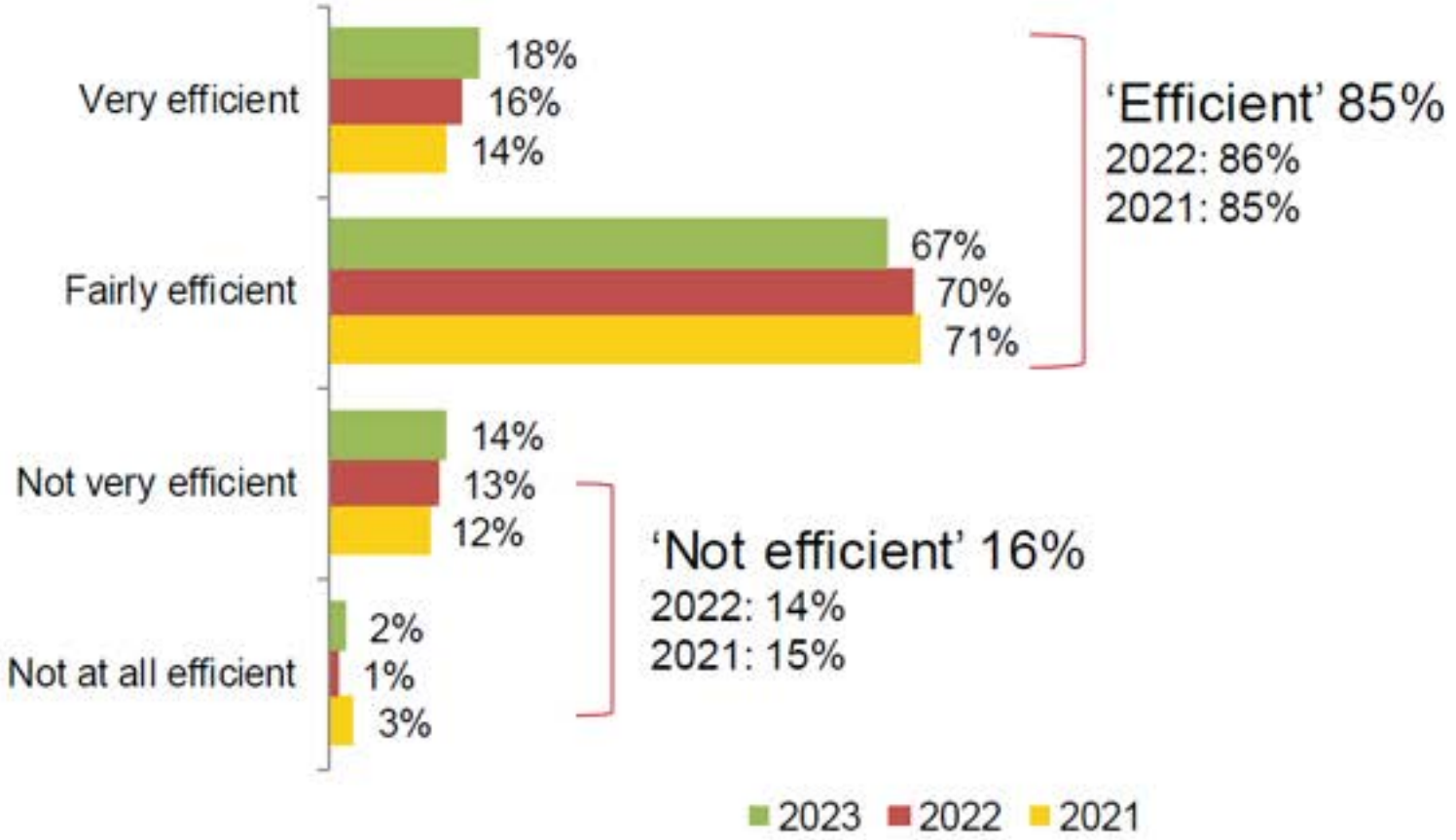
Base: All respondents answering who have been preparing (345)

Q *How have you been preparing?*

Over two-thirds believe their farm is 'fairly efficient'

FARMERS WEEKLY

TRANSITION



Efficient (net score)

Overall	85%	(2022 86%, 2021: 85%)
	85%	(2022 85%, 2021: 87%)
*	82%	(2022 95%, 2021: 87%)
*	84%	(2022 87%, 2021: 73%)

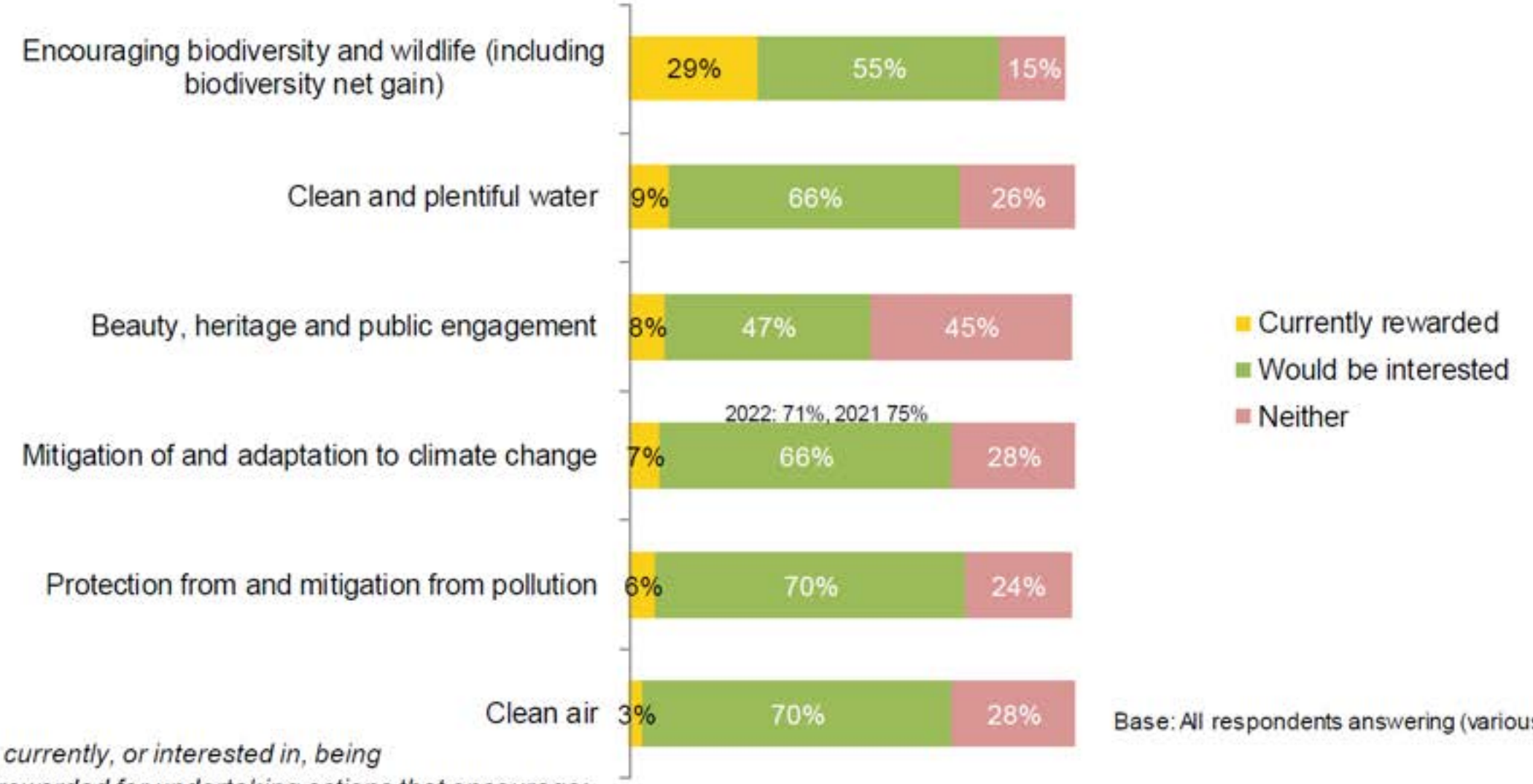
Base: All respondents answering (467)
* Base size low. Exercise care in analysis
** Base very low. Treat qualitatively only

Q *In your opinion, how efficient is your farm?*

Respondents are most interested in being rewarded for clean air, and protection from pollution

FARMERS WEEKLY

TRANSITION



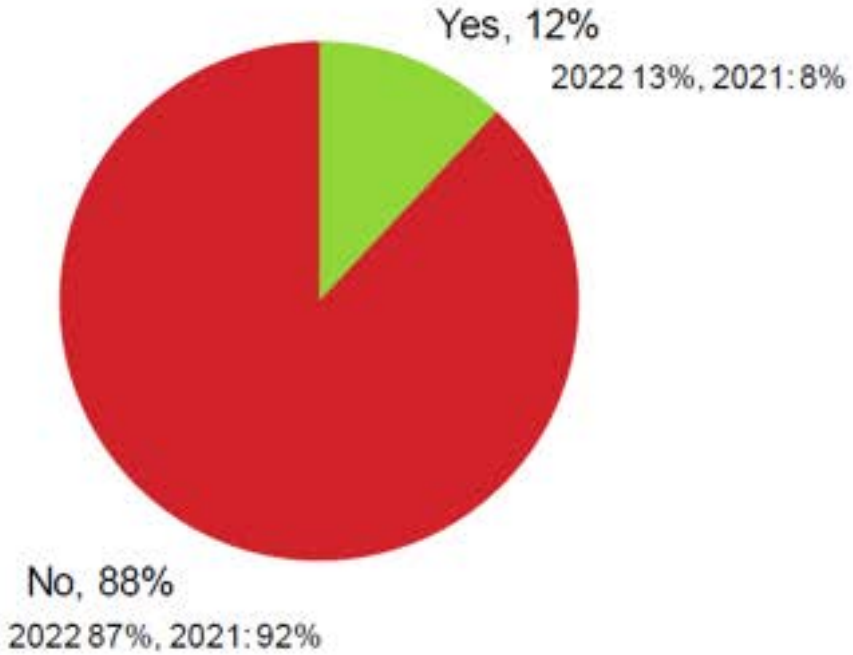
Base: All respondents answering (various 432 - 437)

Q *Are you currently, or interested in, being financially rewarded for undertaking actions that encourage:*

Fewer than one in ten have the information they need from the government on future support measures

FARMERS WEEKLY

TRANSITION



Not enough information

Overall	88%	(2022 92%, 2021: 92%)
	87%	(2022 92%, 2021: 92%)
*	93%	(2022 95%, 2021: 95%)
*	97%	(2022 95%, 2021: 95%)

Q *Farm support in future will be increasingly designed to encourage farmers to undertake environmental measures, increase public access to the countryside and boost productivity.*

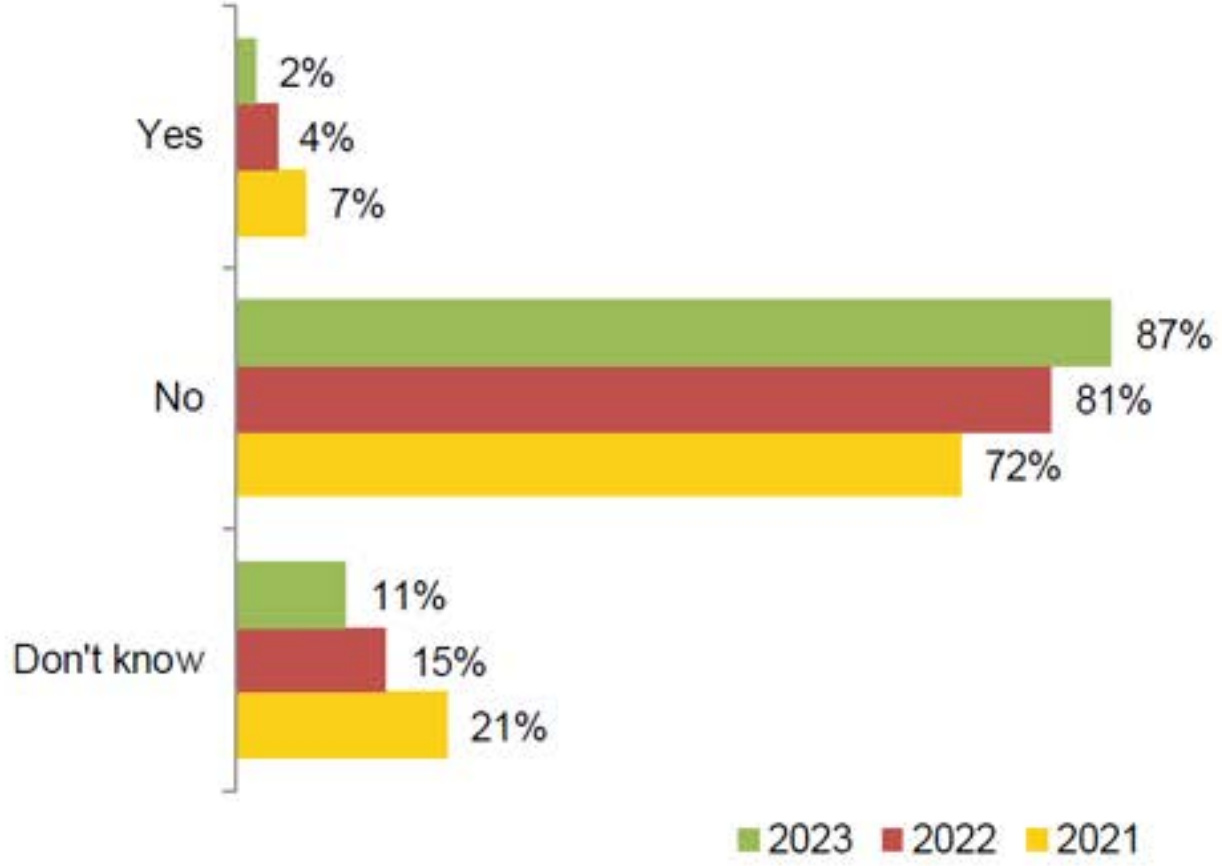
Thinking about the UK country in which you farm (England, Wales, Scotland, Northern Ireland), do you have enough information from your government on future support measures?

