

Woolworths   
*The fresh food people*

 Greenstock  
AUSTRALIAN MEAT BY WOOLWORTHS

# HEALTH - FROM THE GROUND UP BREAKFAST

Tuesday 7th May  
The Stadium

**BEEF**  **2024**  
ROCKHAMPTON AUSTRALIA




# Acknowledgement of Country

Woolworths Group acknowledges the many Traditional Owners of the lands on which we operate, and pay our respects to their Elders past and present. We recognise their strengths and enduring connection to lands, waters and skies as the Custodians of the oldest continuing cultures on the planet.

Woolworths Group supports the invitation set out in the Uluru Statement from the Heart to walk together with Aboriginal and Torres Strait Islander peoples. We are committed to actively contributing to Australia's reconciliation journey through listening and learning, empowering more diverse voices, caring deeply for our communities and working together for a better tomorrow.

"A Brave Heart for a Better Tomorrow."  
artwork by David Williams of Gilimbaa.





# TODAY'S AGENDA

Greenstock Managing Director,  
Anna Speer – Welcome

Keynote Speaker, Professor John Gilliland

Breakfast Served 7:40am

Q&A 8:10am

Event Concludes 8:45am





# “HEALTH” FROM THE GROUND UP..

A Practitioner’s Perspective



---

**JOHN GILLILAND**

Professor of Practice, Queens University Belfast

Chair, ARC Zero

Special Advisor, AHDB & QMS

Owner, Brook Hall Estate



# The Need for Global Leadership

2023 – Three New Reports



Food and Agriculture Organization of the United Nations

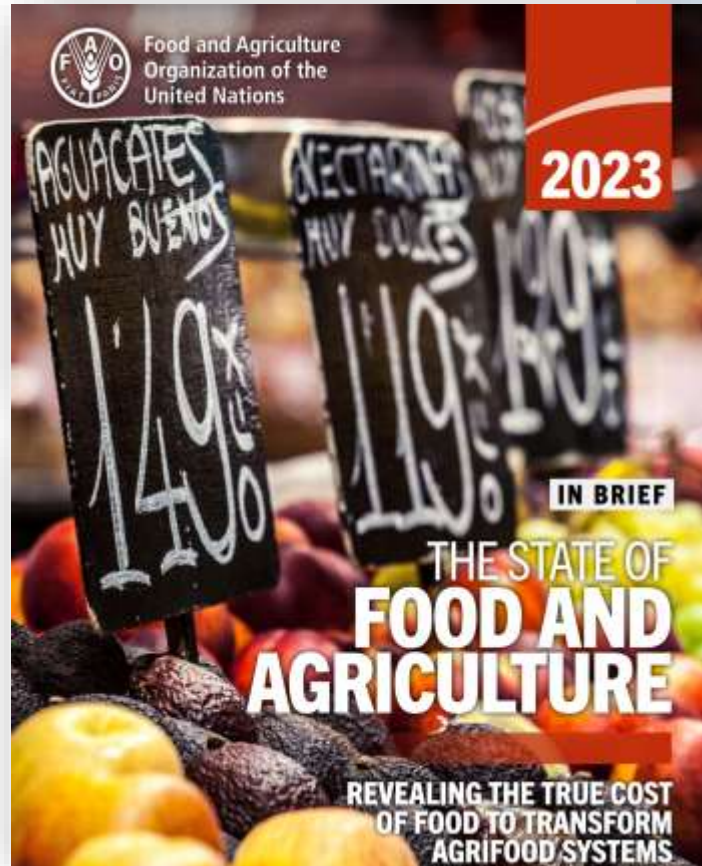
**Pathways towards lower emissions**

A global assessment of the greenhouse gas emissions and mitigation options from livestock agrifood systems



**Achieving SDG2 without breaching the 1.5C threshold: A Global Roadmap**

Accelerated climate actions can transform agrifood systems and help achieve food security and nutrition both today and tomorrow.



Food and Agriculture Organization of the United Nations

**2023**

**IN BRIEF**

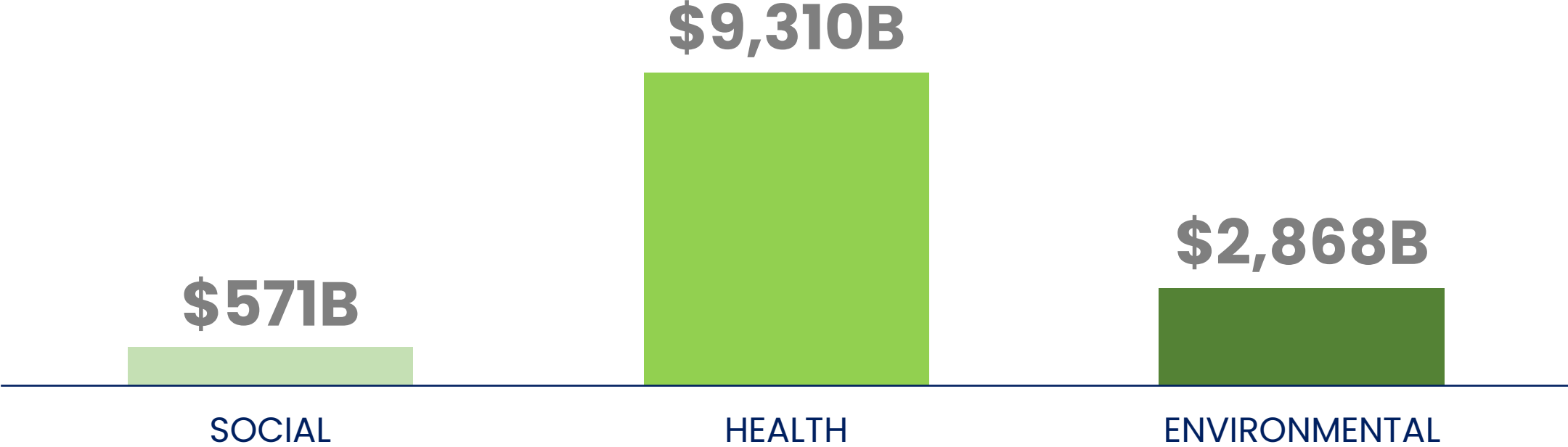
**THE STATE OF FOOD AND AGRICULTURE**

**REVEALING THE TRUE COST OF FOOD TO TRANSFORM AGRIFOOD SYSTEMS**

## What do they tell us?

- Eliminating Zero Hunger will drive Demand for Crop & Livestock Products to 2050
- Livestock Products are Vital for Human Development & Good Health
- Mitigation measures must Reduce Emissions, **Despite rise in Demand**

