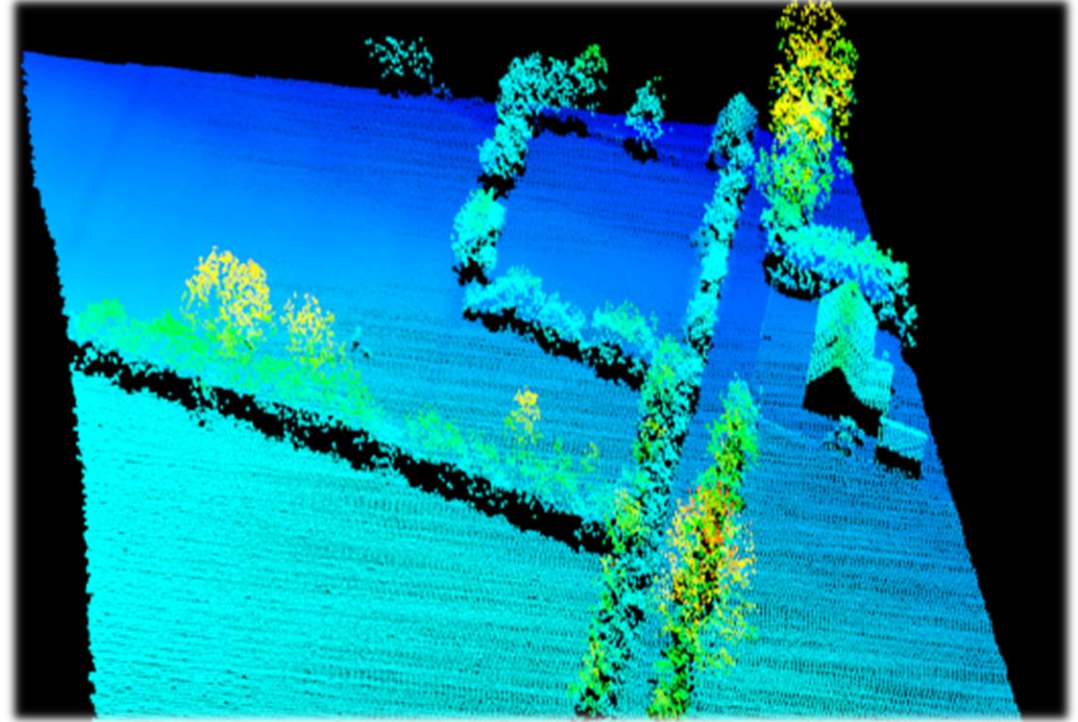


“Smart Food Solutions – One Health from Soil to Society”

Using Good Science to Proactively Improve Human & Environmental Health



John Gilliland

Director of Global Agriculture & Sustainability, Devenish

November 2020

John Gilliland's Journey.....

A Farmer & Innovator

- All Ireland, Tillage Farmer of the Year, 1992
- UK Rushlight Award for Innovation to Waste Water Treatment, 2009
- UK Green Energy Farmer of the Year, Runner up, 2012

An Industry Leader

- President of Ulster Farmers Union (Foot & Mouth Crisis, EU CAP Reform, WTO Mexico 2003)

A Policy Advisor

- Member, EU Commission's Mission Board Assembly on Soil Health & Food
- Former Chair, UK Rural Climate Change Forum, DEFRA, London (2005 to 2012)
- Former Vice Chair, UK Sustainable Development Commission (Nuclear & Severn Barrage)
- Former Non Ex. Director for SAC/SRUC, Edinburgh (Carbon Management Centre)

A Regulator

- Former Non Ex. Director of the N. Ireland Authority of Utility Regulation

Articulating the Devenish Vision

“To inform & deliver more Nutritionally Dense & Diverse food.....

Food item	Nutrient density	GHG emission	NDCI index
Milk	53.8	99	0.54
Soft drink	0	109	0
Orange juice	17.2	61	0.28
Beer	0	101	0
Red wine	1.2	204	0.01
Mineral water	0	10	0
Soy drink	7.6	30	0.25
Oat drink	1.5	21	0.07

Smedman et al. 2010

With an Independently Verified lower Environmental Footprint”

The Imperative - The Need for “Complete” Solutions

Human &
Environmental
Health Improvement



Producer



Processor



Retailer



Consumer



“One Health” ...From Soil to Society
Where Nutrition is optimised at every stage

DEVENISH™
Beyond Nutrition

The Devenish Lands at Dowth – The Irish Lighthouse Farm

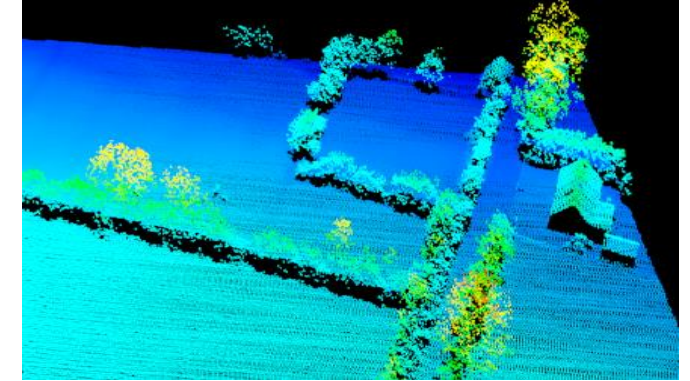
Delivering Carbon Neutral Beef & Lamb by 2025, while driving Profitability



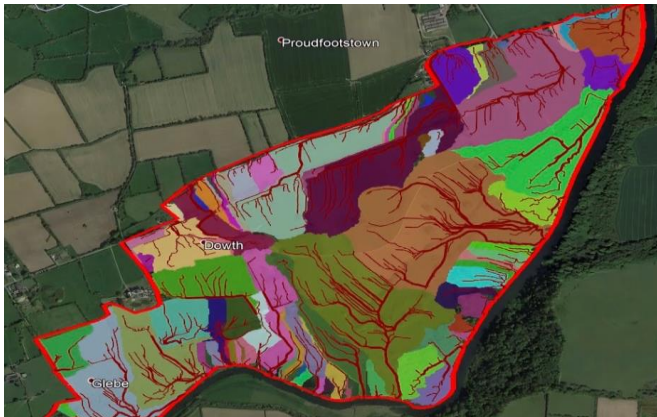
Purchased in 2013
185 ha, Grassland Farm



Delivering Soil Improvement
Fertility & Health



Measuring Carbon Sequestration,
Above & Below Ground



Reducing Over Land Flow
Nutrients & Soil



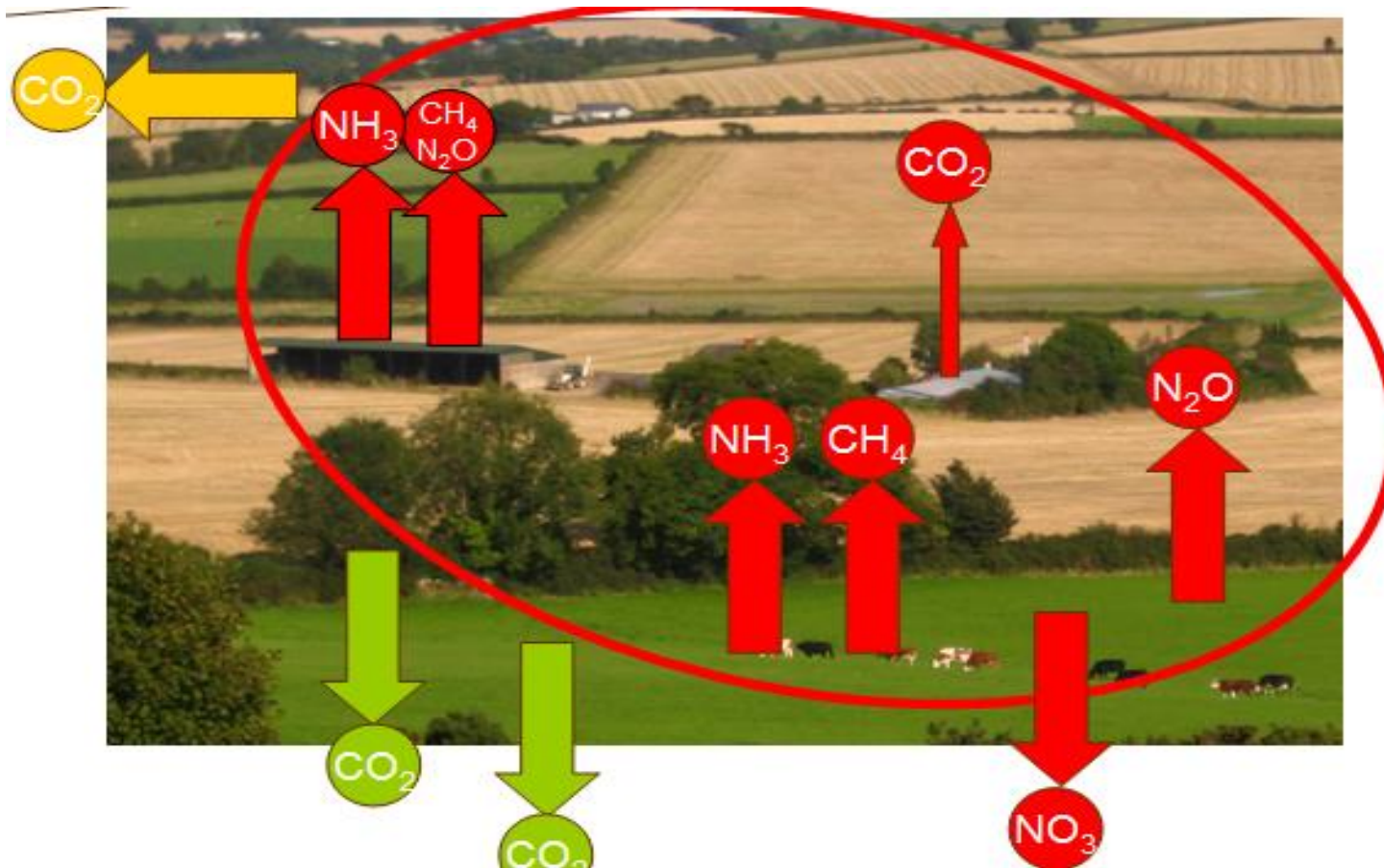
Optimising Biodiversity
Ireland's Top Mammal vis a vis Trees



