Catchment Sensitive Farming

Working together for a healthy environment

Ammonia Reduction from Trees

Project Overview webinar

Catchment Sensitive Farming (CSF) is led by Natural England, in partnership with Defra and the Environment Agency.

UK Centre for Ecology & Hydrology

Forest Research

The Lakes Free Range Egg Co

Cum Farn Envi Part

Lancaster University

Department for Environment Food & Rural Affairs

Environment Agency

NATURAL ENGLAND

Today’s programme

Philippa Mansfield,
Natural England
Introduction

David Vowles,
Defra
Air quality policy

David Brass,
CEO Lake Free
Range Egg Co
Farmer’s view

Bill Bealey, UKCEH
Ammonia Reduction from Trees
Project Overview

Questions and Answer session

ART Stakeholder Meetings

Purpose:

- to present the results of the ART project and
- to gather feedback from stakeholders on how to make use of the findings e.g.in agri-environment schemes, advice & guidance to farmers/advisers etc

14 January 2022

1) 13.30 – 15.00 ART Project Overview webinar
2) 15.10 – 16.30 Farm Survey workshop *What motivates farmers to plant trees?*

28 January 2022 Stakeholder Workshops:

3) 13.30 – 15.00 Field experiments
4) 15.10 – 16.30 Targeting tree planting

Catchment Sensitive Farming partnership

Dr Philippa Mansfield
Natural England CSF

- Network of CSFOs: local trusted farm advisers
- work with farmers & partners across England
- provide advice and grant support to farmers
- for farm infrastructure and land management improvements
- to improve the quality of our water and air and to reduce flood risk

Go to gov.uk/catchment-sensitive-farming

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Department for Environment Food & Rural Affairs

Environment Agency

NATURAL ENGLAND

Ammonia Reduction from Trees (ART) project aims:

- To investigate the effectiveness of trees shelter belts & woods to capture ammonia emissions from farms
- How to target tree planting to protect sensitive habitats and
- To gather the views of farmers on tree planting for this purpose

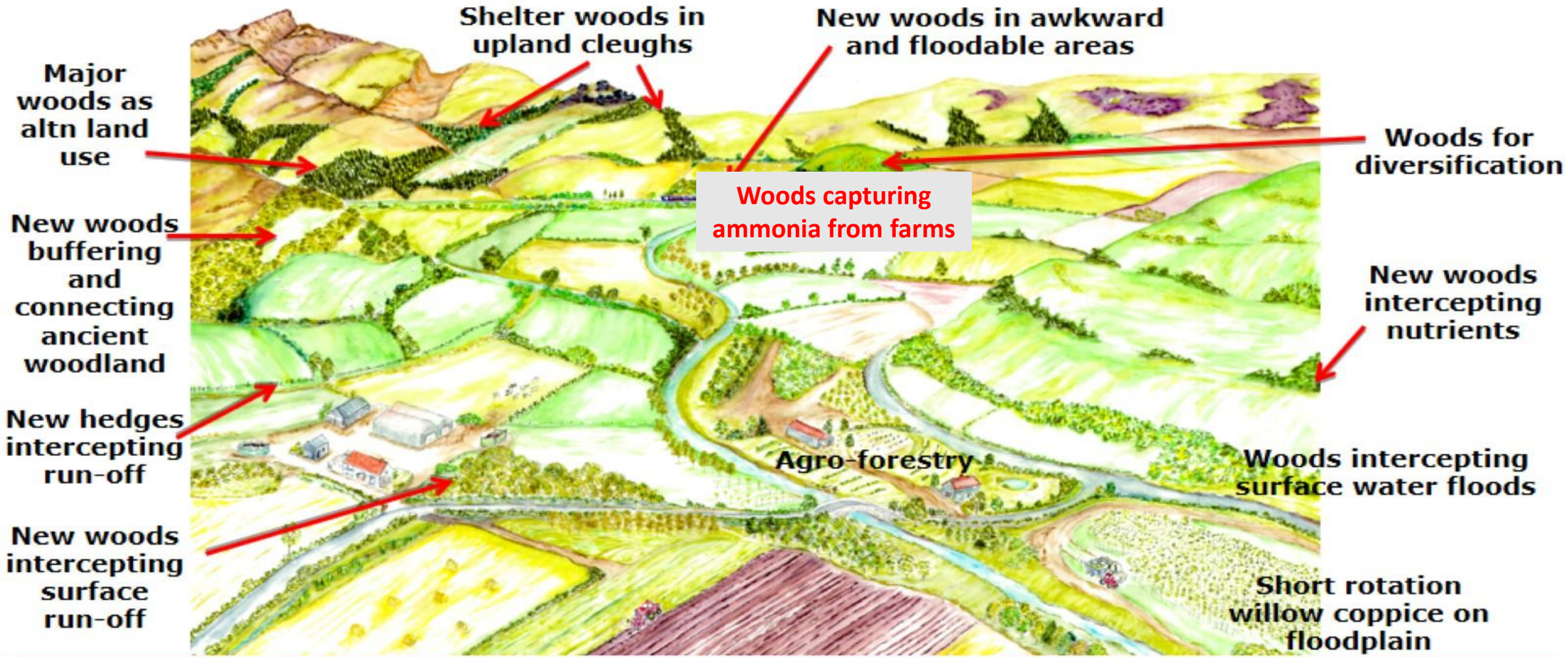
Natural England agri-environment evidence project funded by Defra delivered in partnership with

ART Project team

Trees & woodland in landscape for clean air & other environmental and farm business benefits

Forestry Commission

An integral part of your farm business:



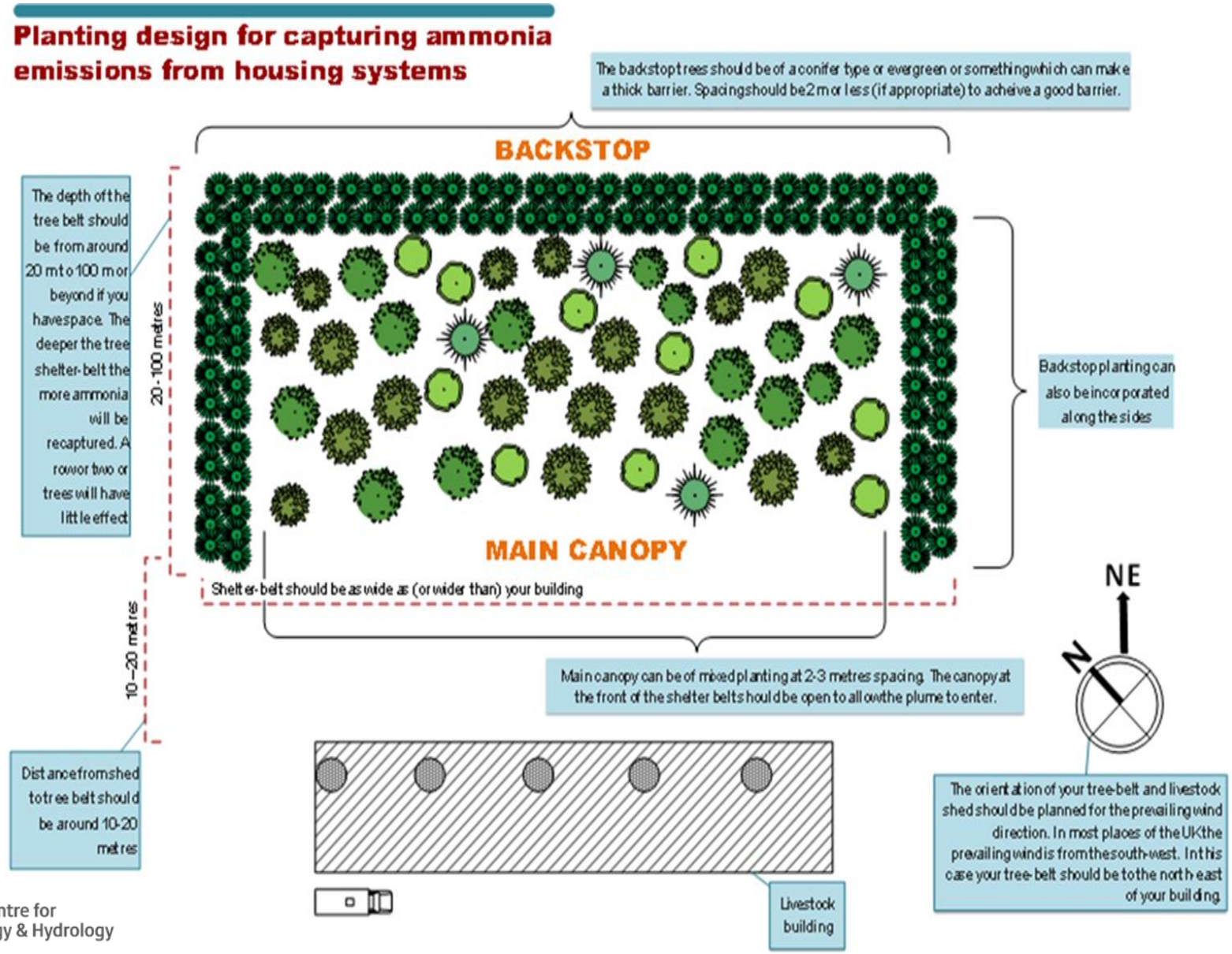
Countryside Stewardship Scheme

Objective to improve air quality

CS Capital grants or Mid tier

grants for planting tree shelter belts to trap ammonia from livestock housing or slurry stores or free range woodland

- Only with CSFO approval
  - advice
  - check site is suitable
  - design guidance



https://www.farmtreestoair.ceh.ac.uk/

UK Centre for Ecology & Hydrology

England Woodland Creation Offer

- Grants for a range of woodland types including tree shelterbelts for air quality
- Grant will cover 100% of capital costs up to £8,500/ha plus maintenance payments
- Additional stackable payments for woodlands that benefit:
  - nature and species, water quality & habitats, risk of flooding
- Search 'Forestry Commission woodland creation'
- Get in touch with your local FC Woodland Officer for free advice

www.gov.uk/guidance/create-woodland-overview

Forestry Commission

Woodland Trust provides advice and subsidized trees & protection:

1. Trees for your Farm scheme - pilot agroforestry
2. MOREwoods – copses/shelter belts
3. MOREhedges

Inspired to take action
contact the Woodland Trust
Woodlandtrust.org.uk/plant

WOODLAND TRUST

The results from the ART project will be used in the Natural Capital & Ecosystem Assessment

RESEARCH


Earth observation


Natural capital assets


Terrestrial ecosystem


Protected areas

Freshwater ecosystem


Surveys


Priority habitats

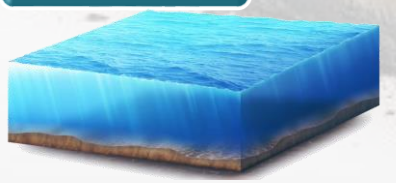

National species data

Local habitat & species

National change

- Local change
- Local site data
- Local species data

+ Marine




Soils

Tools & Products

- Maps
- Data sets
- 25 YEP
- R&D

Intervention Data

- What?
- Where?
- When?

Pressures & Driver Data

- Air quality
- Water quality
- Climate change
- Planning - infrastructure

Geological & Climate Data

- Soils
- Hydrology
- Altitude

Example Policy interventions

- Spatial planning SEAs
- Environment bill targets
- Net gain
- Environment land targets
- Nature Recovery Network
- Local Nature Recovery Strategies
- Other quality interventions

Department
for Environment
Food & Rural Affairs

Ammonia Reduction from Trees stakeholder meeting

Clean Air Strategy, ammonia impacts and current policy developments

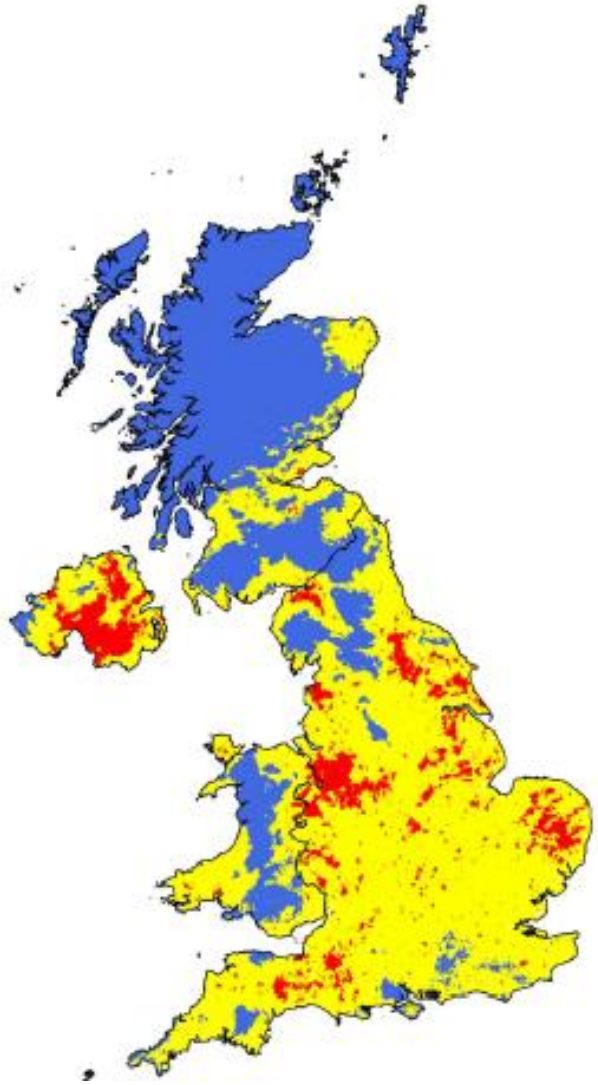
14th January 2022

David Vowles

Senior Policy Advisor

Agriculture Team, AQIE

Ammonia impacts on large areas of the UK



- 88% of total UK ammonia (NH_3) emissions in 2019 were from agricultural sources ~239 kt.
- Emissions have fallen by 14% between 1990-2019, but have risen by >1% since 2005.
- 65% (158,500 km^2) of UK in 2017 had NH_3 concentrations above the lower critical level (1 $\mu g/m^3$) - 1% decreased since 2010.
- 8% (19,000 km^2) of UK had NH_3 concentrations above the higher critical level (3 $\mu g/m^3$) - 4% increase since 2010.

Key:

- <=1 $\mu g/m^3$ NH_3 (critical levels not exceeded)
- >1 & <= 3 $\mu g/m^3$ NH_3 (critical level for lichens and bryophytes exceeded)
- 3 $\mu g/m^3$ NH_3 (critical level for vascular plants also exceeded)

NH_3 impacts on the environment and human health

- Main agricultural emissions sources are from:
  - storage, land-spreading and deposition of manures and slurries
  - application of inorganic fertilisers.
- Directly toxic to plants - adds to existing eutrophication and acidification pressures.
- Main contributor to nitrogen deposition, leading to biodiversity loss in sensitive habitats.
- Concentrations are variable - seasonal emissions variations (e.g. timing of fertilizer and manure spreading) and weather effects.
- Harmful to human health - reacts with other pollutants (i.e. NO_X and SO_2) to form secondary fine particulate matter ($PM_{2.5}$).
- One estimate - halving global agricultural emissions could reduce $PM_{2.5}$ mortality by ~250,000 globally and by 52,000 across Europe.

Ammonia damage to lower plants

Lichen

Moss

Healthy

Damaged by ammonia

Ammonia damage to higher plants

Ballynahone Bog,
Northern Ireland

Algae on Heather
Ammonia 8 to14 µg/m^3

Áine O'Reilly, NIEA/DAERA 2019

Moninea Bog,
Northern Ireland

Algal Slime on Trees
Ammonia 33 µg/m^3

Sutton 2007; Moninea Bog Assessment

Clean Air Strategy (CAS) - basis for action

- UK NH_3 emissions reduction targets - 8% by 2020 and 16% by 2030.
- CAS - identifies how the English farming sector will be required and supported to reduce ammonia emissions to increase nitrogen use efficiency, i.e.:
  - use of low-emission slurry and digestate spreading equipment - 2025
  - covering slurry and digestate stores and rapid incorporation of manure to land - 2027
  - commitment to reduce emissions from urea-based fertilisers.
  - Introduce mandatory design standards for new intensive poultry, pig and beef livestock housing and for dairy housing
  - Extend environmental permitting to dairy and beef sectors - 2025
- Target to reduce deposition of reactive nitrogen by 17% from 2016 over England’s protected, priority, sensitive habitats by 2030.

Further future considerations…

- Will there be stricter NH_3 emissions ceilings targets in future? i.e. via the Gothenburg Protocol
- Will future targets be based on deposition or critical levels rather than national emissions?
- Will there be increasing international pressure for the UK to sign up to additional nitrogen emission/deposition targets? e.g. Colombo Declaration
- Our understanding of the science is constantly improving which may require stricter critical loads and critical levels thresholds for some habitats i.e.
  - CLRTAP review of nitrogen critical loads is expected to complete in early 2022
  - CLRTAP review of ammonia critical levels is due to start in March 2022

Note: CLRTAP = Convention on Long Range Transboundary Air Pollution.