# Quantified, the hidden cost of the global agrifood system

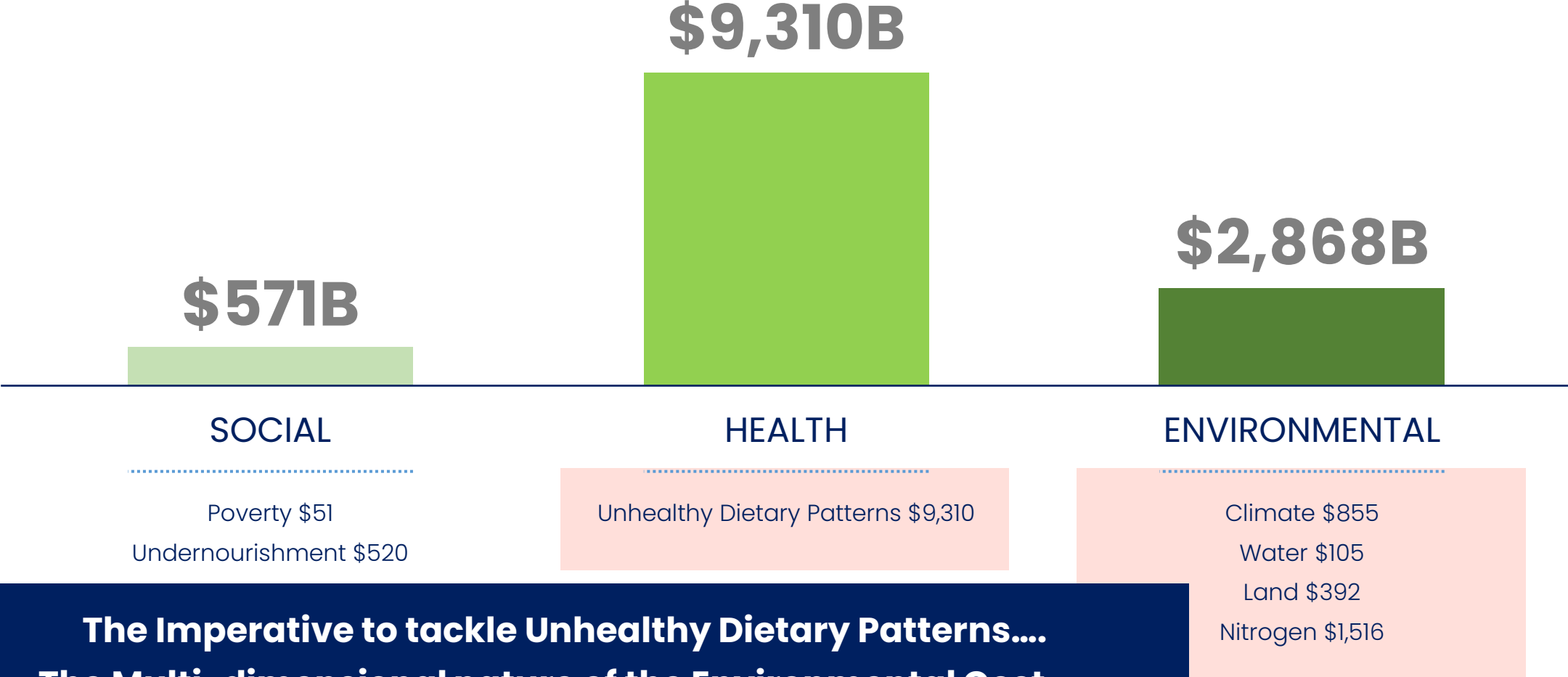


**The hidden health cost is 3 times the hidden environmental cost**

*Note: Hidden Cost by Category and Sub-Category PPP 2020 \$Billions; Source: State of Food & Agriculture, FAO 2023*



# Quantified, the hidden cost of the global agrifood system



**The Imperative to tackle Unhealthy Dietary Patterns....**  
**The Multi-dimensional nature of the Environmental Cost.....**

Note: Hidden Cost by Category and Sub-Category PPP 2020 \$Billions; Source: State of Food & Agriculture, FAO 2023

