afbi Agri-Food and Biosciences Institute ®

SHAPING LIVESTOCK FARMING FOR 2030

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Chair, Expert Working Group on Sustainable Land Management

www.afbini.gov.uk

Delivering Profitable & Sustainable Farming Through Science – Land Management & Ammonia?

Dr John Gilliland, OBE

Chairman, Expert Working Group

Expert Working Group
Sharing the Experience of the Last Three Years

Oct 2016 - The Sustainable Land Management Strategy

Jan 2018 - The Ammonia Annex Report

Expert Working Group

Our Remit:
- Increase Sector's Output
- Increase Farmers' Margins
- Reduce the Sector's Footprint
  & Deliver all three Simultaneously!!!

Our Audience:
- Farmers
- Policy Makers
- Regulators
- Consumers of our Products!!

Our Methodology:
- What is current state of Science
- What are the Science Gaps
- How do we get Uptake!!

Observations
Environmental Performance in N.I., 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**
  EU average 47% failing Good Water Quality status
- **80% of P enters water by "Over Land" flow**
- **The Tail of our Phosphate legacy,** 50 Years **????**
- **Only One, of 49 Priority Habitats, at Favourable Status**
- **75% of 38 Terrestrial Priority Habitats impacted by Ammonia!!**

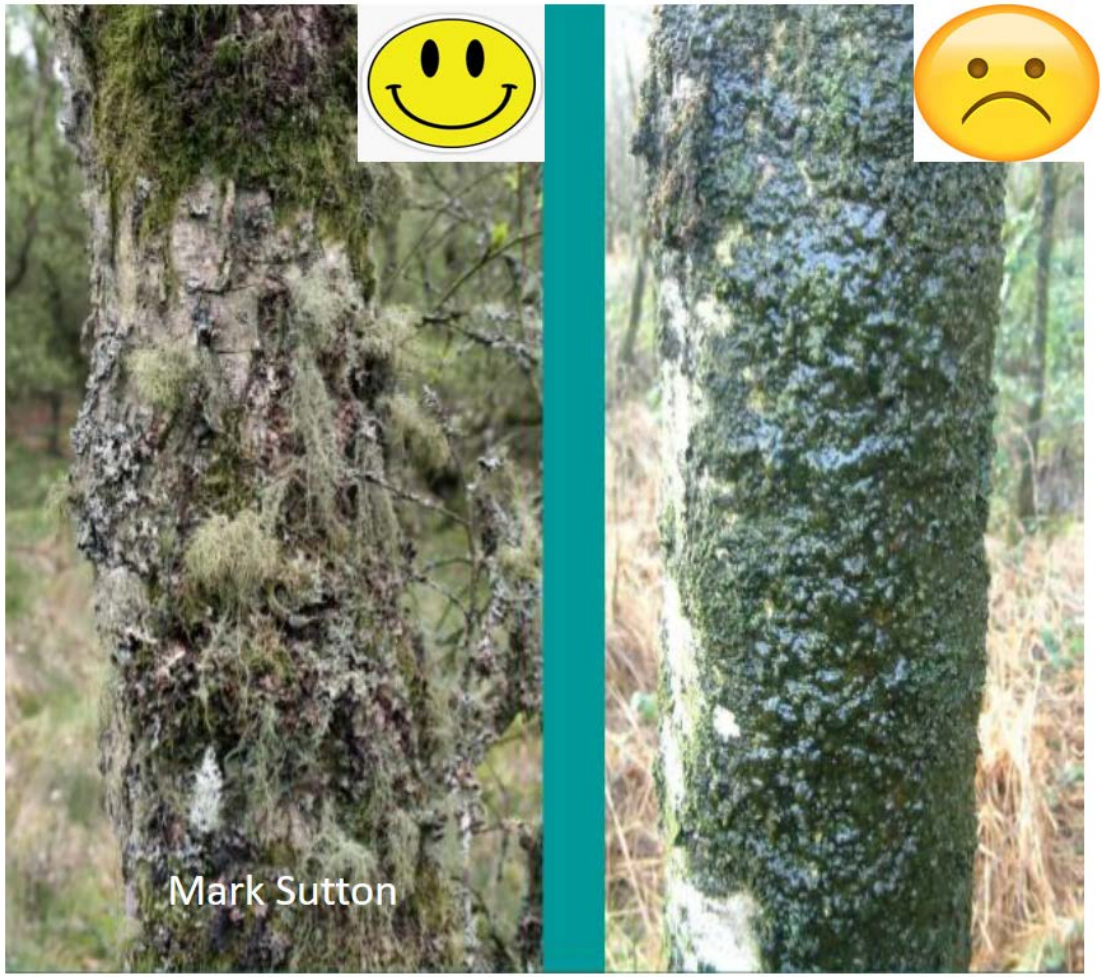
Ammonia – What is it?