Managing UNESCO World Heritage
Site, 6,000 yrs of farming evolution

Accelerating our Journey to Net Zero by 2025

Focusing on Credible, Verifiable Measurement of Improved Farming Practices



Calculating

Gross Annual GHG Emissions
Gross Annual Carbon Sequestration

Delivering

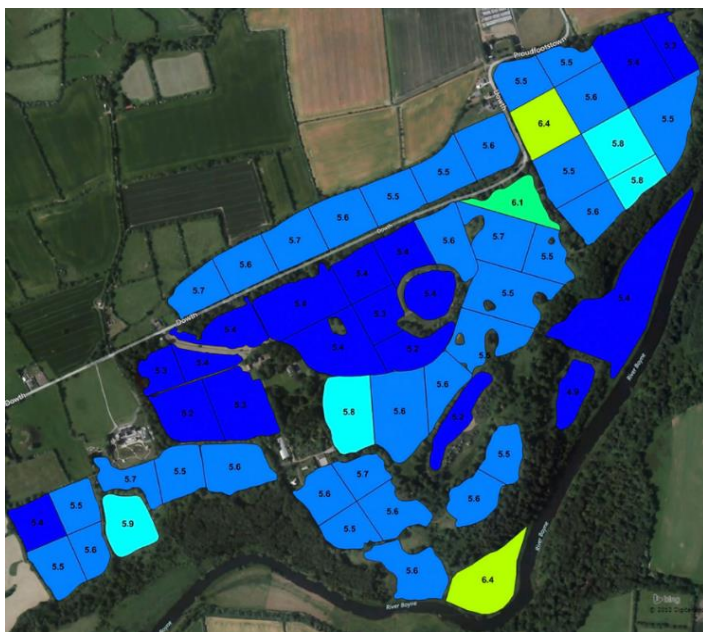
Net Annual GHG Emissions for the
whole farm business

Communicated in a “Whole Farm, Annual Carbon Balance Sheet,” to inform our Journey

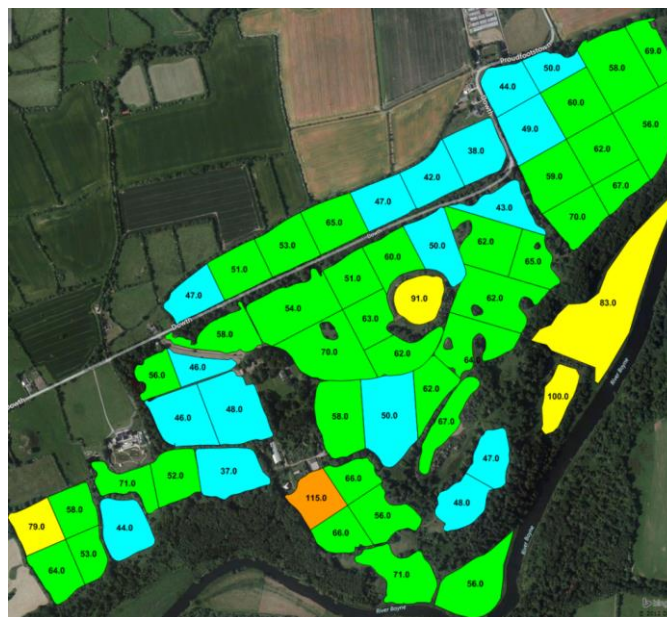
Created Robust GPS Baseline on Soil Fertility

25 soil cores from 2 ha, virtual land parcels, analysed

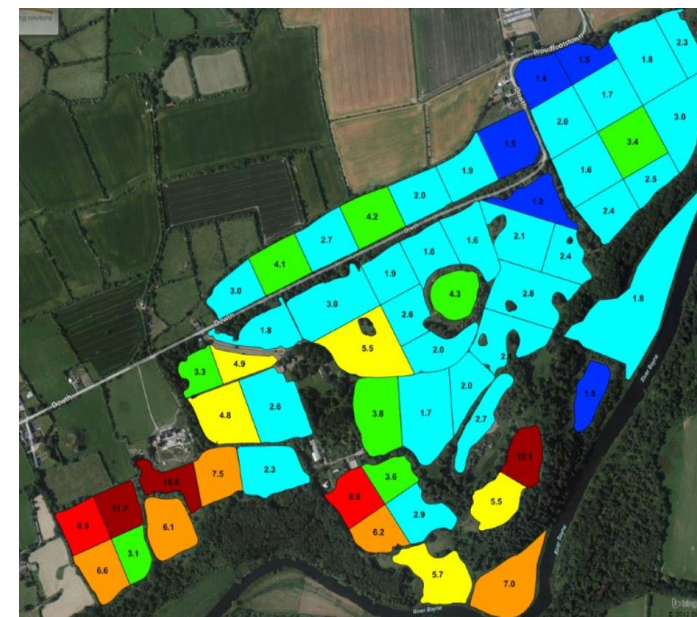
Feb. 2014
Average pH 5.5



Feb. 2014
Average K Index 2-



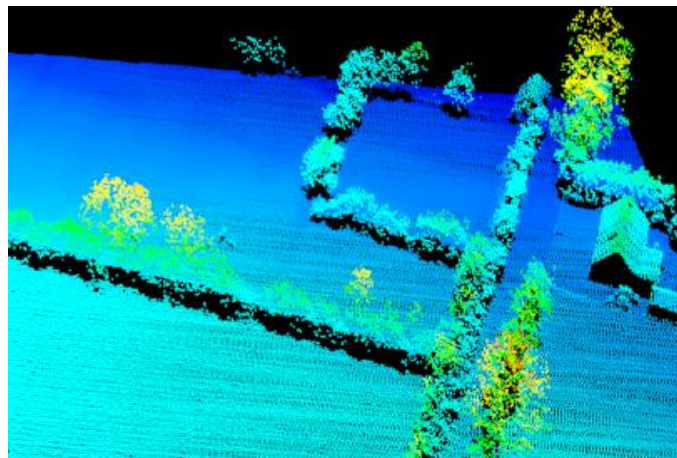
Feb. 2014
Average P Index 1+



Very poor soil fertility, after 40 years of neglect

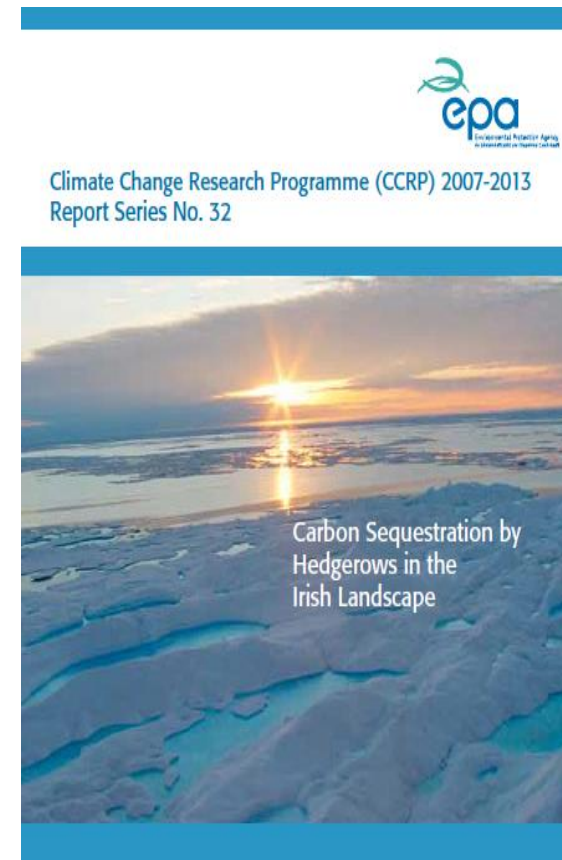
Created Robust GPS Baseline of Carbon in Trees & Hedges

Aerial LiDAR Survey to measure Biomass/Carbon Density



	Woods	Hedges	Total
Biomass Density (t C/ha)	83	127	86
Total Biomass in Dowth (t C)	3495	385	3880
Sequestration Potential for Dowth (t C/Yr)	50	1.2	51