Base: All respondents answering (444)
* Base size low. Exercise care in analysis
** Base very low. Treat qualitatively only

Almost nine in ten are not happy with their government's long-term vision for farming

FARMERS WEEKLY

TRANSITION



Happy with government's long-term vision

Overall	2%	(2022 4%, 2021: 7%)
	2%	(2022 10%, 2021: 7%)
*	4%	(2022 7%, 2021: 3%)
*	0%	(2022 0%, 2021: 5%)

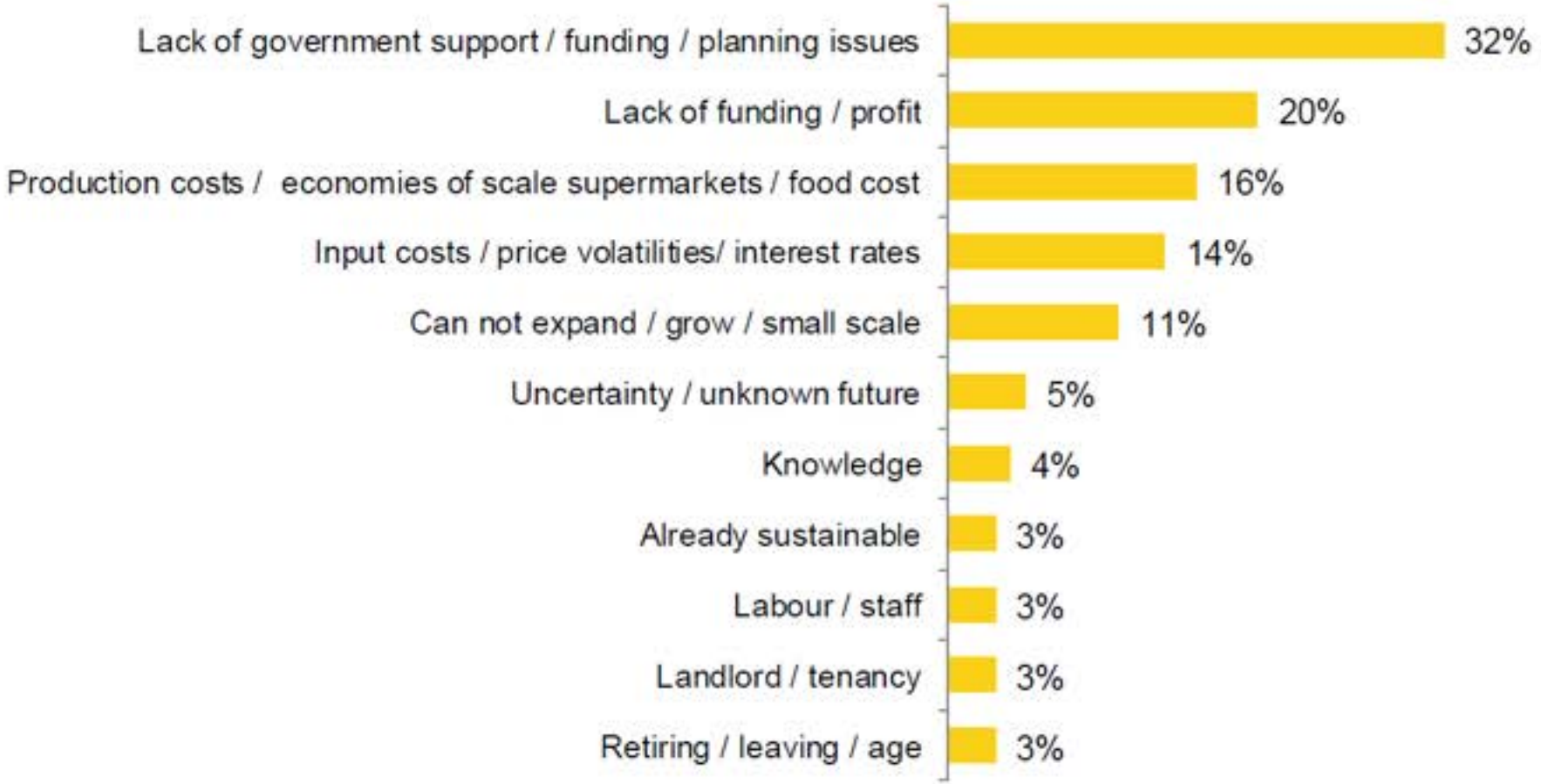
Q *Again, thinking about the UK country in which you farm, are you happy with your government's long-term vision for farming?*

Base: All respondents answering (432)
* Base size low. Exercise care in analysis
** Base very low. Treat qualitatively only

Respondents struggle with a lack of support & funding / profit, the rising cost of production driven by input costs whilst the cost of food is held back

FARMERS WEEKLY

TRANSITION



Q *In your opinion, what is the biggest hurdle preventing your farm business becoming more sustainable? (please type in)*

Base: All respondents answering (367)

Concluding thoughts

FARMERS WEEKLY TRANSITION

- Farmer numbers are going to drop – perhaps sharply by 2030 – presenting threats and opportunities
- Three groups in terms of attitude to new schemes
  - Hardcore opposers
  - Watch and waiters
  - Early adopters
- Defra say over 14,000 expressions of interest in SFI: A big swing into environmental schemes will threaten tenanted sector
- Key barriers to rapid change are electioneering, Tory U-Turns and desire to slash borrowing
- Key thoughts heading into the general election
  - No business in any UK nation should feel confident area payments will remain
  - Rural vote is up for grabs but impact can be easily overstated
  - Anger finds unexpected ways of manifesting itself

Peter Illman

Tesco's Sustainable Farming Manager

Tesco Agri-innovation.

Peter Illman
Tesco Sustainable Agriculture Manager

The challenge.

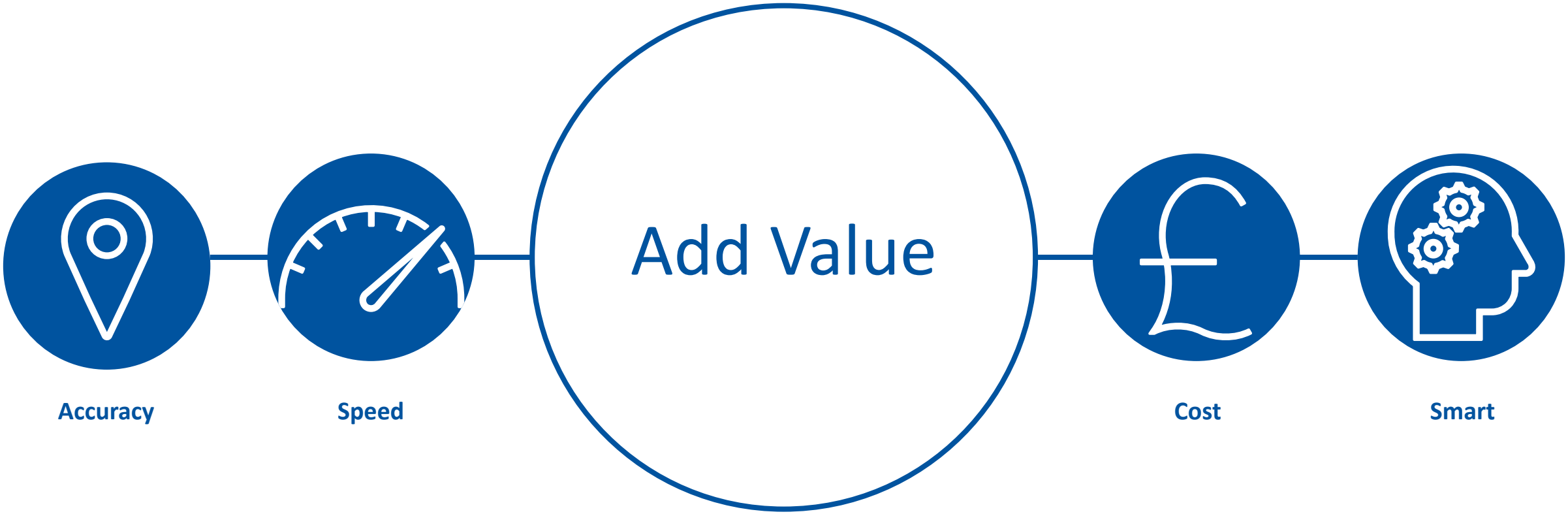
Climate

Feed people

Nature

TESCO

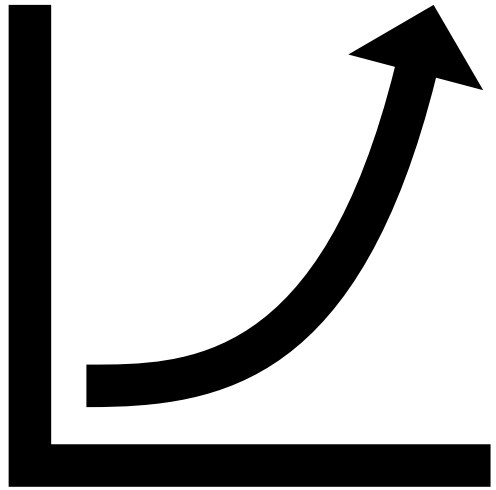
The role for innovation.



How do we deliver a pipeline?

Search and find

Test and trial



Scale up

TESCO

T-Jam.

NATURE METRICS

Number of start-ups

>600

YARD STICK Soil Carbon Revealed

Number of years

6

PROTIOMIX

Number of countries

40

TESCO

Through the funnel

TSFGs

SSFF

Total supply base

Examples from sectors

1

Beef & Lamb

2

Dairy

3

Produce

Low Carbon Fertiliser.

Suppliers/ growers

Stourgarden.

G's Naturally Fresh

HUNTAPAC

THClements
growing with confidence

BRANSTON

POLY4

R-leaf

VEOLIA

CCm

PHOS CYCLE

JSE-Systems Ltd
Johnson's Soil Eco-Systems

YARA

NouriSol
Harnessing Nature to Grow Crops

Forward plans

- Expand in fresh produce
- Explore new sectors
- Share learnings
- Support capacity building

TESCO

Innovation funds.

1

Agrisound

2

Farm Carbon Toolkit

Farm Carbon Toolkit

3

CCm

CCM

4

Future by insects

TESCO

Horizon scan

Soil health/ soil carbon

STENON

ecometric.

TESCO

Biodiversity

NATURE METRICS

BeeHero
Pollinate & Prosper

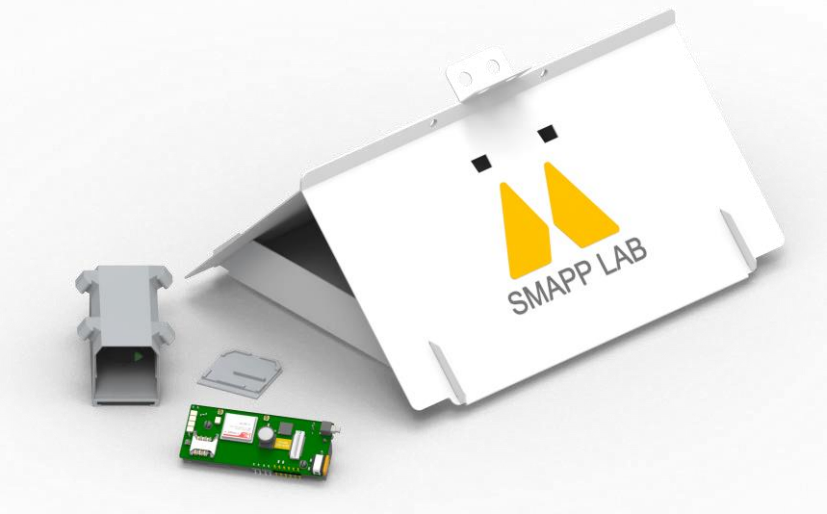
Sabbio

TESCO

Insect pests

BigSis™
WORKING WITH MOTHER NATURE

PheroSyn



GreenLight
BIOSCIENCES™

TESCO

Disease

TESCO

Precision application

Bilberry

ecorobotix

TESCO

Weed control

WeedOUT

Rootwave
Earth rover

TESCO

Automated operations

TESCO

Automated harvesting

FMS/ platforms/ digital farming

Agritask

Cropin®

XFARM TECHNOLOGIES

DigiFarm

AGRIVI

Mantle Labs

deepplanet

TESCO

Thank you.

TESCO

Samantha Charlton

Head of Engagement AHDB

Professor John Gilliland OBE

Special Adviser to the AHDB

Tomorrow's Farming Today

A Practitioner's view of the journey towards Net Zero & Beyond

Prof. John Gilliland OBE

Professor of Practice, Queens University Belfast; Chair, ARC Zero

Environment Advisor, AHDB

1st November, 2023

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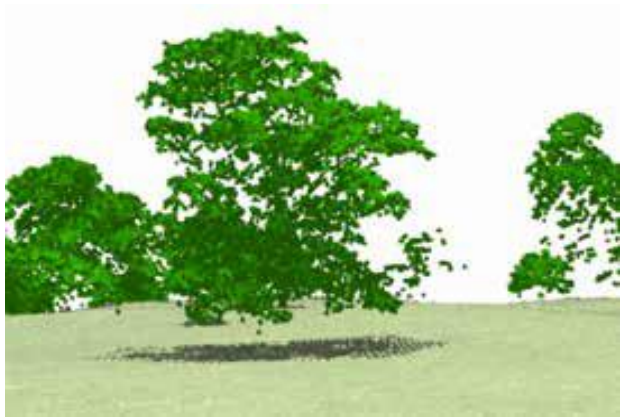
ARCZero

AHDB

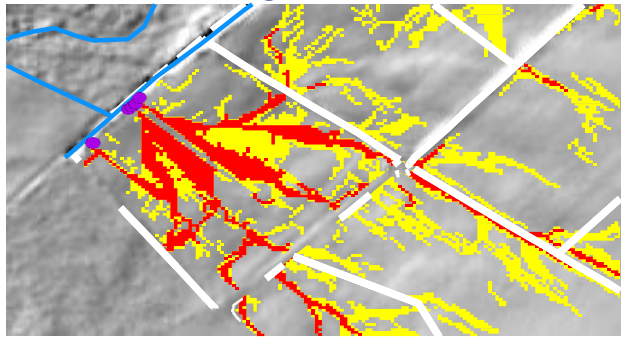
Delivering Multiple Public Goods - Not Single Agendas

Producing Nutritious Food & Tackling Malnutrition

Delivering Soil Improvement Both Fertility & Health



Accelerating Carbon Sequestration, Both Above & Below Ground



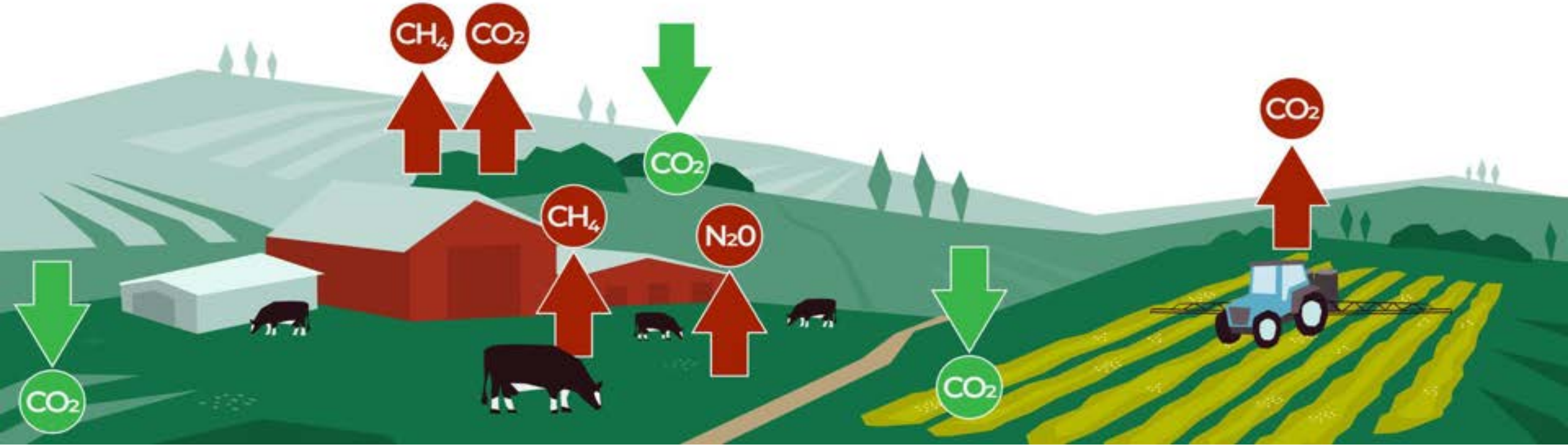
Improving Water Quality by Reducing Over Land Flow

Optimising Biodiversity, Especially Below Ground

Generating Profits

Net Zero Definition: 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……

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So How Do We Move Farming Towards Net Zero?

- Measure & Manage….. Using Life Cycle Assessment Calculators (LCA)
- LCA "Factors," Emissions now to TIER 2 (A National Average)
  Sequestration only at TIER 1 (An International Average)
- Ideally, we need both to be at TIER 3 (Actual on farm data)

But…..

So How Do We Move Farming Towards Net Zero?

- Measure & Manage….. Using Life Cycle Assessment Calculators (LCA)
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But….. The challenge of selecting an appropriate soil organic carbon simulation model: A comprehensive global review and validation assessment

Agata Garsia | Antoine Moinet | Carmen Vazquez | Rachel E. Creamer | Gabriel Y. K. Moinet

WUR, June 2023

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ACCELERATING FARMING TOWARDS CARBON NEUTRALITY

Delivering at the Farm Level

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 Driving Excellence & Innovation
BIRNIE CONSULTANCY
DEVENISH Beyond Nutrition
QUEEN'S UNIVERSITY BELFAST | IGFS

ACCELERATING FARMING TOWARDS CARBON NEUTRALITY

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

Baselined & Benchmarked…..