Not a Greenhouse Gas, but…..

Some falls as **N Deposition** within 15 miles, **on Priority Habitats**

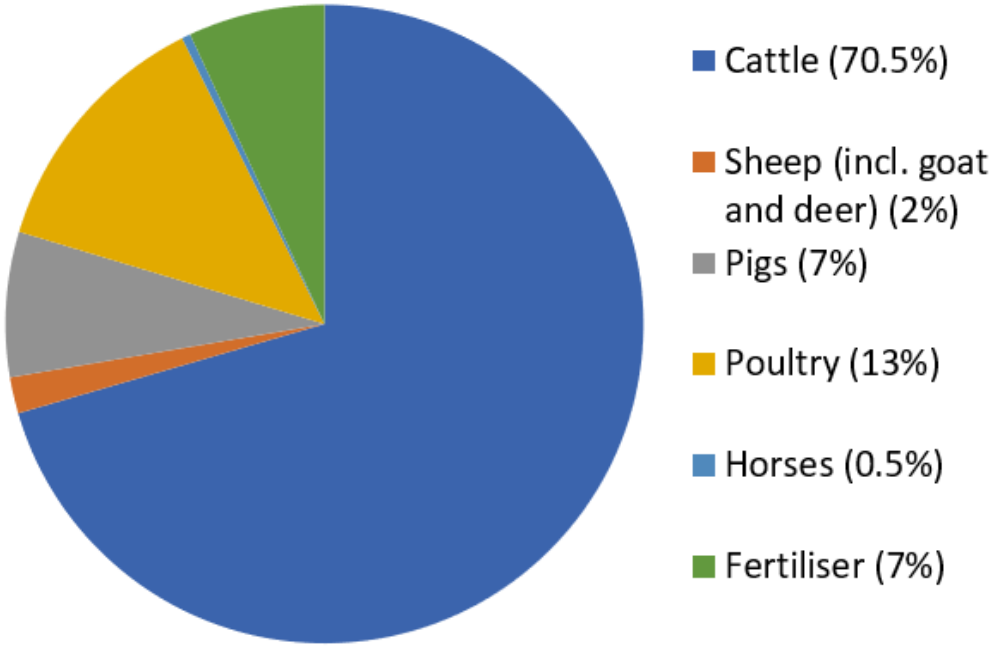
Some subsequent N Deposition **re released** from soils as N2O, a **potent GHG**

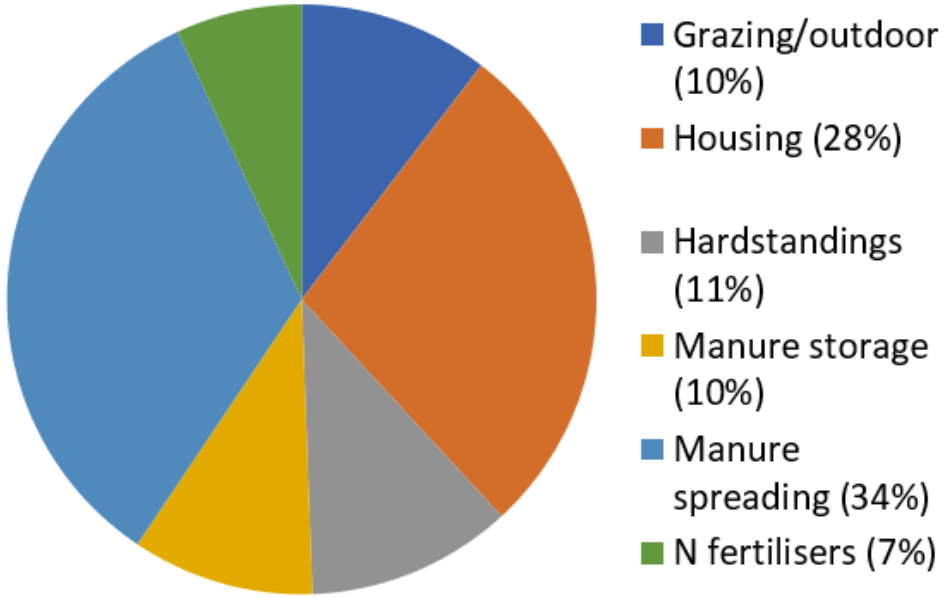
Some reacts with other atmospheric Particulates which can **impact on Human Health**



Ammonia – Where does it come from?