S. Green, Teagasc, 2014



Created Robust GPS Baseline on Soil Carbon

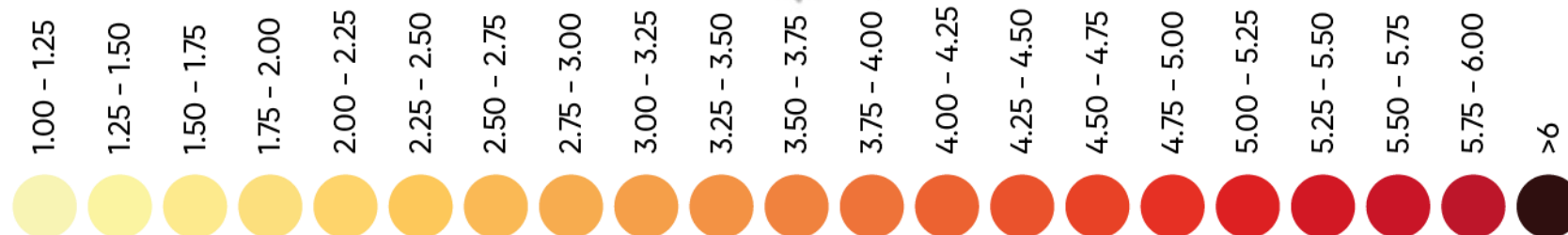
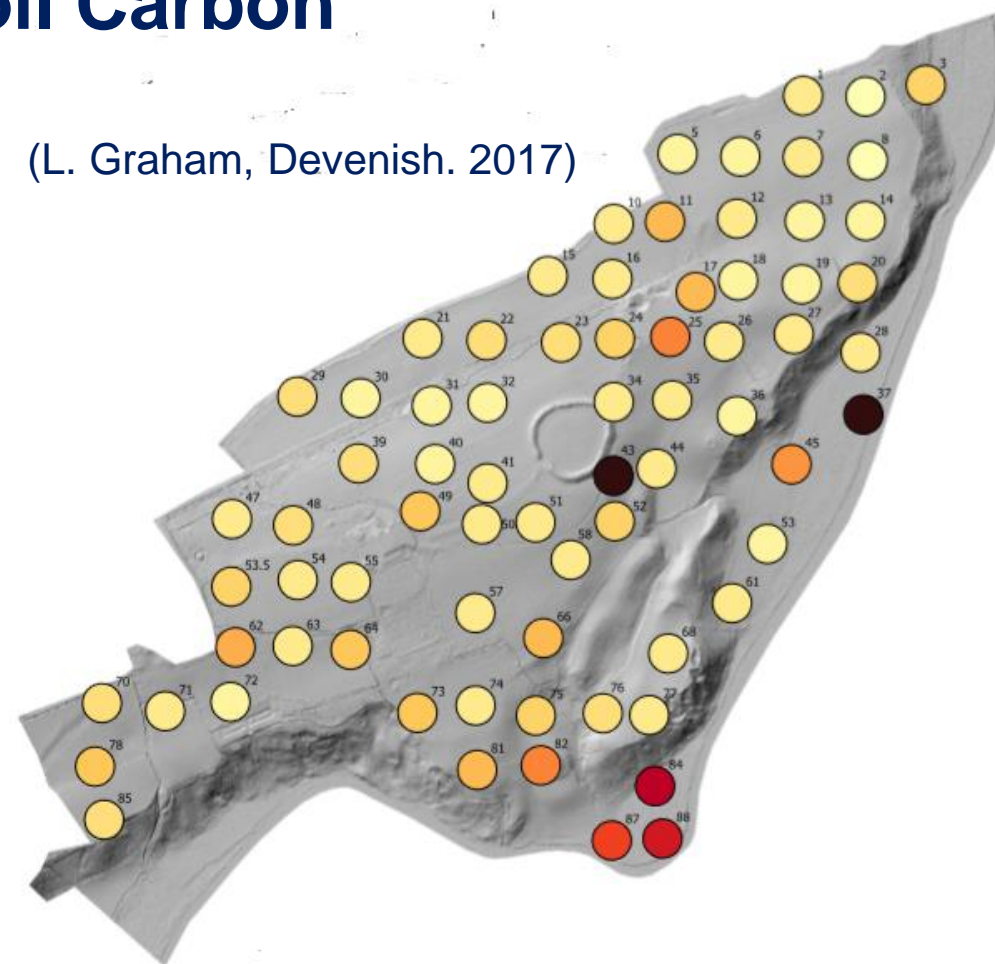
(L. Graham, Devenish. 2017)

Representative Sampling of Soils under Grass
Soil A Horizon sampled to 30cm in 88 soil pits

No ploughing for 40 Years
Some land never ploughed
Soil Type – Brown Earth

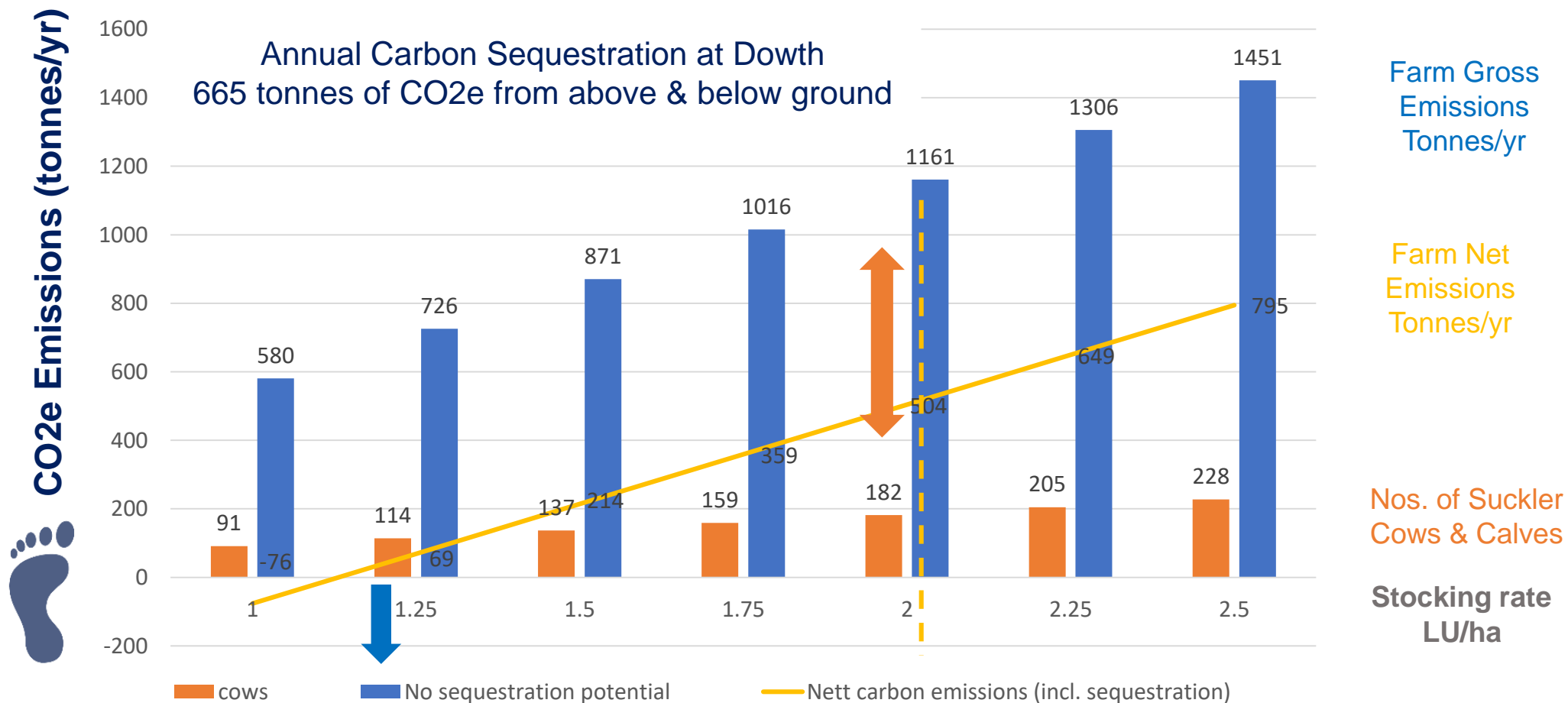
Average Soil Carbon - 2.1%
Expected Soil Carbon – 4 to 5%

Why the disparity in Soil Carbon Levels??