ART Project Why trees?

David Brass

The Lakes Free Range Egg Co Ltd

www.lakesfreerange.co.uk

The Lakes
Free Range Egg Co

THE QUEEN'S AWARDS
FOR ENTERPRISE:
SUSTAINABLE DEVELOPMENT
2018

A journey.

- **Initially just a case of no hens outside.**
- **First grant funded planting cumbersome and poor for poultry.**
- **Paul did not know poultry, David did not know trees.**
- **Nearly 25 years later symbiotic relationship.**

Problems and solutions a 25 Year journey

- Half the density 1100 per Ha enough
- Do not plant randomly – rows
- Tree guards 900mm (pecking)
- Farmers are not foresters!
- Do not plant in clumps
- 20% fast growing sacrificial trees
- Woodland edge for biodiversity
- Constant learning about tree care
- Carbon and Ammonia

The benefits

- **Better welfare –shade, shelter, predators, shed stress**
- **Better welfare gives better performance, pays for trees in 6 months**
- **Odour reduction**
- **Screening**
- **Environmental CO2 and Ammonia (Clean air act)**
- **Biodiversity – woodland trust**
- **Drainage, reduces disease and waste eggs**
- **Biomass production and circular economy**
- **They look nice!! And will be there for 150 years.**

ART Project involvement

- **Why get involved?**
- **Cost very little, learn a lot.**
- **Exceptional team.**
- **Hard facts to support whole of agriculture on CAA implementation.**


The Lakes
Free Range Egg Co
THE QUEEN'S AWARDS
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SUSTAINABLE DEVELOPMENT
2018

Ammonia Reduction from Trees (ART) – Project Highlights

Tang Y.S., Braban C.F., Dick. J.D., Vanguelova E., Timmis R., Fisher B., Carnell, E., Martin Hernandez C., Arkle P., Brass, D., Gill, R., Davies R., Stephens A., Iwanicka A., Mullinger N.J., Cowan N., Simmons I., Jones R., Shutt M., Whyatt D., Benham S., Broadmeadow S., Mansfield P., and Bealey W.J.

January 14th, 2022

UK Centre for Ecology & Hydrology
Forest Research
Environment Agency
Cumbria Farm Environment Partnership
Lancaster University
NATURAL ENGLAND
Department for Environment Food & Rural Affairs

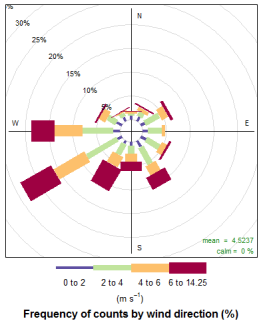
Ammonia Reduction from Trees (ART)

1. **Field case studies at 5 farms for monitoring ammonia reduction from treebelts**

2. **Priority Targeting of treebelts for ammonia mitigation in the landscape**

3. **Farmer’s views on practicalities and farm business benefits of tree planting to capture ammonia**

Ammonia and Treebelts



1. Recapture of NH_3 by the canopy

?%

2. Increased mixing of the air increases plume dispersion

?%

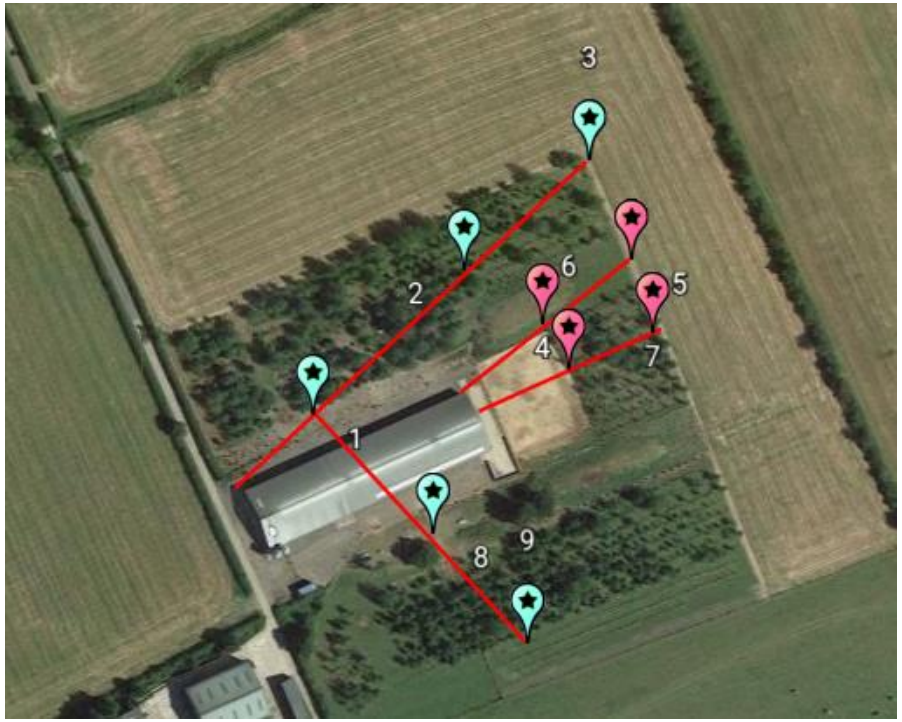
Direction of Wind

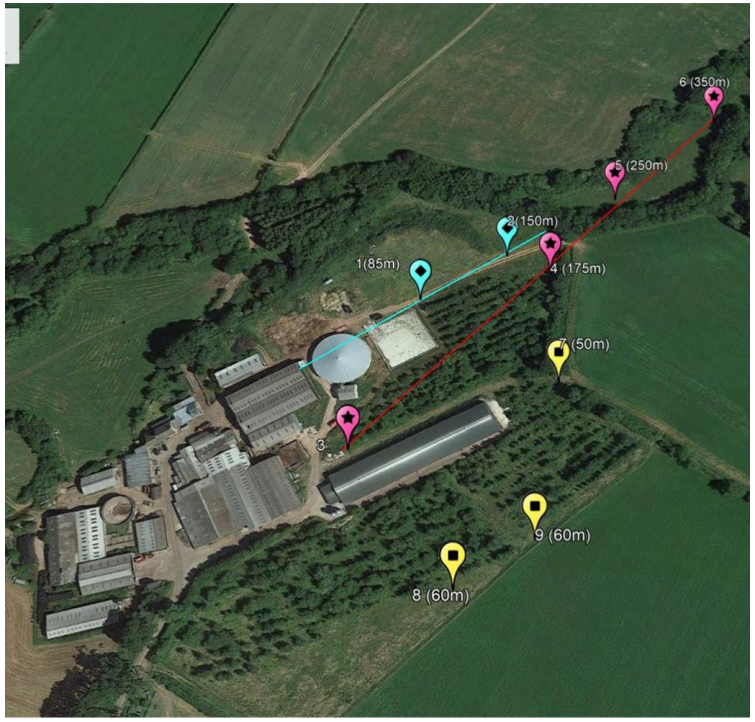
Enhancing local recapture and dispersion = reducing NH_3 concentrations & deposition to nearby sensitive habitats

3. Recapture from livestock under trees

Physical principles of process known. Evidence and methods for gathering evidence to quantify processes in different landscapes and hence quantify dispersion, recapture and concentration reduction needed

1. Monitoring Ammonia among treebelts - Farm field case studies





Poultry 1

- Good depth of treebelt (100 m), 11yrs
- 3 sheds (26k laying birds)
- 1 shed is roof ventilated (12k birds)

Poultry 2

- Treebelt 30m with open transect, 11 years 77ha.
- Single shed 12k laying birds
- Natural ventilation

Dairy 1 (with layers shed)

- Mixed and complex sources
- 12 yr woodland and ancient woodland
- 400 cows permanently housed
- 16,000 layers

Farm field case studies for monitoring ammonia reduction from treebelts

Dairy 2

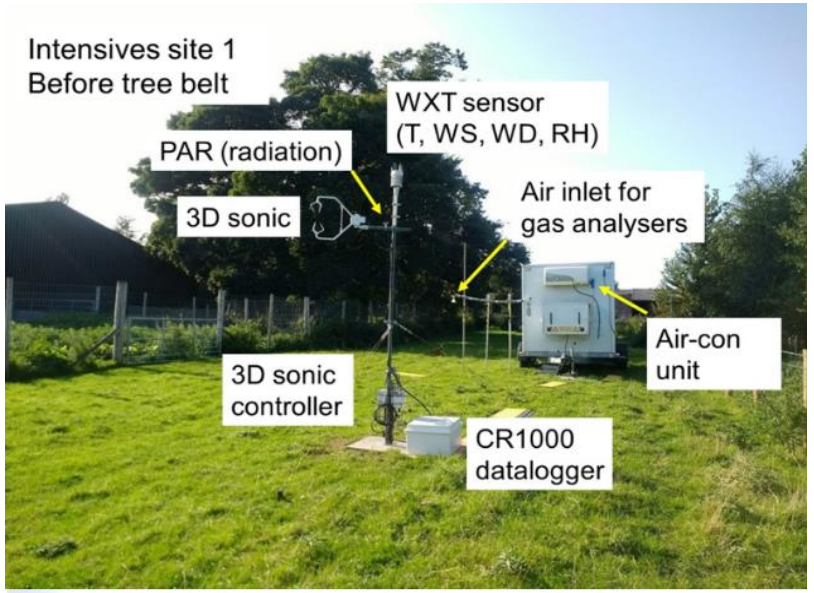
- Mature oak ancient replanted woodland close by sheds ~70m
- Woodland 300 m deep (with some open areas)
- 350 dairy cows inc. followers. housed year round (some dry cows +heifers will go out)

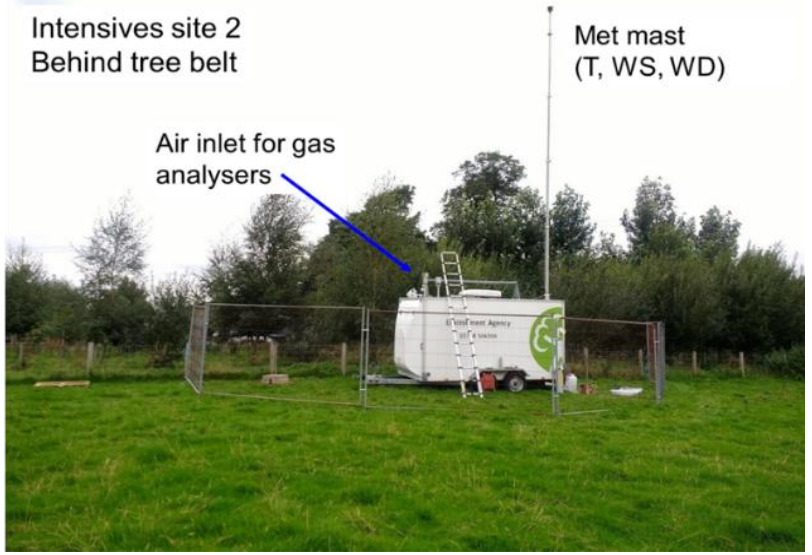
Poultry 3

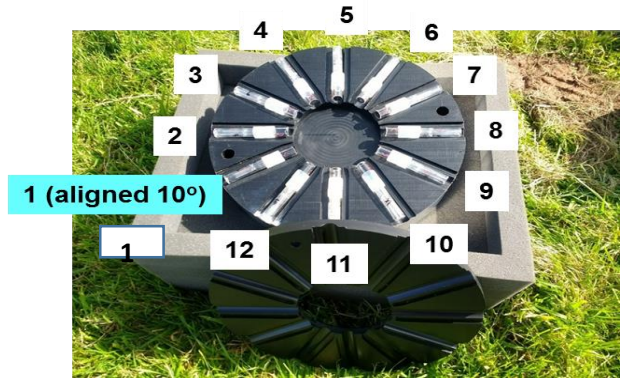
- 6k laying birds (organic)
- Treebelt 12yrs, 25m
- Natural ventilation

Poultry 4

- 32k laying birds
- Treebelt 7yrs, 100m
- Natural ventilation


Intensives site 1
Before tree belt
WXT sensor
(T, WS, WD, RH)
PAR (radiation)
3D sonic
Air inlet for
gas analysers
Air-con
unit
3D sonic
controller
CR1000
datalogger


Intensives site 2
Behind tree belt
Met mast
(T, WS, WD)
Air inlet for gas
analysers


1 (aligned 10°)
1
2
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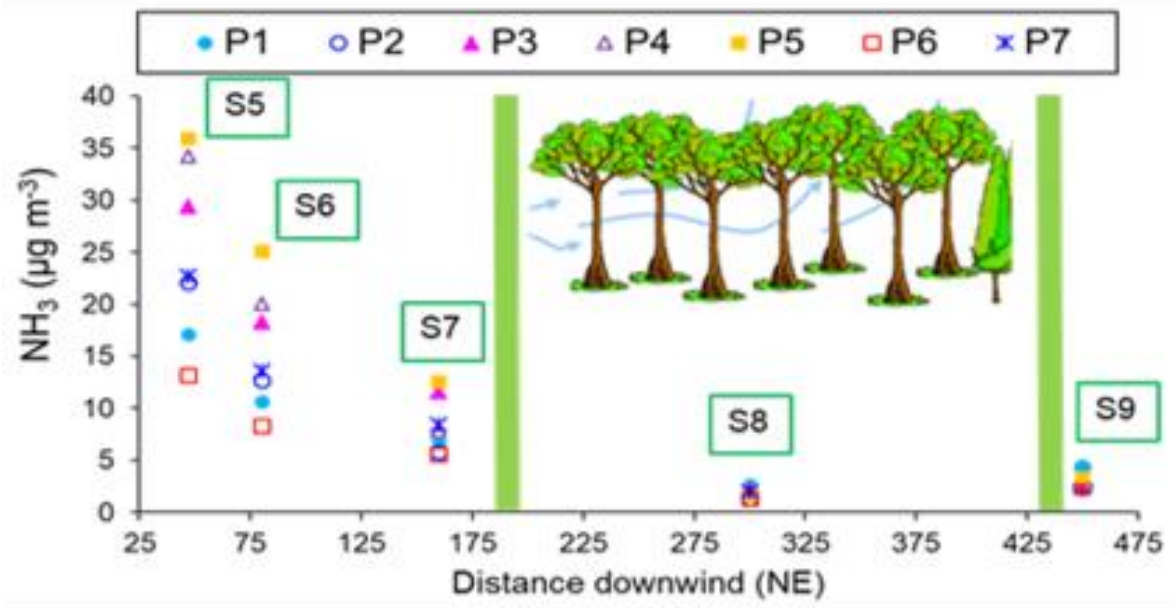
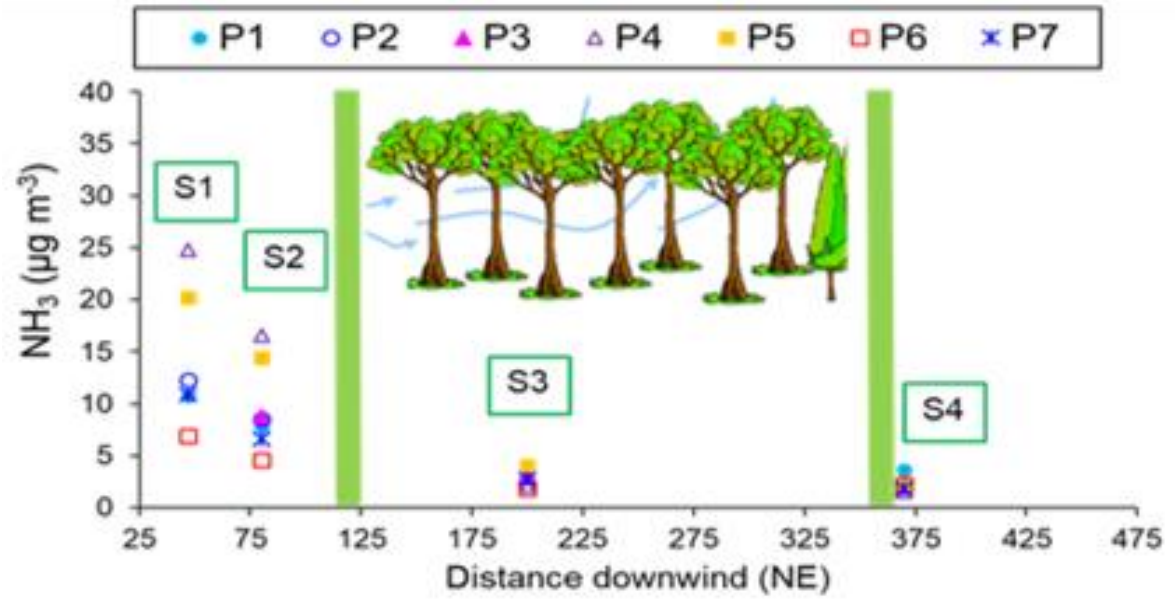
11
12