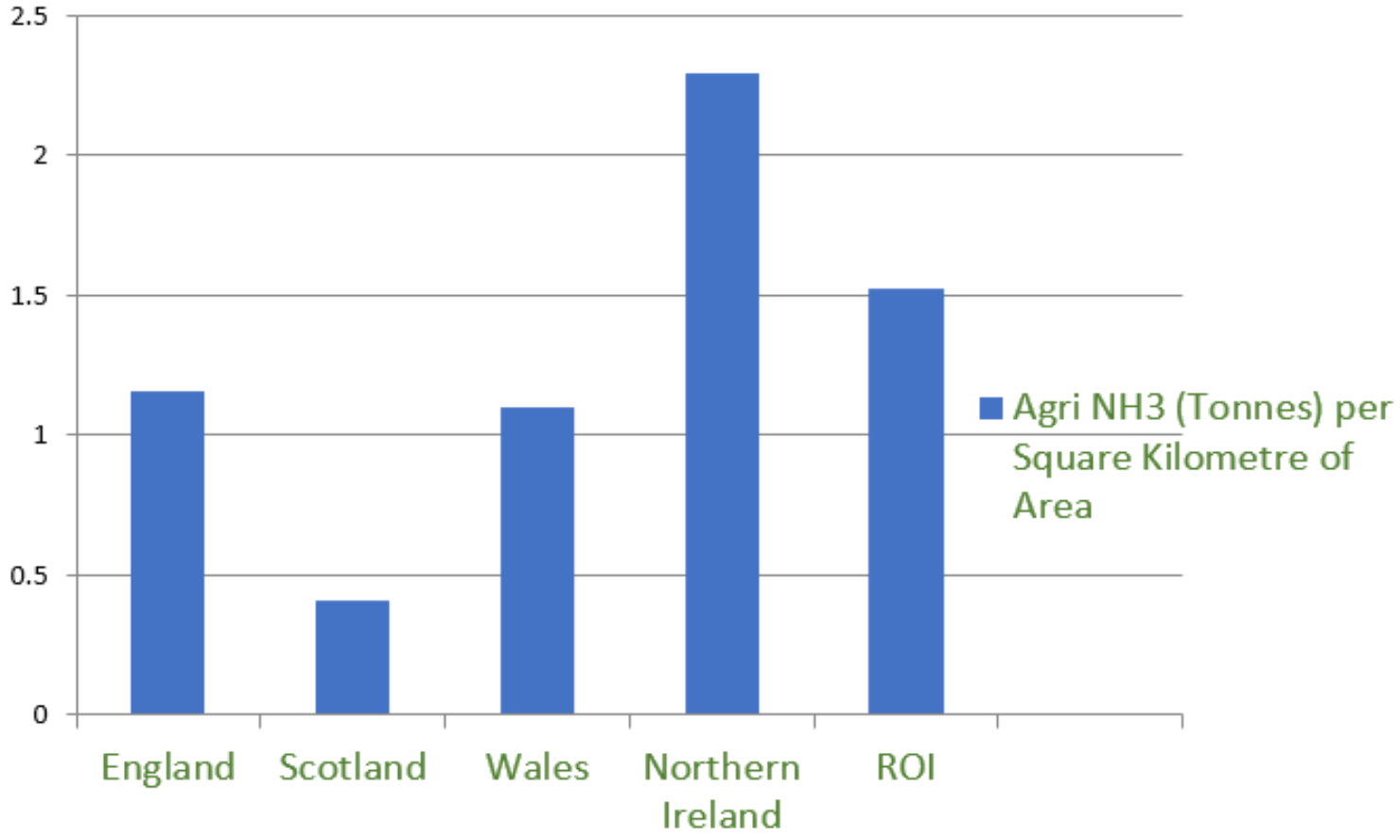
N. Ireland Ammonia Emissions 2015, T. Misselbrook, Rothamsted





73% from Ruminants, Only 20% from Pigs & Poultry
44% from Manure Storage & Spreading
38% from Housing & Hardstands
Only 10% from Grazing Animals

Ammonia – How does N. Ireland compare?