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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 Public Goods

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ACCELERATING FARMING TOWARDS CARBON NEUTRALITY

Gross Emissions for the seven ARC Zero farms

Using agrecalc TIER 2 Emissions Module

2021 Agrecalc Analysis	Enterprises	Gross Emissions t CO2-e/yr
Ian McClelland	Dairy	1,101
Hugh Harbinson	Dairy	2,009
John Egerton	Beef & Sheep	1,475
Roger & Hilary Bell	Sheep with Beef	754
Simon Best	Arable with Beef	1,799
Patrick Casement & Trevor Butler	Beef & Sheep	492
John Gilliland	Willows with Dry Cows	151

ARCZero
ACCELERATING FARMING TOWARDS CARBON NEUTRALITY

Gross Sequestration for the seven ARC Zero farms

Using agrecalc TIER 1 Sequestration Module

2021 Agrecalc Analysis	Enterprises	Gross Sequestration t CO2-e/yr
Ian McClelland	Dairy	309
Hugh Harbinson	Dairy	549
John Egerton	Beef & Sheep	444
Roger & Hilary Bell	Sheep with Beef	456
Simon Best	Arable with Beef	738
Patrick Casement & Trevor Butler	Beef & Sheep	548
John Gilliland	Willows with Dry Cows	156

ARCZero
ACCELERATING FARMING TOWARDS CARBON NEUTRALITY

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……

agrecalc

ARCZero
ACCELERATING FARMING TOWARDS CARBON NEUTRALITY

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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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ACCELERATING FARMING TOWARDS CARBON NEUTRALITY

Carbon Sequestration – New Measuring Technologies

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

Aerial LiDAR Survey
at 40 scans per metre

Soil Sampling to one
metre deep

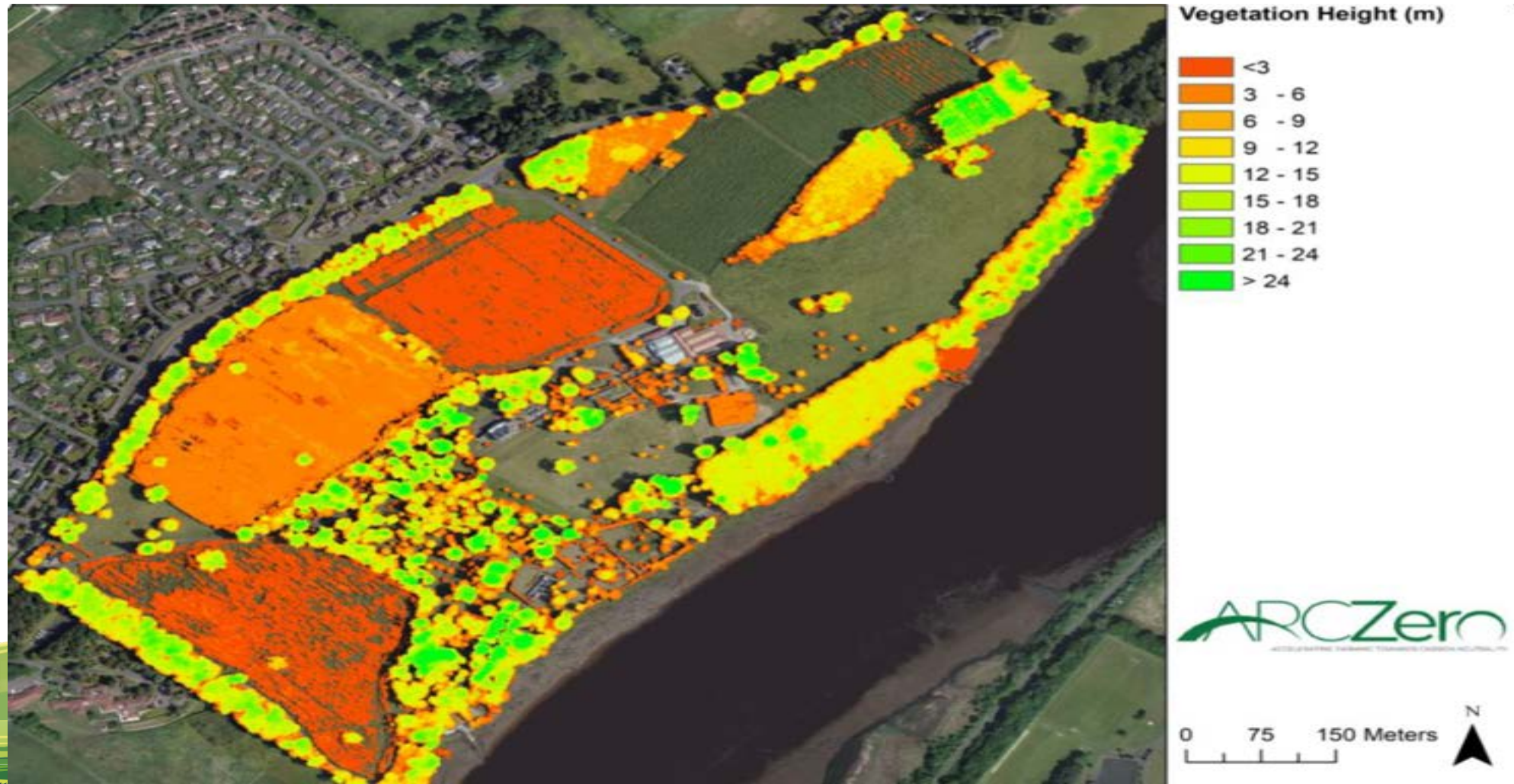
ARCZero
ACCELERATING FARMING TOWARDS CARBON NEUTRALITY

Measuring Carbon in Trees & Hedges

Using Aerial LiDAR at Brook Hall

A. Higgins 2021

afbi AGRI-FOOD & BIOSCIENCES INSTITUTE



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ACCELERATING FARMING TOWARDS CARBON NEUTRALITY

Measuring Carbon in Trees & Hedges

Using Aerial LiDAR at Brook Hall

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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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 CO2e

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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, Perhaps 540,000t? Who will reward the additional carbon stored?

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ACCELERATING FARMING TOWARDS CARBON NEUTRALITY

Empowered, ARC Zero Farmers made the following Changes

For both Mitigation & Building Carbon Stocks…

- Improving efficiency – genetics, age of slaughter, cow size, animal health
- Improving Soil pH – improving nutrient uptake & growth of clover
- Increasing the use of Legumes & Multi Species Pastures
- Reducing the use of Nitrogen fertiliser
- Planting trees & Hedgerow Management
- Grazing Willows

- Installing Renewables……..

ARCZero
ACCELERATING FARMING TOWARDS CARBON NEUTRALITY

The Resultant Improvements Observed over 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
- Timing of sowing legumes
- Livestock ill health

agrecalc

Reporting Methane using GWP*, as well as GWP100 Methodology

IOP Publishing Environ. Res. Lett. 18 (2023) 084014 https://doi.org/10.1088/1748-9326/ace204

ENVIRONMENTAL RESEARCH
LETTERS

LETTER

Are single global warming potential impact assessments adequate for carbon footprints of agri-food systems?

Graham A McAuliffe[1,*], John Lynch[2], Michelle Cain[3], Sarah Buckingham[4], Robert M Rees[4], Adrian L Collins[1], Myles Allen[5], Raymond Pierrehumbert[5], Michael R F Lee[6] and Taro Takahashi[1,7,8]

1 Net Zero and Resilient Farming, Rothamsted Research, North Wyke, Okehampton, Devon EX20 2SB, United Kingdom
2 Nature-based Solutions Initiative, Department of Biology, University of Oxford, Oxford OX1 3SZ, United Kingdom
3 Cranfield University, Cranfield Environment Centre, Bedfordshire MK43 0AL, United Kingdom
4 Scotland's Rural College, West Mains Road, Edinburgh EH9 3JG, United Kingdom
5 Department of Physics, University of Oxford, Oxford OX1 3PJ, United Kingdom
6 Harper Adams University, Newport, Shropshire TF10 8NB, United Kingdom
7 University of Bristol, Bristol Veterinary School, Langford, Somerset BS40 5DU, United Kingdom
8 Agri-Food and Biosciences Institute, AFBI, Large Park, Hillsborough, Belfast, Northern Ireland BT26 6DR, United Kingdom

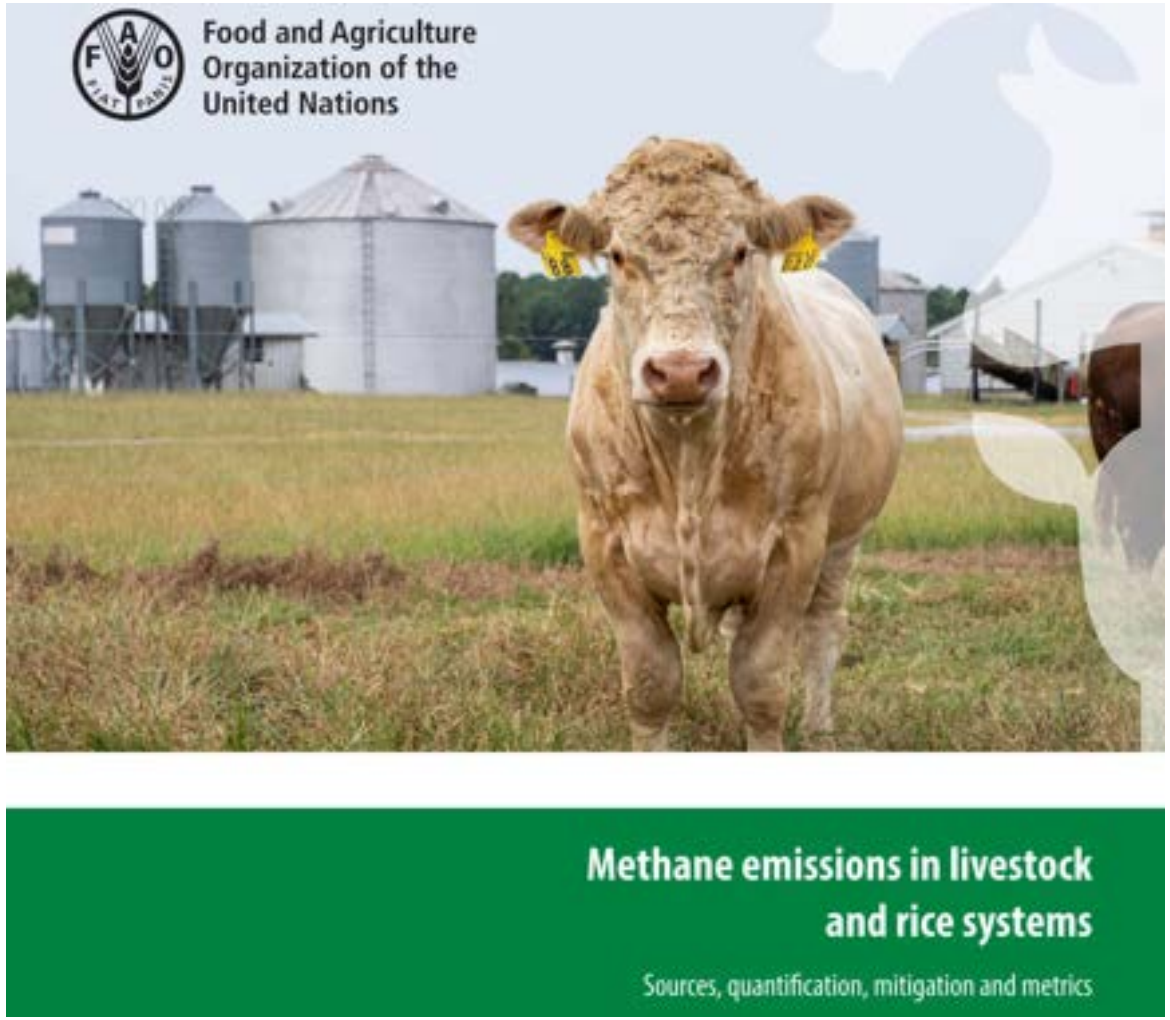
OPEN ACCESS

RECEIVED
5 October 2022

REVISED
9 May 2023

ACCEPTED FOR PUBLICATION
27 June 2023

PUBLISHED
18 July 2023



UN's FAO Methane (CH4) Report

September 2023

- Methane is different, it is short lived

- Biogenic CH4 is different to fossil fuel CH4 GWP100, 27 vis a vis 29.8, for fossil fuel CH4

- Recognises GWP* as a metric

- "Recent guidance recommends considering multiple metric choices in Life Cycle Impact Assessments"

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ACCELERATING FARMING TOWARDS CARBON NEUTRALITY

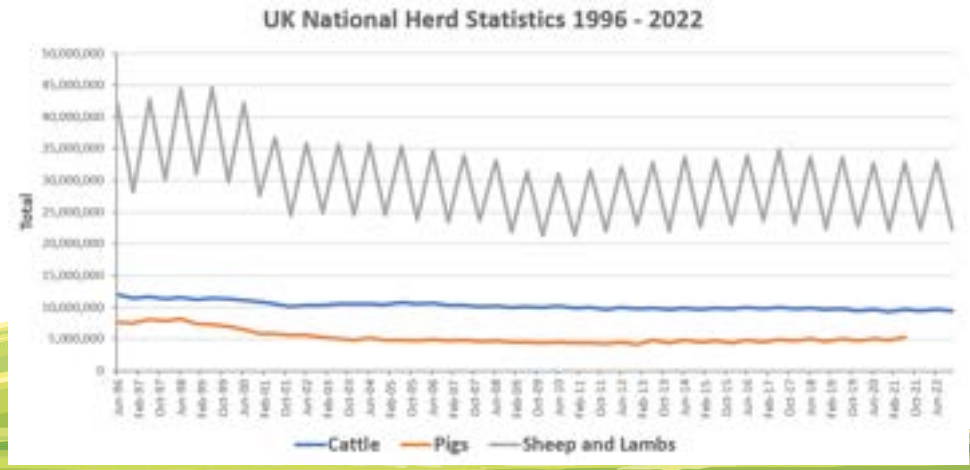
Reporting Methane using GWP*, as well as GWP100 Methodology

2021 Agrecalc Analysis	Enterprises	GWP100 % Reduction	GWP* % Reduction
Ian McClelland	Dairy	28%	47%
Hugh Harbinson	Dairy	27%	51%
John Egerton	Beef & Sheep	30%	63%
Roger & Hilary Bell	Sheep with Beef	60%	126%
Simon Best	Arable with Beef	41%	50%
Patrick Casement & Trevor Butler	Beef & Sheep	111%	325%
John Gilliland	Willows with Dry Cows	103%	251%

Assumptions:

