Presentation slides: IPENS workshop on Atmospheric Nitrogen and Natura 2000 (Peterborough, 22-23 September 2014)

- Natura 2000 and Atmospheric Nitrogen – Wilbert van Vliet, Natural England
- The proposed National Emissions Ceiling Directive – Charlotte Jones, Defra
- Lessons from abroad: Nitrogen deposition and the Nature Directives Workshop – Clare Whitfield, JNCC
- Nitrogen deposition remedies for protected sites – Mark Sutton, CEH
- Measures in the Rural Development Programme – Richard Findon, Defra
- Towards Site Nitrogen Action Plans – Wilbert van Vliet
- Limiting air quality impacts on protected sites – Sarah Watkins, Environment Agency
- Transport sector – Clare Warburton, Natural England
- NFU response – Diane Mitchell, NFU
- Case study Birklands Bilhaugh SAC - Uli Dragosits, CEH
- Case study Culm Grasslands SAC – Uli Dragosits, CEH

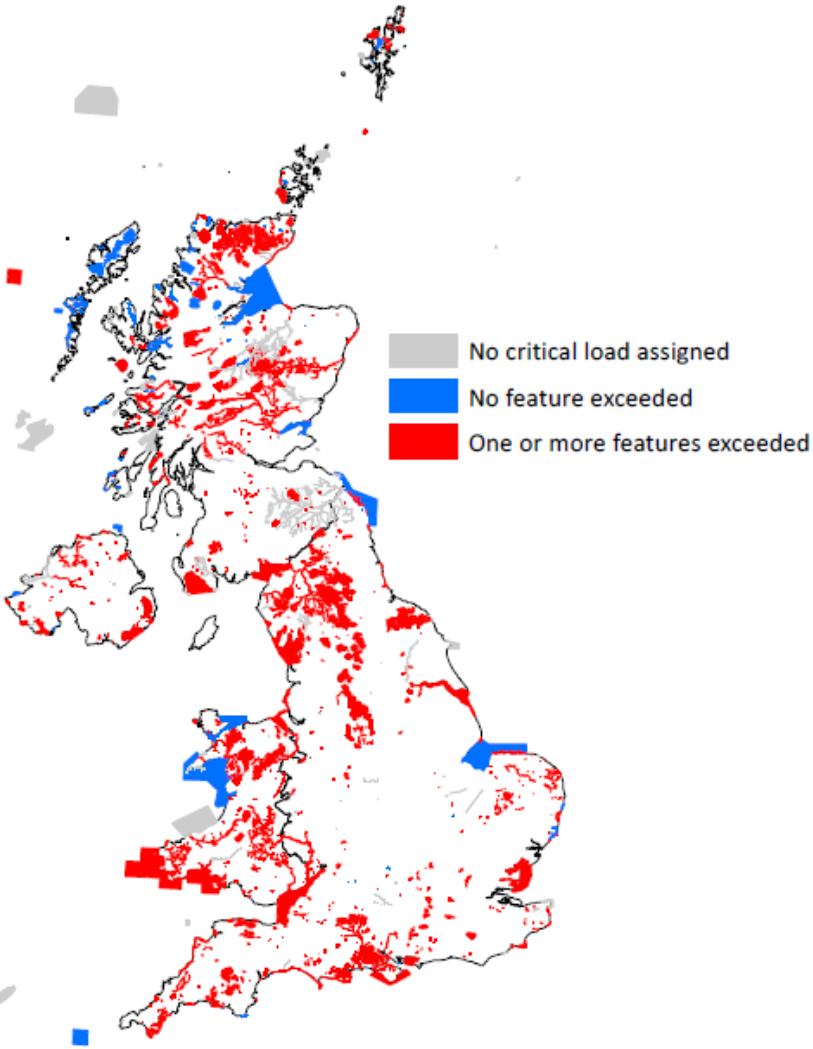
Improvement Programme for England's Natura 2000 Sites (IPENS)