N. Ireland Ammonia Emissions 2015

T. Misselbrook, Rothamsted

Observations of Farming Production Efficiencies & Practices in N.I., 2016

- **Total Farm Income was down 41% in 2015, & 17% in 2014**
- **Grass DM Utilisable Yields –** NI Average 5.1t/ha/yr
  Top Grassland Yields 16t/ha/yr
- **Soil Analysis –** Only 2% analysed on an annual basis
- **Soil pH –**Optimal 6.0, 64% not achieving optimal
- **% Soils at optimal fertility** – 18%
- **30% of Land in rented on 11 month lease -** Conacre

Delivering “Uptake”

To convince Regulators, Policy Makers & Market Place

Uptake must be

Visible
Auditable
Credible
Profitable

Key Principle

If you can’t Measure……. You certainly can’t Manage!!

Measuring & Managing using Current Science

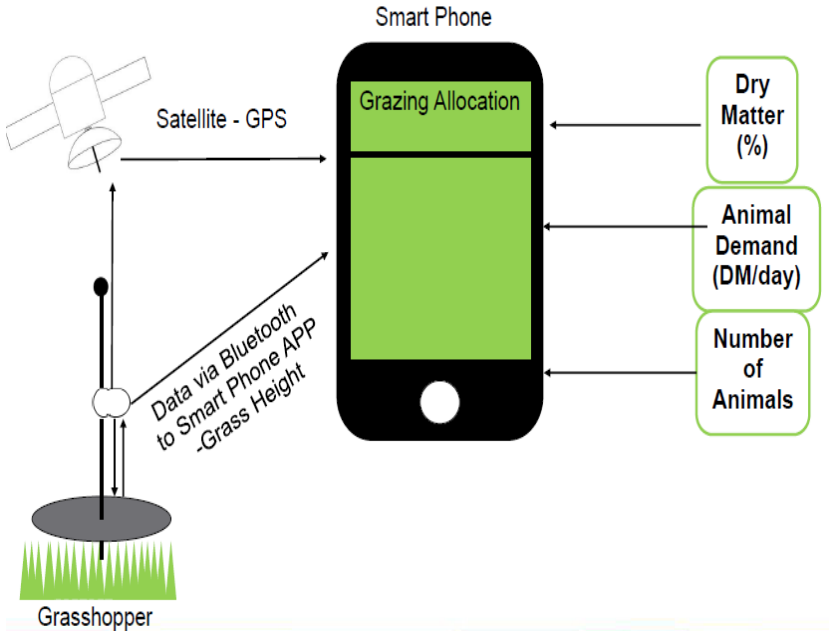
1. **Improving Soil Performance**
   GPS Soil Sampling & Analysis of Productive Land
   pH, P,K, Soil Organic Matter, Mg, Calcium, 2 ha areas

Devenish 2014

Measuring & Managing using Current Science

2. Improving Grass Utilisation

Measuring Grass Growth (DM t/ha)



Grasshopper

John Deere

GPS Digital Recording by “Hand” or by “Machine”

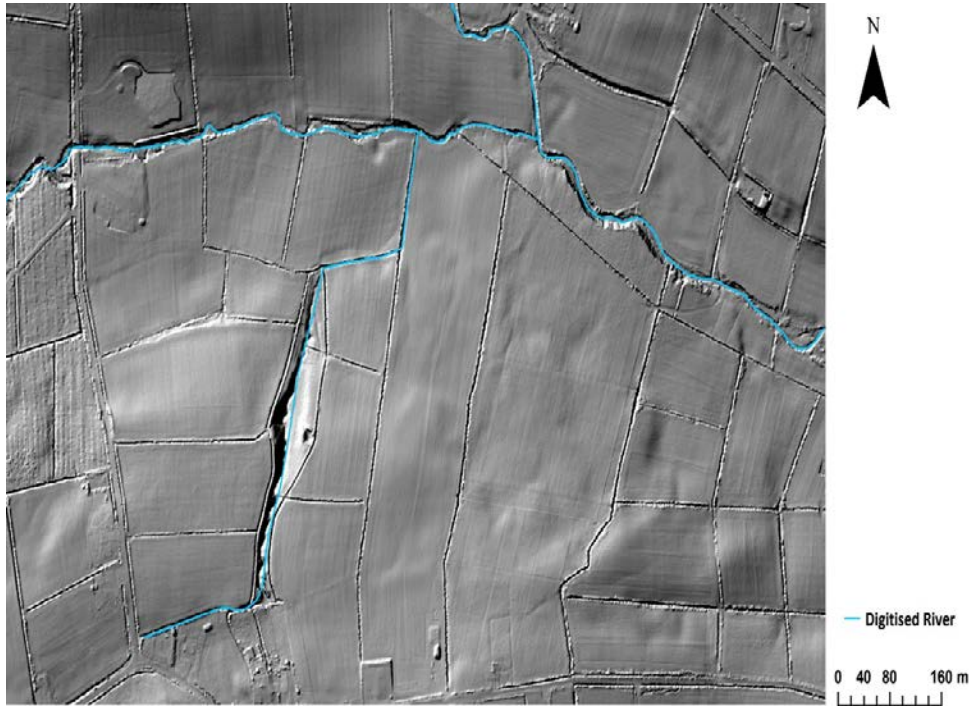
Measuring & Managing using Current Science