# Trade Offs – The Regulatory Challenge?

Human Dietary Guidelines – Human Health versus Climate Health

**Food**  
Standards  
Scotland

**Inbhe**  
**Bìdh Alba**



THE UNIVERSITY  
*of* EDINBURGH

**Approaches to modelling impact of reduction  
in meat and dairy consumption on nutrient  
intakes and disease risk**

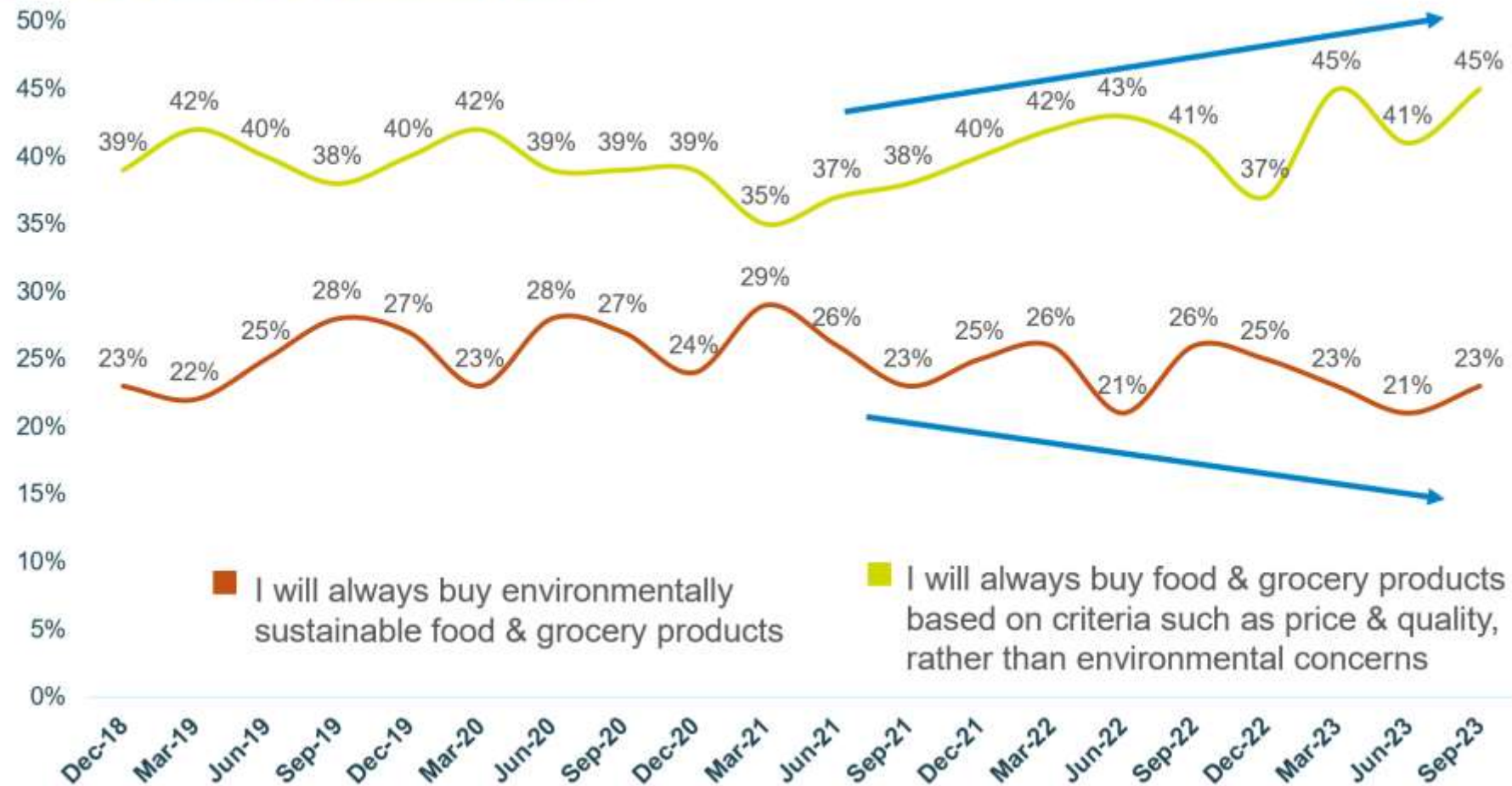
March 2024

“Given the Diet of the Scottish population is so poor, particularly in some sub-groups, an “across the board” population reduction in Meat & Dairy consumption **can not** be recommended, as micronutrient intakes may be worsened among those with already low intakes.”



# Currently, UK Consumers are choosing Price, over the Environment

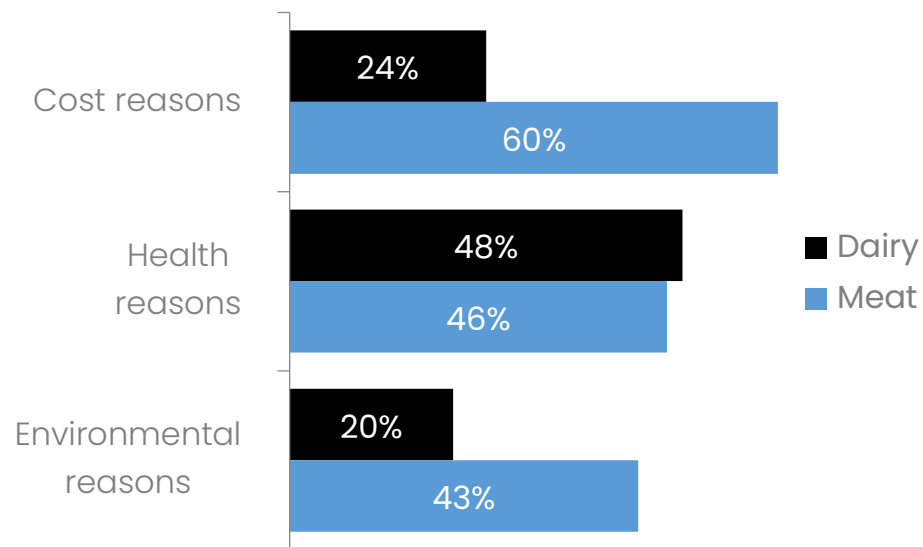
## Affordability vs. Sustainability



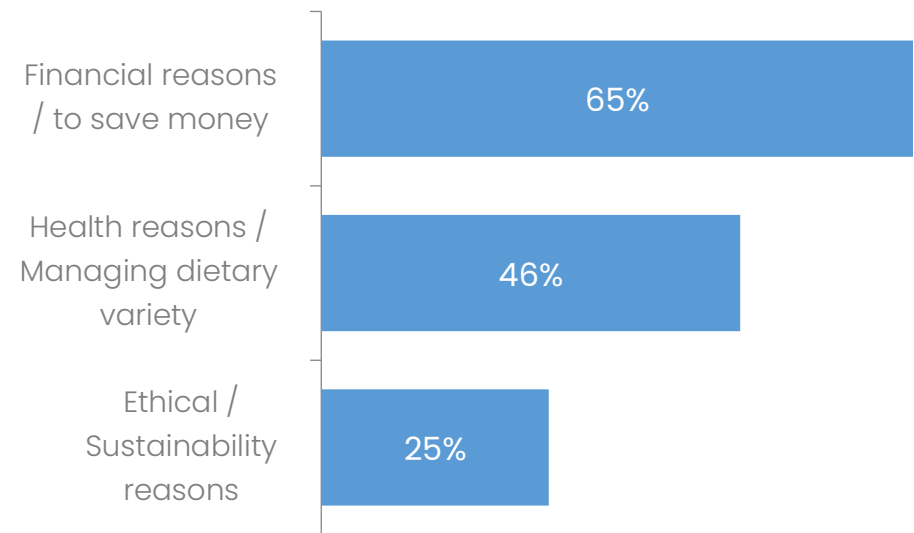
# But the Environment is an important issue for UK and Australian Consumers