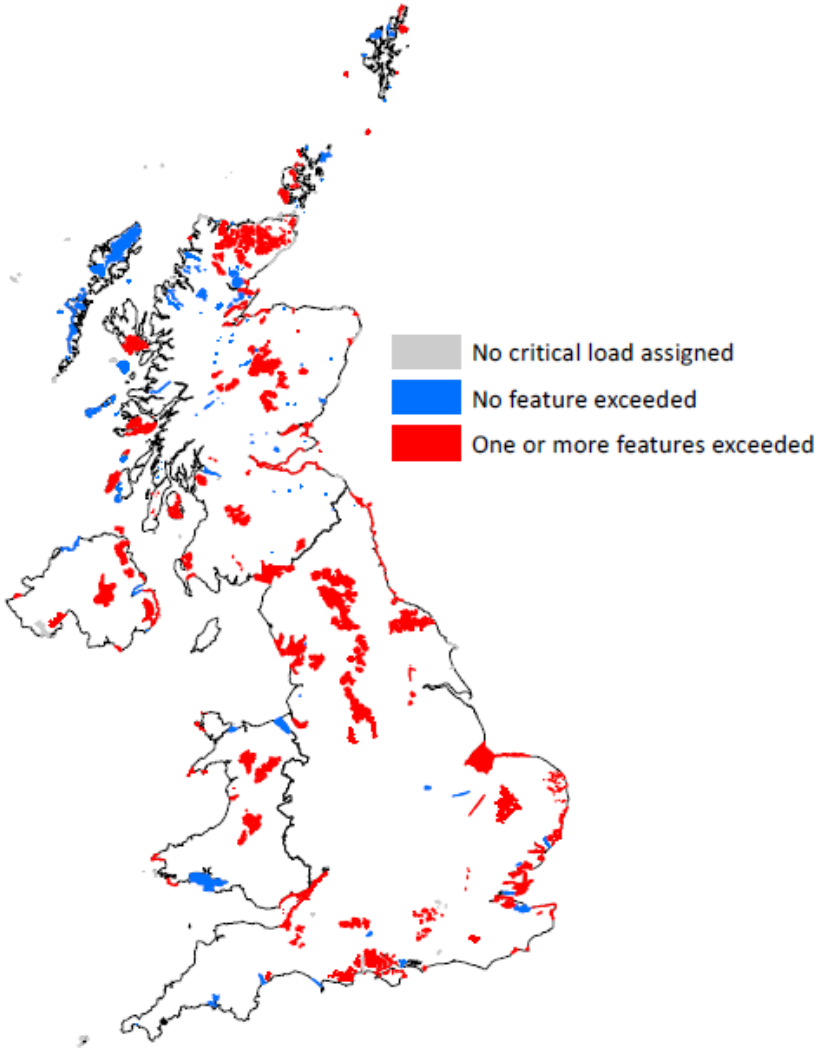
Planning for the future

Wilbert van Vliet

www.naturalengland.org.uk/ipens2000

Natura 2000 and atmospheric nitrogen: Why should I care?



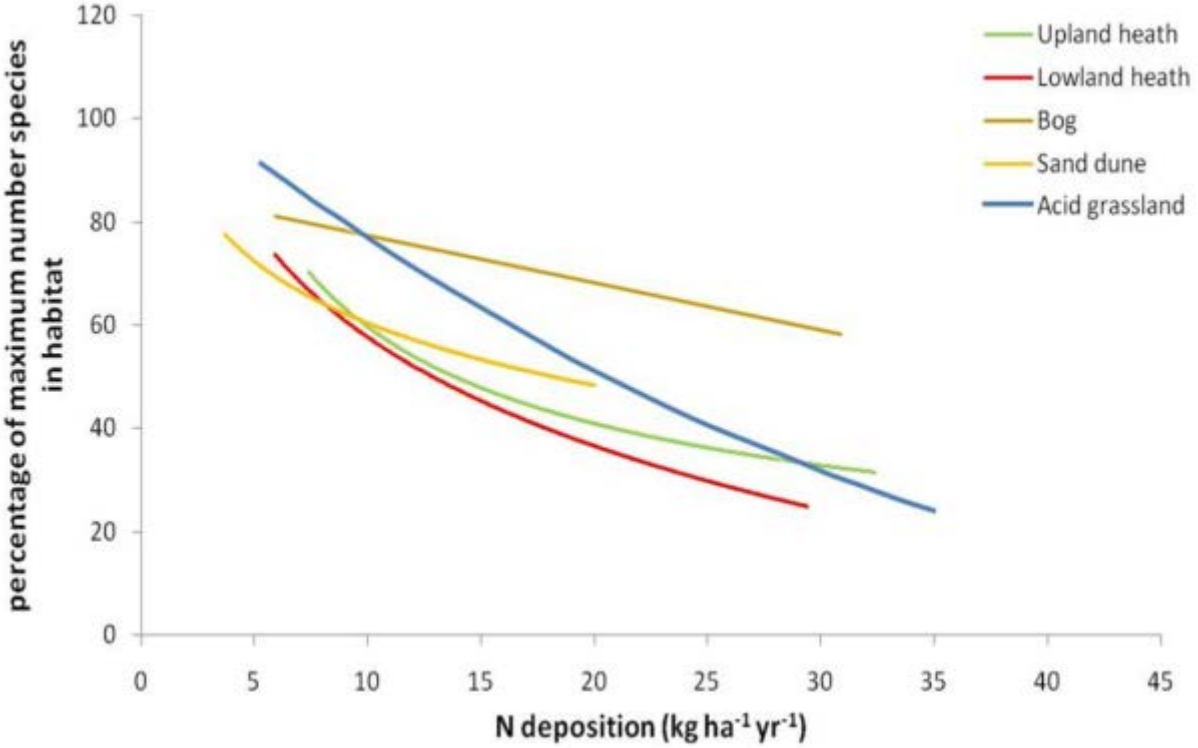


Natura 2000 and atmospheric Nitrogen: Why should I care?

www.naturalengland.org.uk/ipens2000

Data Source http://ukreate.defra.gov.uk/ . Ian Boyd

Natura 2000 and atmospheric Nitrogen: Why should I care?