Sensitised “Net Farm” GHG Emissions to different Stocking Rates

Suckler Cows & Calves, Grazing System, on 91 ha of Grass, at Dowth



D.Hagan, Devenish, 2018

Accelerating Sequestration - Improving our Soils by correcting Soil pH

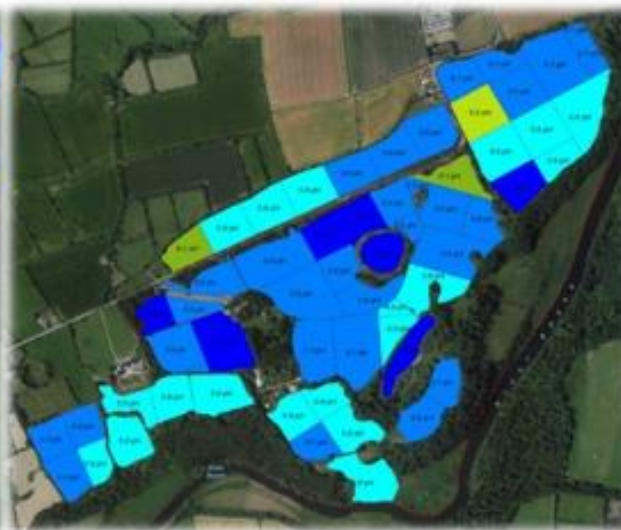
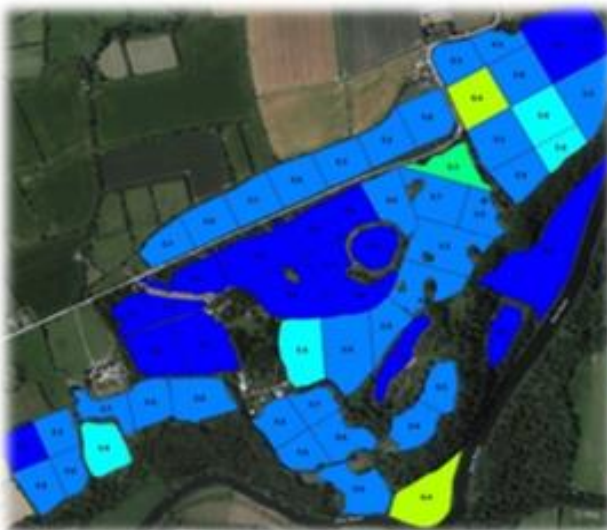
Through disciplined precision, GPS, Biennial, Soil Sampling & Analysis, every 2 Yrs

Feb. 2014
Average pH 5.5

Feb. 2016
Average pH 5.7

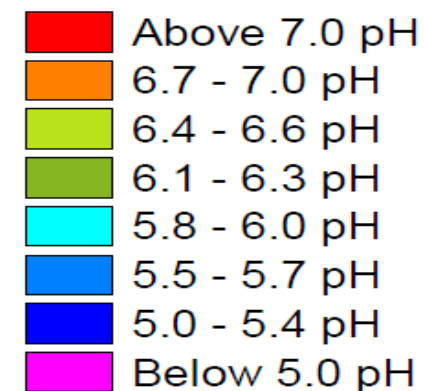
Feb. 2018
Average pH 6.1

Feb 2020
Average pH 6.6



Delivered Credible Transparency of Soil Improvement through the use of regular Precision, GPS, Soil Sampling & Analysis

Dowth Soils now at Optimal pH after only six years!!



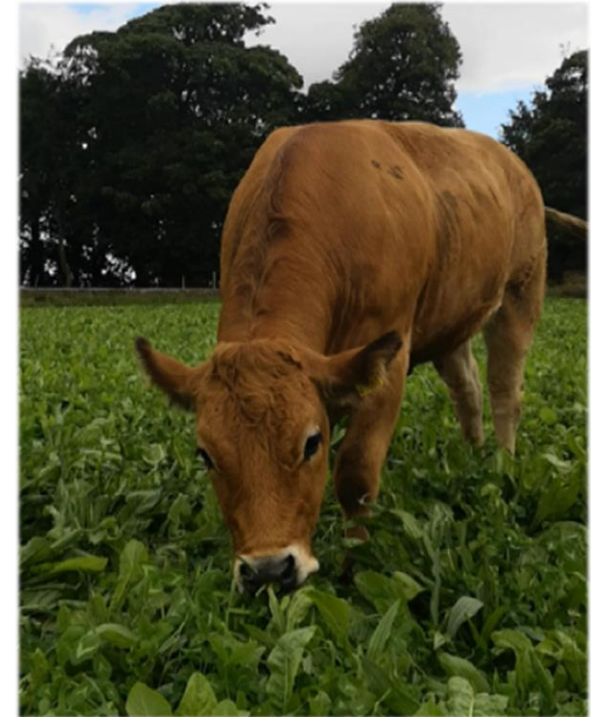
Accelerating Sequestration using our Multispecies Swards “Living Lab”



EU Marie Curie Award for the Optimisation of Multi Species Swards to improve Profitability, Soil & Human Health, Simultaneously

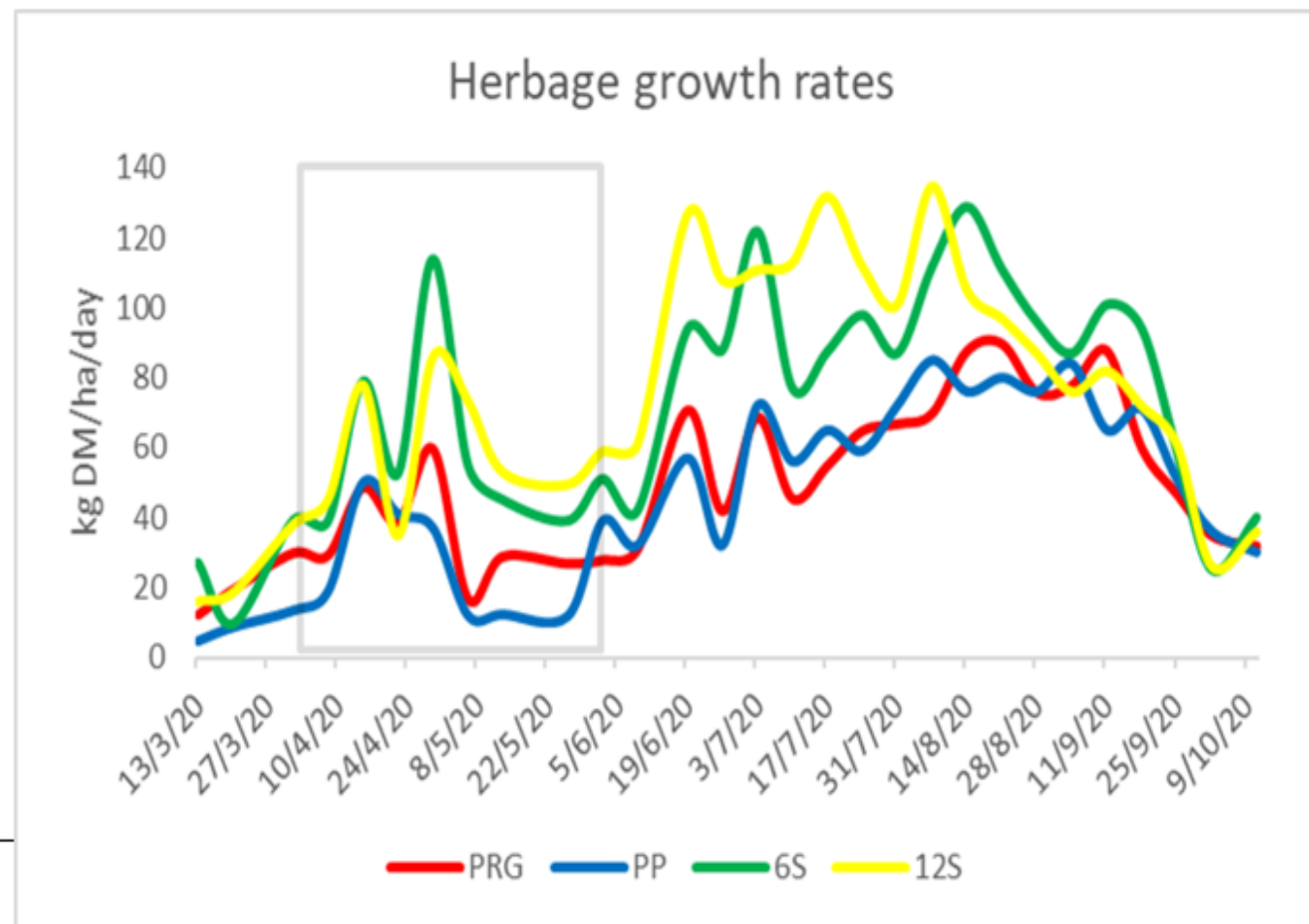
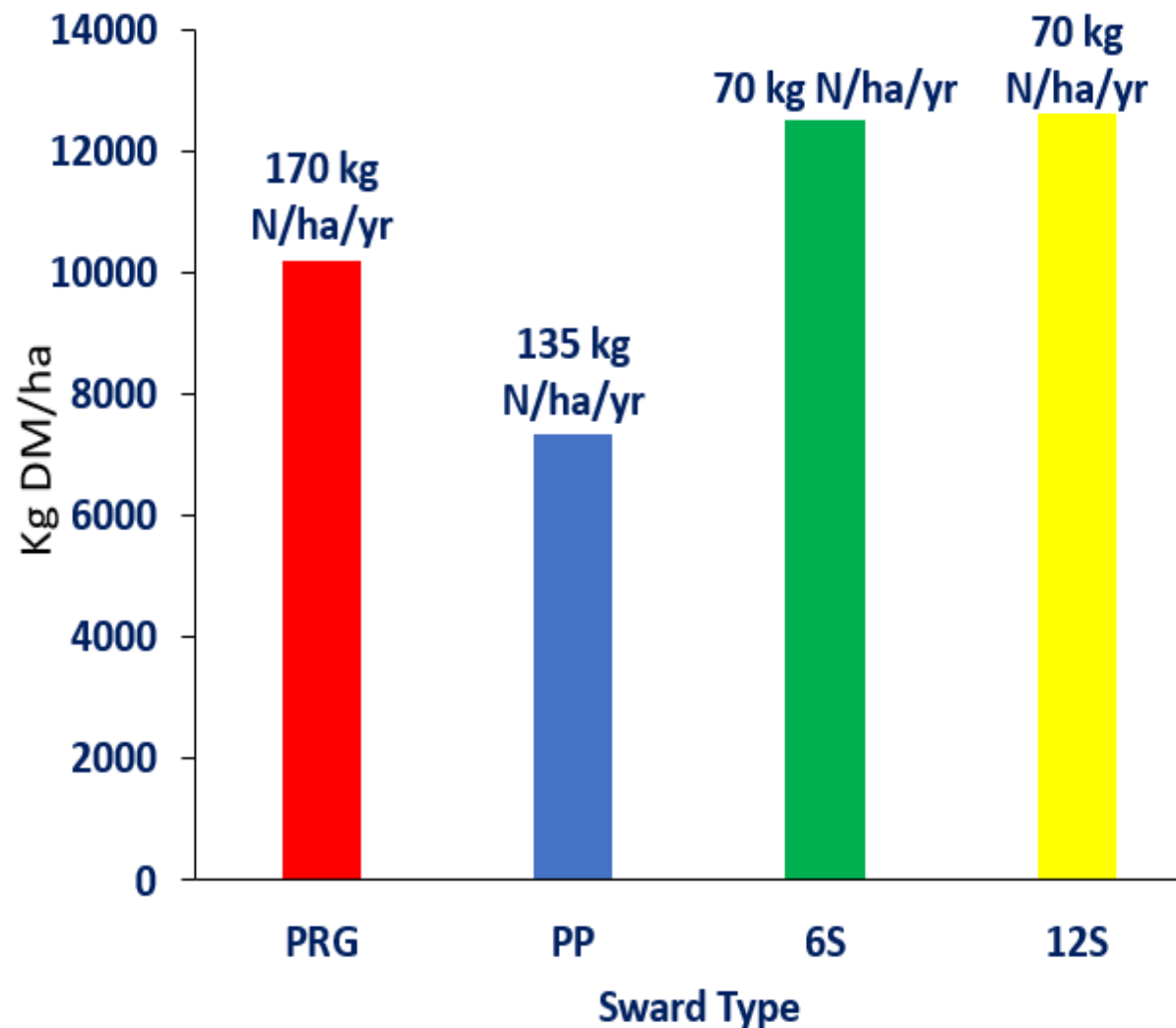
- €1.4m Research Project
- Five PhD Researchers recruited
- 36 ha trials established
- 4 different Sward Compositions
- Co grazed with Cattle & Sheep