Health & Environment, key reasons why consumers may reduce Meat & Dairy

**UK:** After Cost, Reasons for cutting back on Meat & Dairy



**AU:** Reasons for cutting back on Meat & Dairy

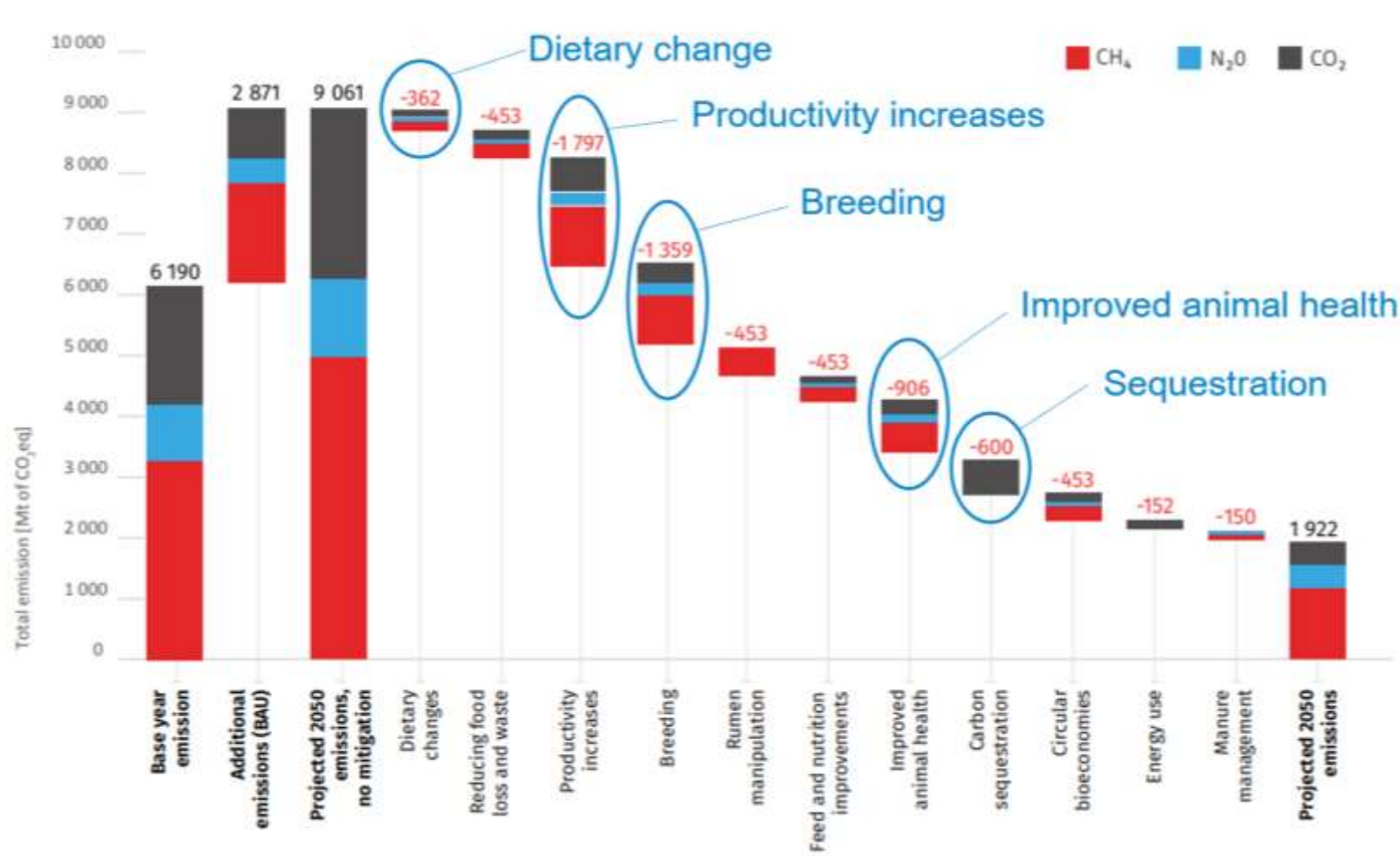


**52%** claim to be reducing meat consumption



# FAO 2023, Pathway to Lower Emissions

Prioritising & Giving Context to the Change required Globally





**So what does this  
all mean to me,  
as a Practitioner?**



# The Lands at Dowth Research Farm, Ireland

Delivering Multiple Public Goods, Simultaneously, from farming livestock

GLOBAL NETWORK OF  
LIGHTHOUSE FARMS

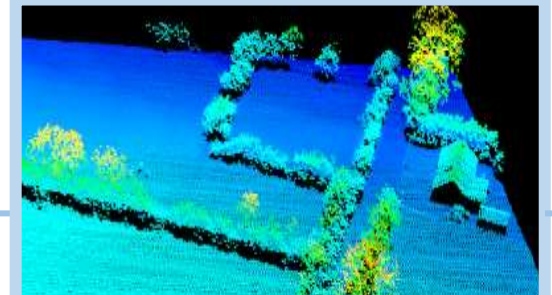
**DEVENISH™**



Purchased in 2013, 185ha  
Grasslands & Woods



Delivering Soil Improvement  
Fertility & Health



Measuring Carbon Sequestration,  
Above & Below Ground



Measuring Carbon Sequestration,  
Above & Below Ground



Optimising Biodiversity,  
Understanding Trade Offs



Managing our Landscape  
UNESCO World Heritage Site

# Measured Multiple Benefits of switching to Multispecies Swards

Using Dowth's "Living Lab..." 32ha trial, with 5 PhD students



## In ONE year:

- 65% reduction in Nitrogen
- 20% improvement in ADLWG
- 300% increase in earthworms
- 14 times faster water infiltration of soil