- WCA section 28G
- Habitat regulations s9(5)

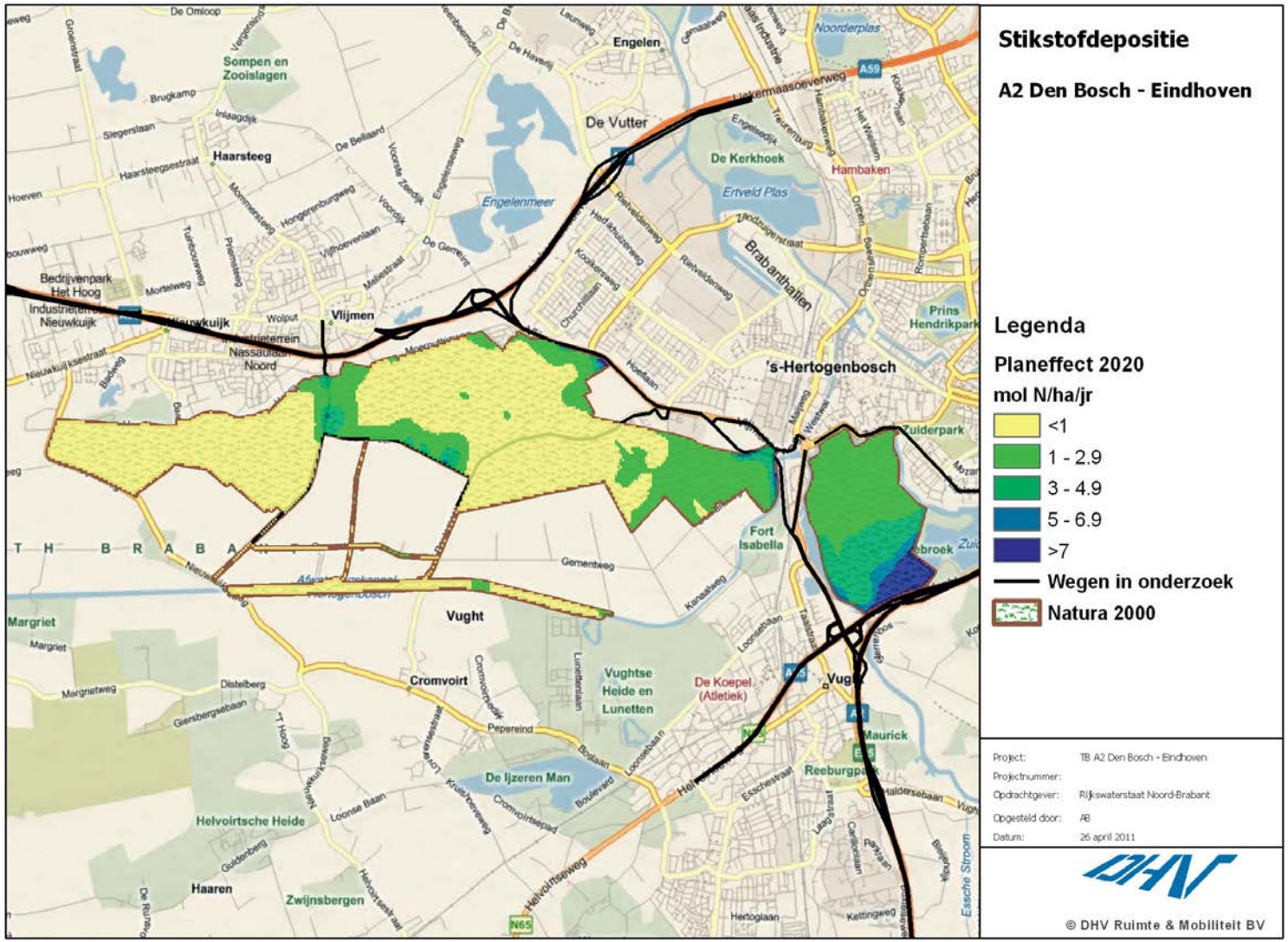
Habitat Directive:

- Assess new projects
- Avoid deterioration
- Establish necessary conservation measures

www.naturalengland.org.uk/ipens2000

Natura 2000 and atmospheric Nitrogen: Why should I care?

Natura 2000 and atmospheric Nitrogen: Why should I care?



NATURAL ENGLAND

Department
for Environment
Food & Rural Affairs

The proposed National Emissions Ceiling Directive

IPENS Meeting
22 September

Overview

- **Introduction**
  - Impacts of air pollution
  - Clean Air for Europe Package
- **National Emission Ceilings Directive**
  - Key elements
  - Initial Member State reactions
- **Negotiating process**
  - Council
  - European Parliament

Drivers for improving air quality - health

- Exacerbates heart & lung conditions.
- Main health pollutants are particulate matter (PM_{10} and $PM_{2.5}$), nitrogen dioxide (NO_2) and ground level ozone.
- Health impacts of $PM_{2.5}$ alone are estimated to cause an average reduction in life expectancy of 6 months (an effect equivalent to 29,000 deaths p.a.).
- Economic costs of health impacts are estimated at £16 billion annually

Drivers for improving air quality - environment

- Causes damage to a wide range of ecosystems services
  - 49% of sensitive habitats at risk from acidity,
  - 68% at risk of eutrophication
- Reduced crop yields, particularly from ozone, affecting food security.