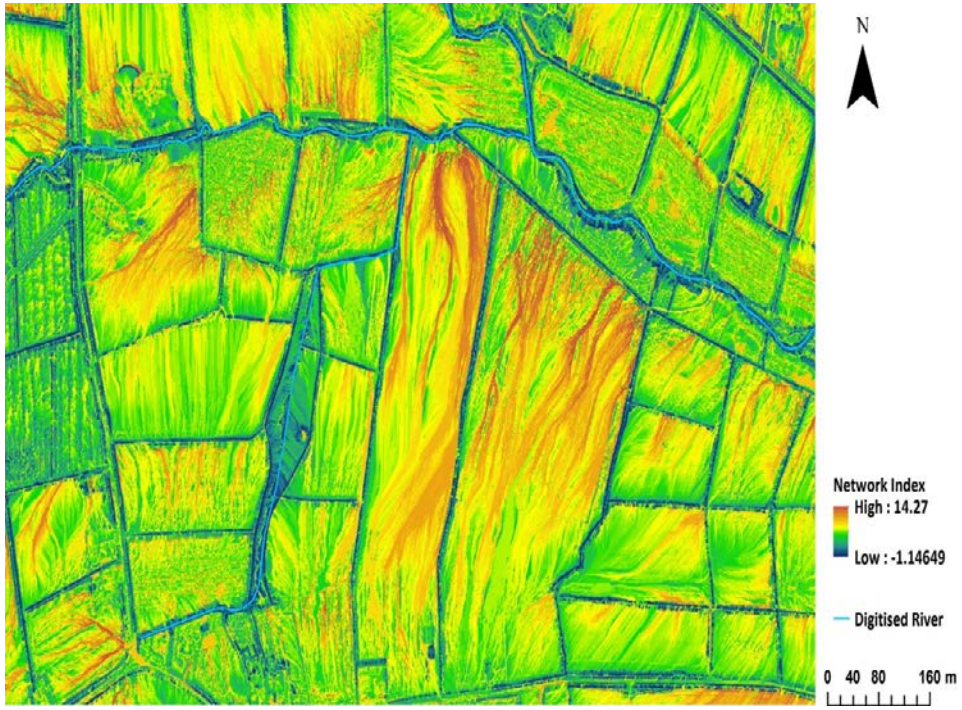
3. **Measuring Water Quality to Communicate the Issue**
   Hourly Monitoring of Catchment Water Quality
   90 of 403 NI Catchments to be Real Time monitored
   Results used through Discussion Groups to secure change

D. Wall, Teagasc

Measuring & Managing using Current Science

4. **Improving Water Quality through Analysing LiDAR**
   Highlighting Critical Source Areas, Routes of Overland Flow
   Positioning of Landscape Interventions