- Livestock Nos. Mirrored UK National Herd Trend over last 20 yrs
- IPCC AR4 CO2e & GWP* conversion values
- GWP* calculation is equation 3, Lynch et al. 2020

agrecalc



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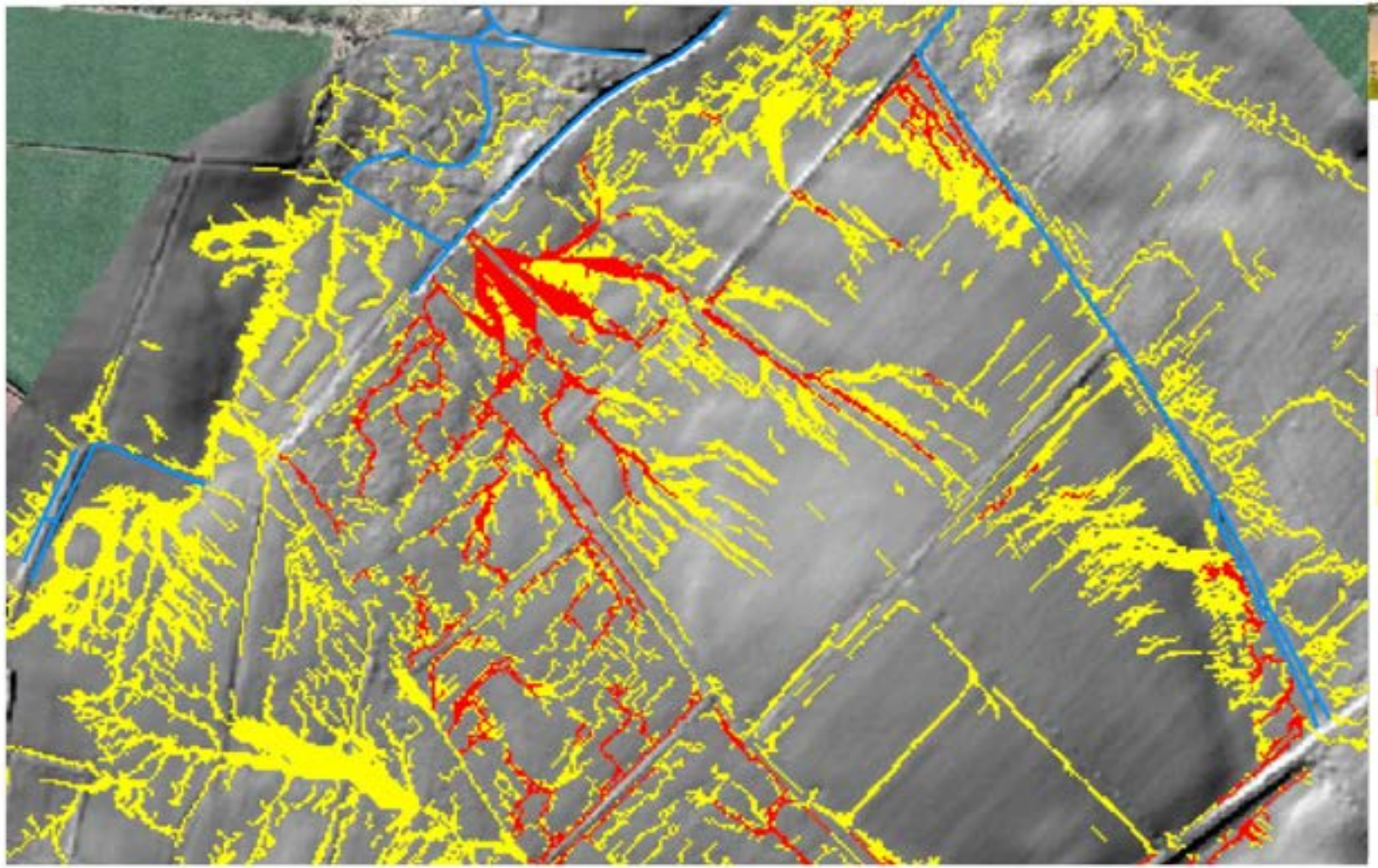
Delivering Multiple Public Goods Simultaneously

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



ARCZero

Farm: Harbison_1

Runoff Risk Maps

R. Cassidy, 2021

Waterbody Lines

Critical Source Areas - high soil Olsen P in these fields means these areas have elevated risk of P loss to water

Hydrologically Sensitive Areas for runoff generation and loss of nutrients*, sediment and other applied substances.

Hugh Harbison’s Farm

0 0.1 0.2 0.3 0.4 Km

N

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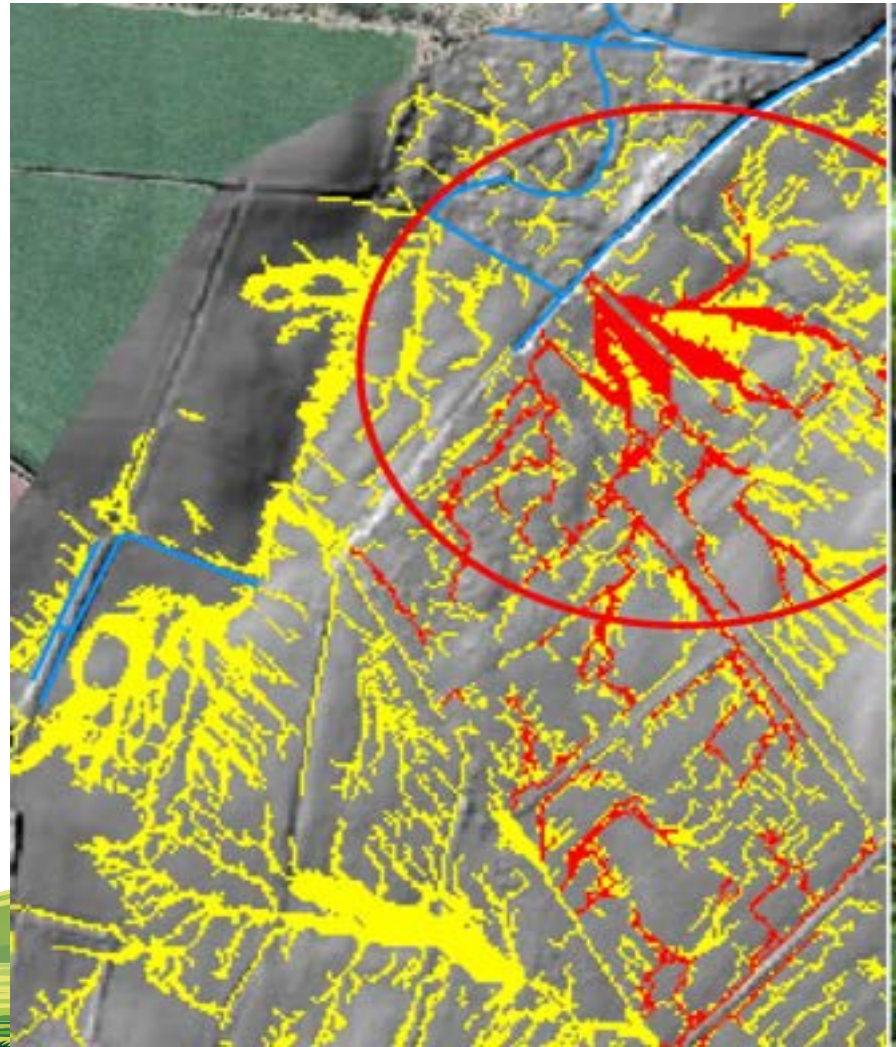
ACCELERATING FARMING TOWARDS CARBON NEUTRALITY

Delivering Multiple Public Goods 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)

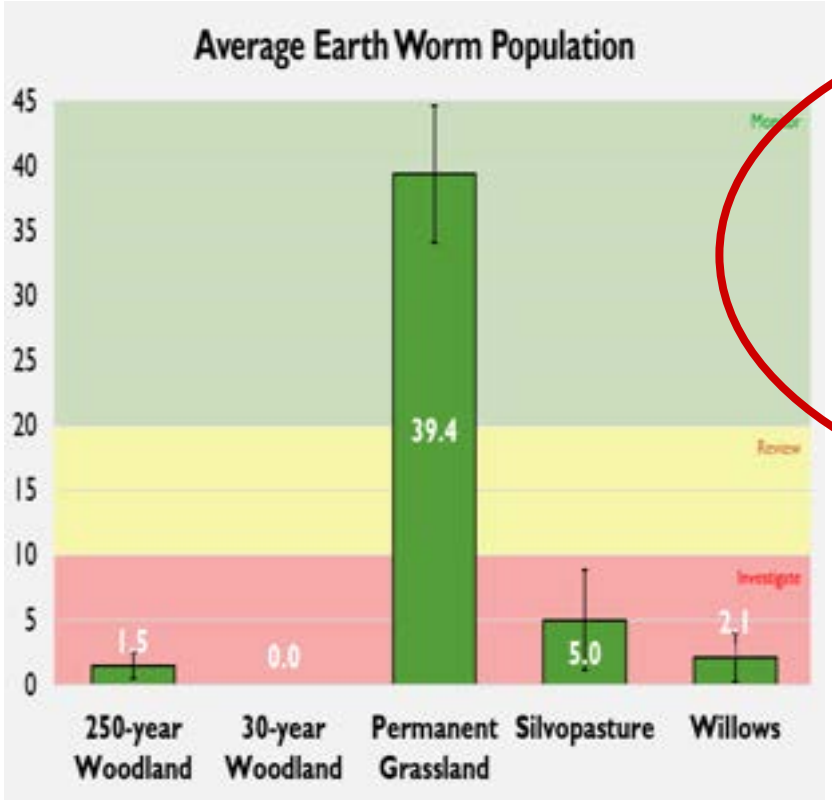
D. Woodland (250 Yrs. Old)

BROOK HALL
Estate & Gardens

R. Buffara, WUR, 2023

Delivering Multiple Public Goods Simultaneously

Increasing Biodiversity Under the Soil…. Role of Livestock Faeces….



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

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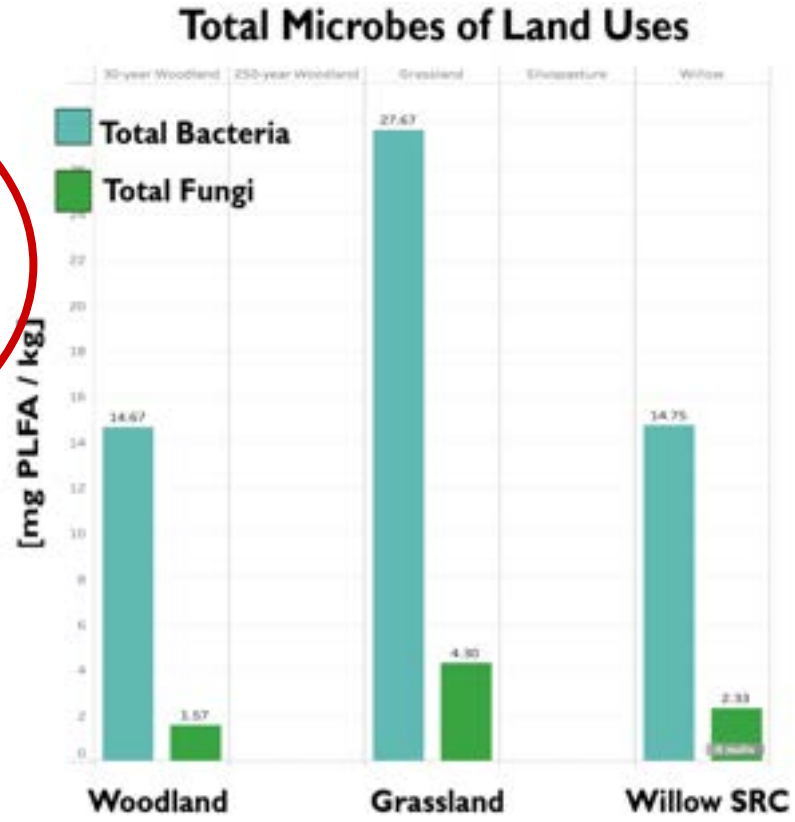
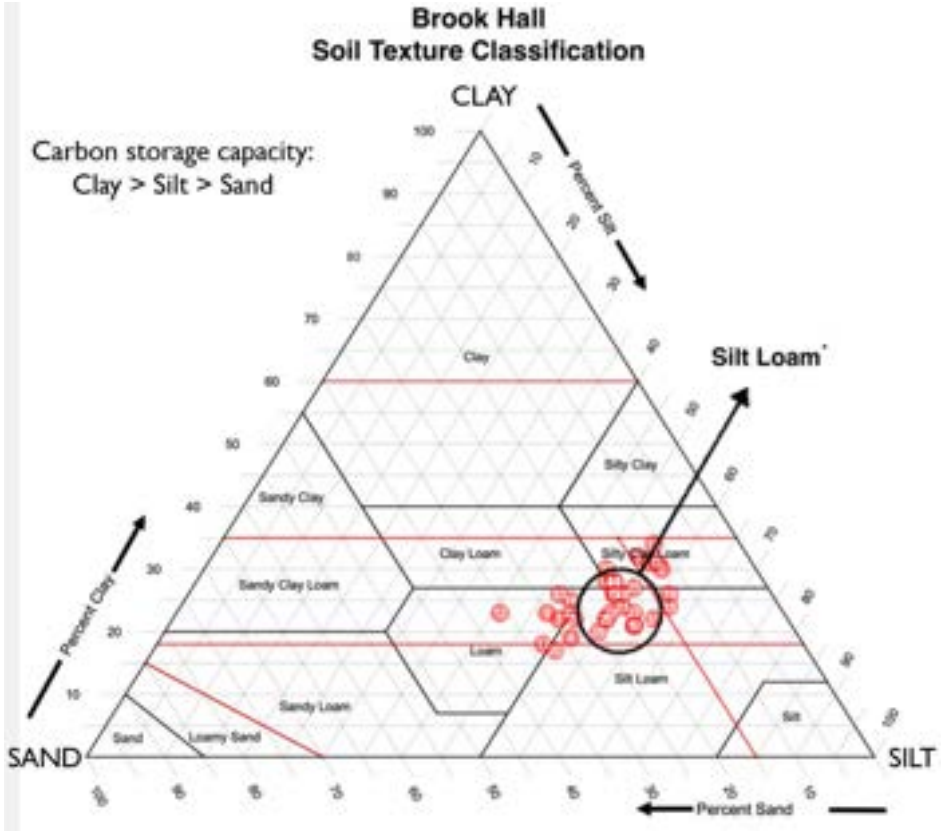
Estate & Gardens

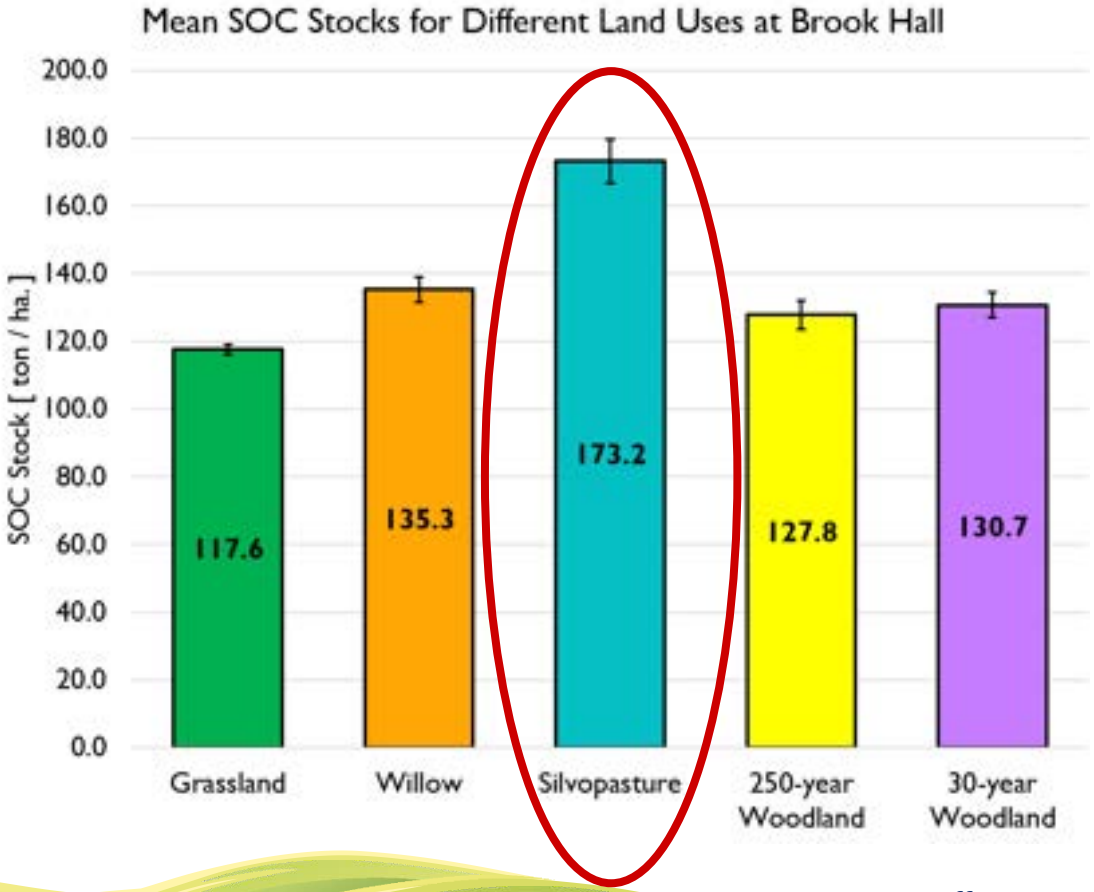


R. Buffara, WUR, 2023

Role of different Land Uses in building Soil Organic Carbon

Diversity of root architecture is best…. Monocultures are not the right answer….