Trends in UK emissions and concentrations

- Emissions of most pollutants have seen significant reductions over the last 30 years – the UK meets all 2010 emissions ceilings under the 2001 National Emissions Ceiling Directive.
- However, trends in concentrations do not always follow reductions in emissions – while the UK has met most standards for concentrations in the 2008 Ambient Air Quality Directive, achieving compliance with levels of nitrogen dioxide (NO2) remains challenging

Fig.1: National Trends in **emissions**

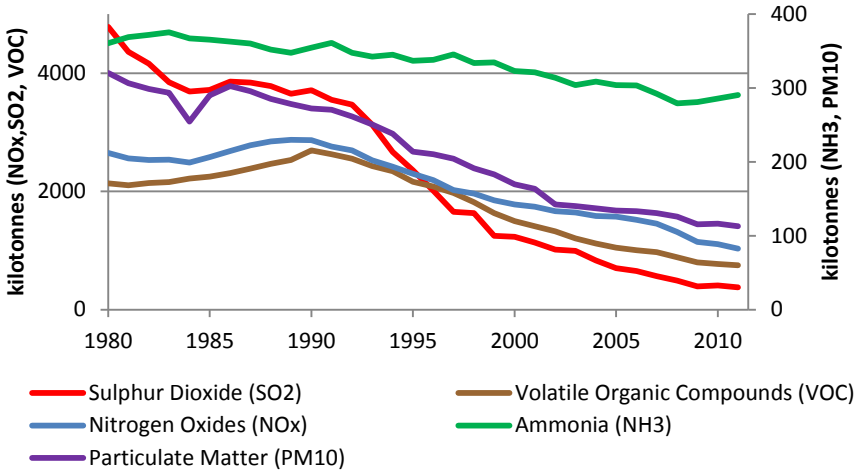
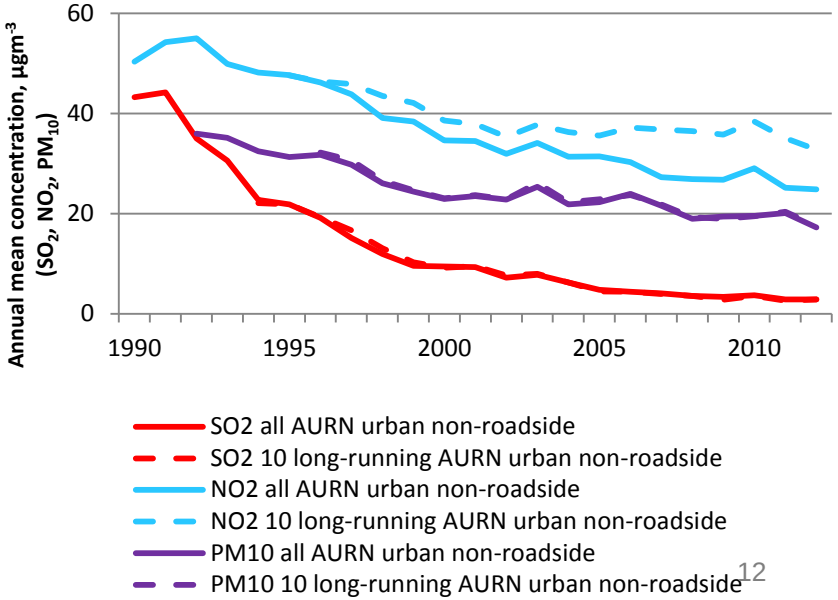


Fig. 2: National Trends in **concentrations**



EU Air Quality Legislation

EU Air Quality Regulation consists of 3 main elements:

a) Ambient Air Quality Directives (Directives 2008/50/EC and 2004/107/EC) - set health based limit values for the concentration of pollutants (incl nitrogen dioxide and particulate matter)

b) National Emissions Ceilings Directive (Directive 2001/81/EC) - tackles transboundary air pollution by setting emission totals for each Member State for key pollutants to be met by 2010; and

c) Legislation controlling emissions from specific sources such as industrial emissions, emissions standards for road and off road vehicles and machinery.