Dairy 1 - ALPHA Ammonia NH_3



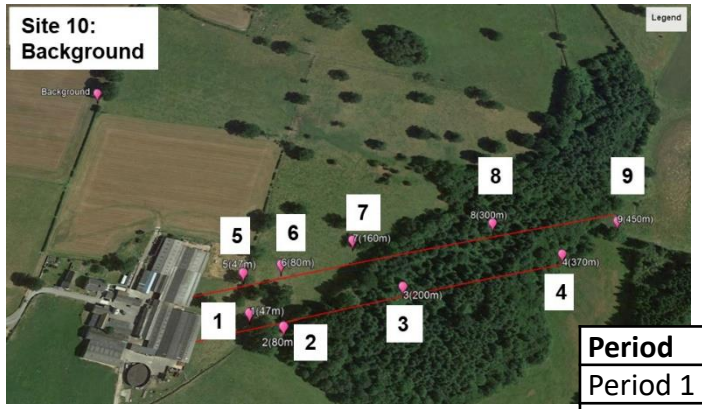


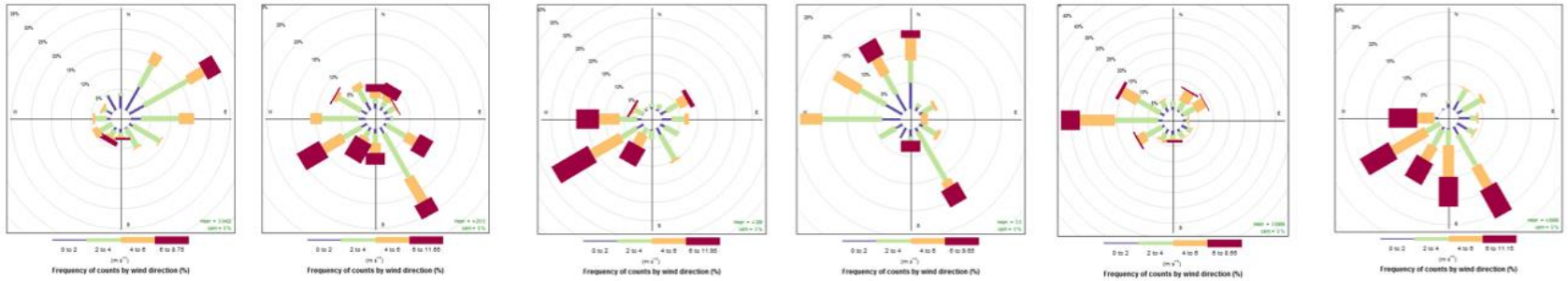
Changes in NH_3 concentrations between:

- open transect (sites 5 - 9)
- wooded transect (sites 1 - 4)

(showing data from individual periods (P1, P2 etc) ~2 weeks)

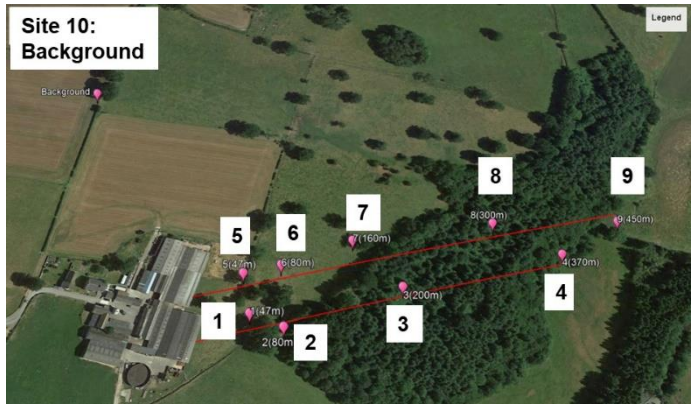
Dairy 1 – Model vs Measured





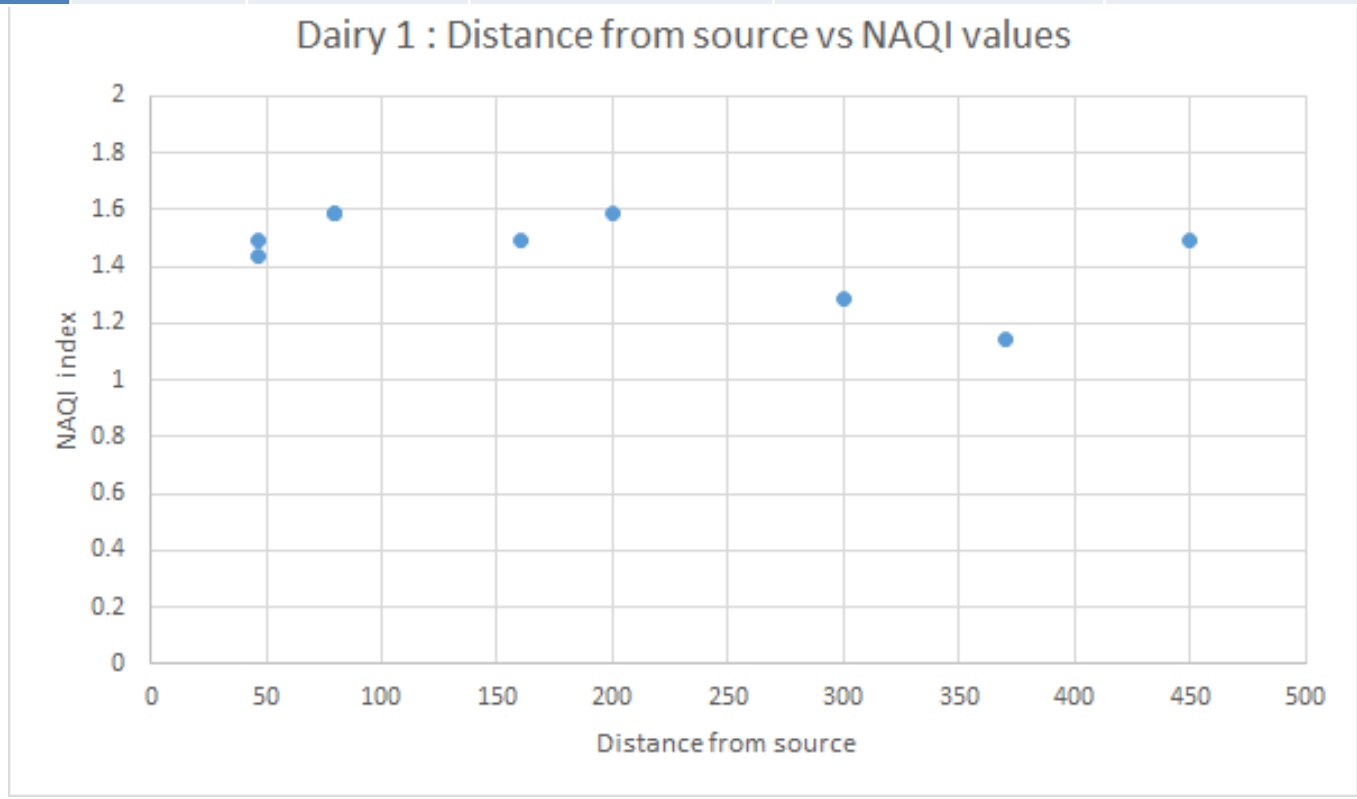
Period	Sampling Site	NH_3 SCAIL	ALPHA	SCAIL % conc △	ALPHA % conc △	SCAIL vs ALPHA
Period 1	2	4.72	7.80	68%	63%	Difference
Period 1	3	1.50	2.90			-5%
Period 1	7	2.43	6.68	67%	61%	Difference
Period 1	8	0.79	2.63			-7%
Period 2	2	6.78	8.58	69%	74%	Difference
Period 2	3	2.11	2.24			5%
Period 2	7	3.78	5.84	69%	78%	Difference
Period 2	8	1.16	1.31			8%
Period 3	2	6.23	8.88	56%	63%	Difference
Period 3	3	2.76	3.25			8%
Period 3	7	5.33	11.66	68%	81%	Difference
Period 3	8	1.73	2.26			13%
Period 4	2	11.37	16.52	69%	87%	Difference
Period 4	3	3.47	2.18			17%
Period 4	7	4.40	7.86	65%	84%	Difference
Period 4	8	1.54	1.28			19%
Period 5	2	14.42	14.47	68%	72%	Difference
Period 5	3	4.66	4.10			4%
Period 5	7	5.98	12.59	64%	87%	Difference
Period 5	8	2.14	1.60			23%
Period 6	2	3.37	4.59	57%	59%	Difference
Period 6	3	1.46	1.87			3%
Period 6	7	2.97	5.57	69%	75%	Difference
Period 6	8	0.91	1.38			6%

Dairy 1 – Corticulous Lichen Survey



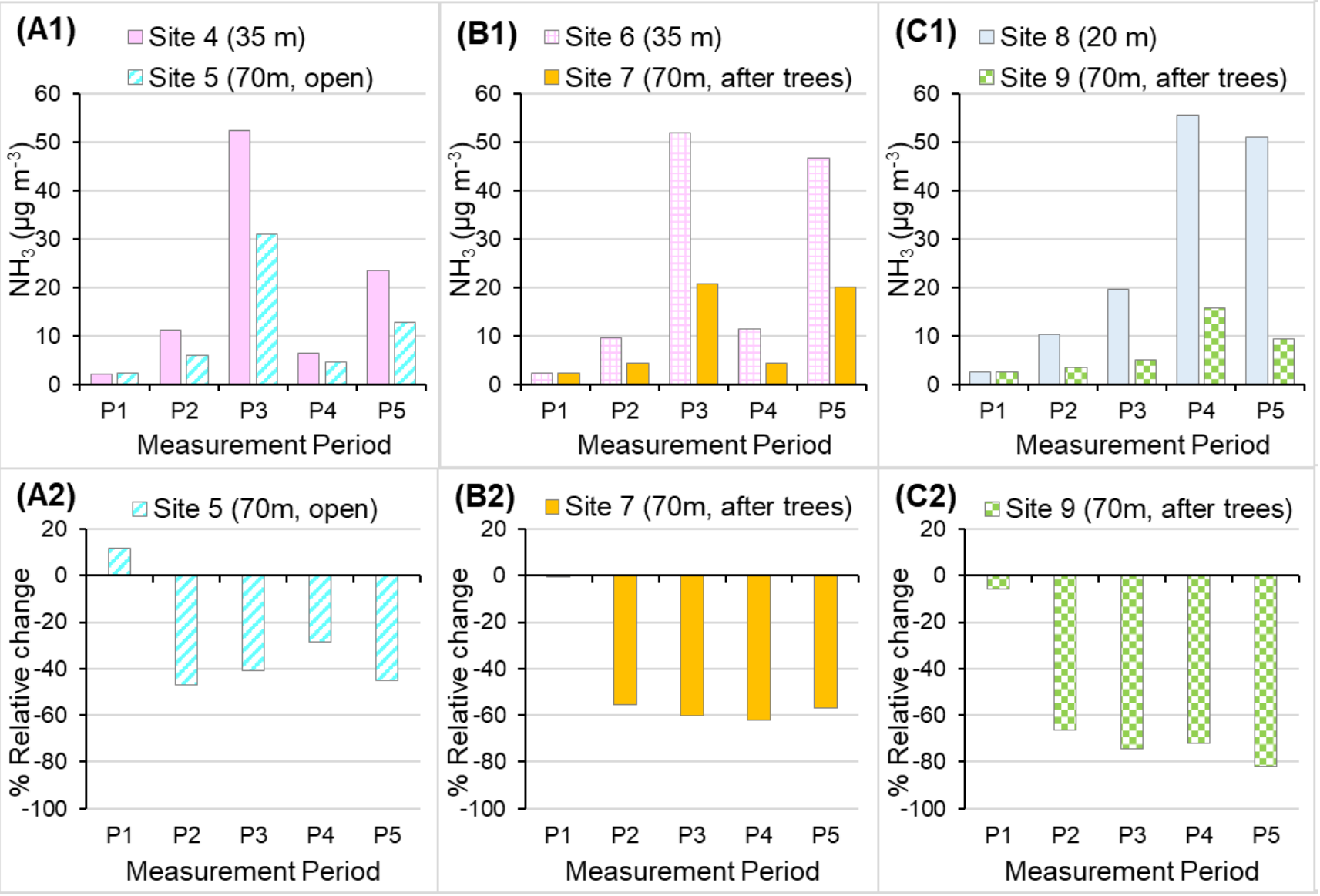
Site No.	LIS	NAQI	[NH_3] µmol m^{-3}	Tree species	Tree position
1	-2.4	1.44	0.33	O	36444 45324
2	-3	1.59	0.42	O	36473 45287
3	-3	1.59	0.42	S	36592 45345
4	-1.2	1.14	0.18	A	36767 45389
5	-2.6	1.49	0.36	O	36437 45392
6	-3	1.59	0.42	O	36471 45334
7	-2.6	1.49	0.36	O	36546 45394
8	-1.8	1.29	0.25	L	36681 45416
9	-2.6	1.49	0.36	O	36817 45465
10	-1.6	1.24	0.23	O	36346 45656

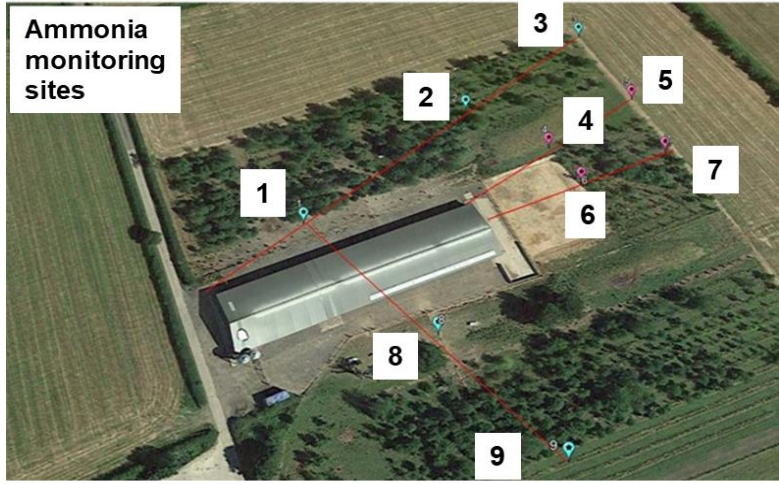
- Sites 1, 5, 6 and 7, situated in open parkland have high NAQI values (>1.4)
- Sites 2, 3 , 4 and 8 situated adjacent to, or within woodland are more varied.
- Sites 4 and 8, situated further away from the farm are lower, more in line with the control site 10.