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





# Delivering at the Farm Level

An EIP Operational Group – **Accelerating 7 N. Irish Farms towards Net Zero**



**Roger & Hilary Bell** *Sheep*

**Simon Best** *Arable & Beef*

**Patrick Casement** *Sheep & Sucklers*

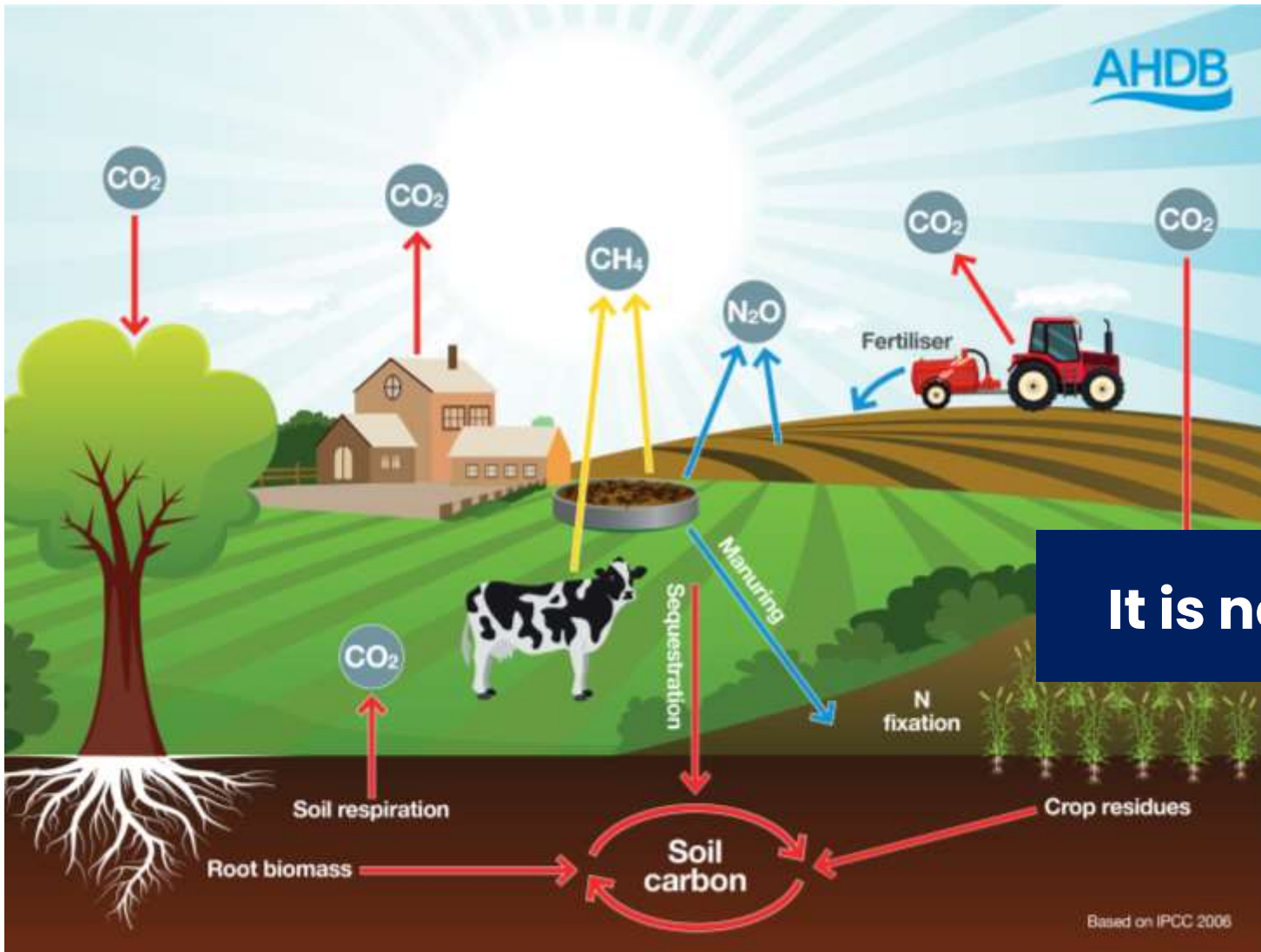
**John Egerton** *Suckler Beef*

**John Gilliland** *Willow & Dry Stock*

**Hugh Harbison** *Dairy*

**Ian McClelland** *Dairy*

# Defined Net Zero: Sum of Emissions equals Sum of Sequestration



Adjusted for any fossil fuel CO<sub>2</sub> emissions displaced by Renewables and for any methane emissions reduced by waste management

**It is not about Zero Emissions...**



# Where did we start – We learnt our numbers



## Baselined & Benchmarked

- GHG Emissions
- Carbon Stocks in Soil
- Carbon Stocks in Trees
- Estimated Carbon Sequestration
- Net Carbon Position
- Empowered Behavioural Change
- **Delivered other Public Goods**

# Baselining Net Emissions for seven ARCZero farms

2021 Agrecalc Analysis	Enterprises	TIER 2 EMISSIONS MODULE	TIER 1 SEQUESTRATION MODULE	Net Emissions t CO <sub>2</sub> -e/yr	% Reduction
		Gross Emissions t CO <sub>2</sub> -e/yr	Gross Sequestration t CO <sub>2</sub> -e/yr		
<b>Ian McClelland</b>	Dairy	1,101	309	792	28%
<b>Hugh Harbison</b>	Dairy	2,009	549	1,459	27%
<b>John Egerton</b>	Beef & Sheep	1,475	444	1,031	30%
<b>Roger &amp; Hilary Bell</b>	Sheep with Beef	754	456	298	60%
<b>Simon Best</b>	Arable with Beef	1,799	738	1,061	41%
<b>Patrick Casement &amp; Trevor Butler</b>	Beef & Sheep	492	548	-56	111%
<b>John Gilliland</b>	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**

# Carbon Sequestration – New Measuring Technologies

When repeated every **5 years** – measures actual change, essential for **TIER 3**



Aerial LiDAR Survey at  
40 scans per metre



Soil Sampling to  
one metre deep



# Measuring Carbon in Trees & Hedges



Using Aerial LiDAR at Brook Hall



# Measuring Carbon in Trees & Hedges

## Using Aerial LiDAR at Brook Hall

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

# 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	Ac. 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, Deciduous 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, Deciduous Woodland	4.6ha	pH 5.3	13%	25	5	6.90%	4.90%	136t	625.6t
<b>TOTALS</b>	<b>57.6ha</b>			<b>165 Soil Cores</b>	<b>33 C. Samples</b>			<b>92.3t/ha</b>	<b>5,319.1t of C.</b>