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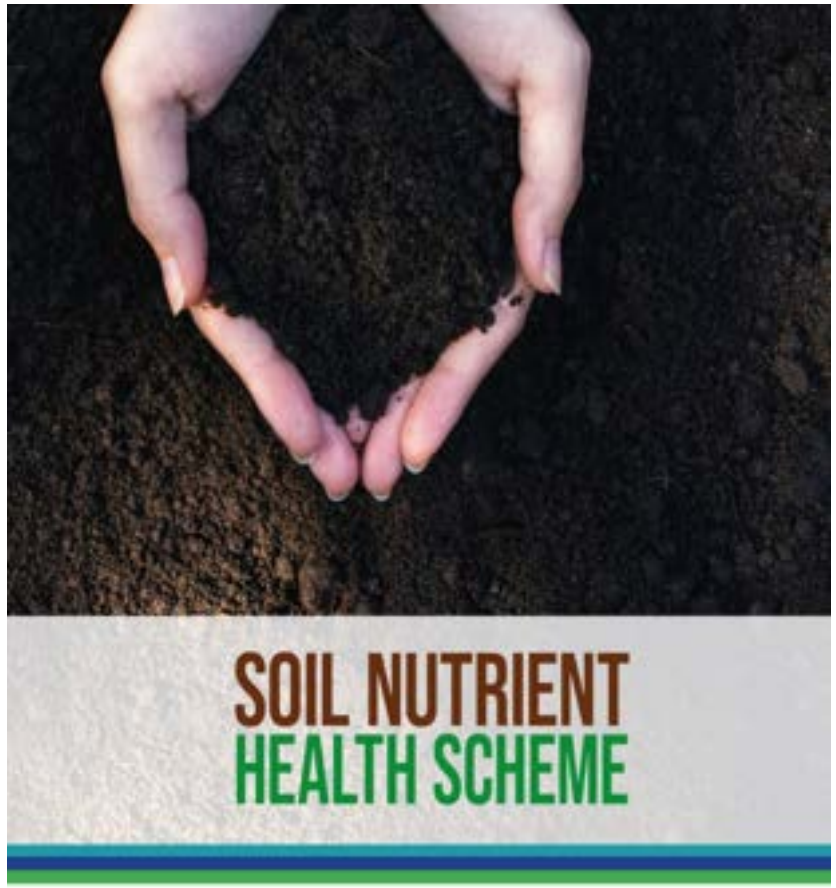
Estate & Gardens

R. Buffara, WUR, 2023

Is this Ambition Possible at a Regional Level……



- £45m 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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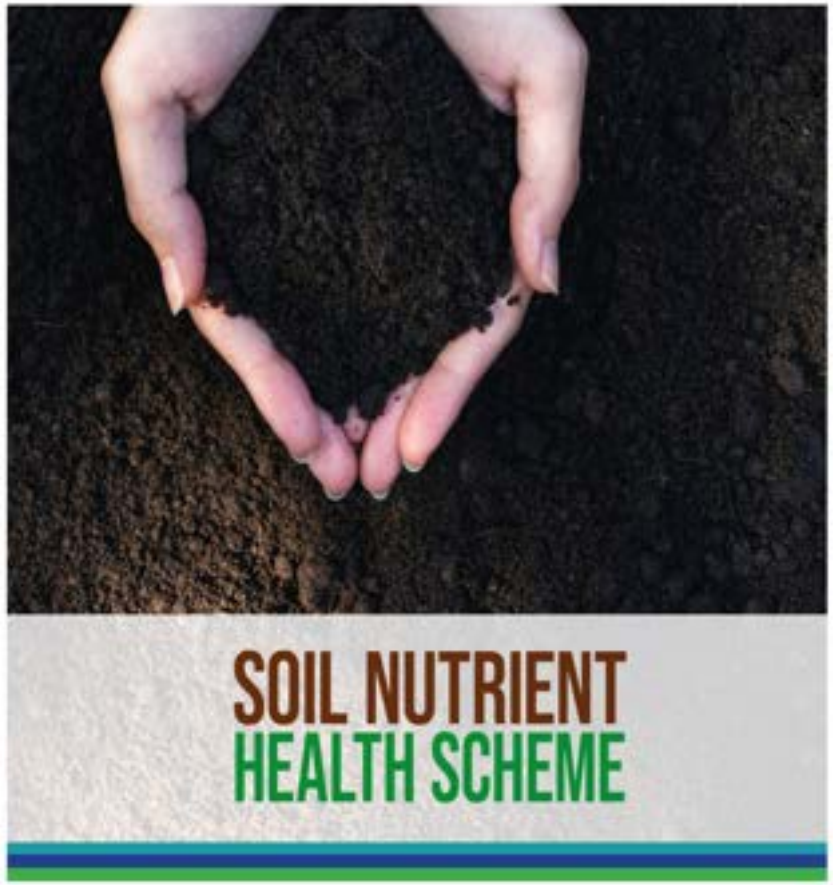

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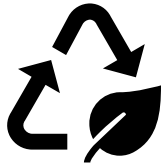
Department of Agriculture, Environment and Rural Affairs

cafre College of Agriculture, Food & Rural Enterprise

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

Embedding in the Pillars of AHDB's Environment Strategy

Collaboration:
Changing the Narrative…..



Multiple public goods

Net carbon

Roadmaps

Baselining

Economics & efficiency

Evidence:
Knowing your Numbers…..

Beware….. Our Global Competitors
1st Seven Grazing farms approved 2023

Farm No. 1

ARCHER PASTORAL

AR

SOC measured to 1 metre, 7 years apart
53kg CO2e sequestered /kg of live weight grazed
Sold at a Premium for AUS$93/t

New soil carbon credit issuance becomes Australia's largest ever with 94,666 ACCUs (Australian Carbon Credit Units)

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

New soil carbon credit issuance becomes Australia's largest ever with 94,666 ACCUs (Australian Carbon Credit Units)

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

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

As a Result Of Regenerative Farming….

Tomorrow's Farming Today

A Practitioner's view of the journey towards Net Zero & Beyond

Empowering farmers by helping them "Know their Numbers"….

Key to the Journey Towards Net Zero & Beyond

john.gilliland@brookhall.org

Caroline Grindrod

Roots of Nature Consultancy, Wilderculture, Primal Meats

Caroline Grindrod

REGENERATIVE AGRICULTURE.

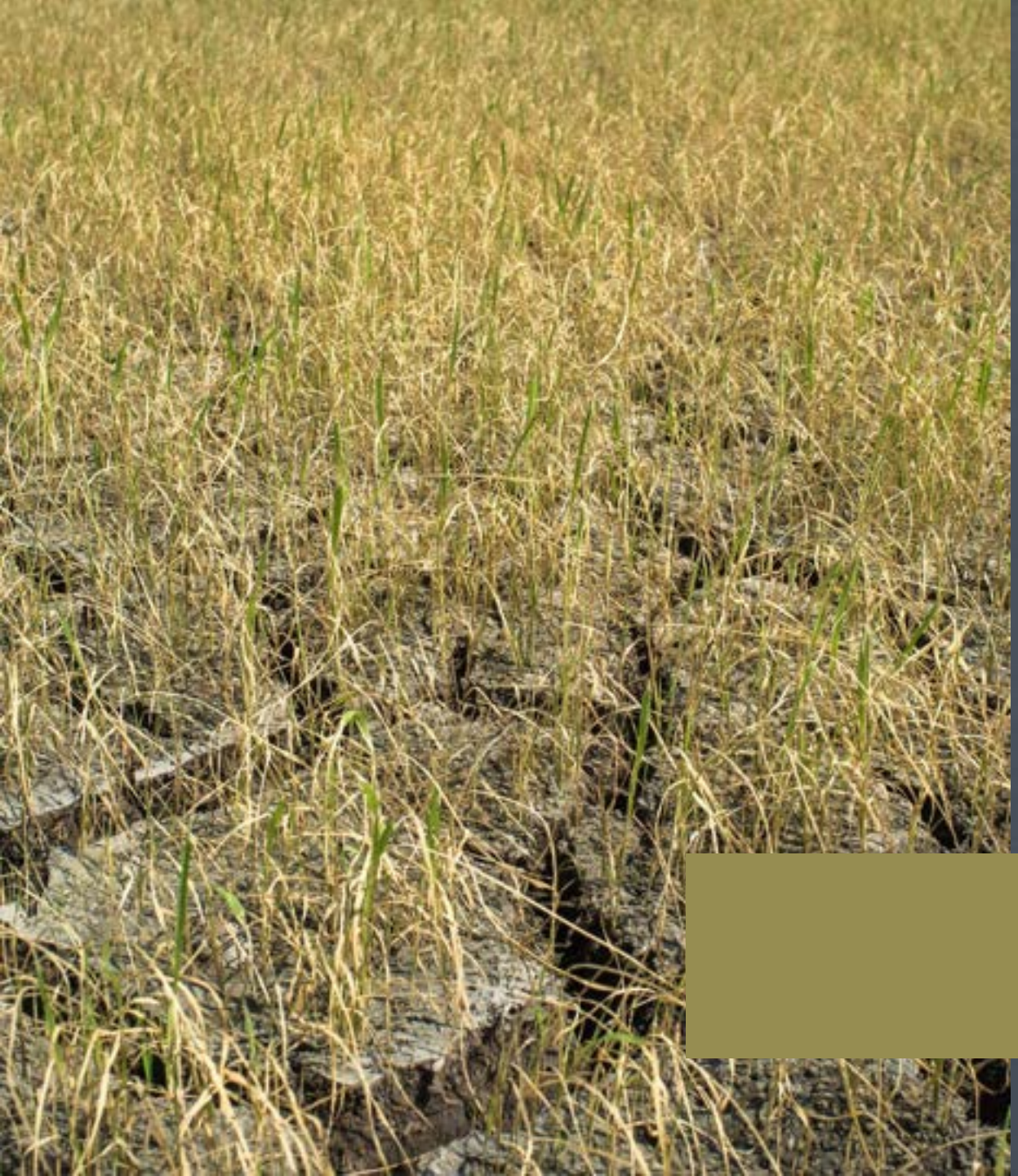
TOMORROW'S FARMING TODAY

Definition

'Regenerative agriculture is a system of farming principles and practices that increases biodiversity, enriches soils, improves watersheds, and enhances ecosystem services.

By capturing carbon in soil and biomass, regenerative agriculture aims to reverse current trends of atmospheric accumulation. At the same time, it offers increased yields, resilience to climate instability, and higher health and vitality for farming communities.''

Terra Genesis



Why do we need it?

We now live in volatile, unpredictable, complex and ambiguous (VUCA) times. It is now being said that we are in the midst of a so-called ‘poly-crisis.’

Solution

- It captures carbon in soil - reversing atmospheric accumulation
- Enhances biodiversity and ecosystem services
- Reduces the need for inputs
- Can improve business resilience and profitability
- Can improve health and productivity of crops and livestock
- Improves resilience to drought and flood
- Promotes higher health and vitality for agricultural communities

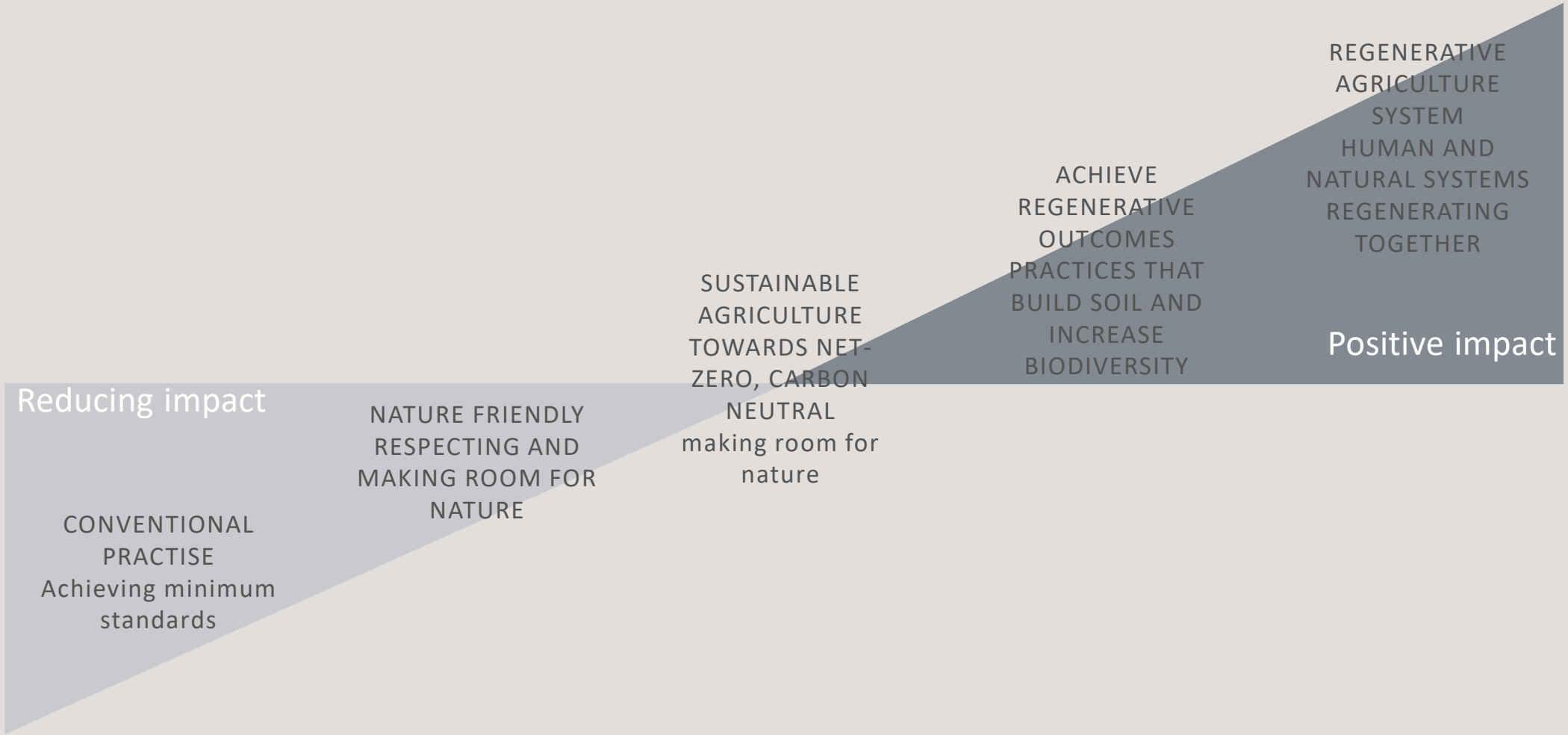
Farm as an ecosystem

Healthy functional ecosystems can out produce even our most advanced agricultural systems.

They are resilient and are driven by sunshine, rainfall and healthy soil - zero inputs required.

They are highly productive due to 'whole system function.'

From sustainable to regenerative



- Transition -


BASE

Whole system function

In regenerative agriculture, the relationships between parts are as important as the parts.

The soil, the plants, the animals and the humans are all in transition.

Simply changing one part of this system won't produce optimal regenerative outcomes.