Poultry 2 - ALPHA Ammonia NH_3

35m: OPEN | 35m: TREES | 50m: TREES

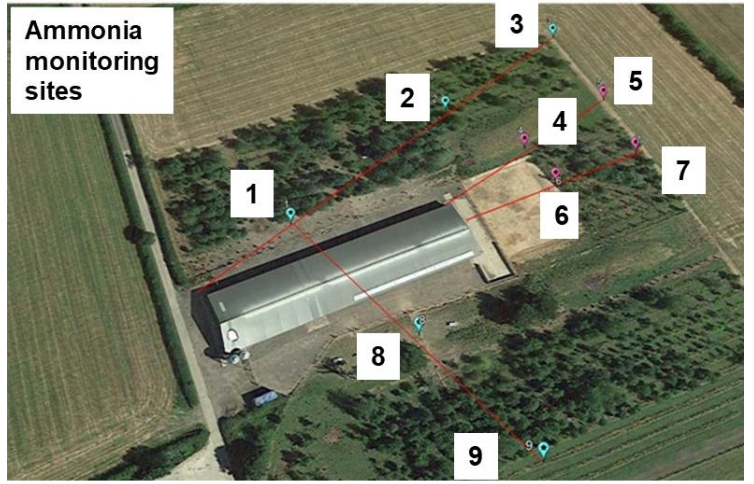


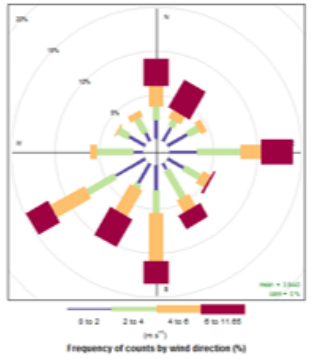


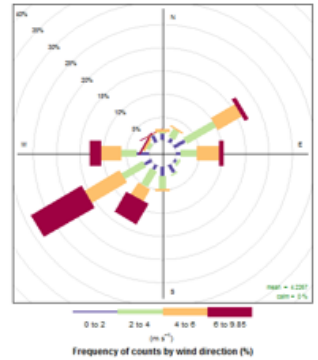
- (TOP graphs) Comparison of NH_3 concentrations between sites in an open transect (A1) with other sites in wooded transects (B1, C1).
- (BOTTOM graphs) Relative change in concentrations, showing larger reduction in concentrations at sites located behind the tree shelterbelt (B2, C2) than at site 5, with no trees (A2).
- A larger reduction in ammonia 19% ($p = 0.02$) was observed through the treebelt (-59%), compared to the open transect (-40%)

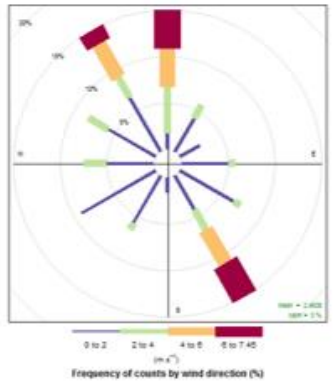
Poultry 2 – Model vs Measured

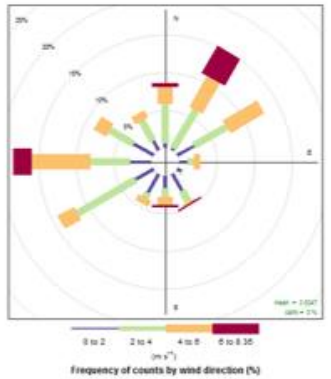
Period	Sampling Site	SCAIL	ALPHA	SCAIL % conc △	ALPHA % conc △	SCAIL vs ALPHA
2	4	5.50	11.14	49%	47%	Difference
2	5	2.79	5.92			-2%
2	6	5.38	9.71	46%	56%	Difference
2	7	2.91	4.32			10%
2	8	16.45	10.33	82%	66%	Difference
2	9	2.97	3.47			-16%
3	4	9.77	52.42	50%	41%	Difference
3	5	4.91	31.15			-9%
3	6	10.11	52.10	47%	60%	Difference
3	7	5.39	20.79			13%
3	8	20.86	19.69	83%	74%	Difference
3	9	3.45	5.05			-9%
4	4	16.56	6.45	46%	29%	Difference
4	5	9.02	4.60			-17%
4	6	15.88	11.43	44%	62%	Difference
4	7	8.90	4.34			18%
4	8	66.51	55.77	78%	72%	Difference
4	9	14.84	15.70			-6%
5	4	9.64	23.57	49%	45%	Difference
5	5	4.88	12.93			-4%
5	6	10.99	46.85	47%	57%	Difference
5	7	5.79	20.19			10%
5	8	36.22	50.99	84%	82%	Difference
5	9	5.90	9.33			-2%



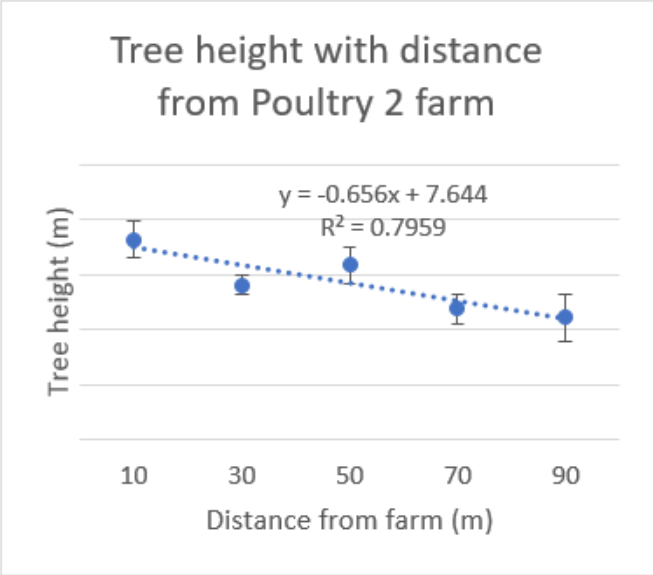


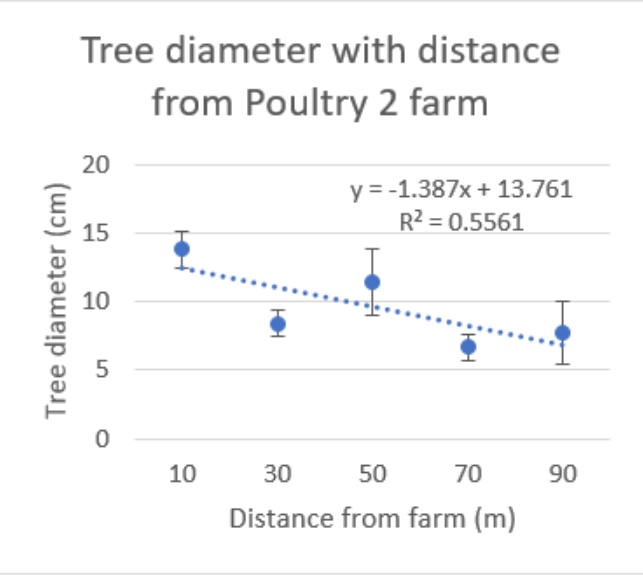


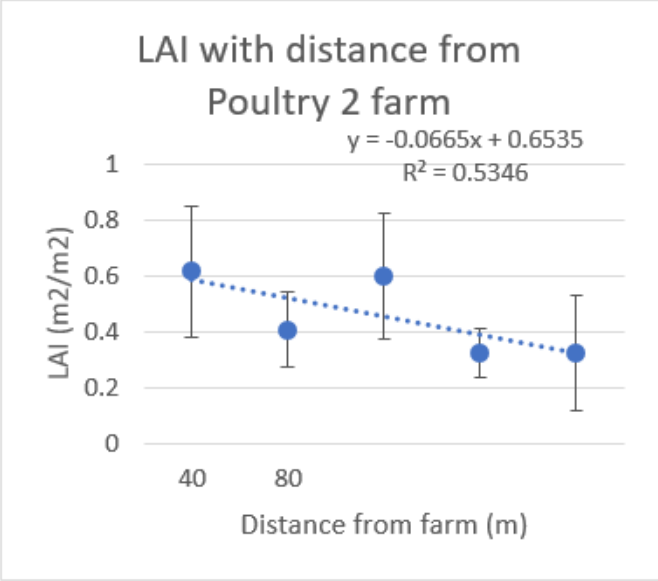


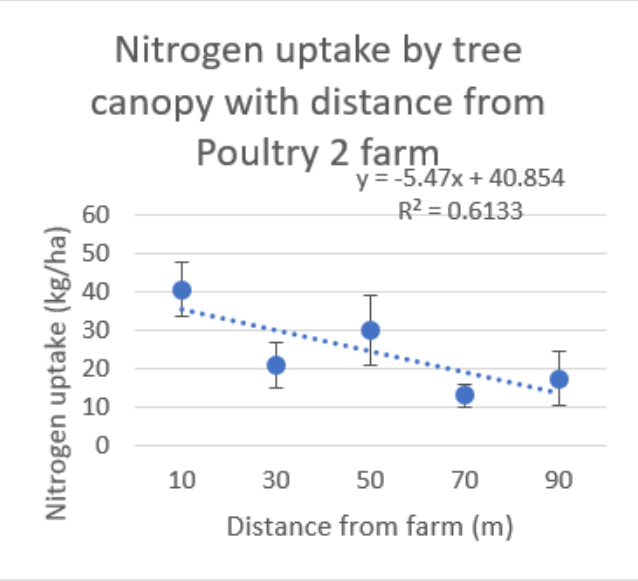


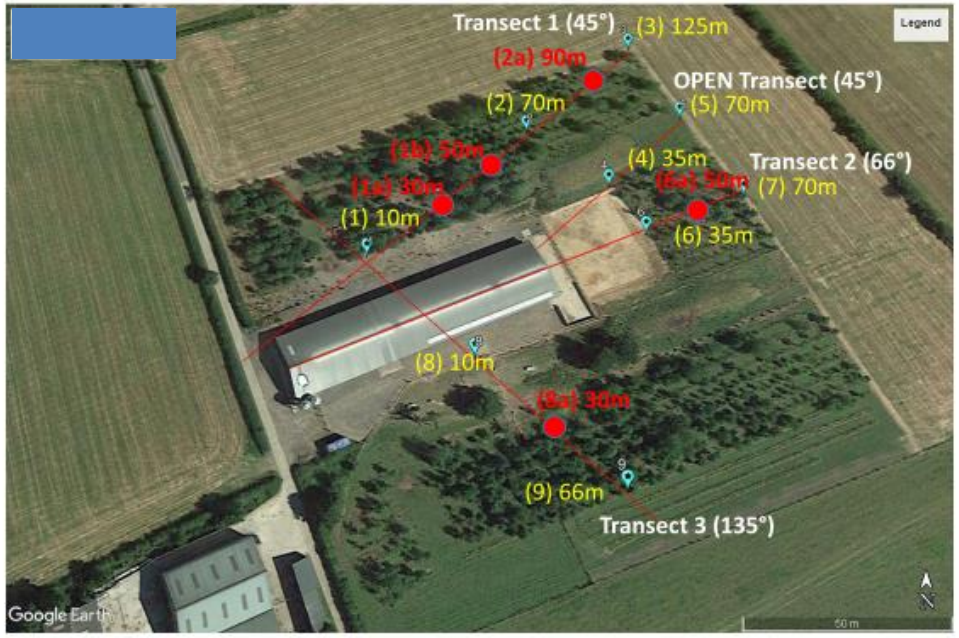
Poultry 2 - Ecology





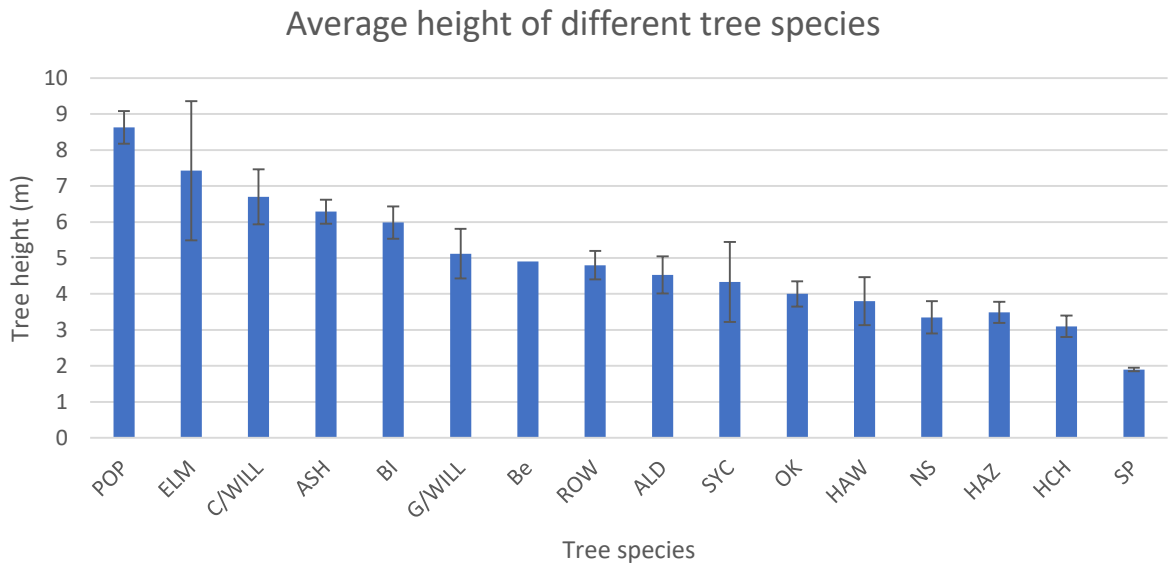


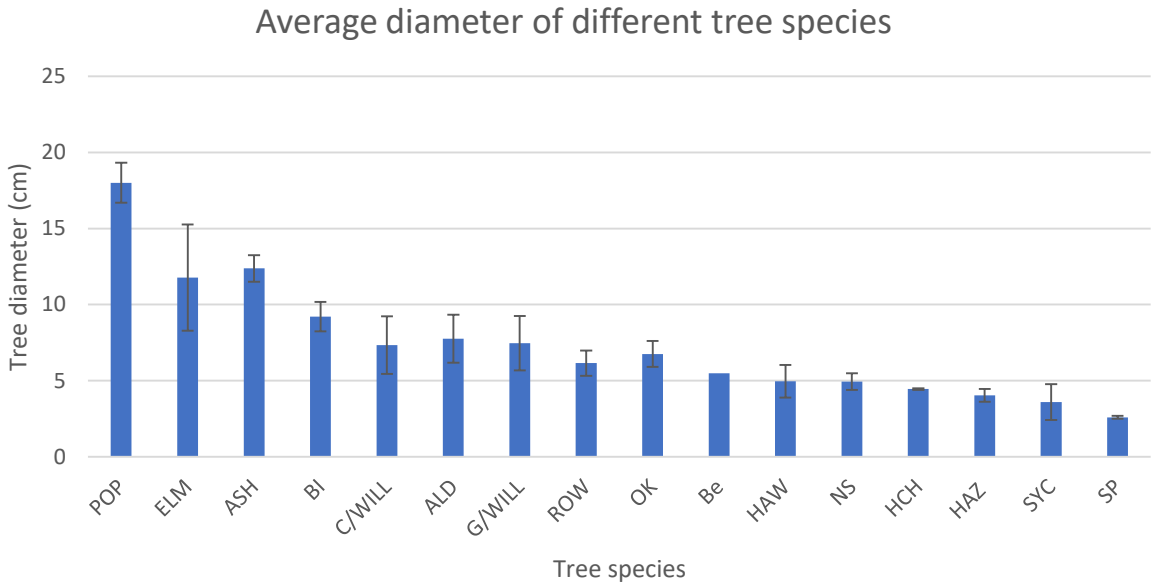


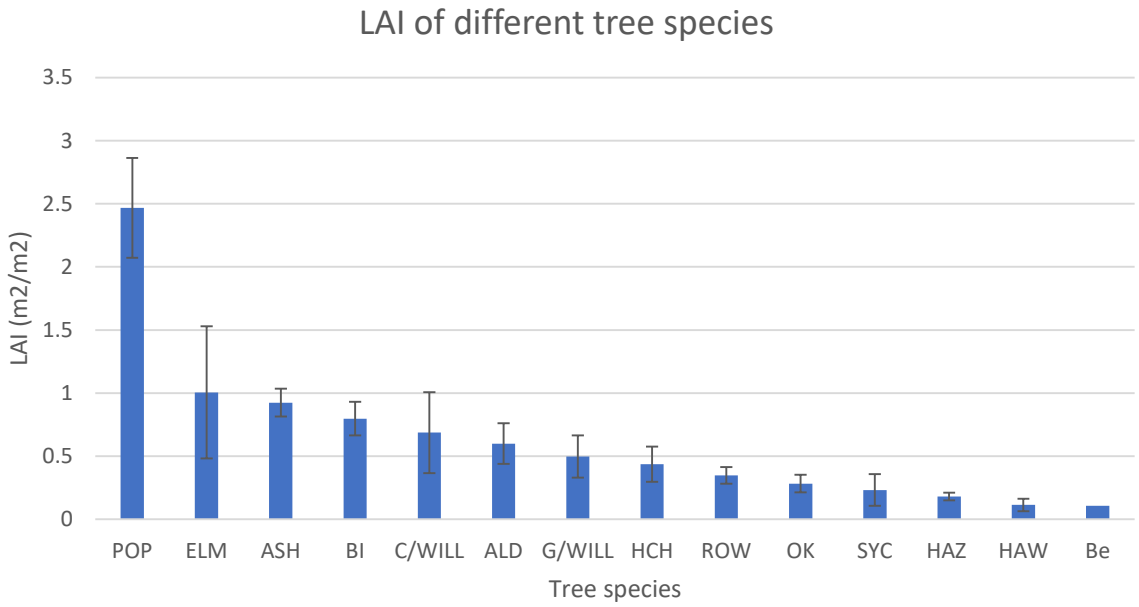


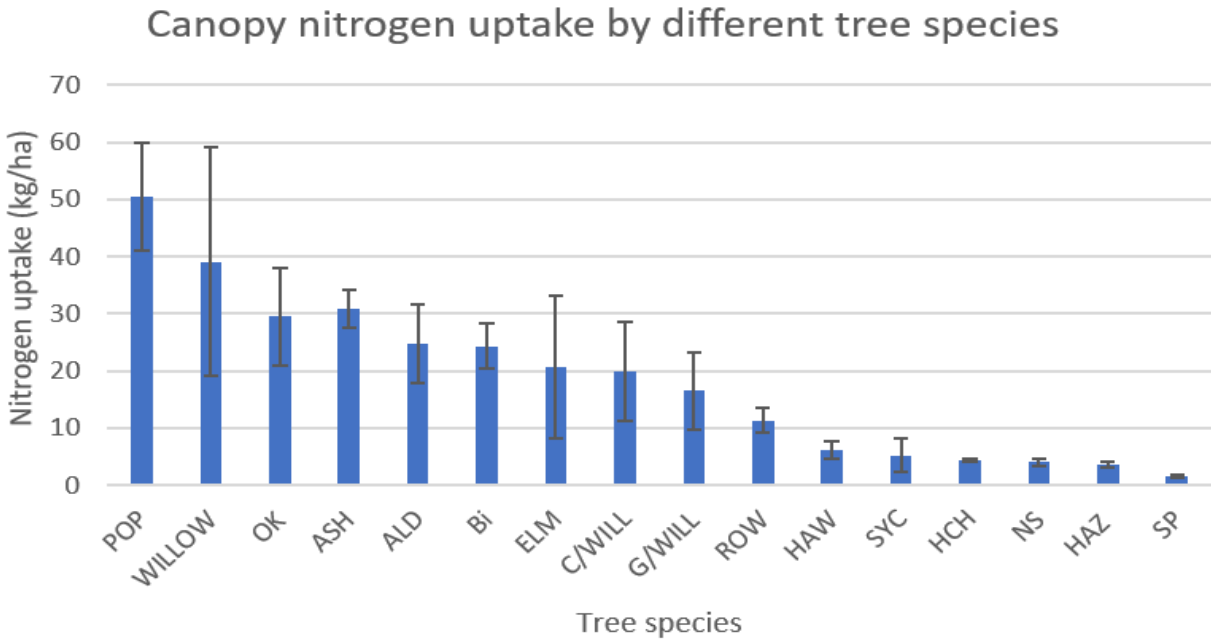
- Tree height, diameter, LAI (Leaf Area Index) and canopy nitrogen uptake all decrease with distance away from Poultry 2 farm.
- Indicative linear relationships between tree parameters and distance from farm.