R. Cassidy, AFBI

Measuring & Managing using Current Science

5. Daily Monitoring of Ammonia to Communicate Issue

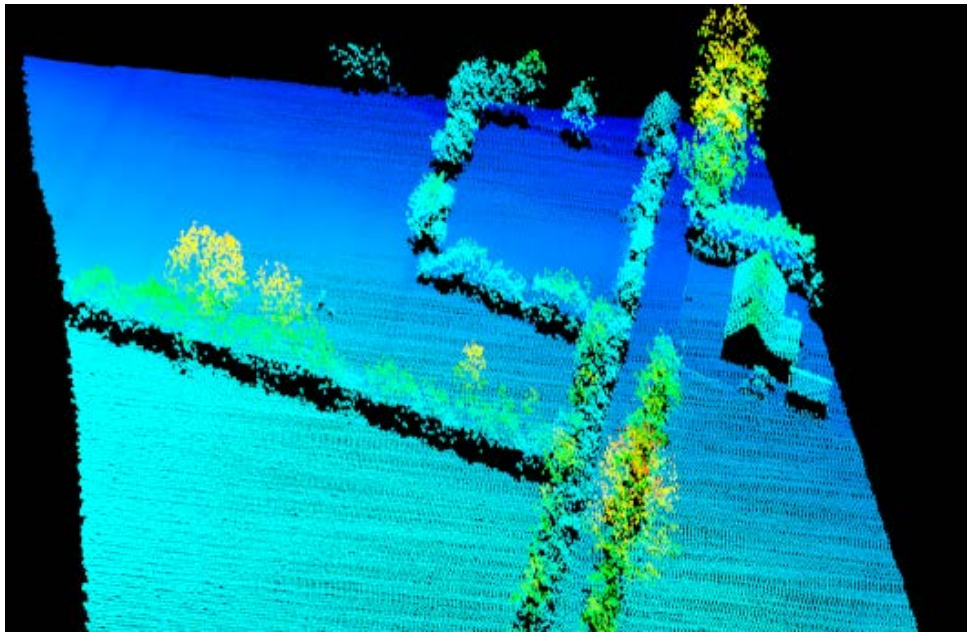
Currently measured on 3 sites
Need 15 or more monitoring sites.
But Recognise all the Findings!!
e.g. Benefits of Dry Air Heating

J. Gilliland, Devenish

Measuring & Managing using Current Science

6. Five Year LiDAR monitoring of Landscape Interventions

Recognising the role of the Landscape & subsequent interventions to improve environmental performance



	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; Dowth, Devenish

Measuring & Managing using Current Science

7. **Creation** of a **Data Base & Decision Support Tools** to store, mine & **improve Decision Making**

8. **Analysing Slurry DM** & **adjusting application rate** to suit need of crop

9. **U**sing GPS Soil analysis**, apply** & **record nutrient application where needed,** using **Variable Rate Application Systems.**

10. **Optimise nutrient efficiency, minimise environmental harm,** apply using **advance spreading technologies e.g. Trailing Shoe**

Accelerating “Uptake” using Sound Science Utilising Nutrient better, while reducing Footprint

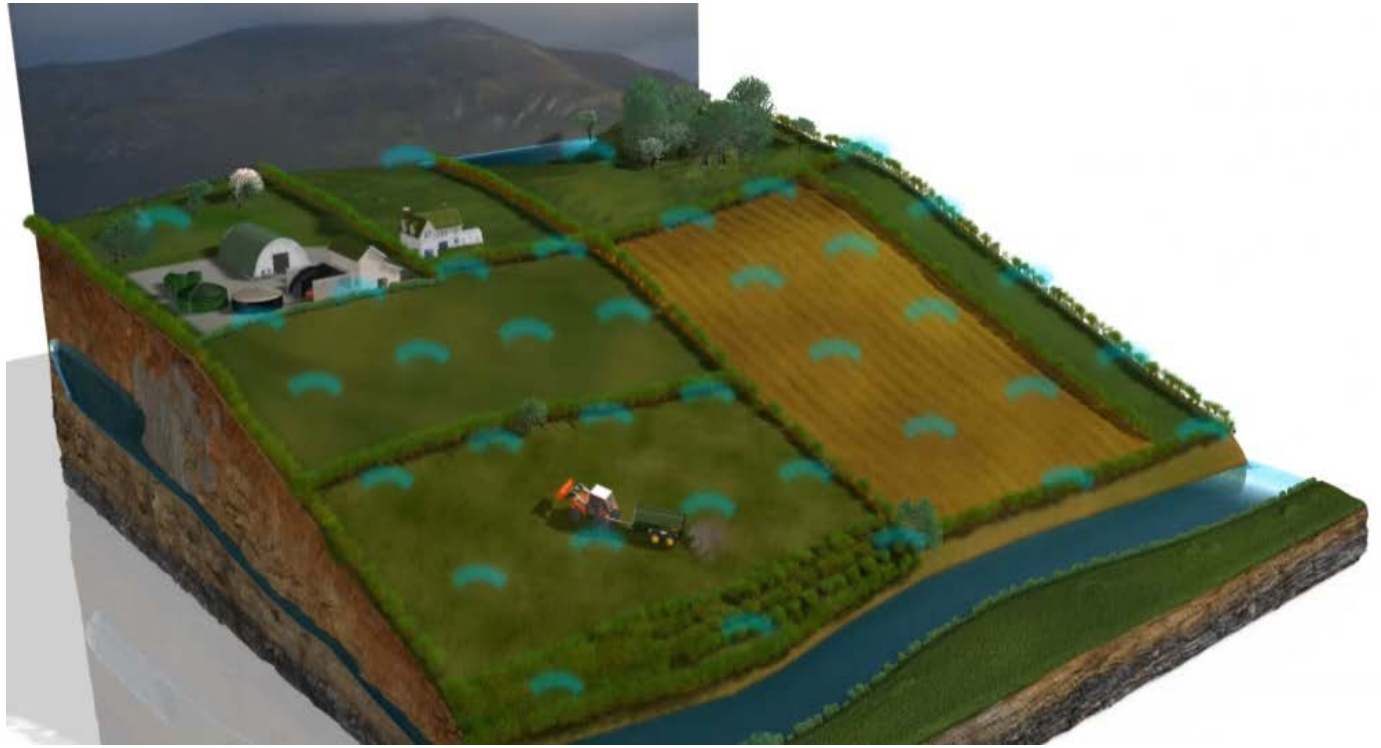
1. **Switching to Advanced Slurry Spreading methods**
   By 2020 – No new splash plates to be sold
   By 2025 – Use of splash plates stopped
   Band Spreading – 26% reduction in Ammonia emissions
   Trailing Shoe – 57% reduction in Ammonia emissions
   Injection – 75% reduction in Ammonia emissions