The soil system

Soluble nutrients

In conventional agriculture we focus on the soluble nutrients and apply what is missing

Available but not soluble

In regenerative agriculture we create the conditions for organisms to unlock unlimited nutrients

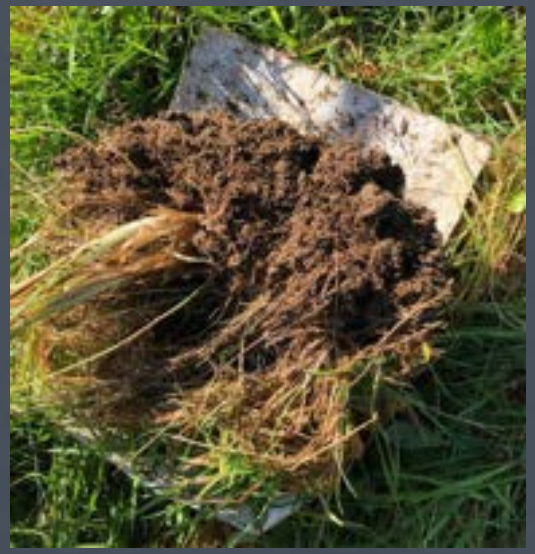
The Soil Food Web

First trophic level:	Second trophic level:	Third trophic level:	Fourth trophic level:	Fifth & higher trophic level:
Photosynthesizers	Decomposing Mutualists Pathogens, Parasites Root-feeders	Shredders Predators Grazers	Higher level predators	Higher level predators

The ecosystem

Water cycle

Capturing all the rainfal and retaining it in healthy soil so it can be buffered and all used for plant growth



Mineral cycle

Creating a healthy living soil system so nutrients are held in carbon matrix and available on demand with little or no inputs

Airflow

Optimising the conditions for growth by reducing exposure and ensuring nitrogen from the air can be fixed by in aerated soils

Energy flow

Increasing the volume and rate of photosynthesis throughout the year to increase productivity improve the health of plants

Does 'it' work

Copying regenerative practices is not the same as managing a regenerative agriculture system.

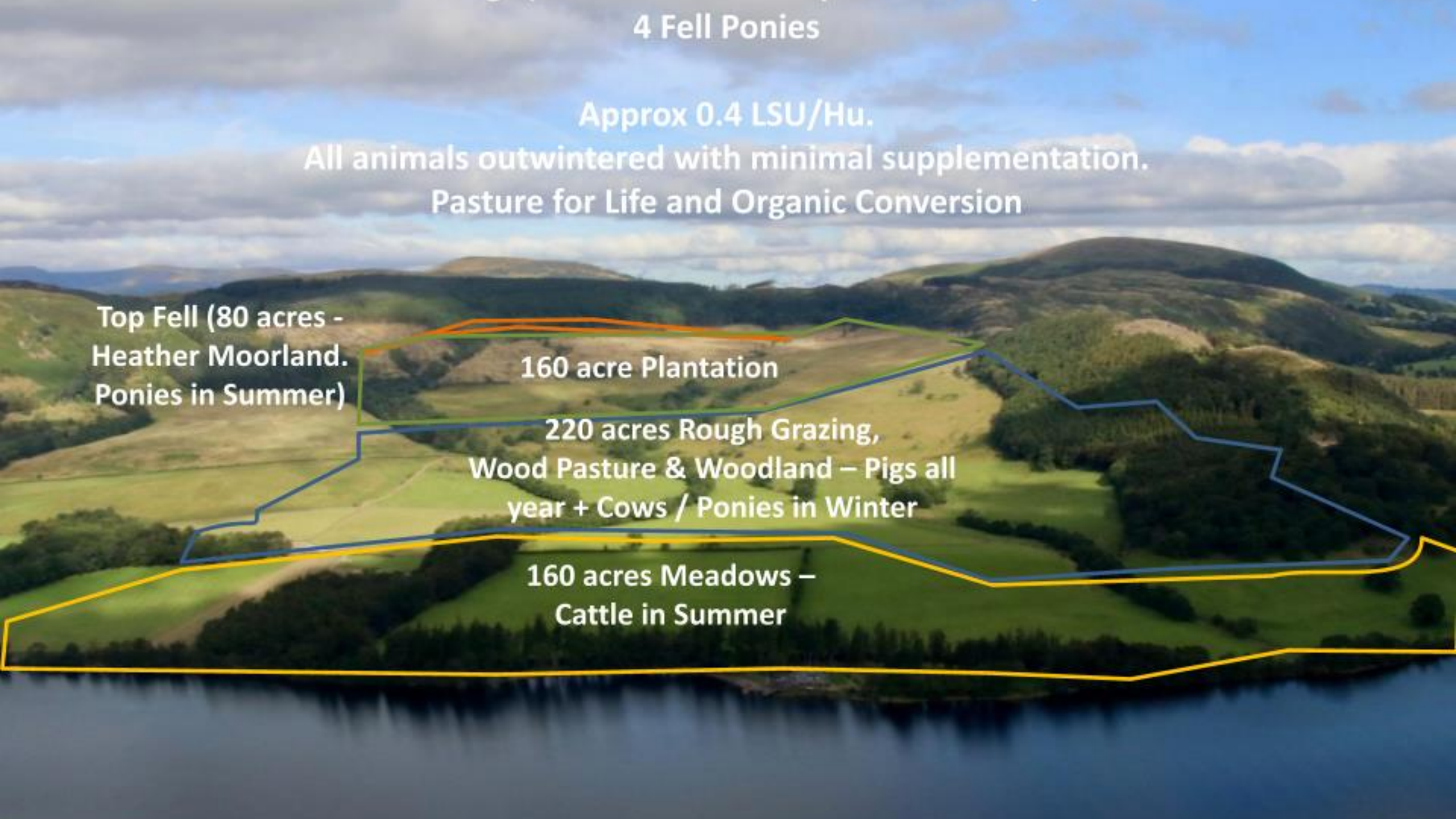
Regenerative farmers learn the principles and the design their own regenerative context.

Nature adapts to its unique conditions and regenerative agriculture is as unique as a finger print to people and place.

Roots of Nature

Regenerative transition

- Learn regenerative principles including how to measure the health of ecosystem processes.
- Design your unique regenerative context.
- Learn holistic decision making to consider the environment, people and economic factors in each decision.
- Decide which tools and practices will help you move towards your regenerative goals.
- Create your land and financial plans.
- Create your cropping/ grazing plans.
- Measure if you are achieving your regenerative outcomes.
- Adapt management.


4 Fell Ponies
Approx 0.4 LSU/Hu.
All animals outwintered with minimal supplementation.
Pasture for Life and Organic Conversion
Top Fell (80 acres - Heather Moorland. Ponies in Summer)
160 acre Plantation
220 acres Rough Grazing, Wood Pasture & Woodland – Pigs all year + Cows / Ponies in Winter
160 acres Meadows – Cattle in Summer

Gowbarrow Hall Farm

Case Study

Sam and Claire Beaumont decided to transition in 2018.

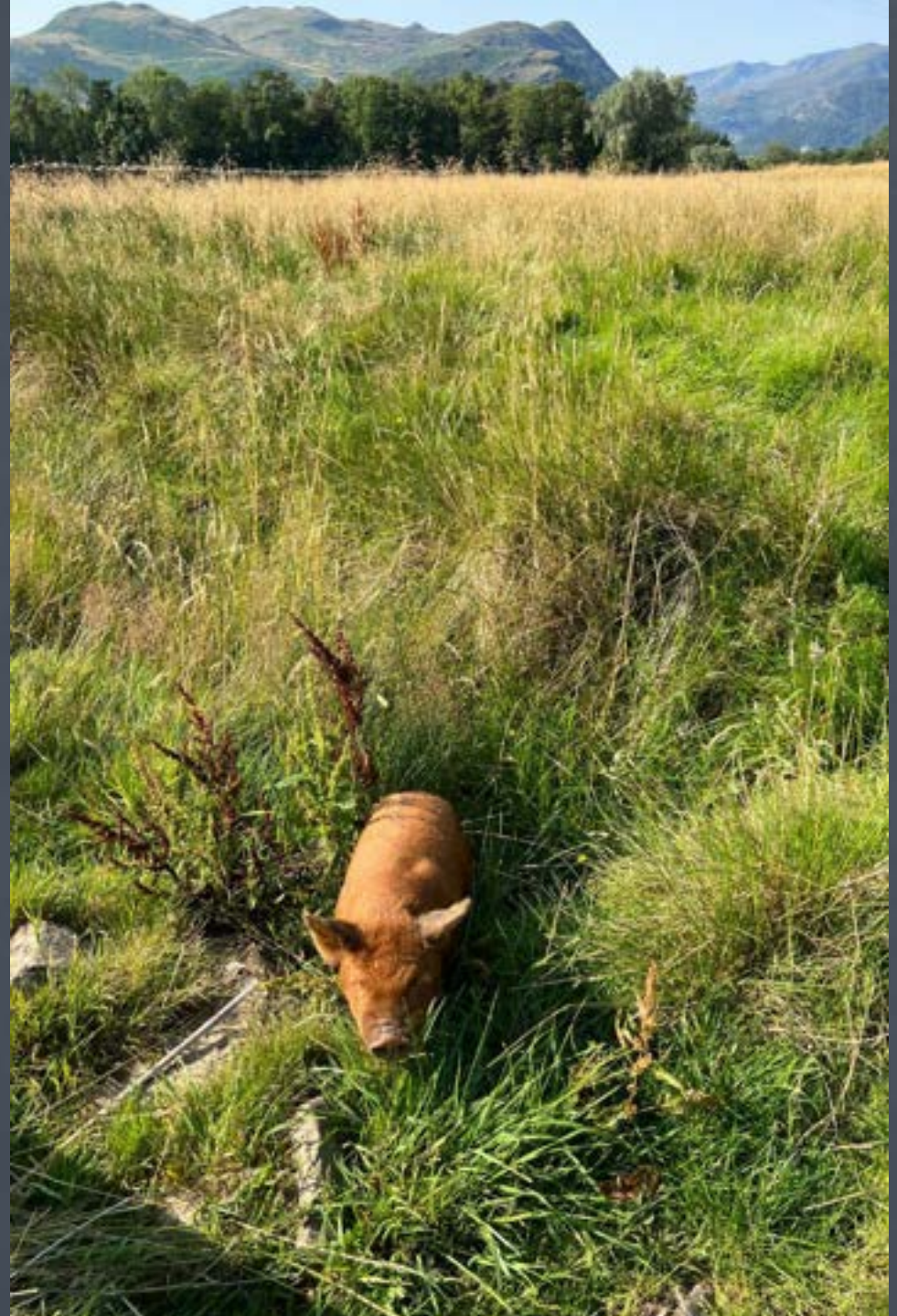
Created a unique context.

Switched from a loss making sheep and beef system to a cattle pig and pony system that is a hybrid of regenerative grazing and rewilding.

100% grass fed and organic out-wintered system.

Regenerative outcomes

Infiltration rates have improved from an inch per hour to a litre in five minutes. The sward diversity has increased from 3 - 14 species with no seeding.
VESS, rooting depth and rhyzosheath development all improved.



Gowbarrow Hall Farm

Case Study

Removed all fertilisers, sprays, feed, straw and reduced diesel to almost nothing.

Profitable without subsidy. Able to access a higher tier scheme that enhances existing regenerative plan.

Gowbarrow Hall Farm

Case Study

Daily live weight gains average 1.2kg - 1.5kg per day.

Produce grass-fed beef with a net profit of £1600 a head.

Genetics and outcomes improving yearly.

Still increasing the herd to optimal capacity. Expected to reach national average stocking rate.
Reducing vet med costs annually.

REGENERATIVE PARADIGM SHIFT

From specialisation and efficiency to complexity and resilience.

From short term productivity to long term consistent profitability.

From quantifying and controlling to trust in natural systems and trust in animal nutritional wisdom.

From large scale to optimal scale and able to buffer disruptions.

From measuring success through the window of productivity and yield to observing the effectiveness of the whole system.

THANK YOU

W W W . R O O T S O F N A T U R E . C O . U K

Andrew Ward MBE

Farmers Weekly Farming Champion & Arable Farmer of the Year, Founder of Forage Aid

Northern Farming Conference 2023

Andrew Ward MBE

1st November 2023

To discuss

- Eliminating blackgrass
- Cover crops
- Direct drilling
- Carbon
- Organic matter
- Floods – food security

Traffic light cropping

Sort fields into 3 black grass categories

Cat A: Severe

Cat B: Manageable

Cat C: None

Traffic light cropping

	Clay Soils Cat A	Medium Soils Cat B	Sandy Soils Cat C
Year 1	S Barley	Sugar Beet	Sugar Beet
Year 2	S Barley	Wheat / S Barley	Spring Barley
Year 3	S Barley	Oats / Beans	Oats
Year 4	S Barley	Wheat / S Barley	Wheat

Cropping changes 2012/13 – 2022/23

Crop	2012	/ 13	2017	/ 18	2022	/ 23
Winter wheat	323	49%	140	21%	328	50%
Holl oil seed rape	226	34%	133	20%	0	
Sugar beet	60	9%	56	9%	54	8%
Spring barley	23	4%	140	21%	46	7%
Spring wheat	0		163	25%	0	
Spring oats	0		0		98	15%
Spring beans	0		0		66	10%
Flower margins + CS	28	4%	28	4%	68	10%
Total	660		660		660	

Blackgrass - what is it?

One seed head can produce over 1000 seeds

Blackgrass

Wheat like this is not sustainable and serious changes needed

Blackgrass

Why do a lot of farmers accept crops looking like this?

Control measures

Benefits of destroying bad patches in the previous crop

Control measures

Control measures

Control measures

Control measures

My control measures

Spring beans not good for red & amber zone fields.

The result!

My control measures

Why is this not good?

Blackgrass control strategy & cost – w wheat 2022

	Worst	case	Me	
Autumn / pre drill	1x Glyphosate 2.5 lt	£23	2x Glyphosate 2.5 lt	£46
Pre emergence	Luximo + Stomp	£80	Liberator 0.6 lt	
			Hurricane 0.1 lt	
	Avadex	£50	Defy 2.0 lt	£52
Peri emergence	Liberator + Defy	£40		
Post emergence	Pacifica plus	£60		
Hand pulling		£0		£74
Total		**£253 / ha**		**£172**
% BG control	????			99

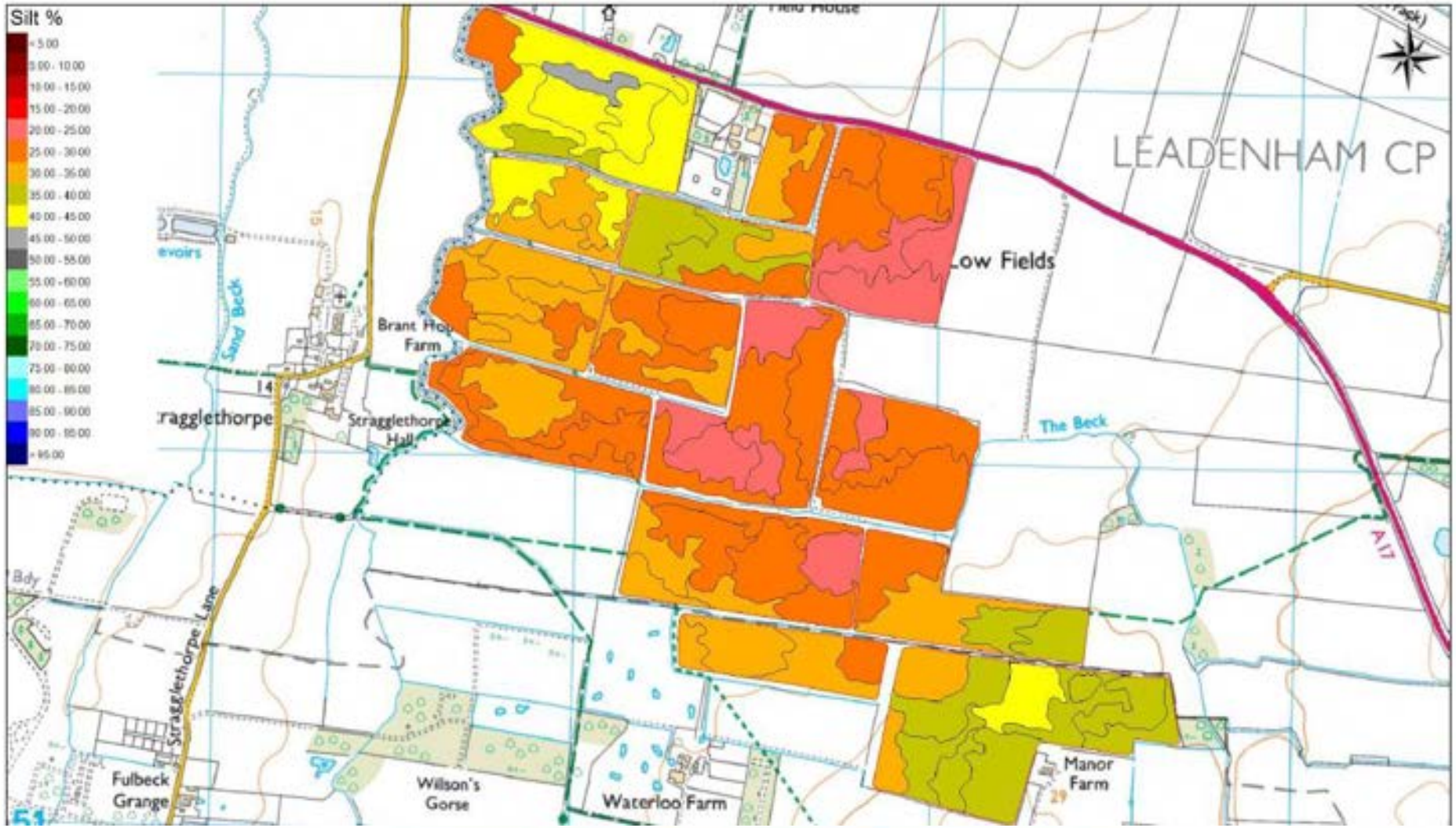
Total blackgrass control costs 2020 £/ha