Across all farms – variation in tree species parameters



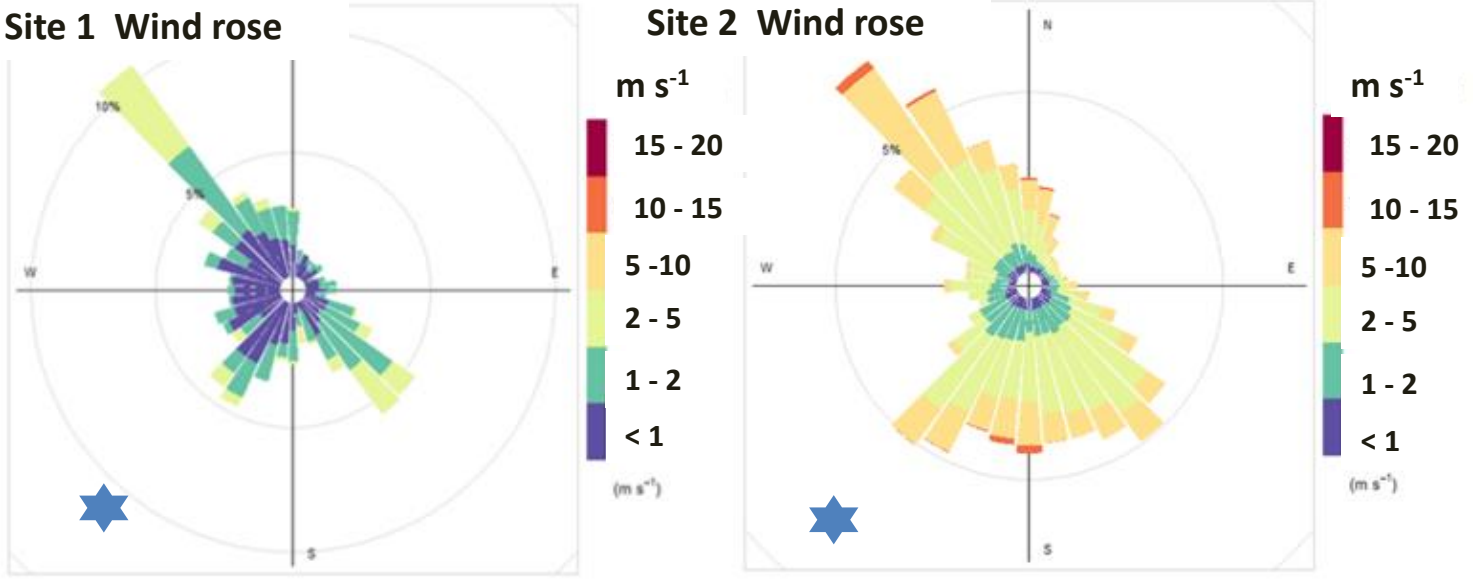






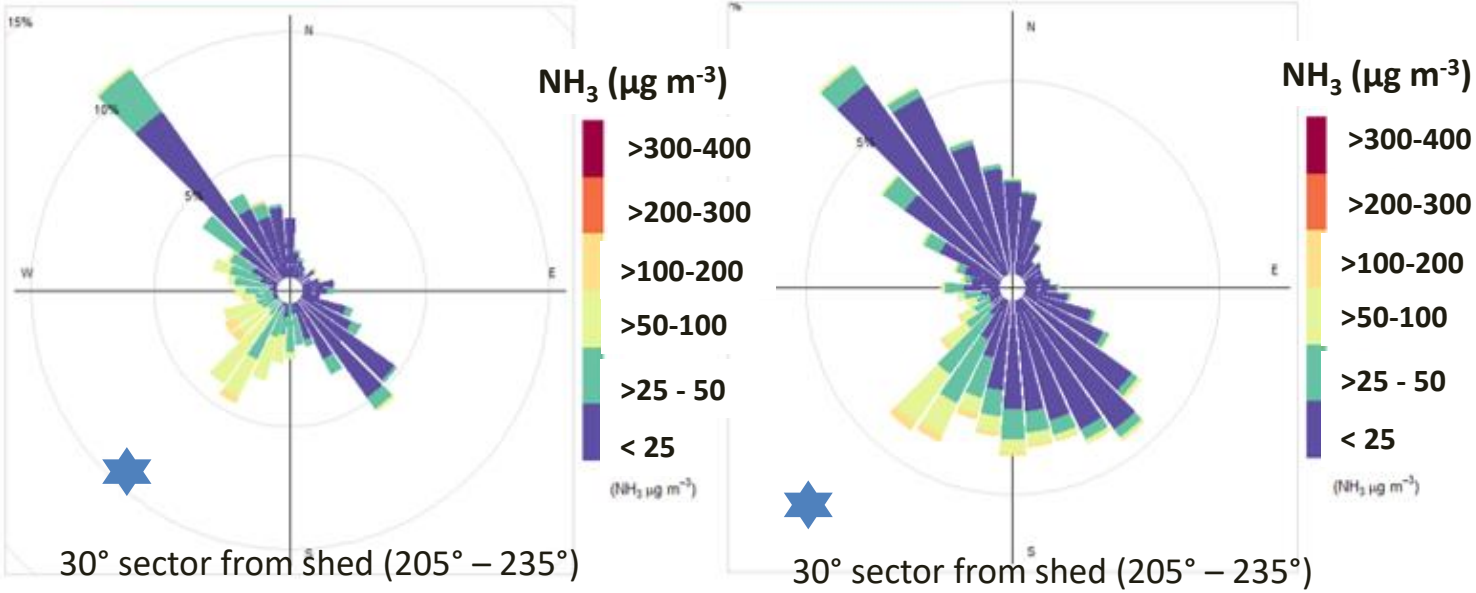
• Intensive Campaign at Poultry 3

Site 1 Wind rose



Site 2 Wind rose

Site 1 AiRRmonia NH_3



30° sector from shed (205° – 235°)
Mean = 120 µg NH_3 m^{-3}

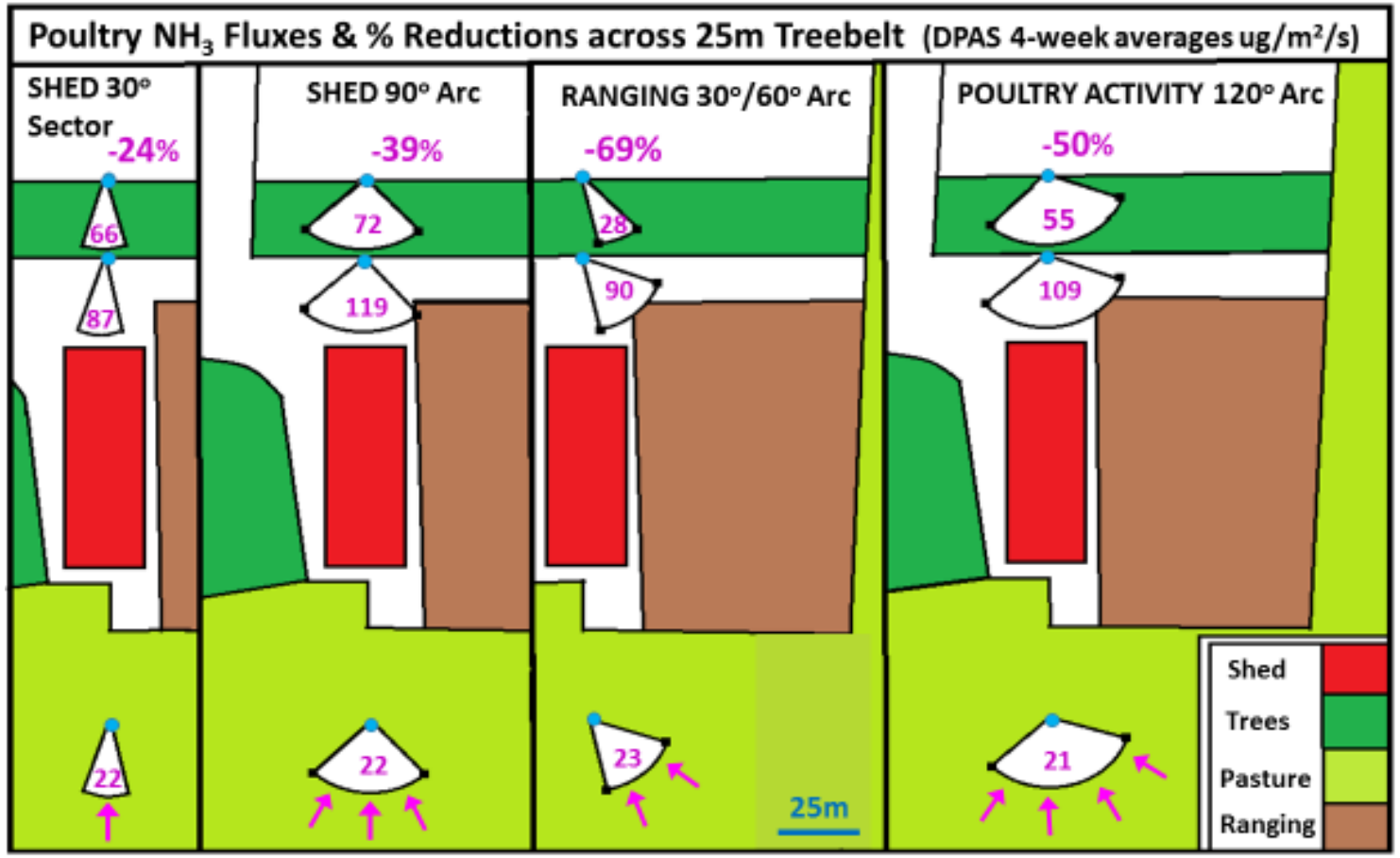
Site 2 AiRRmonia NH_3

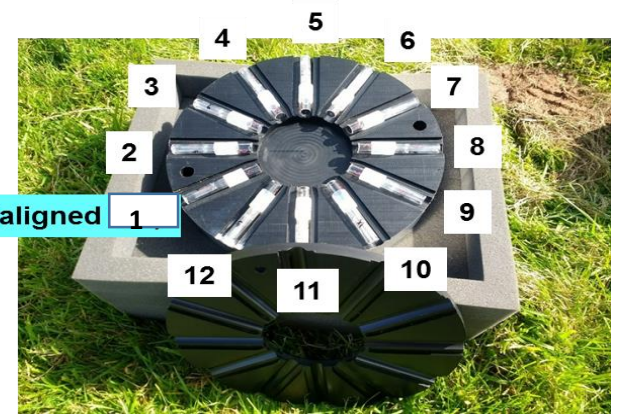
30° sector from shed (205° – 235°)
Mean = 95 µg NH_3 m^{-3}

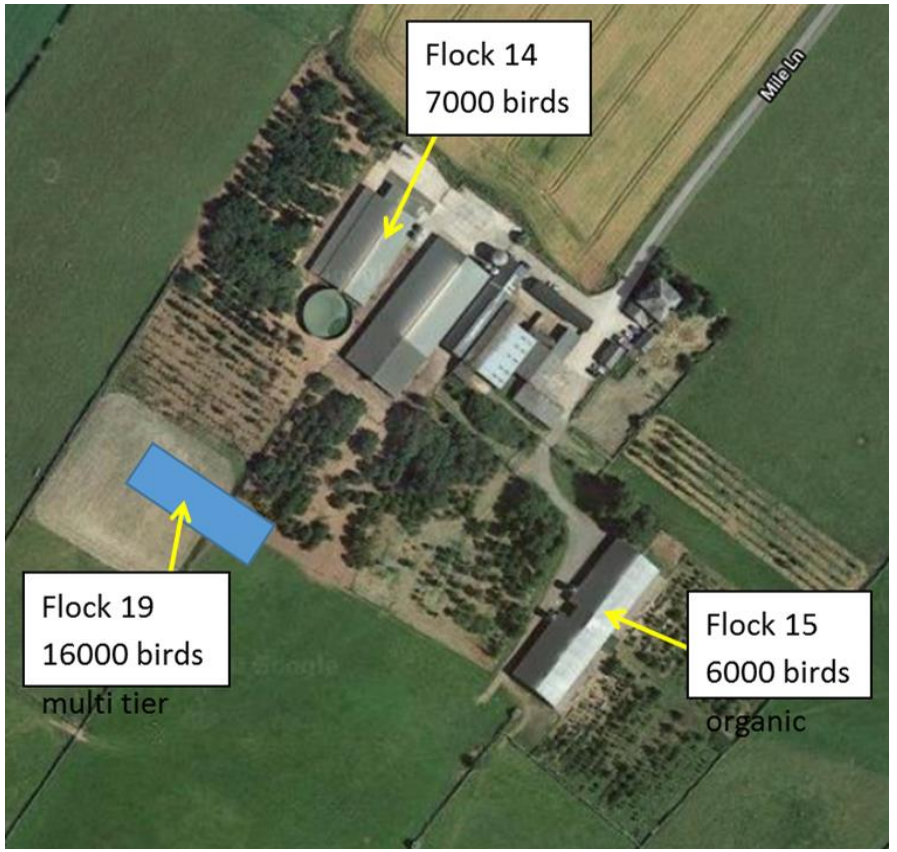
Wind rose and ammonia (AiRRmonia data) polar plots

- Site 1 weather station at site 1 before trees (height = 2 m),
- Site 2 weather station at site 2 behind trees (height ~8m).
- The highest NH_3 concentrations are from the directions of the poultry shed (✡) and ranging area.

Intensive Campaign at Poultry 3 - DPAS







Directional Passive Air Sampler (DPAS) with Mini ANnular Denuders (MANDEs) in 30° Channels

30° sector aligned with the shed.
90° arc that covered the shed and ranging area.
30°/60° arc from the ranging area.
120° arc that covered all poultry activities.