Clean Air Programme for Europe

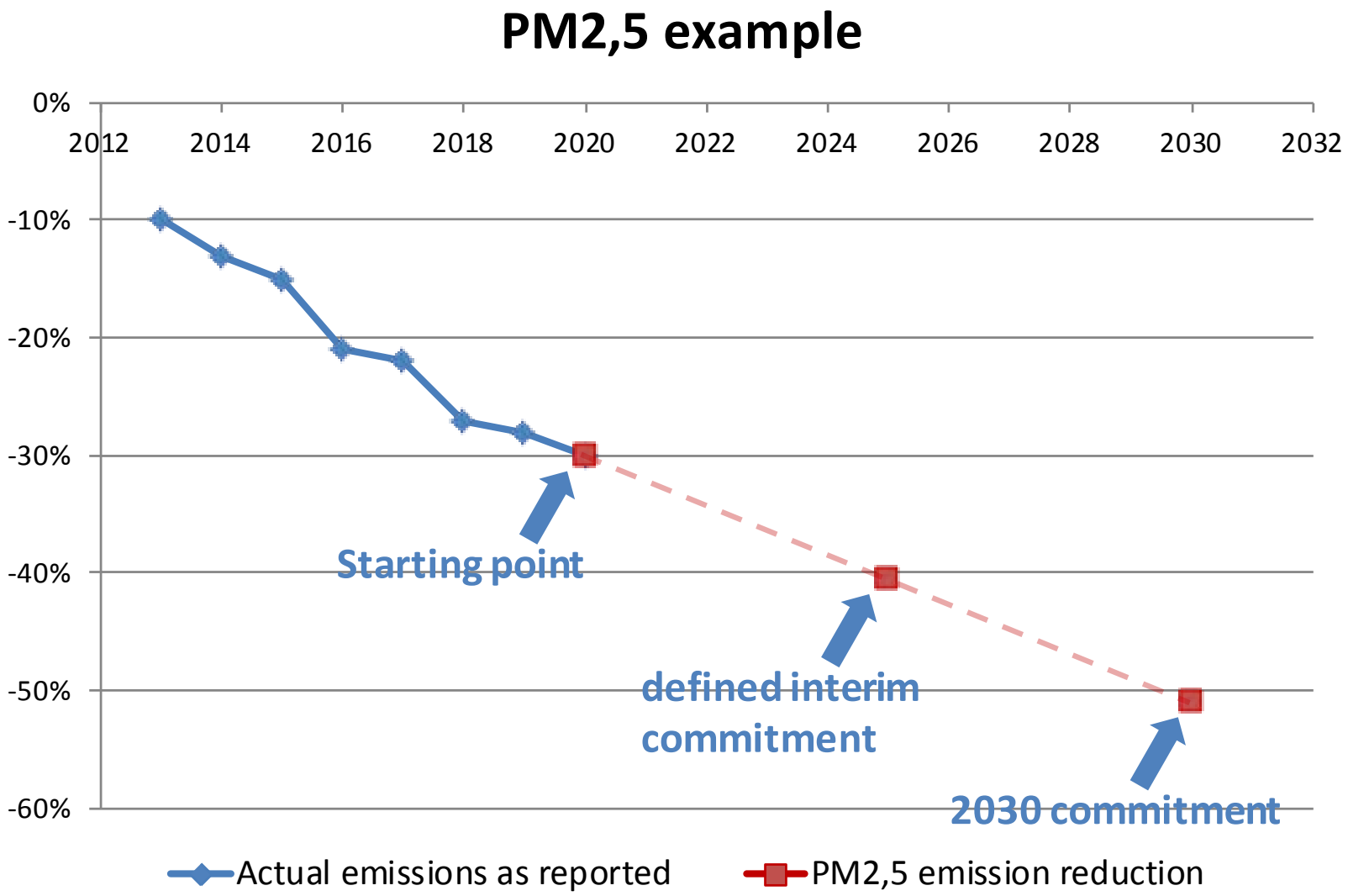
- Published 18 December 2013 after 3 year review of EU air policy
- 4 elements:
  - New strategy on air pollution
  - New National Emission Ceilings Directive
  - Directive on Medium-sized combustion plants
  - Decision to ratify Gothenburg Protocol

Proposal for a new National Emission Ceilings Directive

Key elements: Ceilings

- Repeals and replaces current Directive
- Ceilings for SO_2, NO_x, VOC and NH_3
- Extends ceilings to $PM_{2.5}$ and CH_4
- Sets limits for 2020 and 2030 based on reduction from 2005 emissions
- No target for 2025 but obligation to show on track

Reduction commitments for 2025

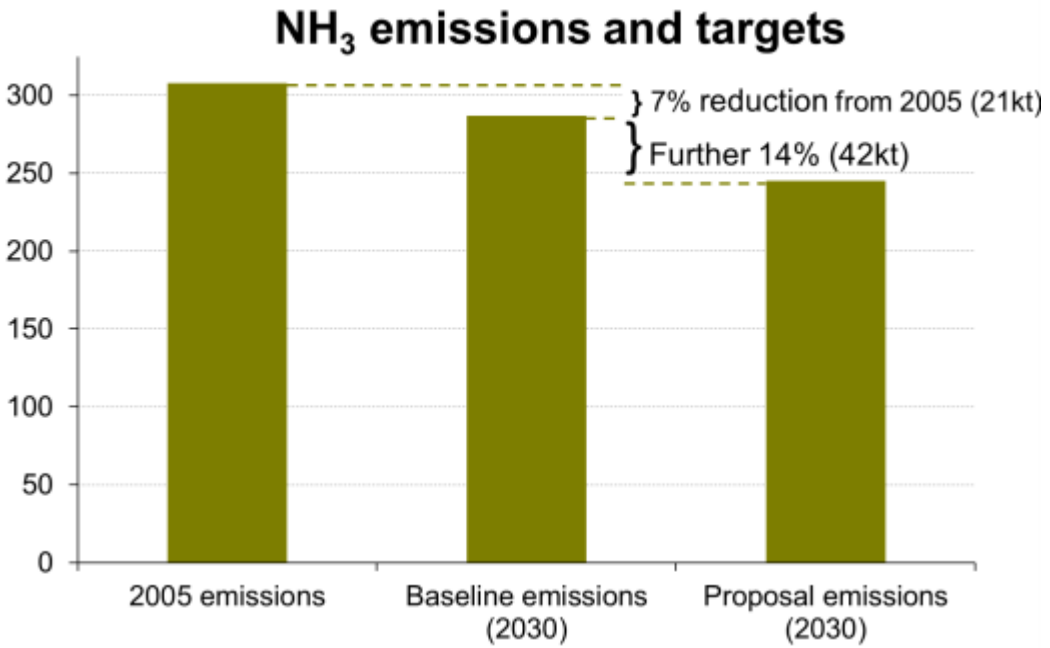


Emission ceilings

Emission reductions required in 2030 (%, relative to 2005)

	SO_2	NO_x	PM	NH_3	VOC
EU-28	81%	69%	51%	27%	50%
UK	84%	73%	47%	21%	49%

- Emission reduction commitments are relative to 2005 emissions
- Some reductions have happened already; some future reductions are expected without these proposals
- Emission projections to 2030 can indicate the level of ambition represented by the proposed ceilings



Source: IIASA analysis for the Commission

How were the ceilings arrived at?