Partners:



Yield Comparison between different Sward Diversities, 2020

Shackleton et al., 2020

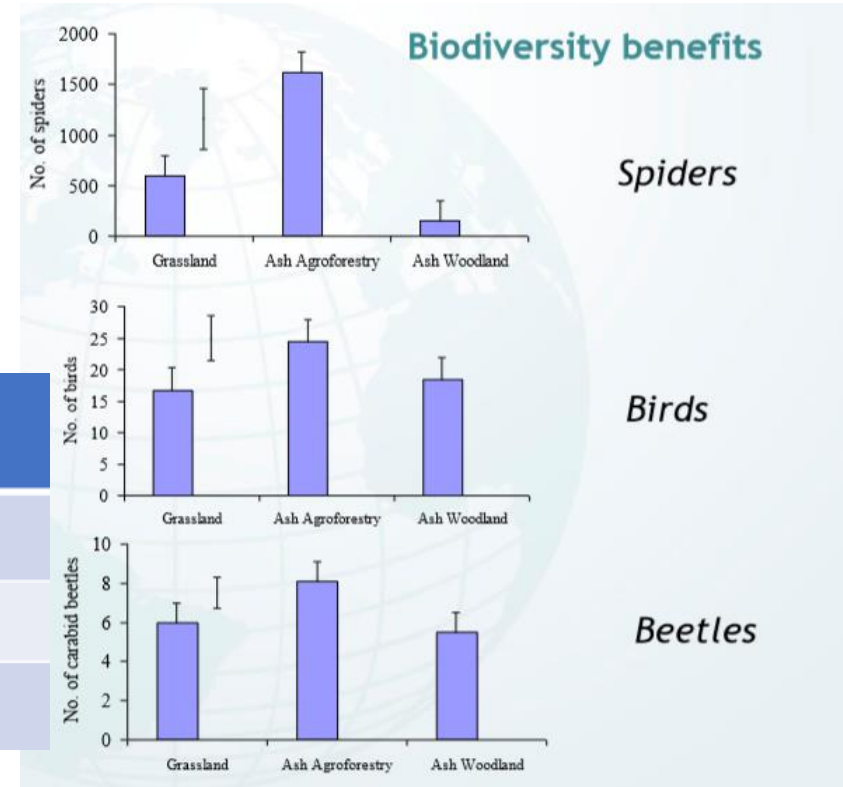


We are Accelerating Carbon Sequestration by planting Silvopasture

Planting Silvopasture in Grazing Platform, Jim McAdam, AFBINI, QUB

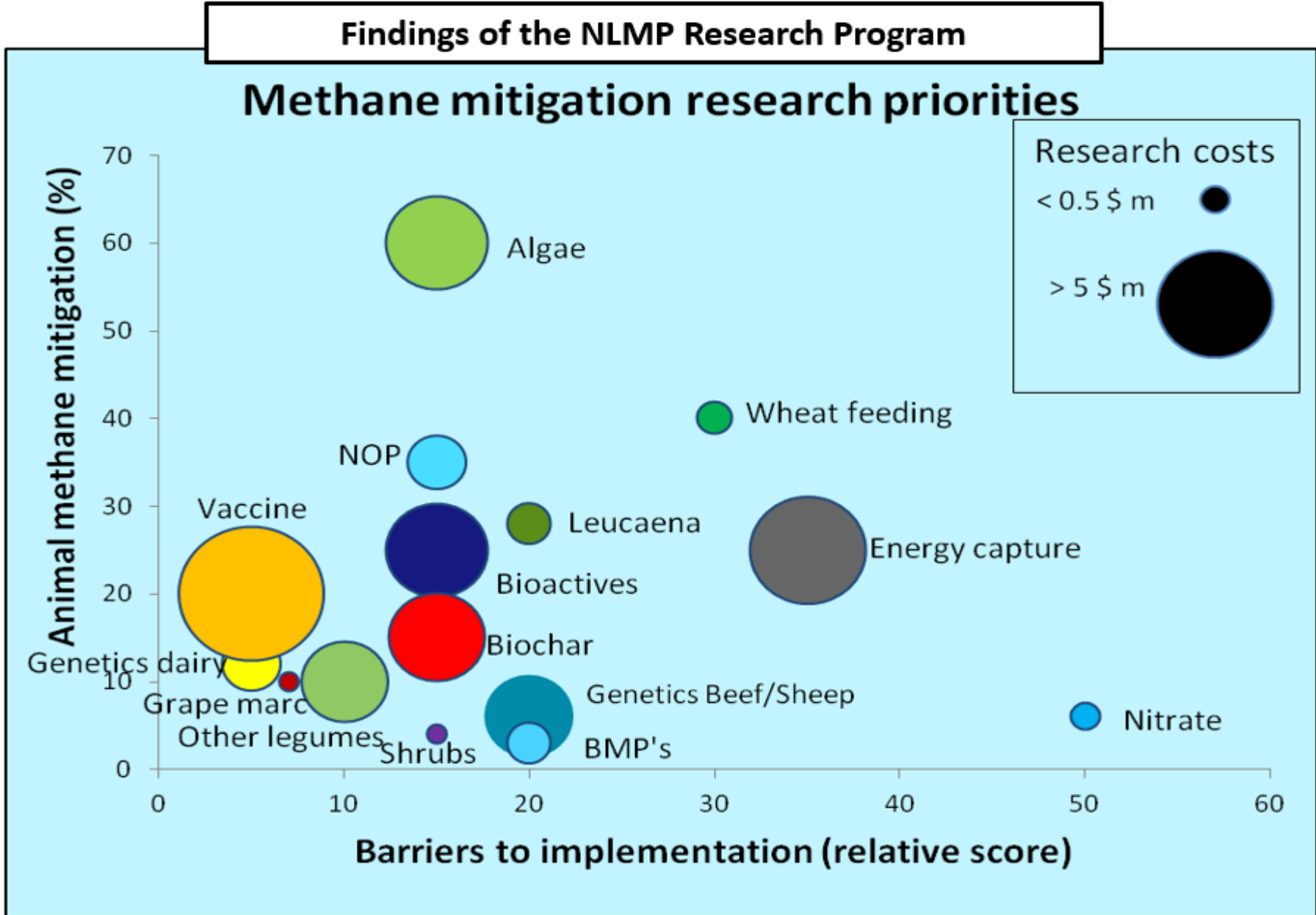


Land Use Practice	Species	tC/ha/yr
Silvopasture	Ash /Mixed Species	2.4
Pasture	Perennial ryegrass	0.6-1.2
Forest plantation	Sitka Spruce	3.8



- Planting 400 trees per ha, on mineral soils, growing grass
- Pollarding of trees to optimise grass growth, biodiversity & sequestration
- Extending Soil Trafficability by 17 weeks, improving grass utilisation & reducing nutrient & soil loss, to water courses

Going beyond Carbon Neutrality through Rumen Methane Reduction?