Summary – Concentration difference across treebelt?

	average % NH_3 concentration difference across treebelt				
Farm / **Method**	**Poultry 1**	**Dairy 1**	**Poultry 2**	**Poultry 4**	**Poultry 3**
ALPHA measurements	97%	73%	58%	56%	42%
SCAIL (modelled as if no treebelt)	83%‡	66%	46%	78%	29%*‡
High resolution measurement NH_3					45%**
DPAS					40%**

‡ *SCAIL modelling at these farms did not align well with the nearest sampling point to source. The model was around x10 less than the measurements (discussed in main text); * modelled over 3 measurement periods;** Sept-Oct only*

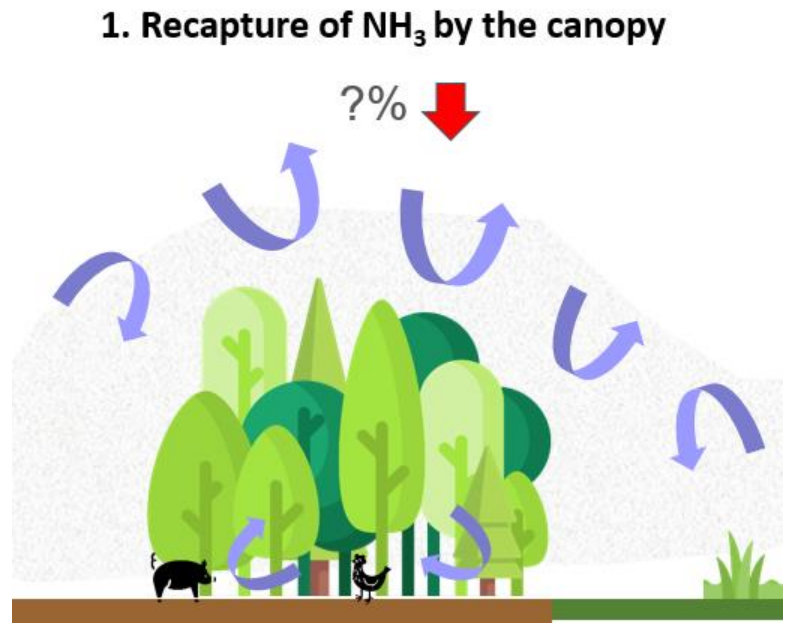
2. Increased mixing of the air increases plume dispersion

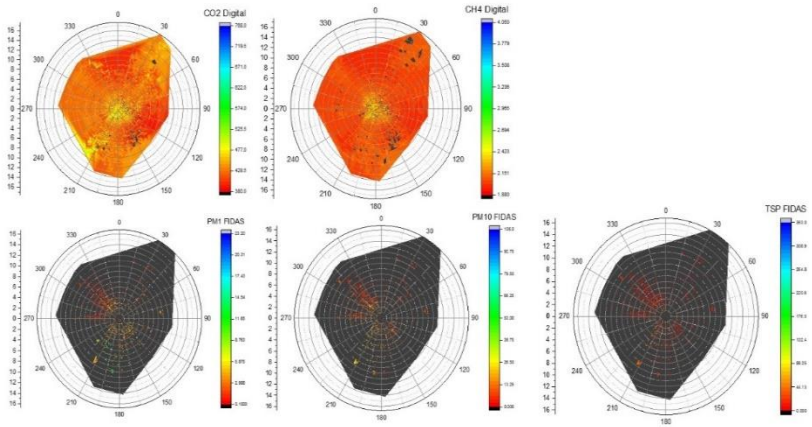
?%

Enhancing local recapture and dispersion = reducing NH_3 concentrations & deposition to sensitive habitats

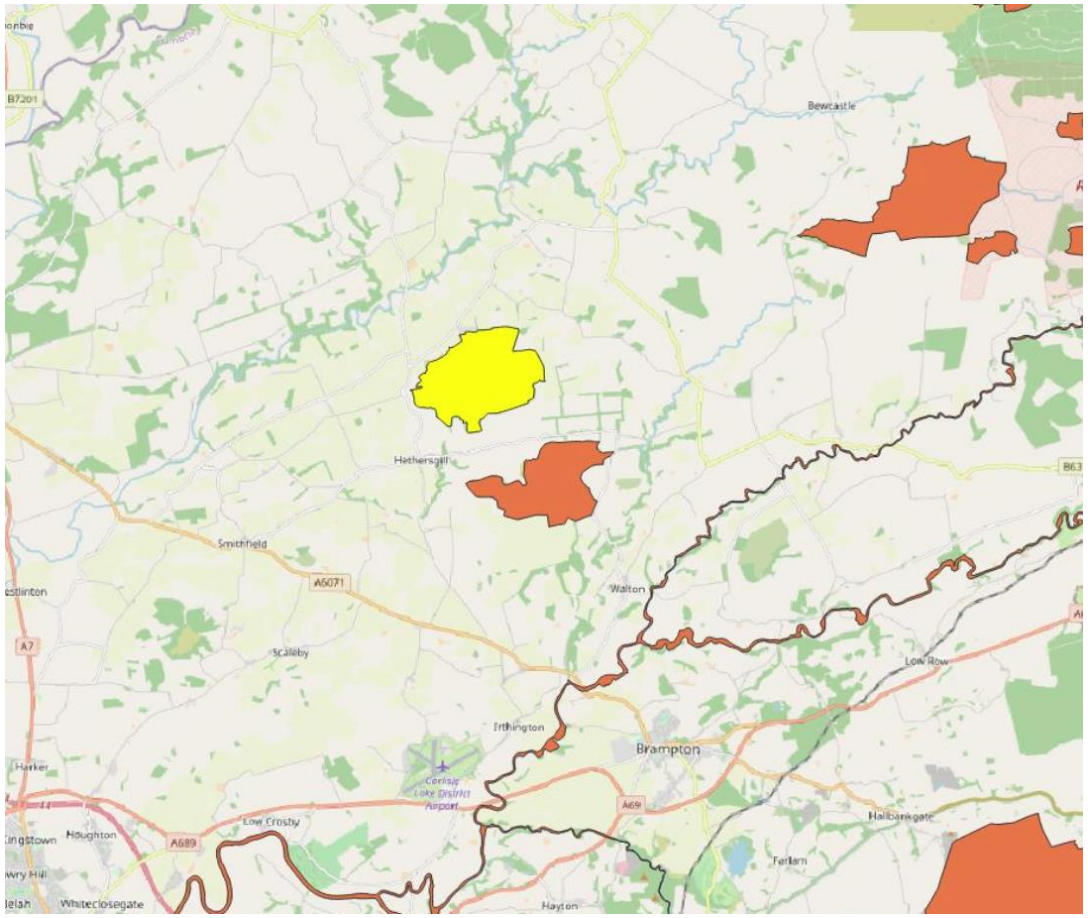
Intensive Campaign at Poultry 3 – Recapture by canopy?

	% recapture of Ammonia (NH_3) by Treebelt					
Recapture calculation method	**Poultry 1** Treebelt Depth 100 m	**Poultry 2** 30 m	**Poultry 3** 25 m	**Poultry 4** 65 m	**Dairy 1** 330 m	**Dairy 2** 170 m
MODDAS-OPenFoam*	1.0 (roof fans) 1.6 (side ventilated)	1.3	1.7	0.1	80.6	4.2
High resolution measurement CO_2 tracer			6.6			
High resolution measurement CH_4 tracer			0.3			





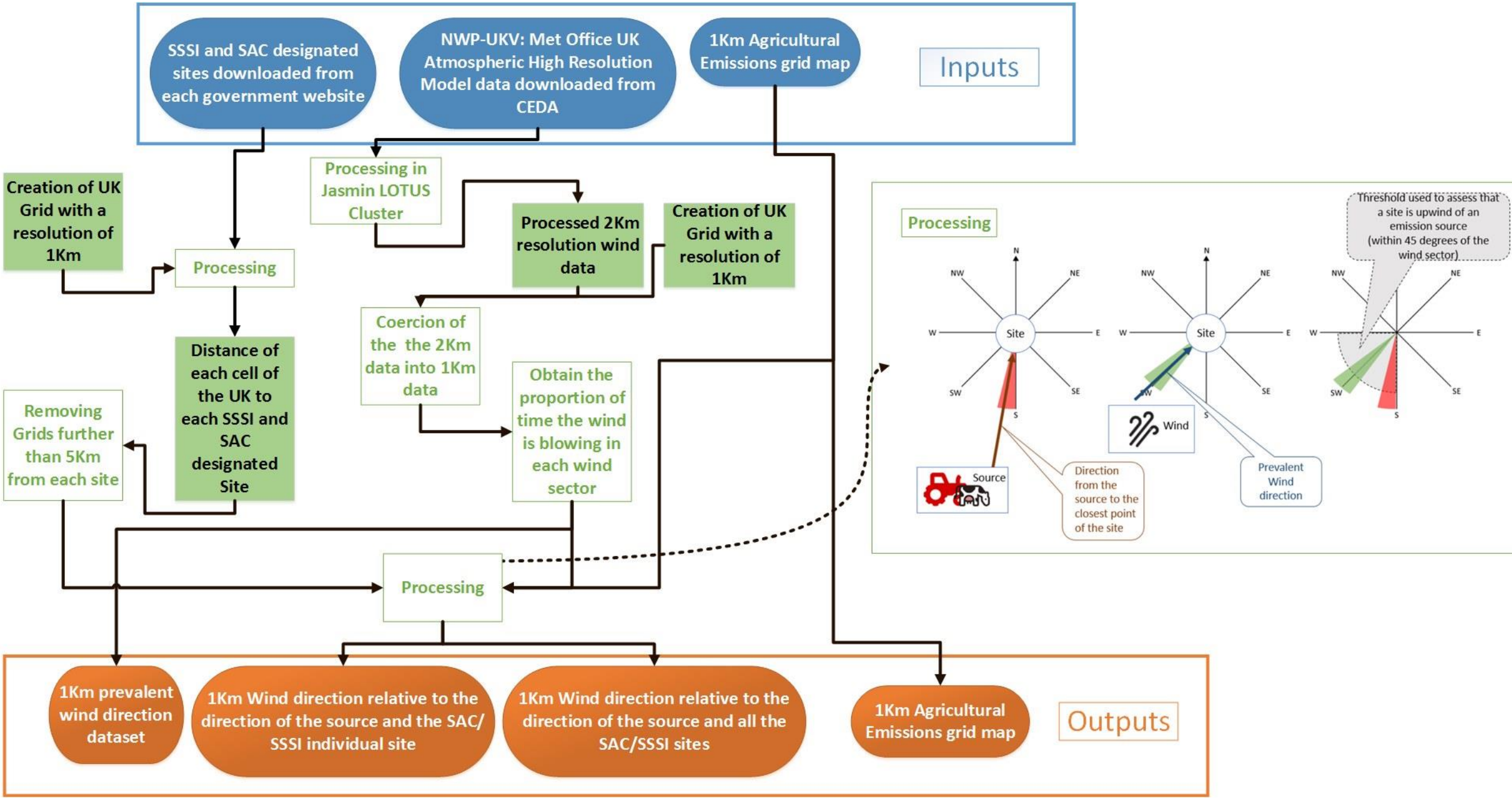
2. Priority Targeting of treebelts for ammonia mitigation in the landscape

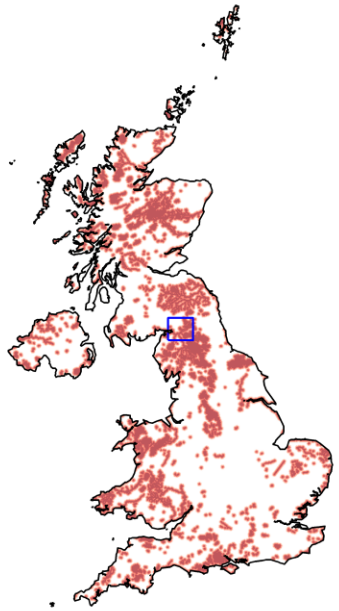


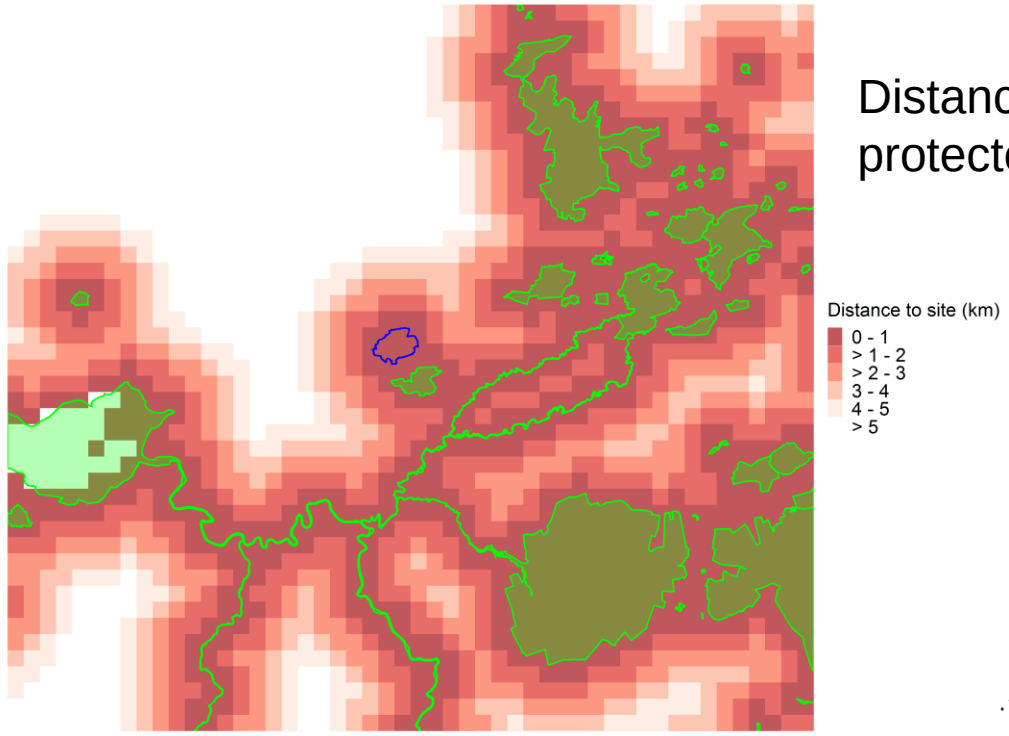
SCOPE: Target the best places to plant trees to ‘protect’ designated and semi-natural sites.

CRITERIA:

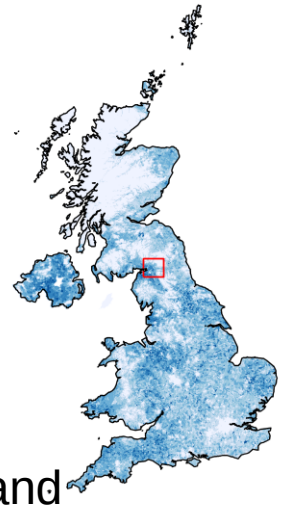
- Distance to Habitat
- Dominant Wind Direction (upwind/downwind)
- Emission Strength

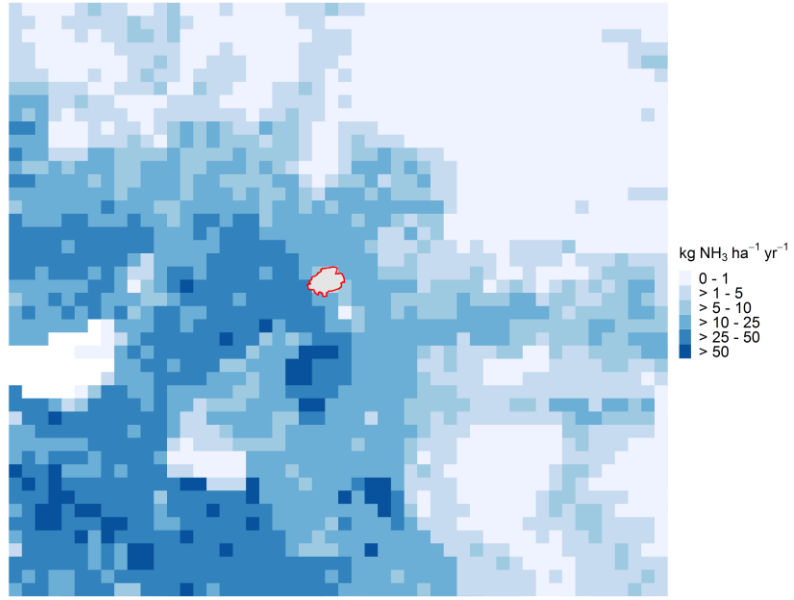

Inputs
SSSI and SAC designated sites downloaded from each government website
NWP-UKV: Met Office UK Atmospheric High Resolution Model data downloaded from CEDA
1Km Agricultural Emissions grid map
Creation of UK Grid with a resolution of 1Km
Processing
Processing in Jasmin LOTUS Cluster
Processed 2Km resolution wind data
Creation of UK Grid with a resolution of 1Km
Coercion of the the 2Km data into 1Km data
Obtain the proportion of time the wind is blowing in each wind sector
Distance of each cell of the UK to each SSSI and SAC designated Site
Removing Grids further than 5Km from each site
Processing
Processing
N
NW
NE
W
E
SW
SE
S
Site
Wind
Source
Direction from the source to the closest point of the site
Prevalent Wind direction
Threshold used to assess that a site is upwind of an emission source (within 45 degrees of the wind sector)
Outputs
1Km prevalent wind direction dataset
1Km Wind direction relative to the direction of the source and the SAC/ SSSI individual site
1Km Wind direction relative to the direction of the source and all the SAC/SSSI sites
1Km Agricultural Emissions grid map