- Optimisation process comparing costs of further action to benefits of the air quality improvement
- Commission set a target reduction in health impacts
- Emission reductions required to achieve target split between Member States based upon most cost-effective allocation.

Key elements: flexibilities

- Inventory adjustment
  - Similar to flexibility in Gothenburg Protocol
- Offsetting maritime emissions of NO_x, SO_2 and $PM_{2.5}$
  - Up to 20% of emissions reductions can count
- Joint Implementation of methane ceilings
- Use of all flexibilities subject to Commission approval

Key elements: Air Pollution Control Programmes

- Member States required to have National Air Pollution Control Programmes
- Must be updated every 2 years (every time flexibilities are used)
- Requirements to include measures on black carbon and ammonia
- Increased monitoring of impacts on ecosystems

Negotiation process

- We are still at an early stage of negotiations
- Proposal has to be agreed by both the Member States in the Council and the European Parliament before it can become law
- Likely to take around 2 years to negotiate

Council discussions

- Working Groups (attended by Member States experts) and Environment Council meetings (also Agriculture Council)
- Mainly focused on Impact Assessment
- Emerging concerns:
  - 2030 targets
  - Methane
  - Administration (NECPs and monitoring)

European Parliament

- ENVI lead committee, opinions ITRE and AGRI
- Julie Girling MEP appointed as rapporteur
- Shadows:
  - Elisabetta Gardini (EPP/IT)
  - Bas Eickhout (Greens)
  - Catherine Bearder (ALDE)
  - Seb Dance (S&D)
- Draft report likely by end of year/early 2015


JNCC
Joint Nature Conservation Committee

LESSONS FROM ABROAD:

Nitrogen Deposition and the Nature Directives Workshop

Clare Whitfield, JNCC

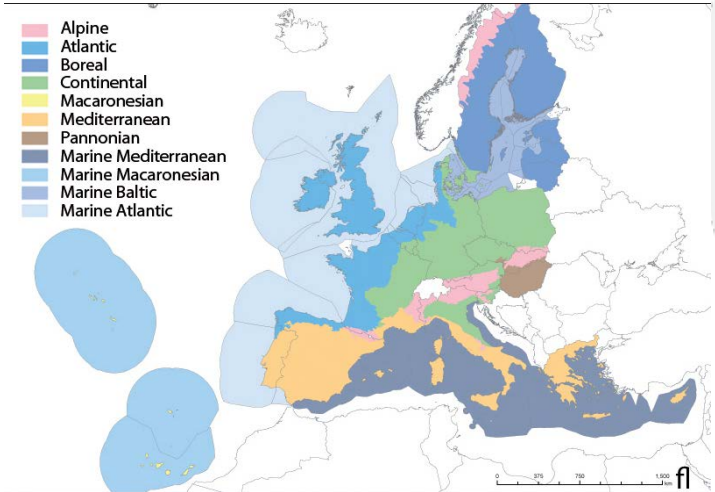
22 September 2014, IPENS Workshop

Outline

- Introduction to the workshop and the Natura 2000 Biogeographic Process
- N deposition impacts – a shared issue
- Solutions
- Recommendations

Natura 2000 Biogeographic Process

- Seminar series covering each biogeographic region
- Sharing practical experience and best practice to address threats, in order to improve conservation status
- Atlantic Region Seminar held in December 2012
  - Identified N deposition as a significant pressure/threat
  - UK offered to run a knowledge sharing workshop



Nitrogen Deposition and the Nature Directives Workshop – December 2013

- Objectives
  - Share knowledge & experience of the assessment of N deposition impacts on conservation status
  - Examine and share best practice about strategies and measures to reduce N impacts
- Collaboration with the Netherlands Ministry of Economic Affairs
- ~50 delegates from Atlantic Region

Belgium	Germany	European Commission
Denmark	Ireland	TFRN, CCE, ETC-BD
France	Netherlands	NGOs
	UK	Industry bodies

Theme 1: Reporting and assessment of nitrogen deposition impacts

- N impacts is a shared concern
- **Strong evidence of N impacts across all countries**
- Wide recognition in some countries and integration with Habitats Directive reporting (e.g. BE, DE, DK, NL, UK)
- Lower awareness in biodiversity community (*cf* research community) in other countries (e.g. FR, IE)

Theme 2: Knowledge sharing of practical solutions to reduce nitrogen deposition impacts

- Examples of strategies and measures to address N impacts, e.g.
  - Low-emission spreading
  - Low-emission housing
  - Feeding strategies
  - Site management mitigation
- Co-benefits e.g.
  - human health
  - climate change
  - at source (e.g. a win-win for farmer)

Theme 2: solutions

- Range of sources (source type, local-transboundary)

- Integrated approach recommended
  - International-national-local-site
  - Range of sources
  - Optimisation
  - Best example - Netherlands

Programmatic Approach to Nitrogen (PAN)

- Ensures N2K objectives are met while creating room for economic development.
- Inter-governance approach across all sectors and areas
- Analysis of:
  - Future emission reduction scenarios based on measures at national, provincial and local levels together with site management
- Supported by AERIUS toolkit
  - Facilitates permitting of plans and projects under Article 6.3. (process/tools and reaching agreed outcomes)
- Flanders will adopt “PAN”.