2. **Switching to Stabilised or Protected Urea, away from CAN and Urea, by 2020**
   CAN to Stabilised Urea reduces GHGs by up to 75%
   Urea to Stabilised Urea reduces Ammonia by up to 78%

AFBI, Rothamsted, Teagasc

Science Gaps Needing further Investigation

1. **Investigate** Soil Moisture **Potentiometers** & **Thermometers**, to **spread Nutrient by Soil Conditions** & **not by Calendar Date**



Science Gaps Needing further Investigation

2. A quick analysis of FYM & Slurry nutrient content

3. A low cost way to reduce Biosecurity risk when exporting Slurry

4. Define the Ammonia Emission Factor for slatted floor slurry systems

5. Define the Ammonia Emission Factors for Dietary Crude Protein reduction in livestock

6. Define the correct Ammonia Emission Factor for Poultry units using “dry air” heating systems

Science Gaps Needing further Investigation

7. Assess the Cost Benefits of Slurry Additives in mitigating Ammonia Emissions, improving Nutrient Efficiency and their impact on Soil Biology

8. Research benefits of slurry bubbler systems for improving Human Health, vis a vis, increasing Ammonia Emissions

9. Assess Cost Benefits of all Ammonia mitigation solutions & rank them on Cost Effectiveness

10. Quantify the synergies, or other wise, of a collection of Ammonia mitigations options being utilised simultaneously, on the same farm.