**Soil Carbon at Brook Hall = 5,319 t of C, or 19,468 of CO<sub>2</sub>e**



# Total Carbon Stocks across 7 ARCZero farms

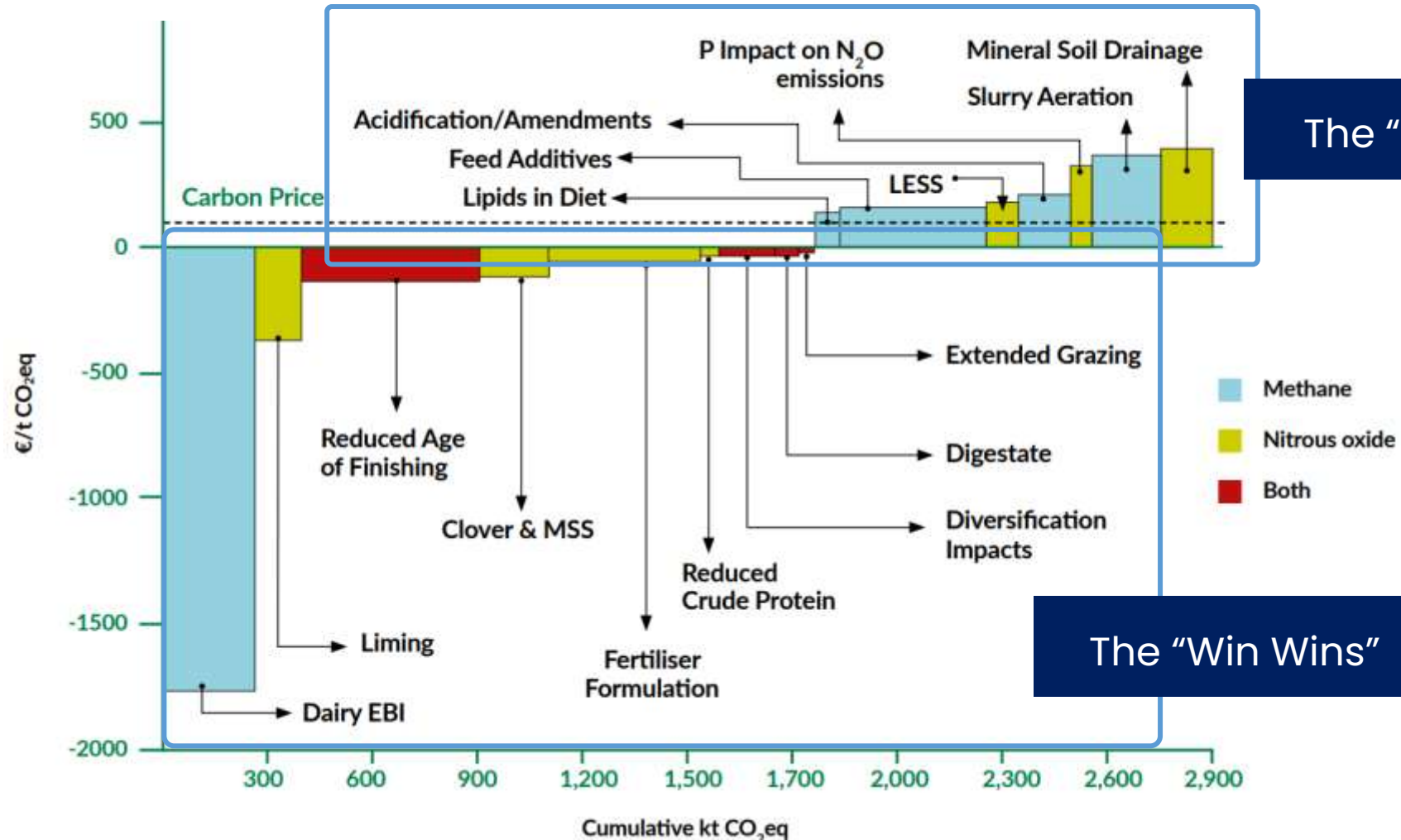
Total ARCZero CO2e Stocks	Enterprises	Soil Carbon	Tree Carbon	Total Carbon	% C in Soil
Ian McClelland	Dairy	31,813t	1,310t	33,123t	96%
Hugh Harbison	Dairy	68,054t	1,969t	70,023t	97%
John Egerton	Beef & Sheep	31,813t	1,310t	33,123t	96%
Roger & Hilary Bell	Sheep with Beef	50,819t	668t	51,507t	98%
Simon Best	Arable with Beef	237,915t	6,493t	244,407t	97%
Patrick Casement & Trevor Butler	Beef & Sheep	54,556t	4,022t	58,578t	93%
John Gilliland	Willows with Dry Cows	19,468t	4,937t	24,405t	80%
			<b>TOTAL</b>	<b>515,166t</b>	

ARCZero's 7 farms manage 515,166t of CO2e – **97% is in SOIL, not trees**

In 2027, targeting **530,000t**, but will GHG Inventory or Scope 3 recognise increase?

# Accelerating towards Net Zero – How do we do it?

Understand the costs of the different Mitigation Options – MACC Curve



The "Win Lose"

The "Win Wins"

# Empowered, ARCZero farmers made the following changes

Focusing on the most Cost Effective Solutions first

- 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**





# The Resultant Improvements Observed over two years

LCA comparison between 2021 & 2023, gross emissions/unit of output

GHG Reduction 2021 to 2023	Enterprises	2021	2023	% Reduction in GHGs
<b>Ian McClelland</b>	Dairy	1.3kg CO <sub>2</sub> e/kg FPC Milk	1.1kg CO <sub>2</sub> e/kg FPC Milk	13%
<b>Hugh Harbison</b>	Dairy	1.25kg CO <sub>2</sub> e/kg FPC Milk	1.2kg CO <sub>2</sub> e/kg FPC Milk	4%
<b>John Egerton</b>	Beef & Sheep	32.8kg CO <sub>2</sub> e/kg dwt	25.6kg CO <sub>2</sub> e/kg dwt	22%
<b>Roger &amp; Hilary Bell</b>	Lamb	22kg CO <sub>2</sub> e/kg dwt	15.7kg CO <sub>2</sub> e/kg dwt	28%
<b>Simon Best</b>	Wheat	0.99kg CO <sub>2</sub> e/kg grain	0.47kg CO <sub>2</sub> e/kg grain	53%

## Determining Factors

- Price of fertiliser
- Sowing legumes
- Health of livestock
- Weather

# Delivering Multiple Public Goods Simultaneously

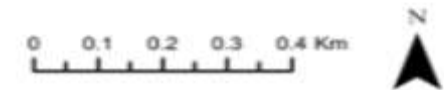
Using LiDAR & Phosphate Soil Surveys to create “Run Off Risk” Maps

Hugh Harbison's  
Farm (Dairy)



Multi Species Pastures –  
Water Infiltration, Biodiversity,  
Carbon Sequestration

- 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.