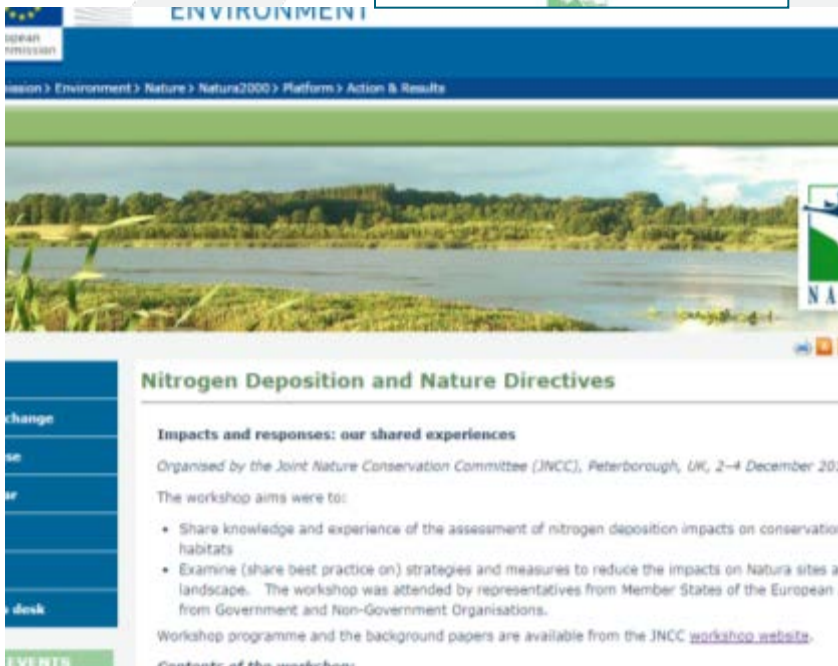
Key recommendation

- Nitrogen Action Plans for Natura 2000 sites.
  - Evaluate sources
  - Identify and target measures to reduce N inputs
  - Incorporate site management actions if relevant
  - Facilitate permitting of plans and projects

Further information

- Final report – **JNCC website**
  - http://jncc.defra.gov.uk/page-6729

- Presentations - **Natura 2000 Platform**
  - http://ec.europa.eu/environment/nature/natura2000/platform/action_results/102_nitrogen_deposition_and_nature_directives_en.htm