Precision Nutrition Mitigating Environmental Impacts in Pigs

DeviGainPG – Displacing Crude Protein with refined Amino Acids

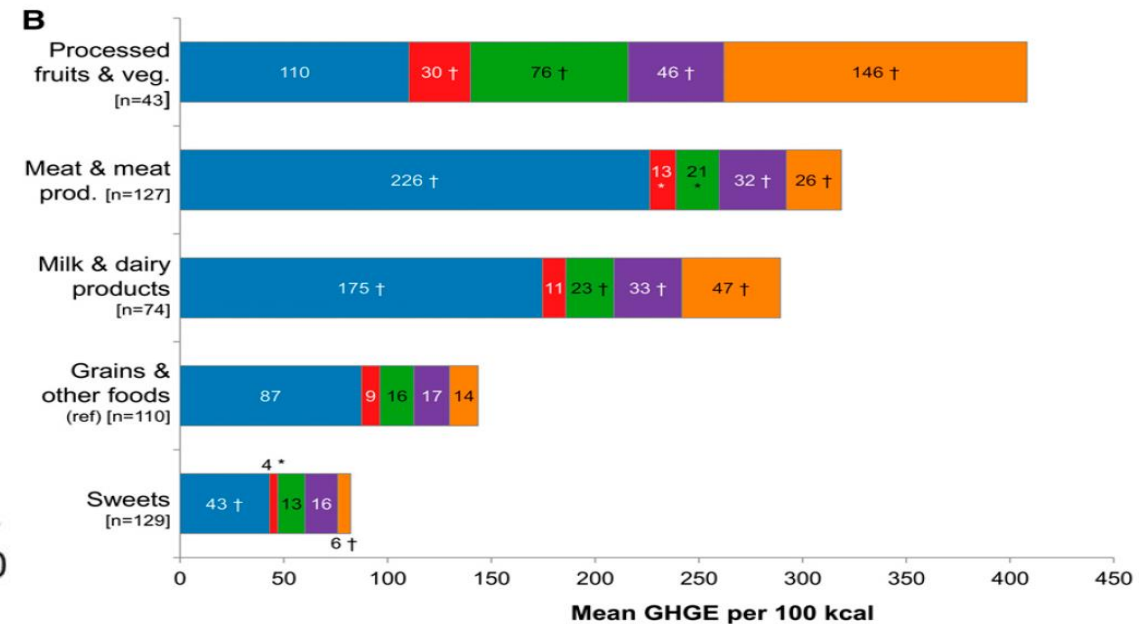
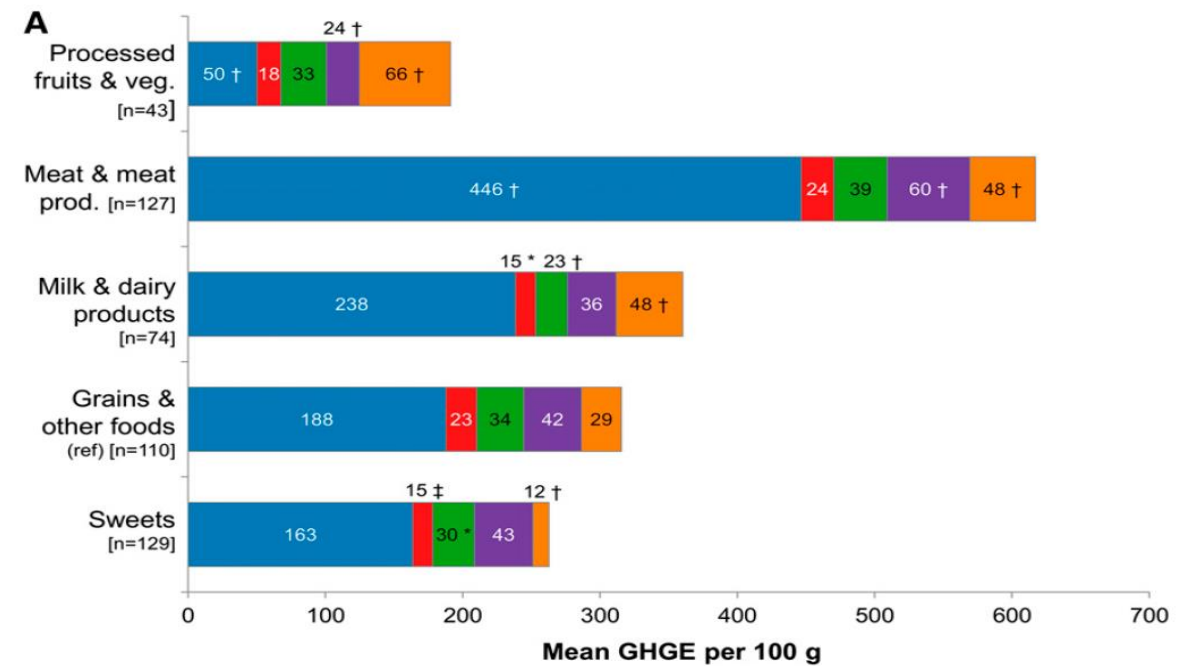
- 5% improvement in growth rate
- 17kg per pig soya reduction
- 25% reduction in water intake
- 38% reduction in slurry volume
- 49% reduction in ammonia
- 16% reduction in GHGs*

*SAC, AgRE Calc, Calculator accredited PAS 2050 to BSI



Which GHG Metrics deliver both Environmental & Human Health?

- GHG footprint per 100 g
- GHG Footprint per 100 kcal
- GHG Footprint per Nutrient Density of 15 key nutrients



The Role of Nutrition & Human Health?

The 2016, Global Human Nutritional Disease Risk Factors, on Deaths & Disability Adjusted Life Years (DALYS), Lancet 2017

DALYs, rather than Deaths the **bigger issue**

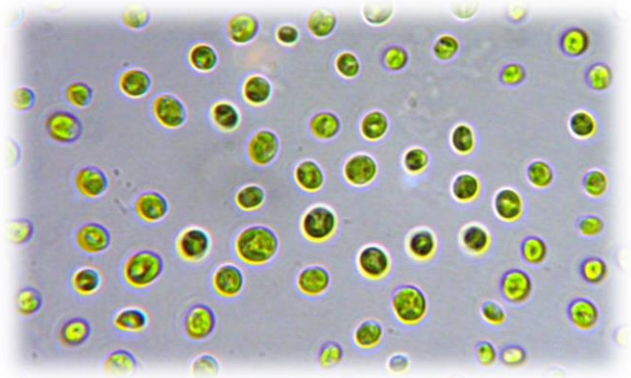
Diet, rather than Food Is the **bigger problem**

Deficiencies, rather than Excesses Is the **bigger problem**

Risk	Summary Exposure Values (%)		Deaths (in 1,000's)	DALYs (in 1,000s)
	Male	Female		
Nutritional Excesses				
Diet High in Calories / High BMI	10	11	4,525	135,381
Diet High in Sodium	40	36	2,310	47,567
Diet High in Trans Fatty Acids	4	5	224	5,111
Diet High in Processed Meats	6	4	140	3,196
Diet High in Red Meat	25	11	32	1,247
Diet High in Sugar Sweetened Beverages	18	13	23	780
Total for Excesses			7,254	193,282
Nutritional Deficiencies				
Diet Low in Whole Grains	59	61	2,499	62,596
Diet Low in Fruit	62	57	2,361	60,982
Diet Low in Nuts & Seeds	81	82	1,879	49,493
Diet Low in Iron		9	20	35,850
Diet Low in Vegetables	42	43	1,519	35,489
Diet Low in Marine Omega-3 PUFAs	77	79	1,539	33,347
Diet Low in Fibre	53	62	888	20,119
Diet Low in Legumes	45	52	672	14,214
Diet Low in Polyunsaturated Fatty Acids (PUFAs)	40	39	404	8,352
Diet Low in Calcium	57	61	160	3,353
Diet Low in Milk	83	84	123	2,582
Total for Deficiencies			12,064	326,377