# Comparing Different Land Uses



Willow SRC (28 Yrs. Old)



Silvopasture (120 Yrs. Old)



Permanent Pastureland (200 Yrs. Old)



D. Woodland (30 Yrs. Old)



D. Woodland (250 Yrs. Old)

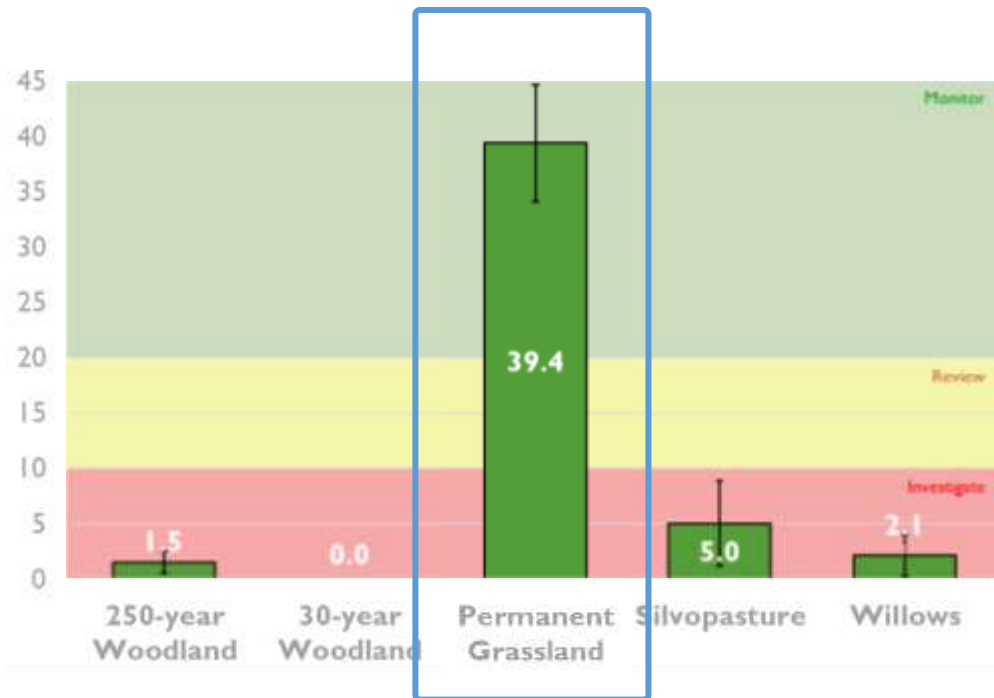
B R O O K H A L L  
*Estate & Gardens*



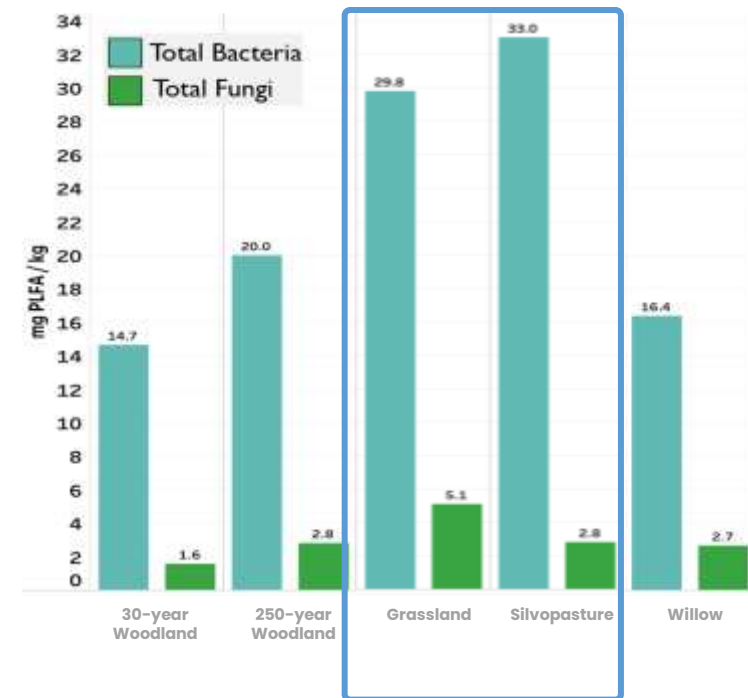
# Delivering Multiple Public Goods Simultaneously

## Role of Livestock Faeces in Increasing Soil Biodiversity

Average Earth Worm Population



Bacteria and Fungi Biomass per Land Use



# Delivering Multiple Public Goods Simultaneously

## The Importance of Increasing Biodiversity Under the Soil

### Three 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

Aug 2023

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

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

Oct 2023



Review

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

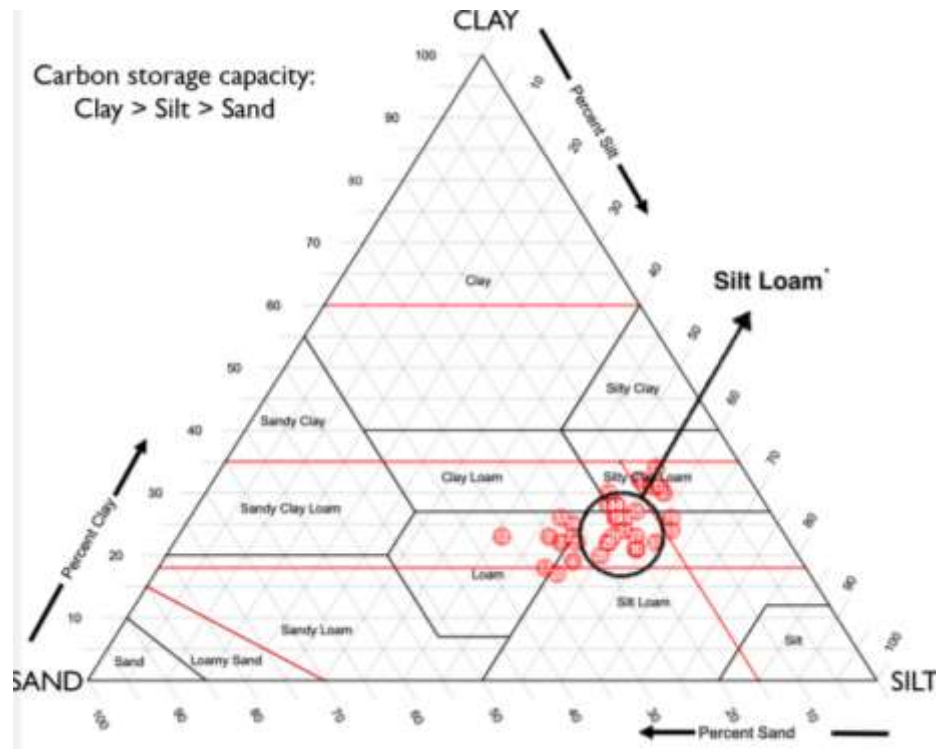
Arne Brummerloh<sup>1,\*</sup> and Katrin Kuka<sup>2</sup>