Impacts of Implementing Current Science

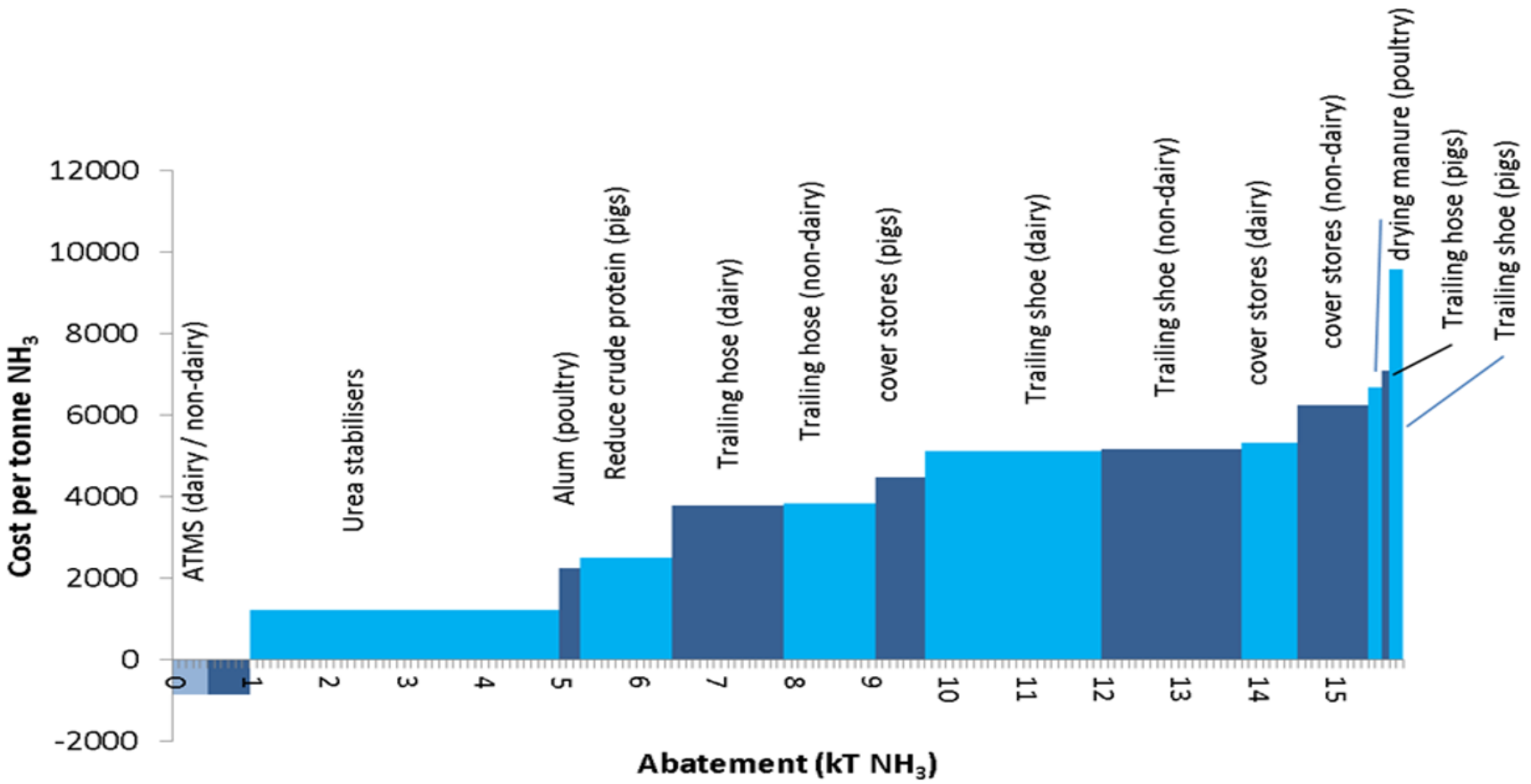
Impact on Dairy Farms - NI Land Management Strategy/AFBI 2016

System Variables	Current non derogated System †	(a) Non-derogated 1 t/ha extra grass DM utilisation	(b) Non-derogated 1 t/ha extra (good quality) grass DM utilisation
Grass & silage utilization per ha (t DM/ha/yr)	7.5	8.5	8.5
Grass or silage intake per head (t DM/yr)	4.05	4.59	4.59
ME content of grass (MJ/kg DM)	11.2	11.2	12.0
ME content of silage (MJ/kg DM)	10.7	10.7	11.5
Concentrates required per head (t DM/yr)	2.09	1.44	1.44
Milk yield per head (litres/yr)	7,700	7,250	7,990
Milk yield (litres/ha/yr)	13,600	12,850	14,150
Milk P export (kg P/ha/yr)	12.9	12.2	13.4
Concentrate required (t DM/ha/yr)	3.71	2.56	2.56
Concentrate P input (kg P/ha/yr)	22.2	15.4	15.4
Whole Farm P Balance (kg P/ha/yr)	**11.3**	**4.2**	**3.0**
System Changes	**Milk Price**	**Net Saving**	**Net Saving**
Change in milk yield	18p/l	- £135/ha/yr	+ £99/ha/yr
Change in milk yield	28p/l	-£210/ha/yr	+ £154/ha/yr
Change in concentrate use	-	+£267/ha/yr	+ £267/ha/yr
Additional costs for silage cutting †	-	£0/ha/yr †	- £68/ha/yr †
Additional fertiliser N on silage area †	-	-£12/ha/yr †	- £19/ha/yr †
NET CHANGE IN PROFIT	18p/l	**+£120/ha/yr**	**+ £279/ha/yr**
NET CHANGE IN PROFIT	28p/l	**+£45/ha/yr**	**+ £334/ha/yr**
Change in N conc in land drainage water		**+ 2 mg nitrate-N/l**	**+ 3 mg nitrate-N/l**

Worth £196m annually to Total Income to Farming in NI

Impacts of Implementing Current Science Ammonia

Little Cost Benefit Analysis yet, 1st Attempt - Teagasc 2016



Extending Grazing Season? Stabilised Urea vis a vis CAN?
Better Nutrient efficiency with Advanced Slurry Applications?

Delivering Profitable & Sustainable Farming Through Science – Land Management & Ammonia

It is the Only way!!!

Implementing what we already Know

Investing in what we need to Know

Measuring …..Managing….. & then Measuring again!!