Solutions Already Delivered by Devenish

Naturally enriched Chicken & Eggs, with Algae-Sourced, Omega-3



Microalgae



Animal feed

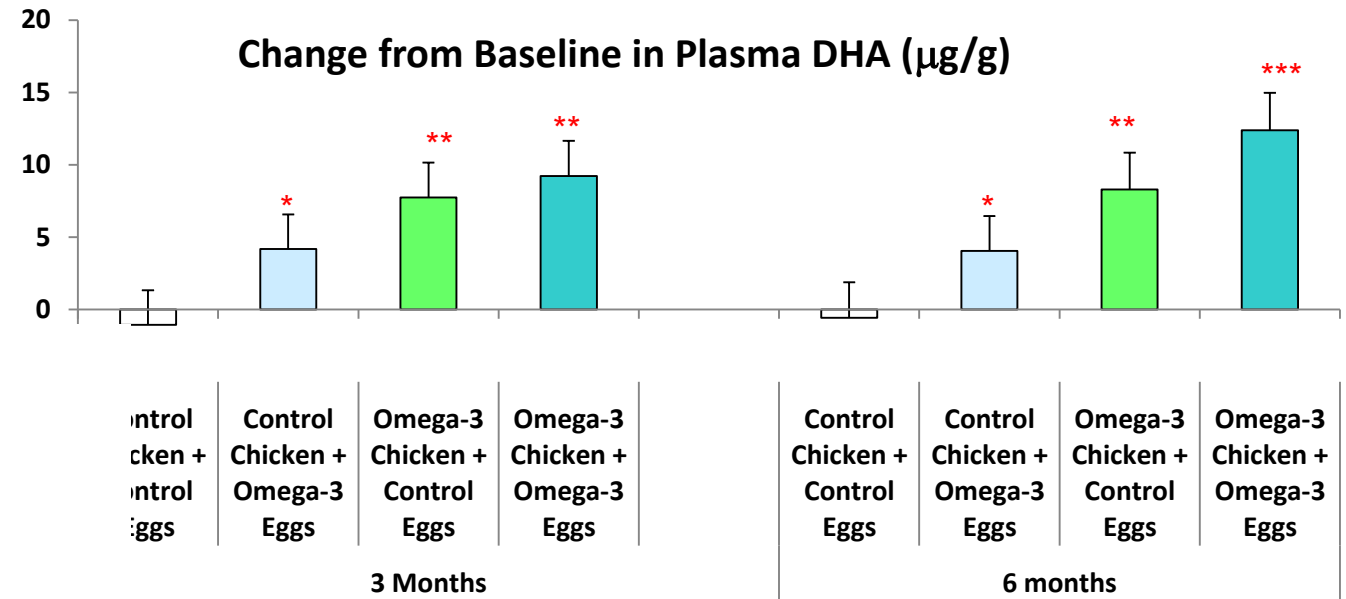


Validating the Journey

Human Trials to Validate Health Improvement of Omega 3 Enrichment

1. Clinically & Statistically Significant Increases in Plasma DHA Levels

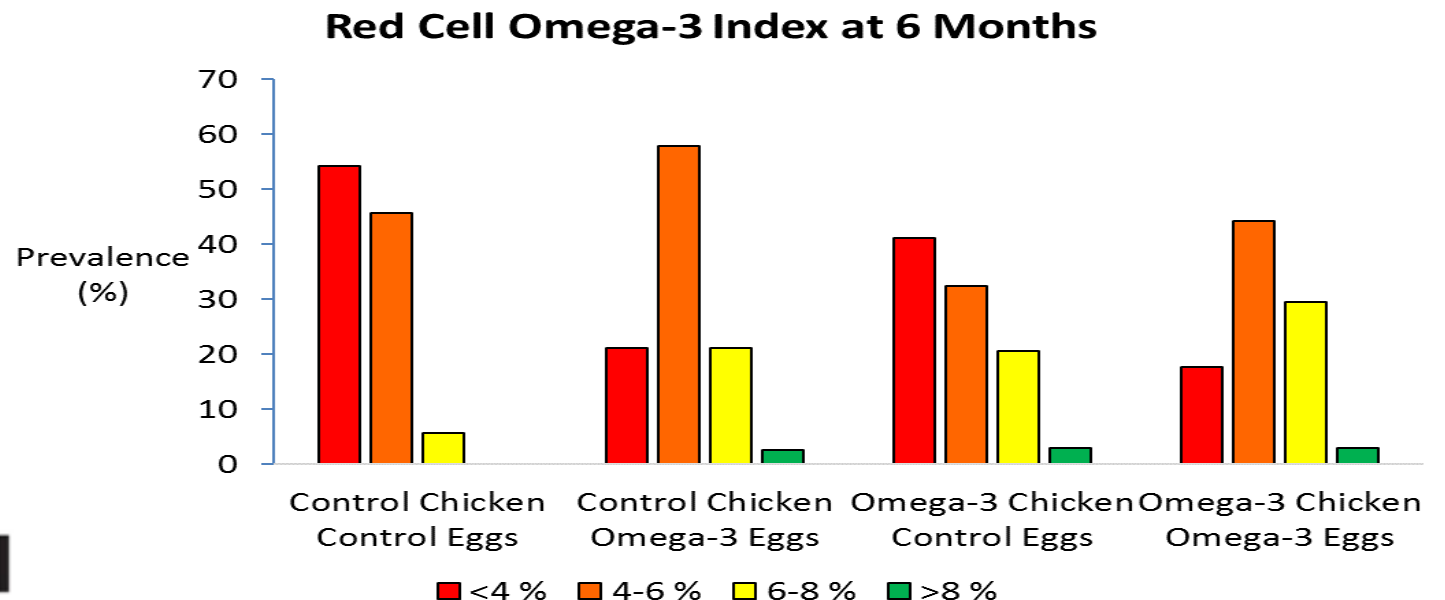
* $p < 0.05$
 ** $p < 0.01$
 *** $p < 0.0001$



2. Substantial Shift in the Distribution of the Omega-3-Index in a Healthy Adult Population

3. 70% reduction in individuals with a high risk Omega-3 Index

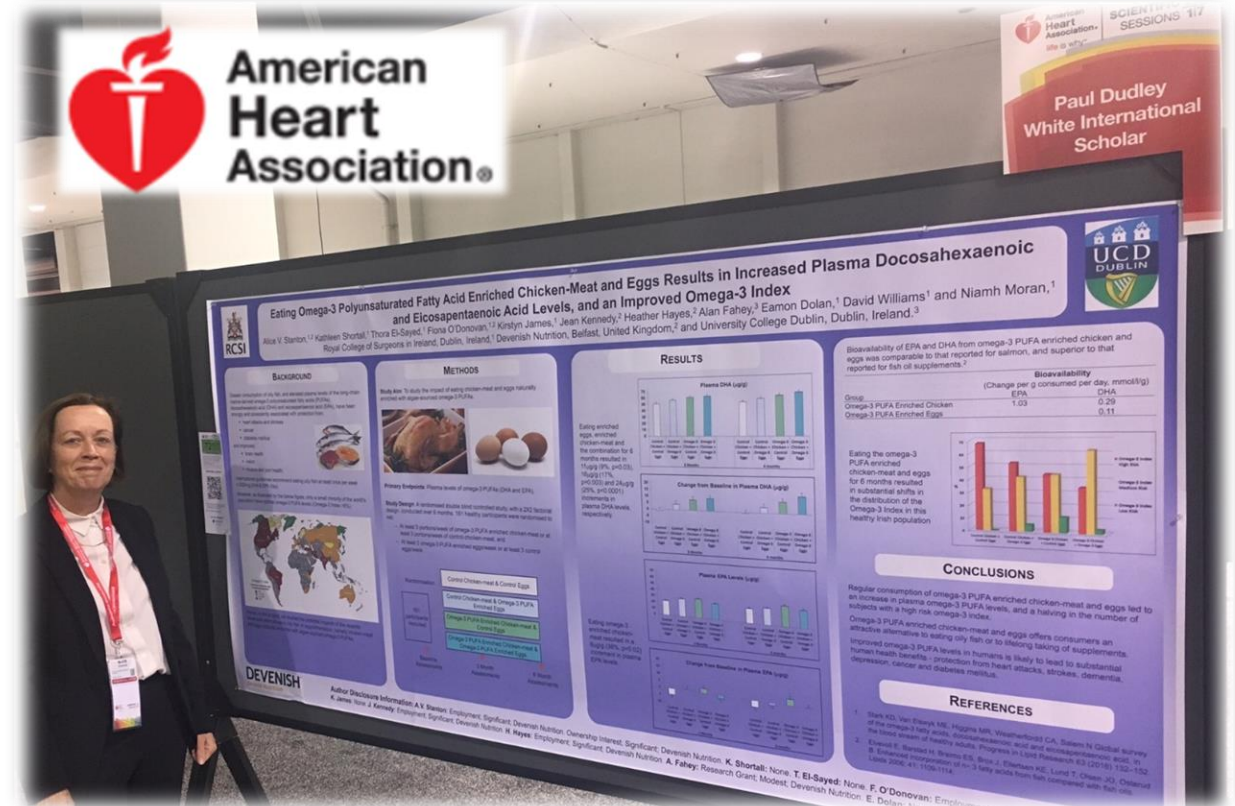
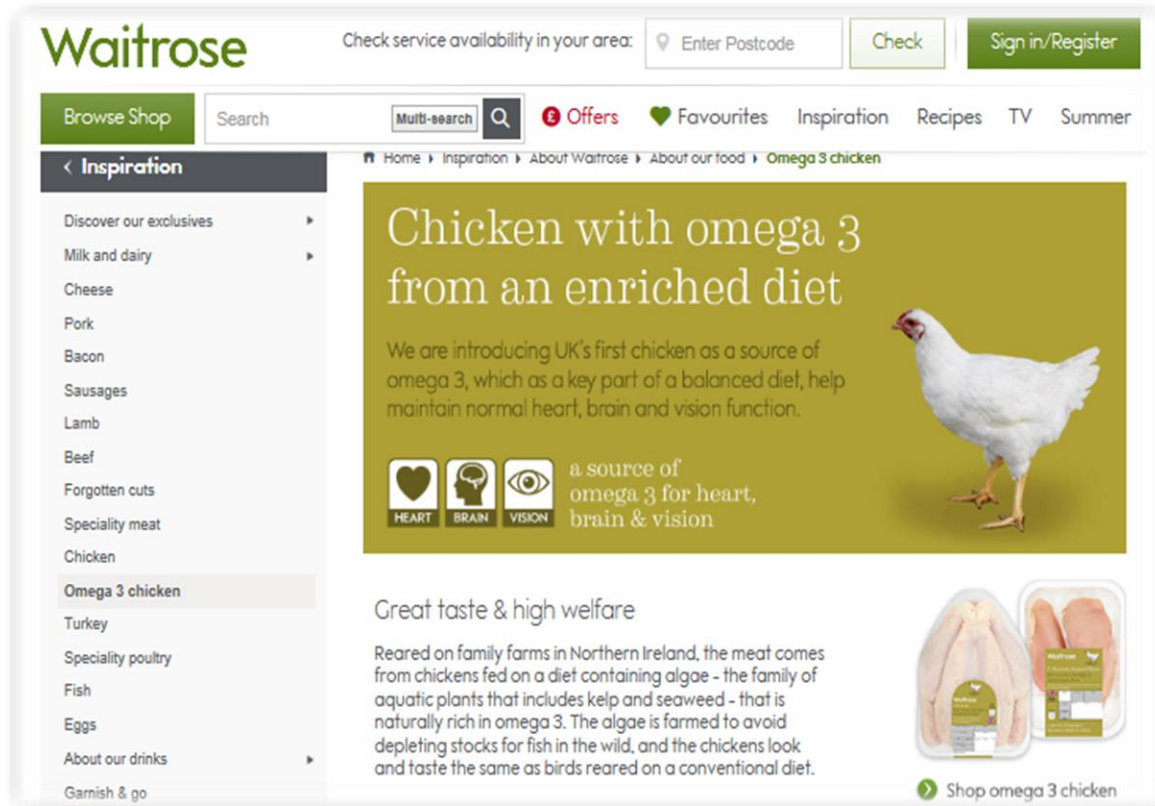
4. 5 fold increase in those with an Omega-3 index > 6%