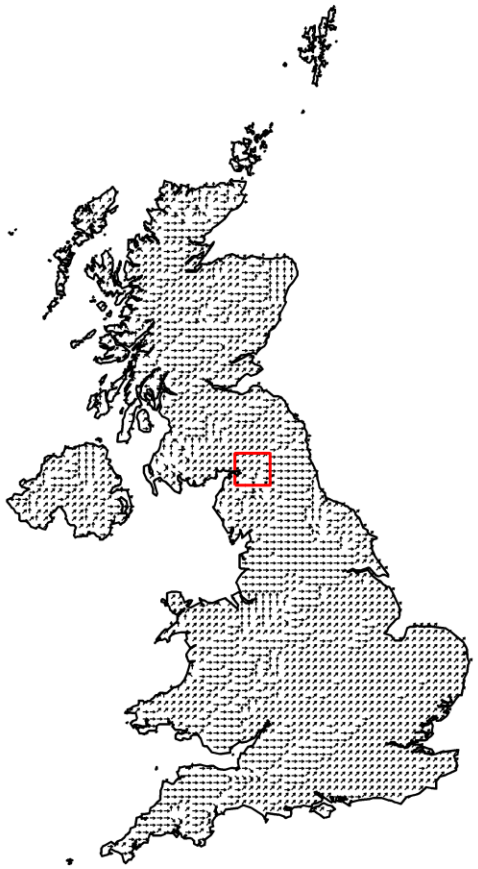


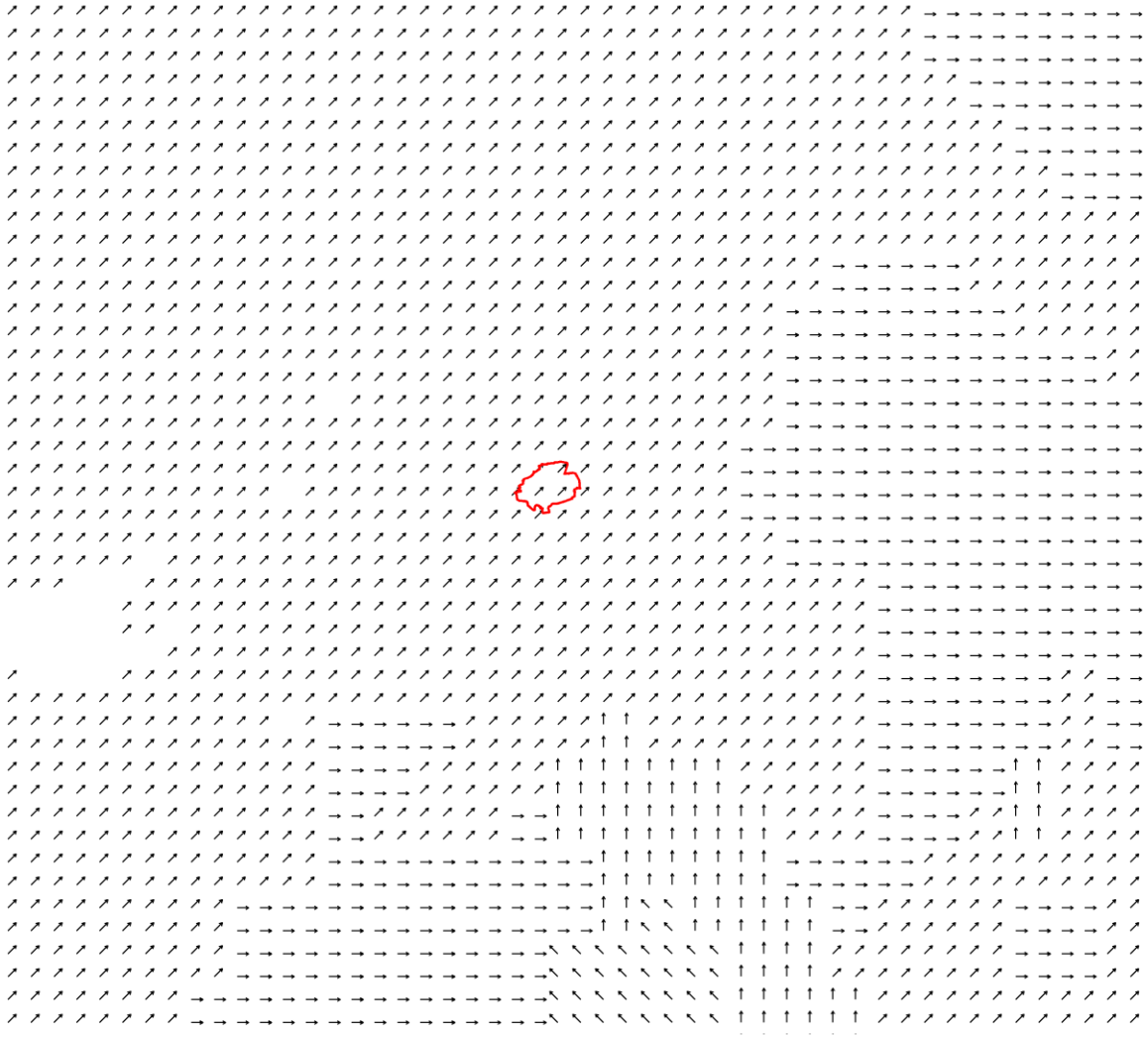
Distance criteria of 5 km radius was applied to protected sites



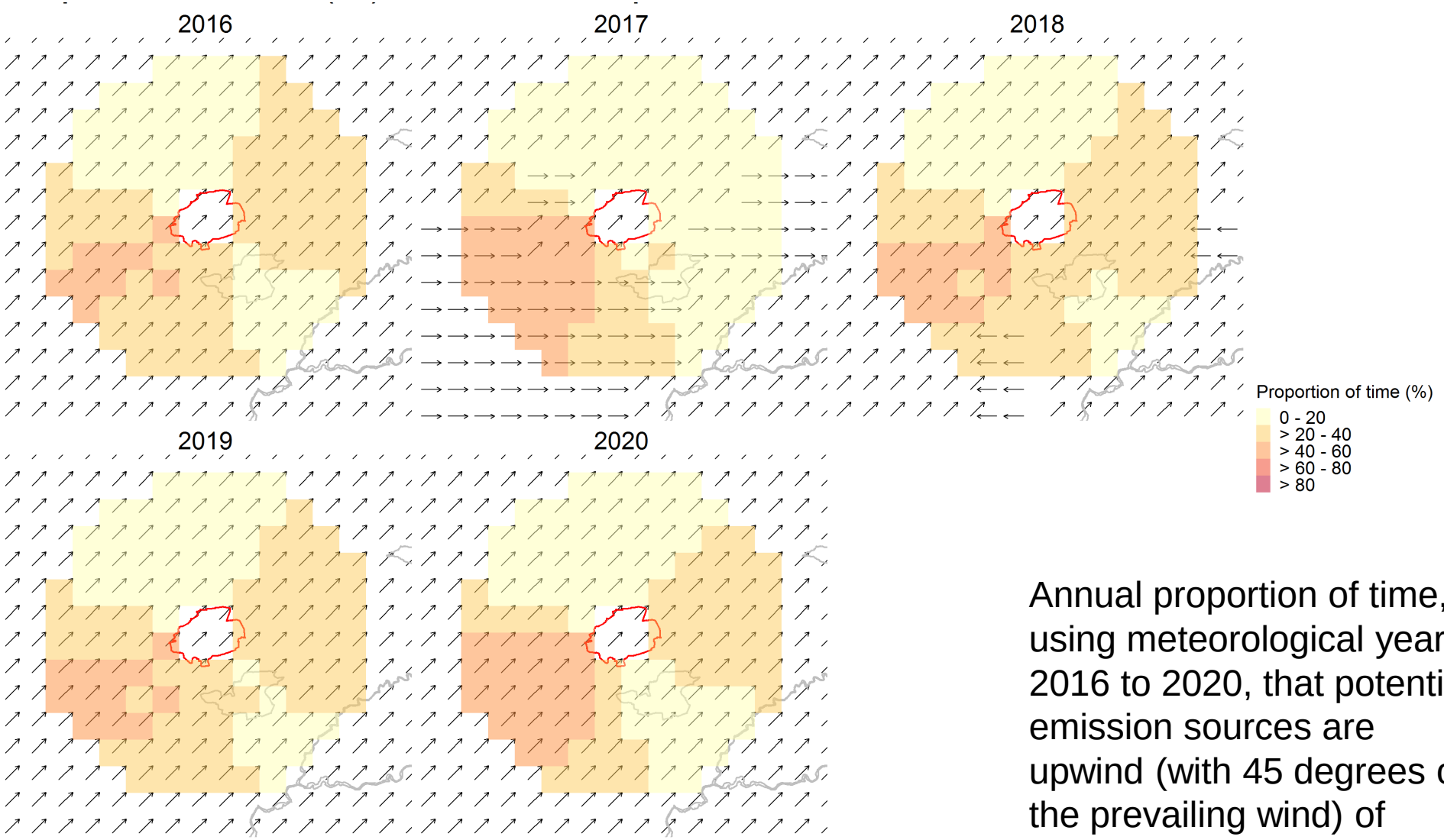


2018 UK agricultural NH_3 emissions and zoomed in to study region





Prevailing wind direction across the UK and inset of study area. Data is available for every 2 x 2 km grid but is shown for the UK on a 10 km grid and at 2 x 2 km for the Bolton Fells Moss study area (in red right hand image)

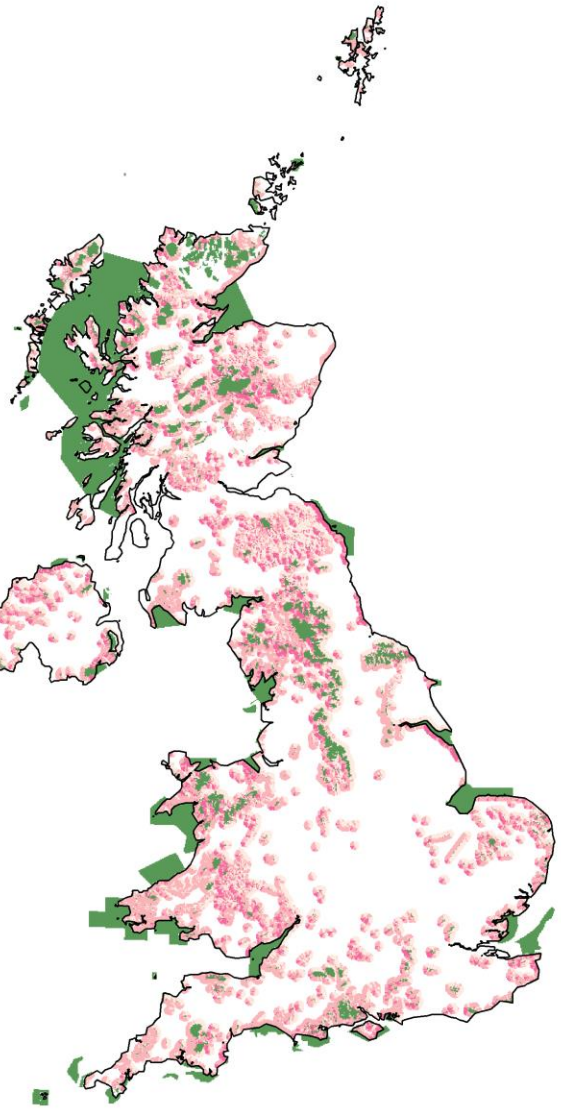


Annual proportion of time, using meteorological years 2016 to 2020, that potential emission sources are upwind (with 45 degrees of the prevailing wind) of Bolton Fens Moss SAC

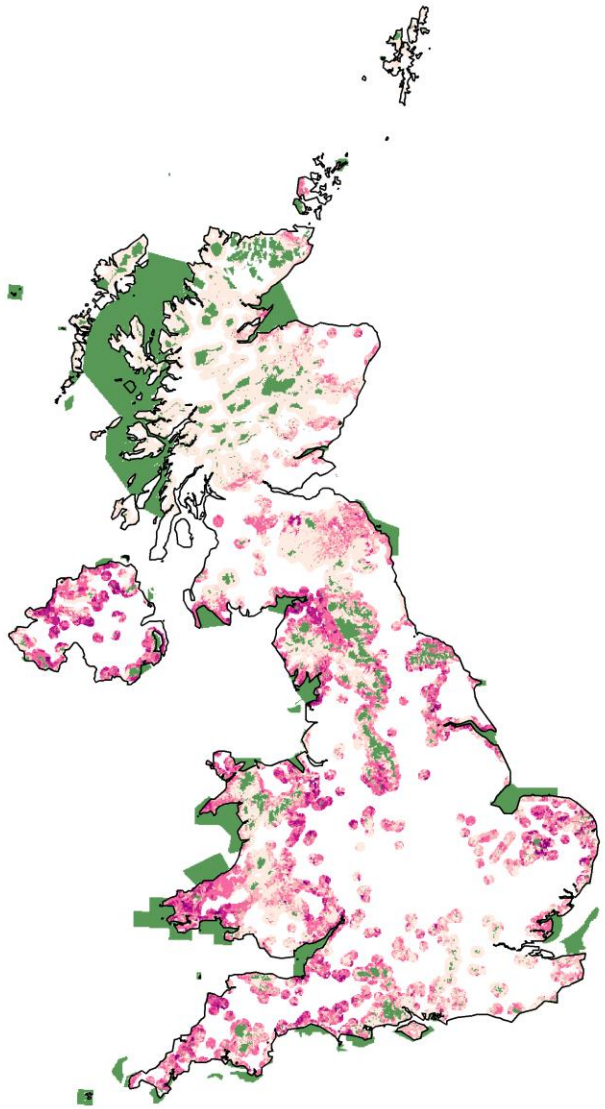
Combined Indicator scores based on emissions and relative location of source and wind statistics.

Score	Agricultural Ammonia NH_3 emission criteria ($kg\ NH_3\ ha^{-1}\ year^{-1}$)	Relative location of source criteria (% of time upwind/within 45 degrees of wind)
1	≤ 5	≤ 20
2	> 5 – 10	> 20 - 40
3	> 10 – 25	> 40 - 60
4	> 25 – 50	> 60 - 80
5	> 50	> 80