	Herbs	Rogue	Total
Winter wheat	58	28	86
Spring wheat	30	47	77
Spring barley	33	35	68

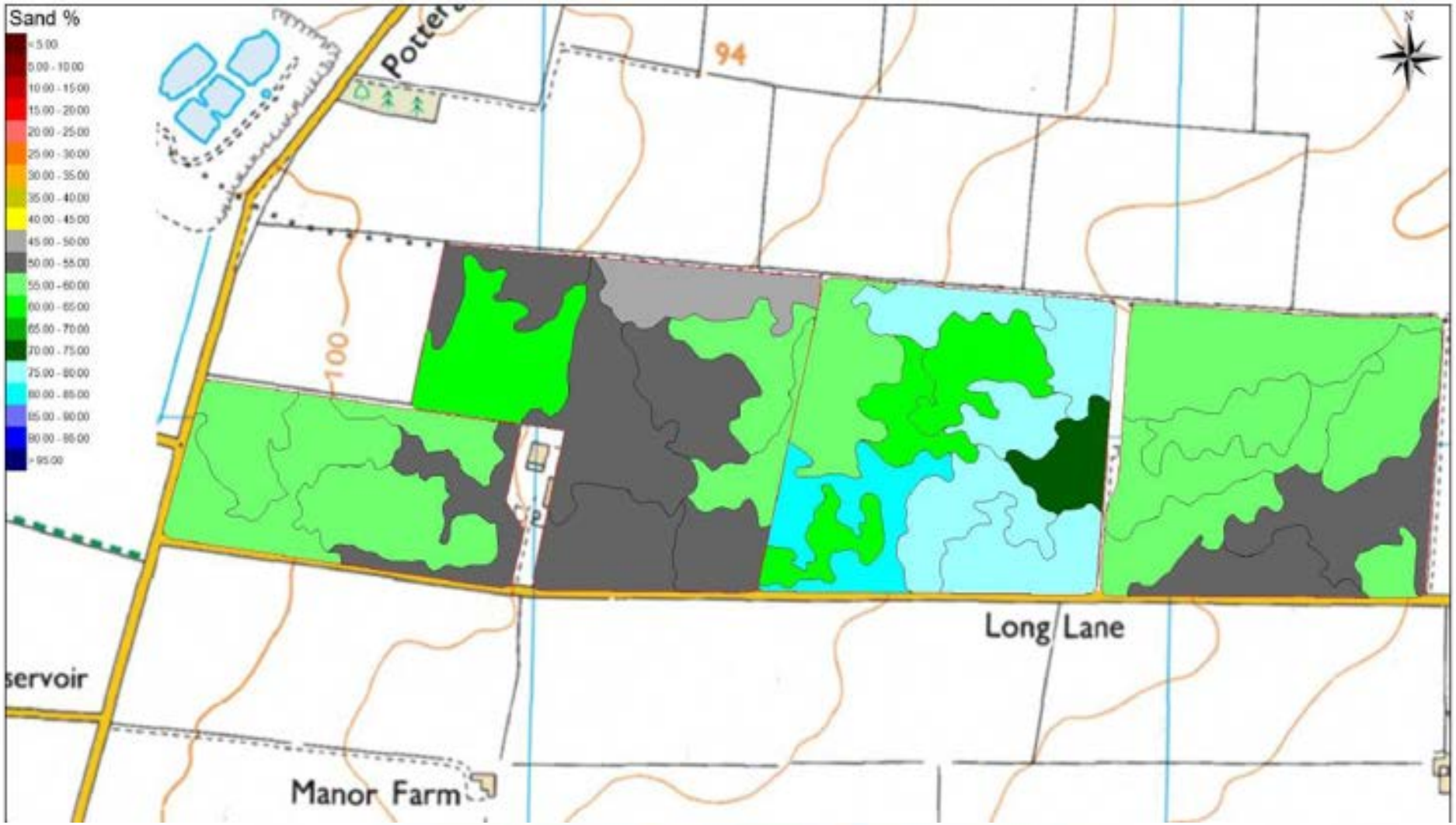
Light land cover crops

Glebe Farm clay map

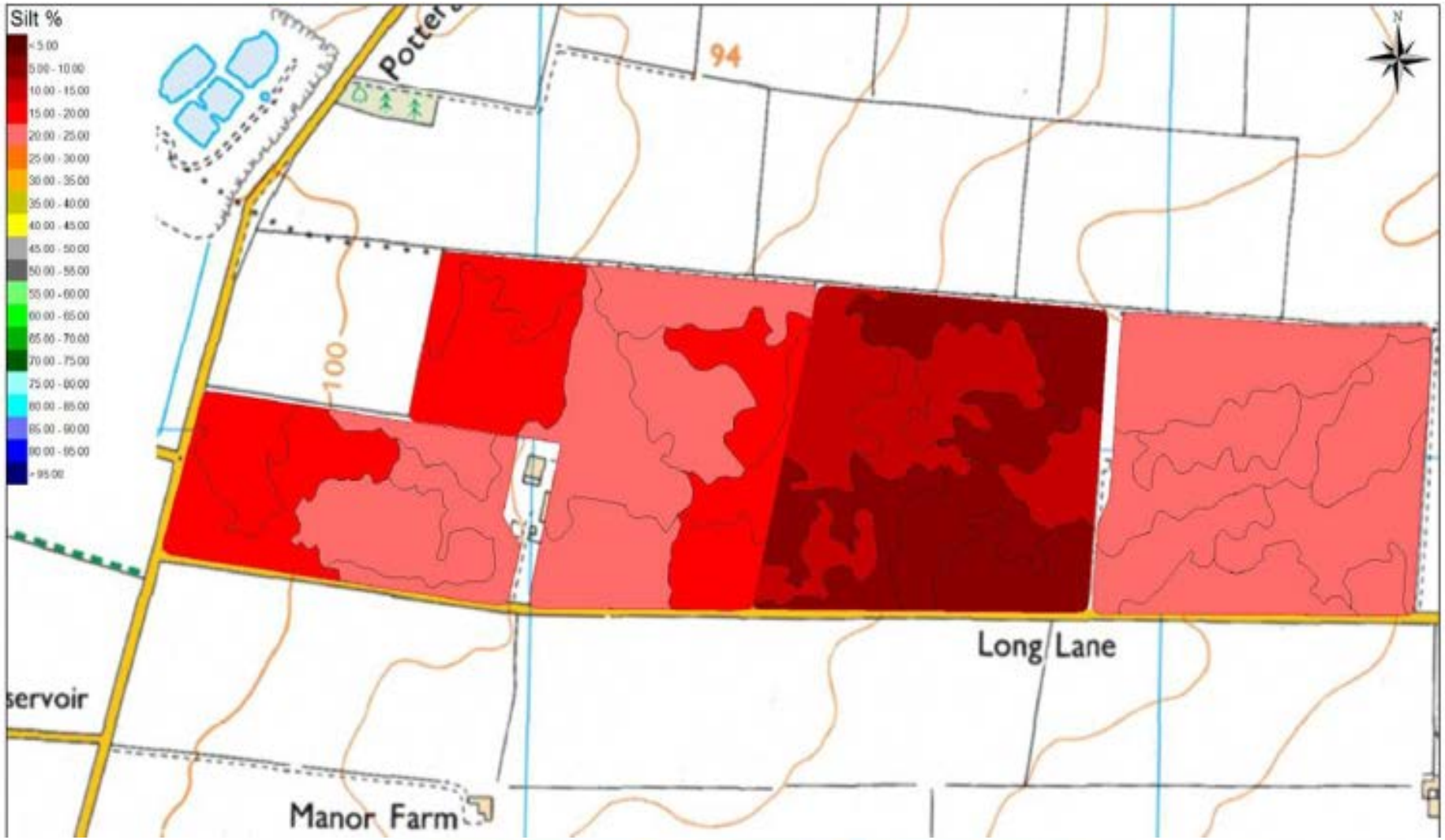
Glebe Farm silt map



Heath Farm sand map



Heath farm silt map



Direct drilling

YOU ARE INVITED TO THE

Leadenham Direct Drilling Demo

Wednesday 6th April 2022

Field located at the bottom of Leadenham Hill - Roy Ward Farms, Leadenham
what3word location: ///fruits.crawling.nags.

Morning session: 9:00 - 13:00

Afternoon session: 12:15 - 17:00

AGENDA

MORNING SESSION	AFTERNOON SESSION
9:00 Refreshments will be served before the session	**12:15** Meet for lunch
9:30 Short introduction from: Steve Corbett, Andrew Ward & Fred Fowler	**13:30** Short introduction from: Steve Corbett, Andrew Ward & Fred Fowler
9:45/10:00 - 12:30/13:00 Demo kicks off	**14:00** Demo kicks off
The session ends with lunch	Finishes at approximately17:00

HOW TO RSVP

E-mail **Becky.Cox@agrii.co.uk** confirming your attendance and your chosen session, plus:

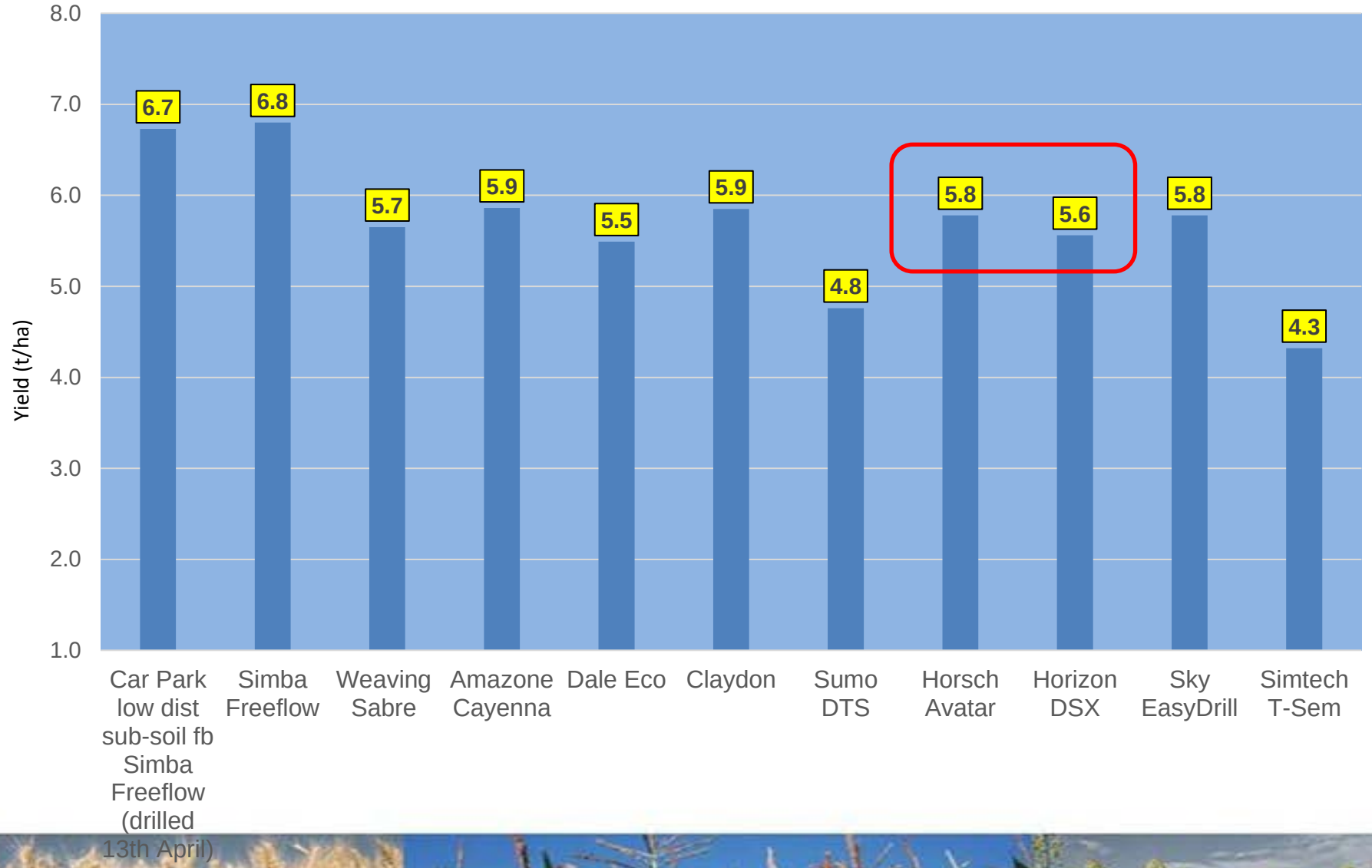
- Any dietary requirements
- Your trading account name or number
- Your contact number or email address

HORSCH SUMO DALE DRILLS WEAVING Sky Simtech T-Sem HORIZON AMAZONE CLAYDON

Site contact mobile: **07977 501870** Email **Fred.Fowler@agrii.co.uk**

Agrii

Yield by Drill Type: Laureate Drilled 6th April 2022 @ 400 Seeds m²



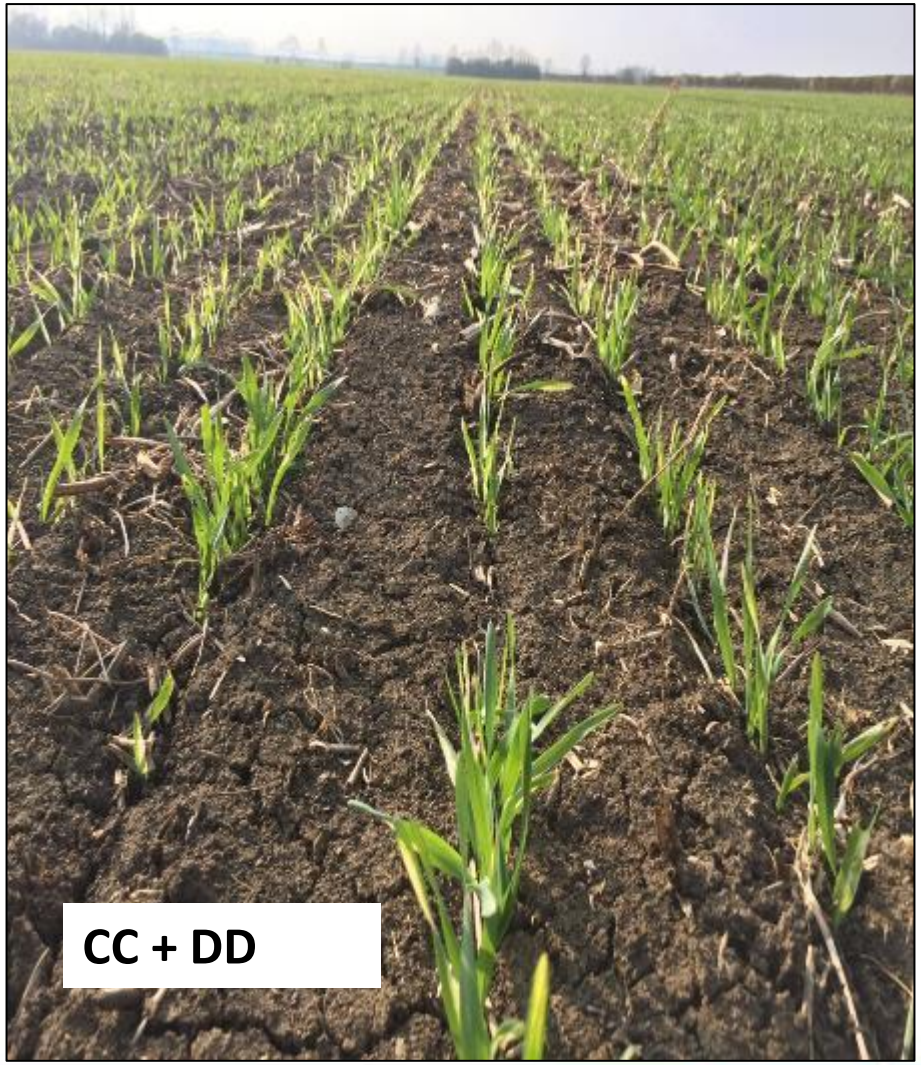
Drilled 6th April 2022: Laureate @ 400 seeds m²