Dec 2023

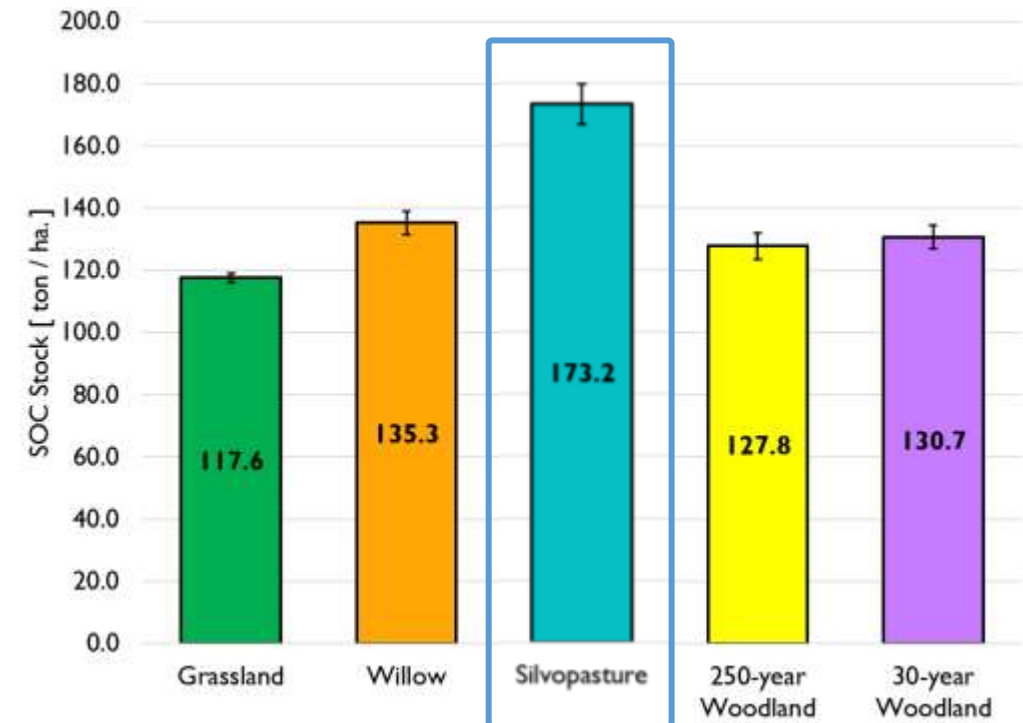
# Role of Different Land Uses in Building Soil Organic Carbon

## Role of Diverse Root Architecture – Monocultures' Root Structure Struggling

Brook Hall Soil Texture Classification



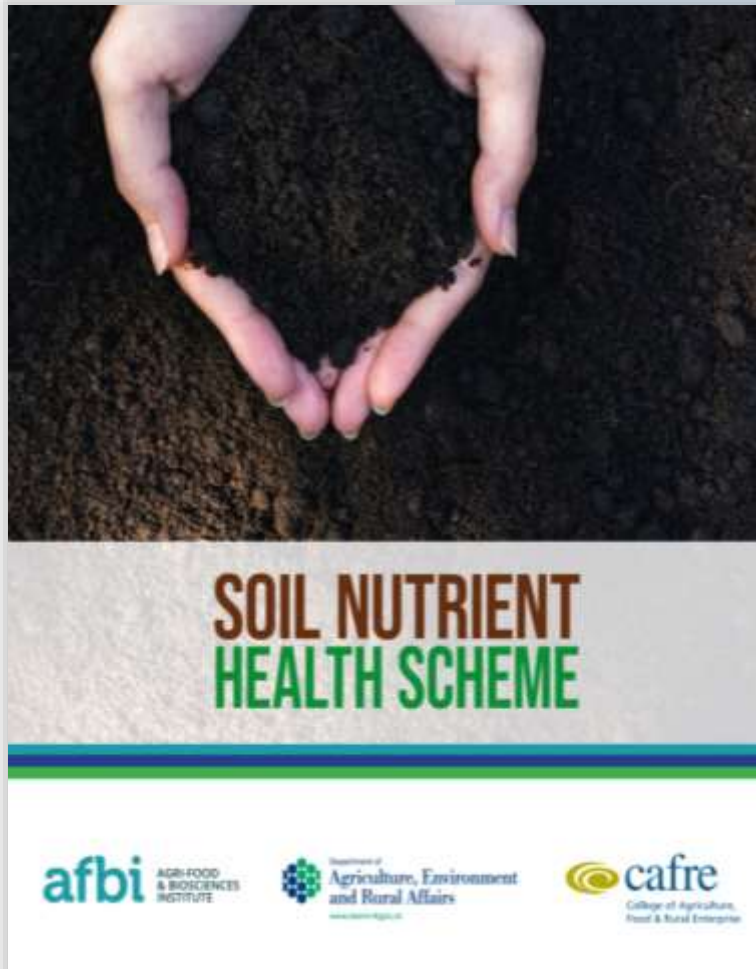
Mean SOC Stocks for Different Land Uses at Brook Hall





# Is this Scale of Ambition Possible at a Regional Level?

## N. Ireland



- £45m Scheme to base line every field, tree & hedge
- Carried out over 4 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 5 years
- **92% Farmer uptake in Zones 1 & 2 (50% of N. Ireland)**

Critical Achievement in N.I

**The Cost of Measuring, Reporting & Verification (MRV) Is a Public Good**

# FAO, Achieving Zero Hunger: A Global Road Map, COP28



Activity	Target Year	Description
Livestock	2030	Methane Emissions Reduced by 25%, compared to 2020
	2050	Total Livestock Productivity Growth, 1.7% per year, Globally
Crops	2050	Total Crop Productivity Growth, 1.5% per year, Globally
	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
		All Countries have Legislation Restricting Food Advertisements targeting children
Forests & Wetlands	2025	Zero Global Net-Deforestation achieved
	2035	Zero Global Gross-Deforestation achieved
Soil & Water	2030	Achieve Universal & Equitable access to Safe & Affordable Drinking Water for all
	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
	2050	All Food Loss & Waste Integrated into Circular Bioeconomy, or used for Feed & Soil Enhancement

# “Health” from the Ground Up



## What Role does Australian Farming & Food want in delivering this 2050 Vision?

**It won't happen if we don't...**

- Baseline, Measure & Manage with forensic integrity
- Empower Farmers with Knowledge to Change
- Invest in Delivering Human Health & Zero Hunger





# Q & A

HEALTH - FROM THE GROUND UP