As a Result.... Naturally Bio Enriched Food delivered

June 2016, Waitrose launches World's first, Naturally enriched Chicken Meat

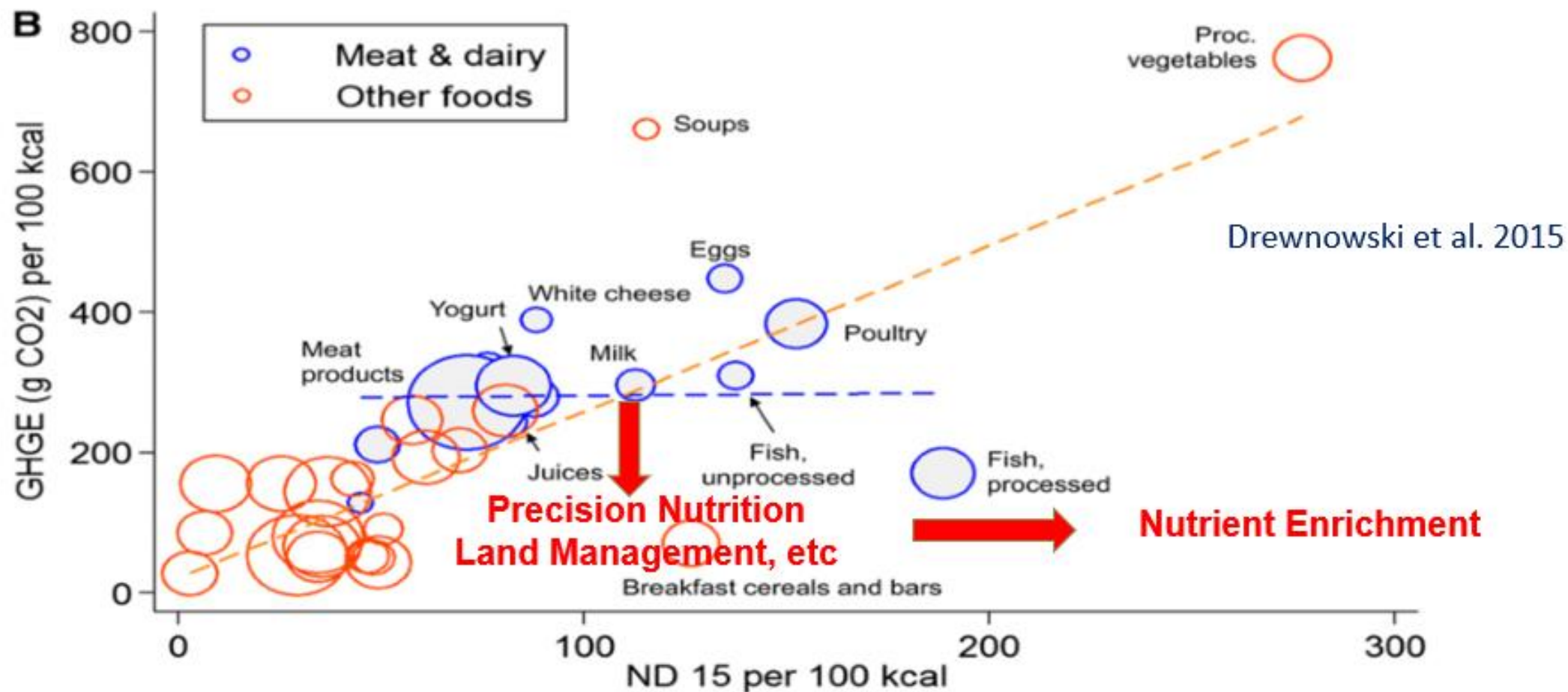
Nov 2017, American Heart Association awards Research, best International Paper



Adding Value Pre Farmgate, with Rapid Human Bio Availability

But... Without the need for Consumer Behavioural Change!!

Delivering the Devenish Vision



Delivering against 11 of the 17 UN Sustainable Development Goals

Enhancing Cow Welfare through Soil Improvement Programme



Improving Human Health with Omega 3 enriched chicken



Stimulating Pork Production in Uganda, in partnership with Irish Aid

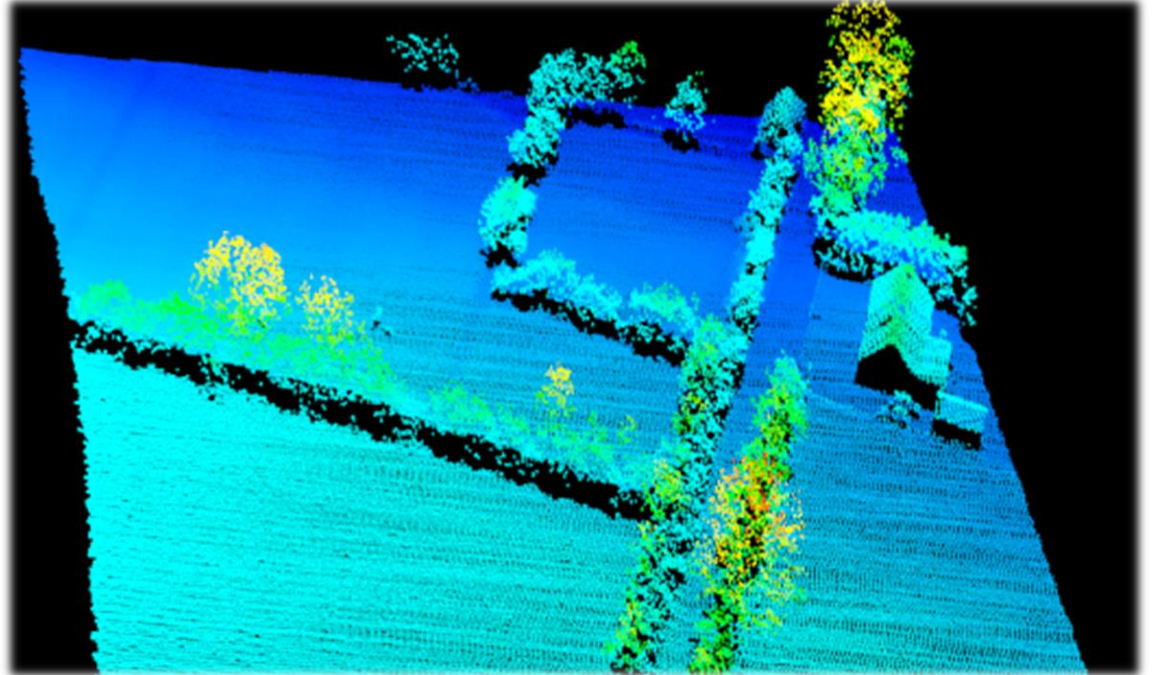


Improving Environmental Health with Sustainable Agriculture Land Management



“Smart Food Solutions”

Using Good Science to Proactively Improve Human & Environmental Health



- Empowers Positive Improvement in Farm Management Practices
- Brings Credible Transparency, Real Change, Future Profits & Mitigates Risks

One Health..... from Soil to Society