Drill type	Crop drilling cost	Fert	Seed	Agchem	Total costs	Total N Kgs/ha (50kgs 31/3 + 78kgs 27/4)	Yield to 15%	Price	Crop value	Gross margin £/ha	Specific Weight	Grain N	Screen 2.5mm Retained	Screen 2.25mm	Admix
Car Park low dist sub-soil* fb Simba Freeflow (drilled 13th April)	117.94	124.22	111.53	134.38	488.07	128	6.73	267.00	1797	1309	62.7	1.52	89.1	3.5	0.6
Simba Freeflow	40.95	124.22	111.53	134.38	411.08	128	6.80	267.00	1816	1405	64.8	1.50	90.7	3.5	0.2
Weaving Sabre	40.95	124.22	111.53	134.38	411.08	128	5.65	262.00	1480	1069	63.5	1.71	91.3	3.2	0.6
Amazone Cayenna	40.95	124.22	111.53	134.38	411.08	128	5.86	266.00	1559	1148	62.8	1.62	85.8	4.7	0.2
Dale Eco	40.95	124.22	111.53	134.38	411.08	128	5.49	262.00	1438	1027	63.3	1.66	93.2	2.6	0.2
Claydon	40.95	124.22	111.53	134.38	411.08	128	5.85	267.00	1562	1151	62.9	1.62	90.6	1.9	0.0
Sumo DTS	40.95	124.22	111.53	134.38	411.08	128	4.76	262.00	1247	836	62.4	1.71	94.3	1.7	0.7
Horsch Avatar	40.95	124.22	111.53	134.38	411.08	128	5.78	267.00	1543	1132	61.8	1.57	90.9	3.2	0.0
Horizon DSX	40.95	124.22	111.53	134.38	411.08	128	5.56	266.00	1479	1068	62.9	1.60	88.6	4.5	0.7
Sky EasyDrill	40.95	124.22	111.53	134.38	411.08	128	5.78	267.00	1543	1132	62.9	1.55	92.3	2.6	0.0
Simtech T-Sem	40.95	124.22	111.53	134.38	411.08	128	4.32	262.00	1132	721	62.4	1.80	90.9	2.2	0.2
Cover crop fb Horsch Sprinter - 22 Acre	142.95	124.22	103.00	137.00	507.17	128	6.38	262.00	1672	1164	66.7	1.71	92.6	3.2	0.4
Simba Solo (Aut) fb Freeflow - Squires	126.95	124.22	99.00	139.00	489.17	128	8.25	267.00	2203	1714	70.9	1.57	92.2	2.8	0.3

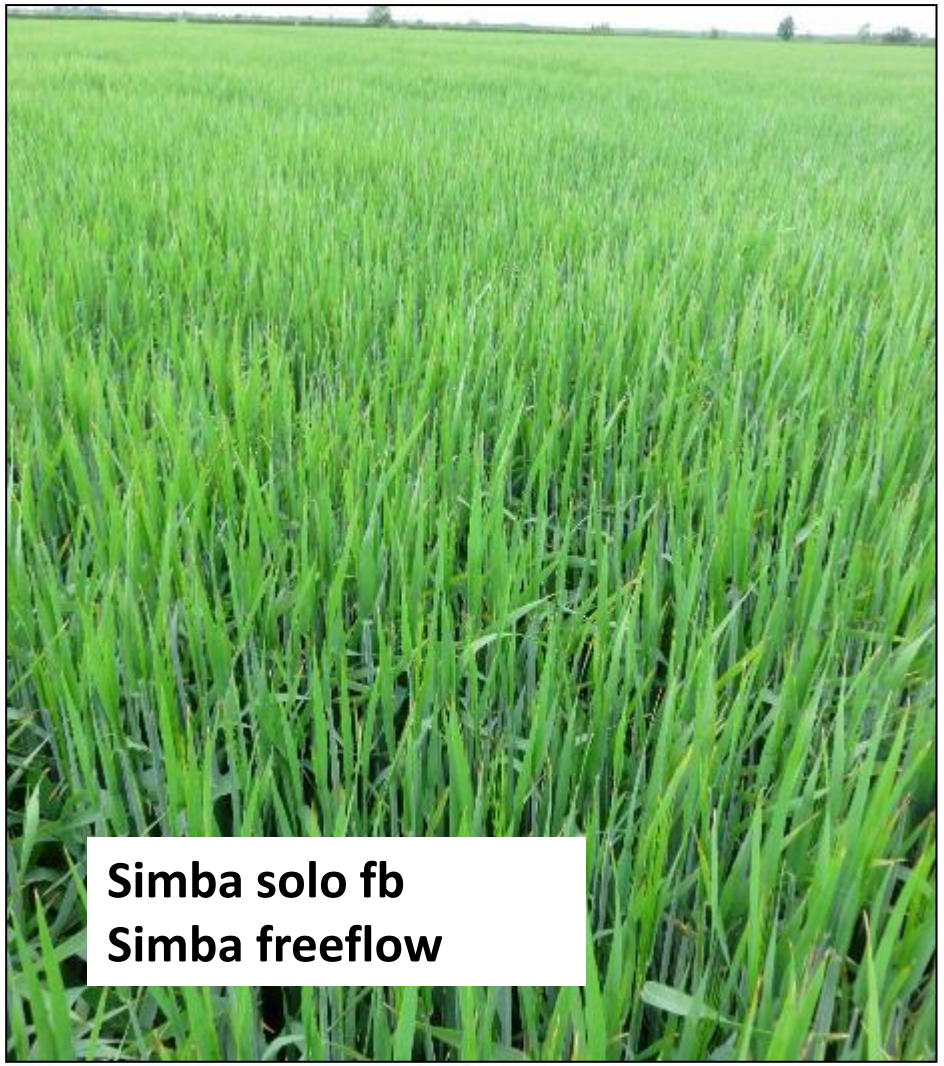
7 year direct drill and cover crop trial

7 year direct drill and cover crop trial

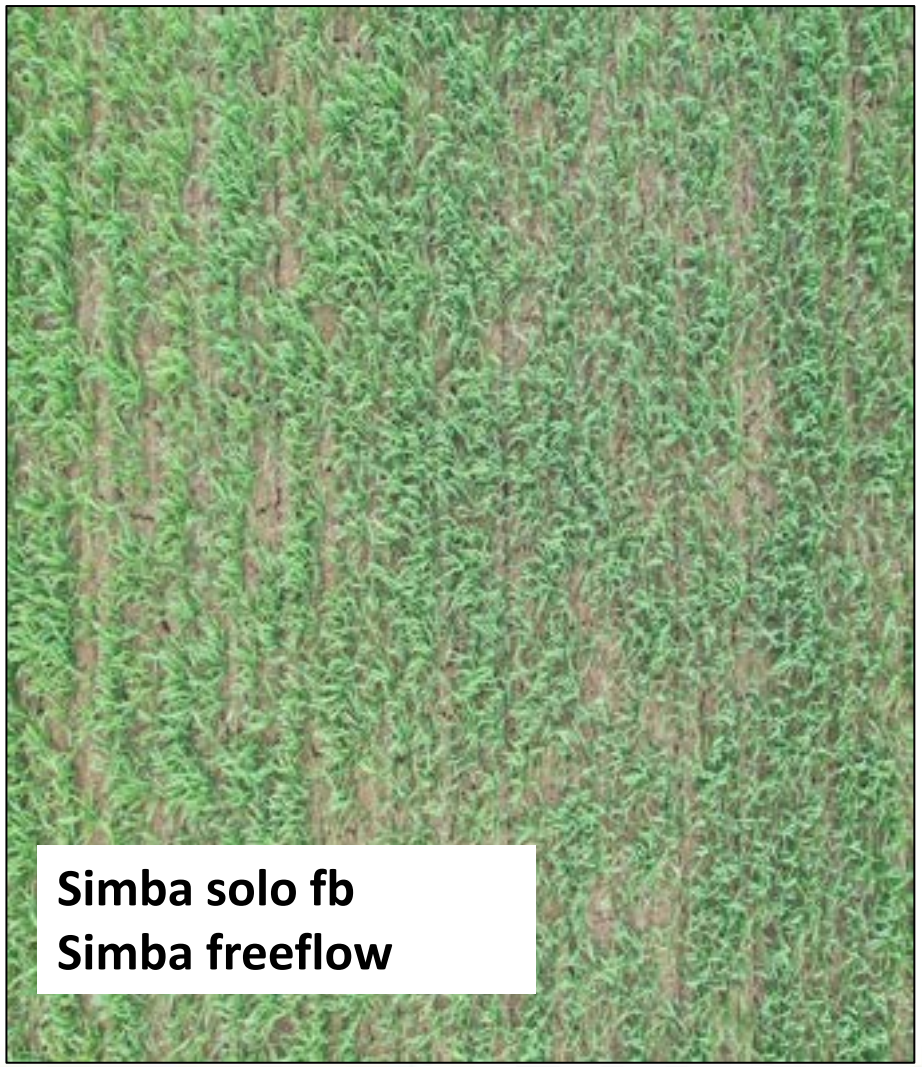
7 year direct drill and cover crop trial



7 year direct drill and cover crop trial . . . . . ongoing



7 year direct drill and cover crop trial



Direct drilling with the Freeflow

	Crop		CC & DD	Farm S
2016	S B	Yield	-	7.61
		£ / Ha	- £43	£440
2017	SB	Yield	8.35	8.53
		£ / Ha	£685	£640
2018	OSR	Yield	3.1	3.3
		£ / Ha	£482	£516
2019	SB	Yield	9.19	8.42
		£ / Ha	£642	£524
2020	SB	Yield	6.7	7.6
		£ / Ha	£413	£632
2021	SB	Yield	5.9	6.4
		£ / Ha	£492	£633
2022	SB	Yield	6.38	8.2
		£ / Ha	£1,164	£1,714

7 years of data ……

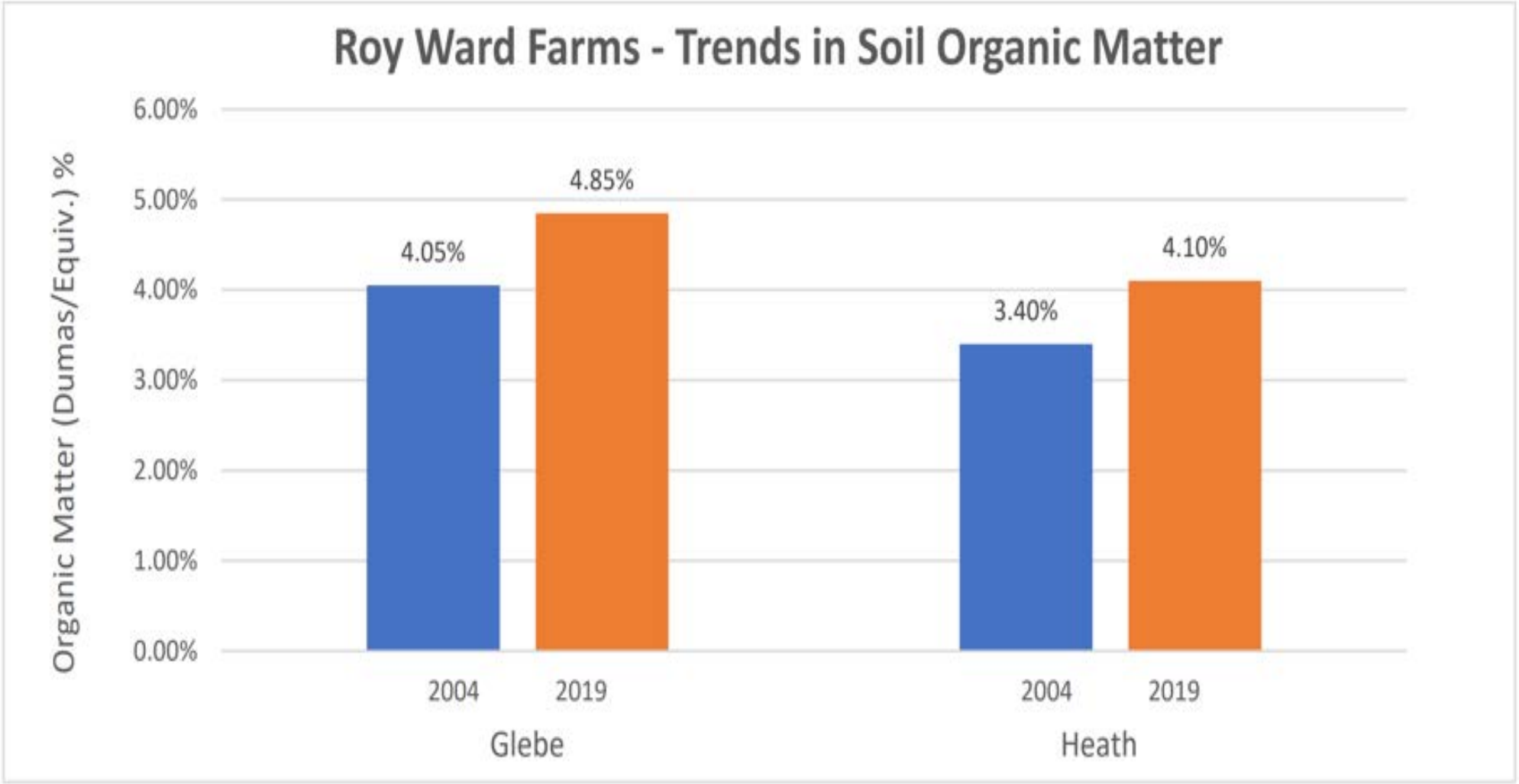
	CC & DD	Farm S
Av yield t/ha	6.08	7.79

	CC & DD	Farm S
Net return £ / ha	£547.00	£728.00

	CC & DD
7 yr difference	£181 / ha
2022 difference	£550 / ha

Building fertility

Regen progress



Field Operations presently used on all soil types

Quadtrac 620 (2018) and 8m Simba Freeflow

Fuel use: 17 litres/ha
Weight: 29 tons
HP: 620

JD 8RX (2022) and 8m Simba Freeflow

JD 8RX and 4.5m Simba solo

Lincolnshire floods – food security

Lack of maintenance

To finish . . . . .

- Not all soils are able to grow good enough cover crops
- There's too much pressure from Defra to push us ……
- Cover crop seed and establishment must not be forgotten
- Yield is still king, NUE, Carbon, roots etc
- We have world class farmers, don't let tree huggers take this away
- DD does not suit some of our difficult soils, it might not yours
- Look to the future, standing still, end up going backwards
- Environmetal care & food production – hand in hand

Thank You

Andrew Ward MBE

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YouTube: WardysWaffle

Email: andrew@roywardfarms.com

Northern Farming Conference 2023

Tomorrow's farming, today

Wednesday 1st November

NORTHERN FARMING CONFERENCE

ArmstrongWatson® Accountants, Business & Financial Advisers

CLA

HSBC

NORTH EAST GRAINS

Hexham and Northern Marts

WOMBLE BOND DICKINSON

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