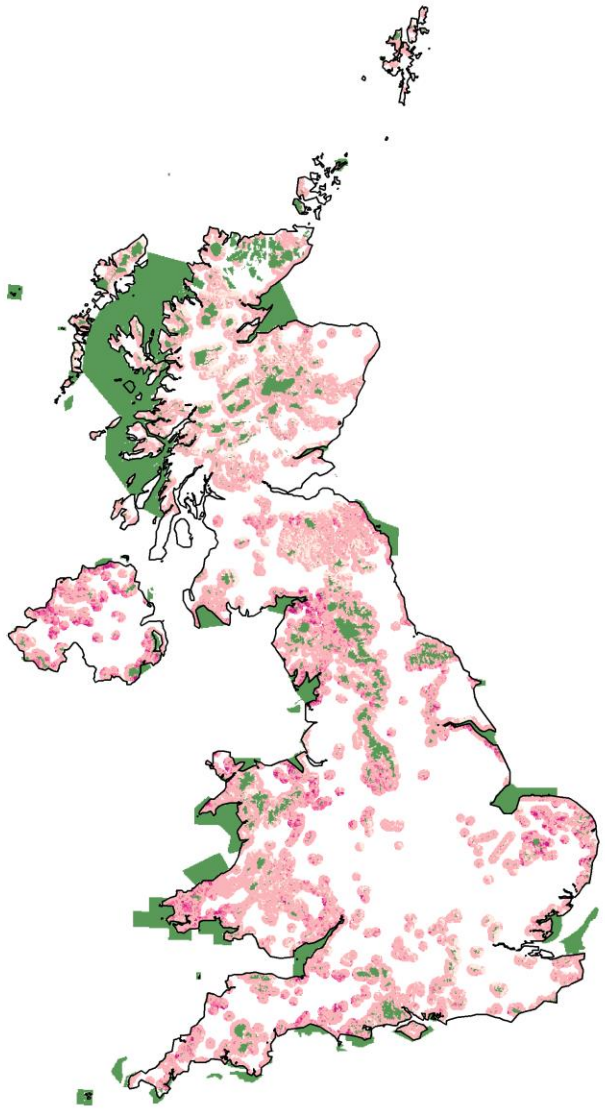
Wind Score



Emission Score



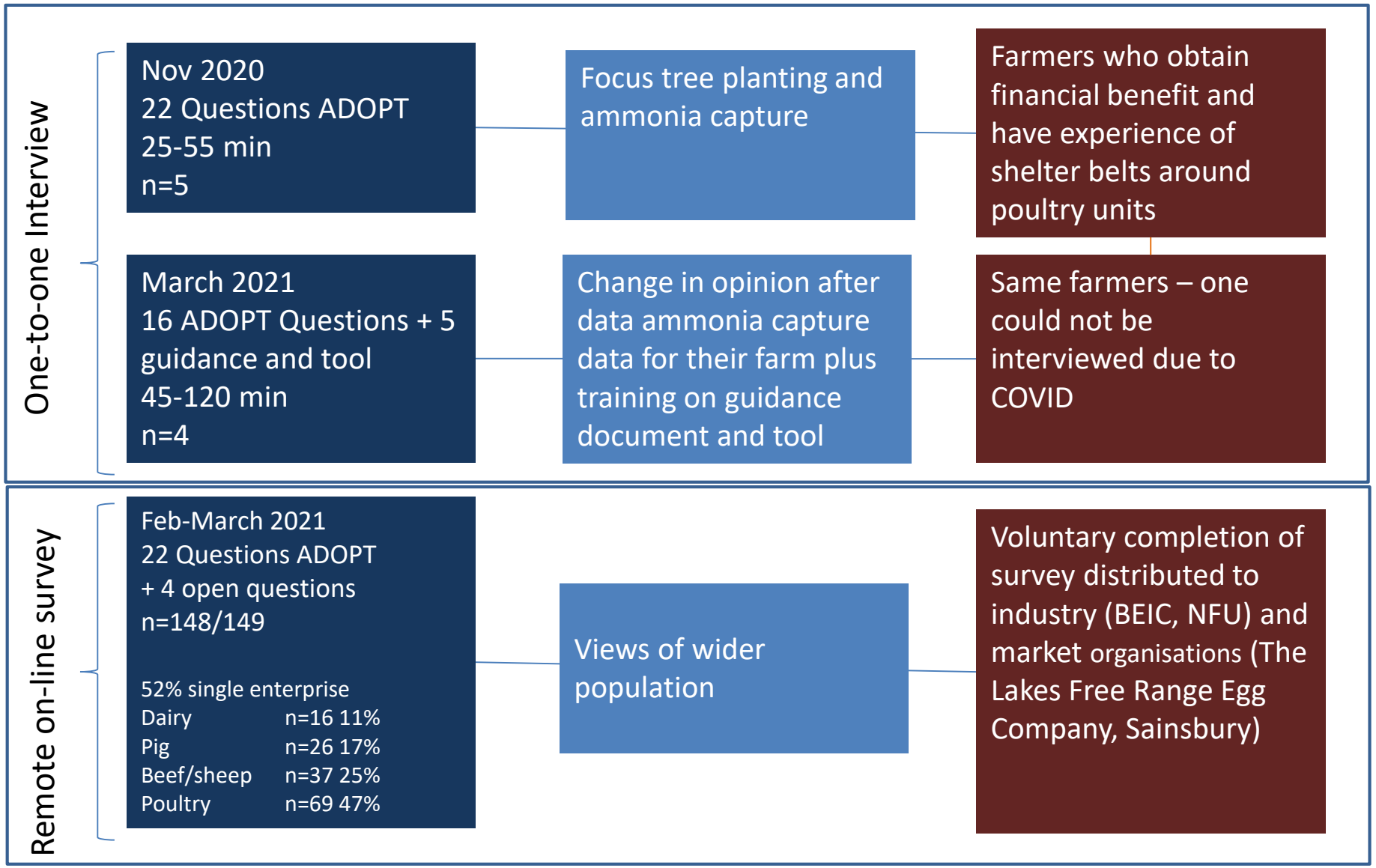
Combined Score



Score 1 2 3 4 5 SAC

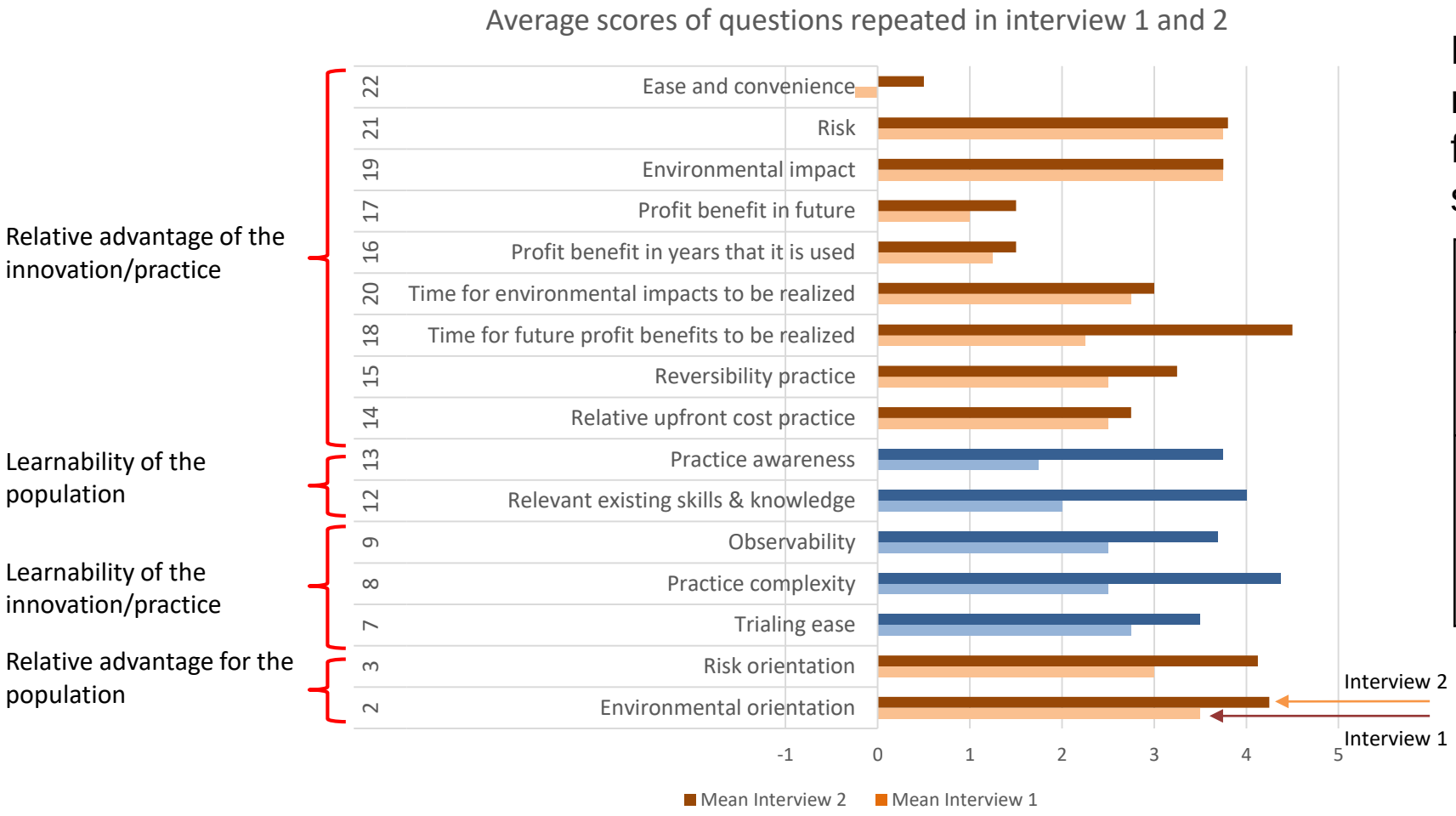
Combined scores for all SACs across the UK based on Wind and Emissions scoring. The higher the number the more suitable to plant trees

3. Farmer's views on practicalities and farm business benefits of tree planting to capture ammonia from hen or dairy units



ADOPT model (Adoption and Diffusion Outcome Prediction Tool)

Farmer's views on practicalities and farm business benefits of tree planting to capture ammonia from hen or dairy units



Parameterising the ADOPT model with estimates from the first and second interviews suggested:

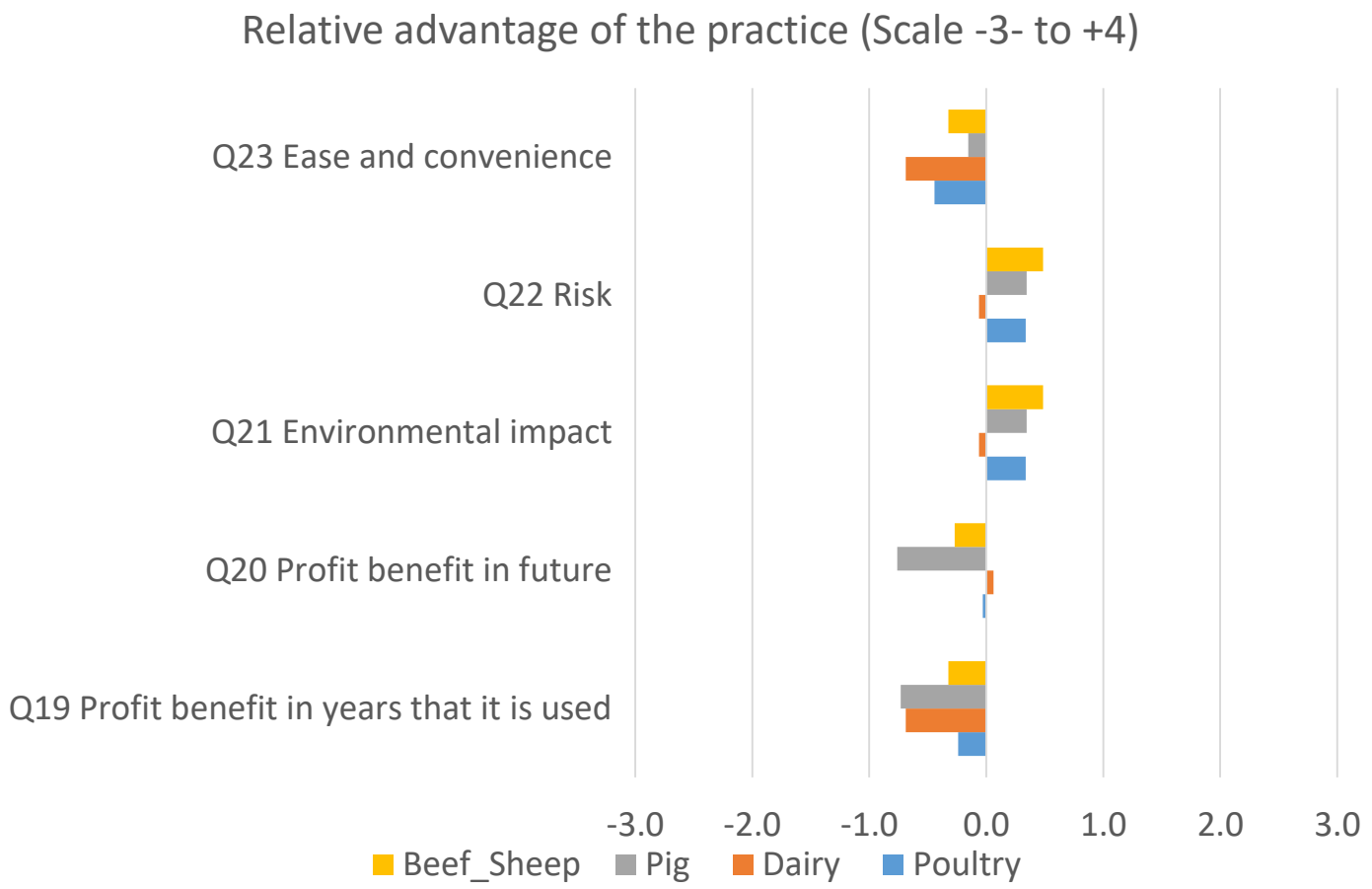
	1st Interview	2nd Interview
Uptake of practice	45%	85%
time to near-peak adoption levels	18 years	10 years

The average scores for all repeat questions was higher or very similar in the second interview after the farmers had access to data detailing the capture of ammonia on their farm, the ammonia calculator and the guidance document (n=4)

Farmer's views on practicalities and farm business benefits of tree planting to capture ammonia from hen or dairy units

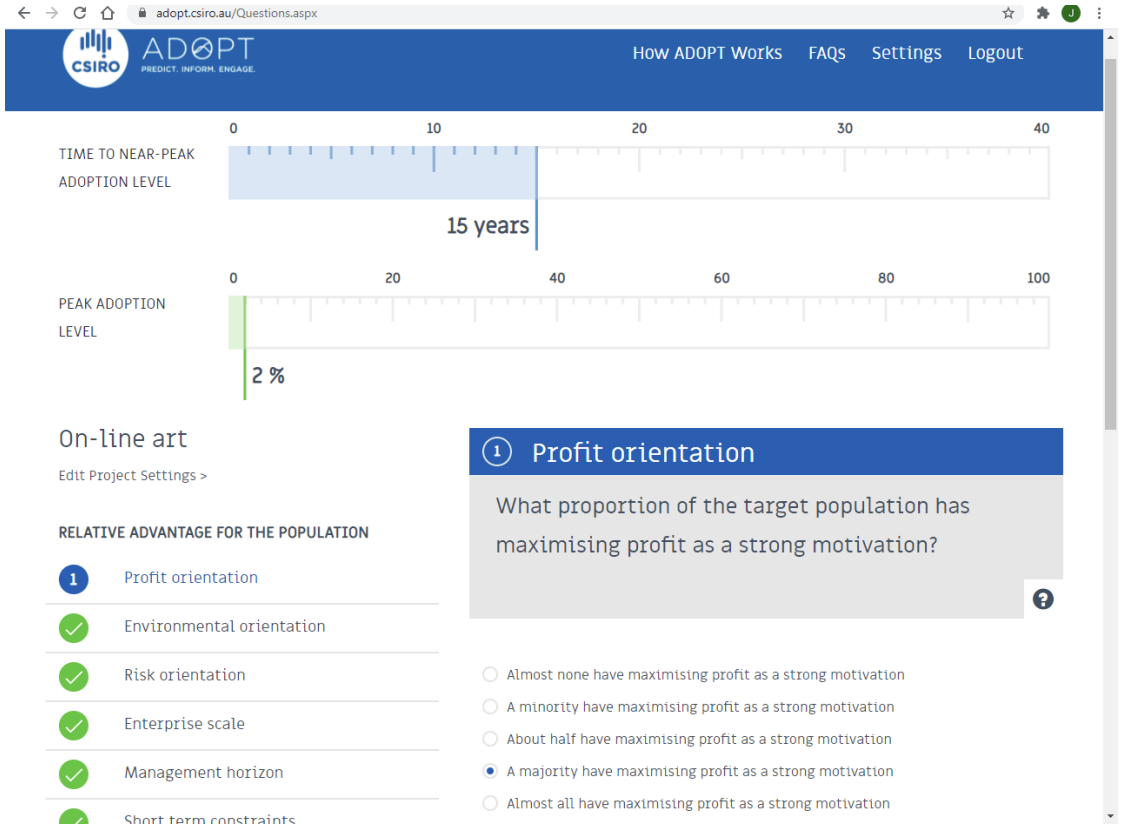
Farm type	Number of respondents
Poultry	69
Beef/Sheep	37
Pig	26
Dairy	16
Unknown	1
Grand Total	**149**

Negative score of -3 represented 'Large disadvantage' while +4 was a 'Large advantage'



ADOPT Model predictions – online survey

	Poultry	Dairy	Pig	Beef_Sheep
Time to near-peak adoption (years)	15	17	17	19
Uptake of practice (%)	2	2	2	2



Model predicts poultry farmers likely to adopt the practice slightly quicker but low adoption predicted for all sectors

1:1 Farmer interviews

	1st Interview	2nd Interview
Uptake of practice	**45%**	**85%**
time to near-peak adoption levels	**18 years**	**10 years**

‘What benefits would you expect to see from planting trees on your farm?

‘What would motivate you to plant a tree shelter belt or woodland on your farm?

Project Summary

- ART delivered modelling tools, verification measurements for future use, and farmer studies
- It was be shown that the trees have an effect on the ammonia plume from livestock housing and that there are interactions with the treebelt through deposition and dispersion effects.
    - e.g. at Poultry 2 significantly larger reduction in ammonia 19% (p = 0.02) was observed through the treebelt (-59%), compared to the open transect (-40%)
- For the majority of the farm treebelts, the change in the measurements before and after the treebelts were higher than in the modelled runs, suggesting the trees are having an effect on the ammonia plume through canopy dispersion (increased turbulence and mixing) and deposition (capture and uptake by trees)..
- Findings from ecological monitoring suggest that the trees have been growing faster nearer to the farms where ammonia concentrations were higher.
- Combined scoring of emissions and wind direction provide a suitable method for targeting sources around protected sites
- From the farmer surveys there is a clear interest in learning and developing use of farmland trees to improve the wider environment, but establishing woodland to capture ammonia was not seen as an easily observable or easy to trial activity
- Uptake of practice is enhanced by knowledge transfer (1:1 interviews)
- ART is a starting point to build tools and advice to enable the evidence base for policy makers and farmer to develop plans and evidence effects

Outputs: x3 Work Package Reports, Project Summary Report and many many datasets… THANK YOU