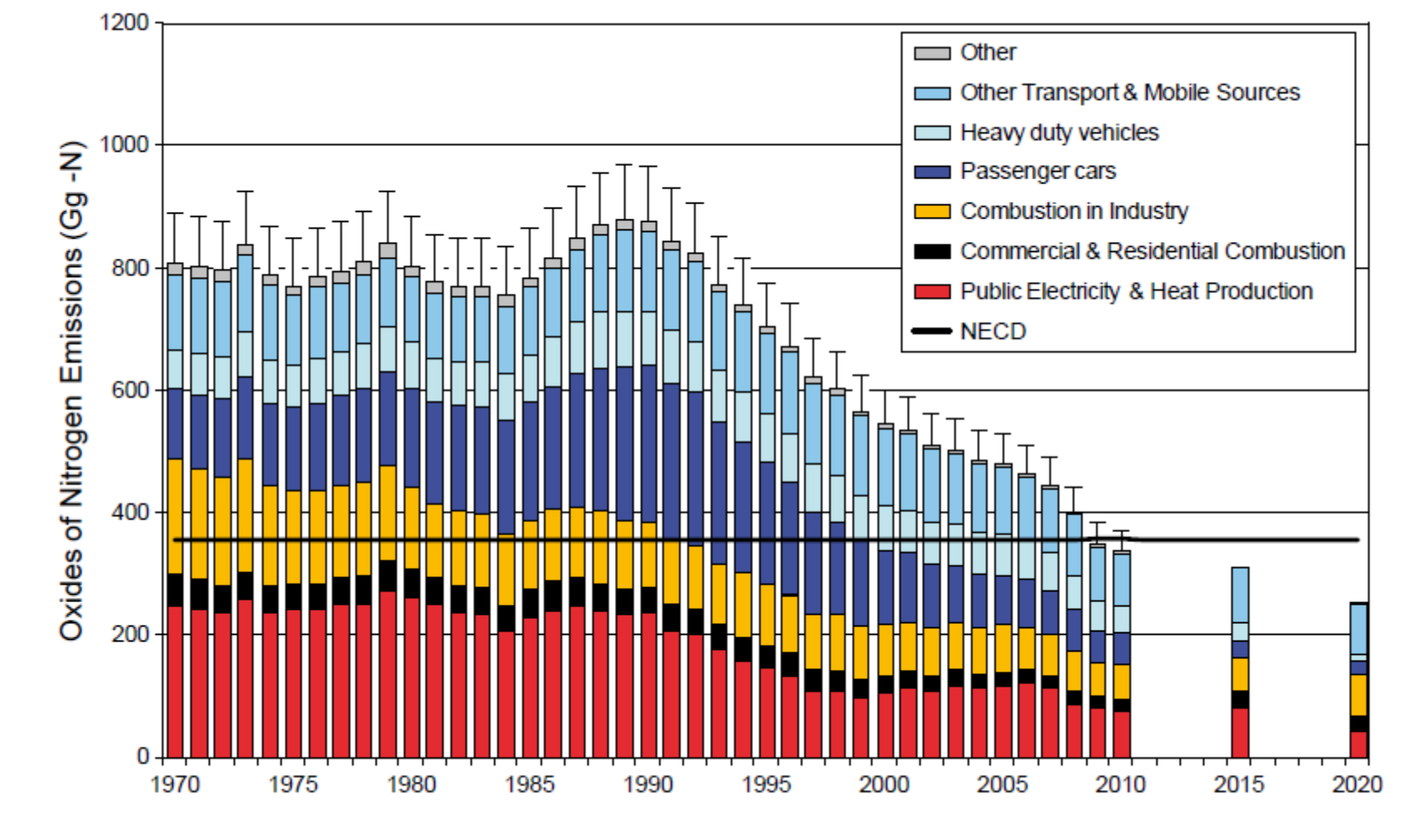


Nitrogen deposition remedies for protected sites

Mark Sutton
CEH Edinburgh

IPENS
Peterborough, 22 September 2014

UK NO_x emissions

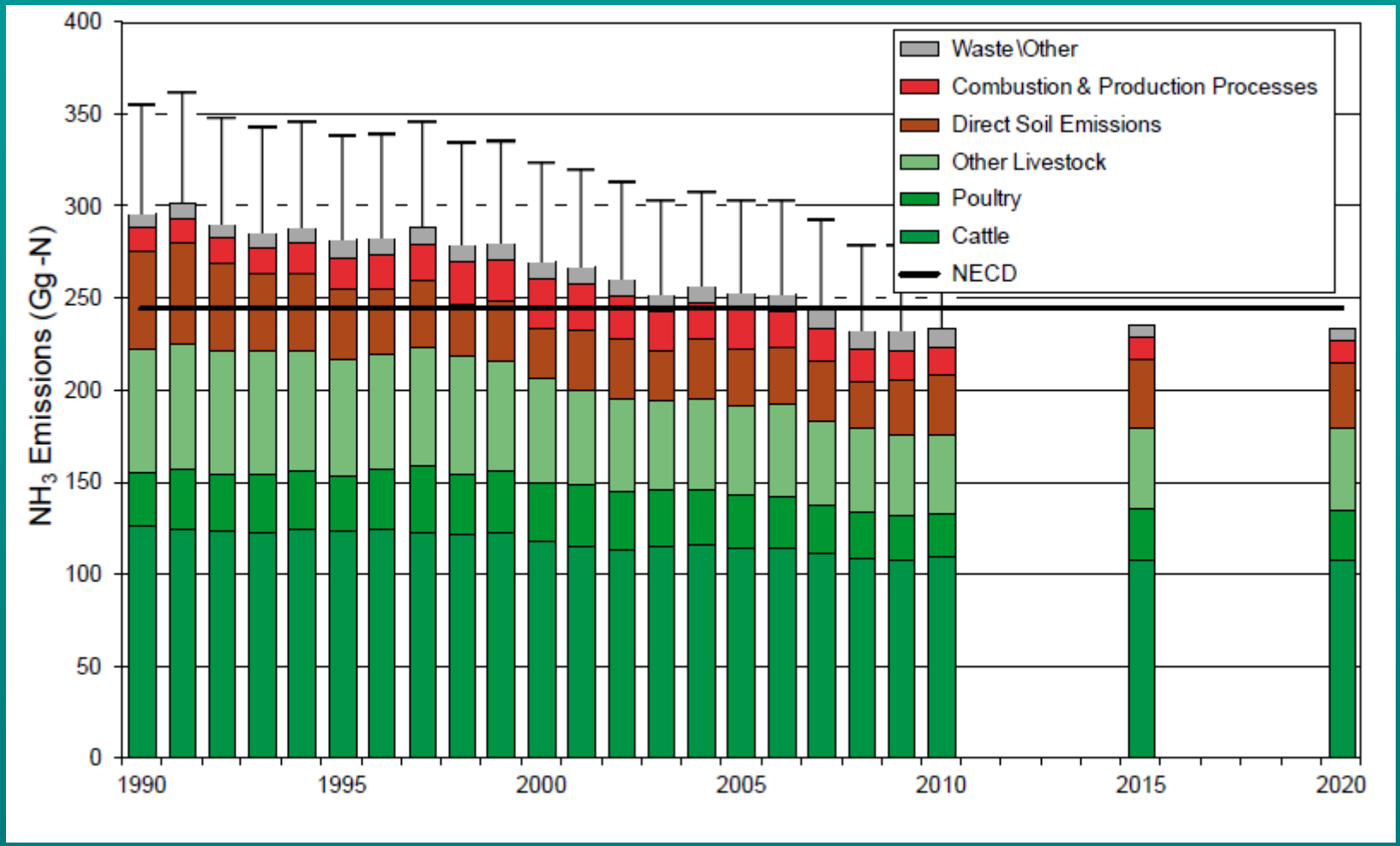


ROTAP

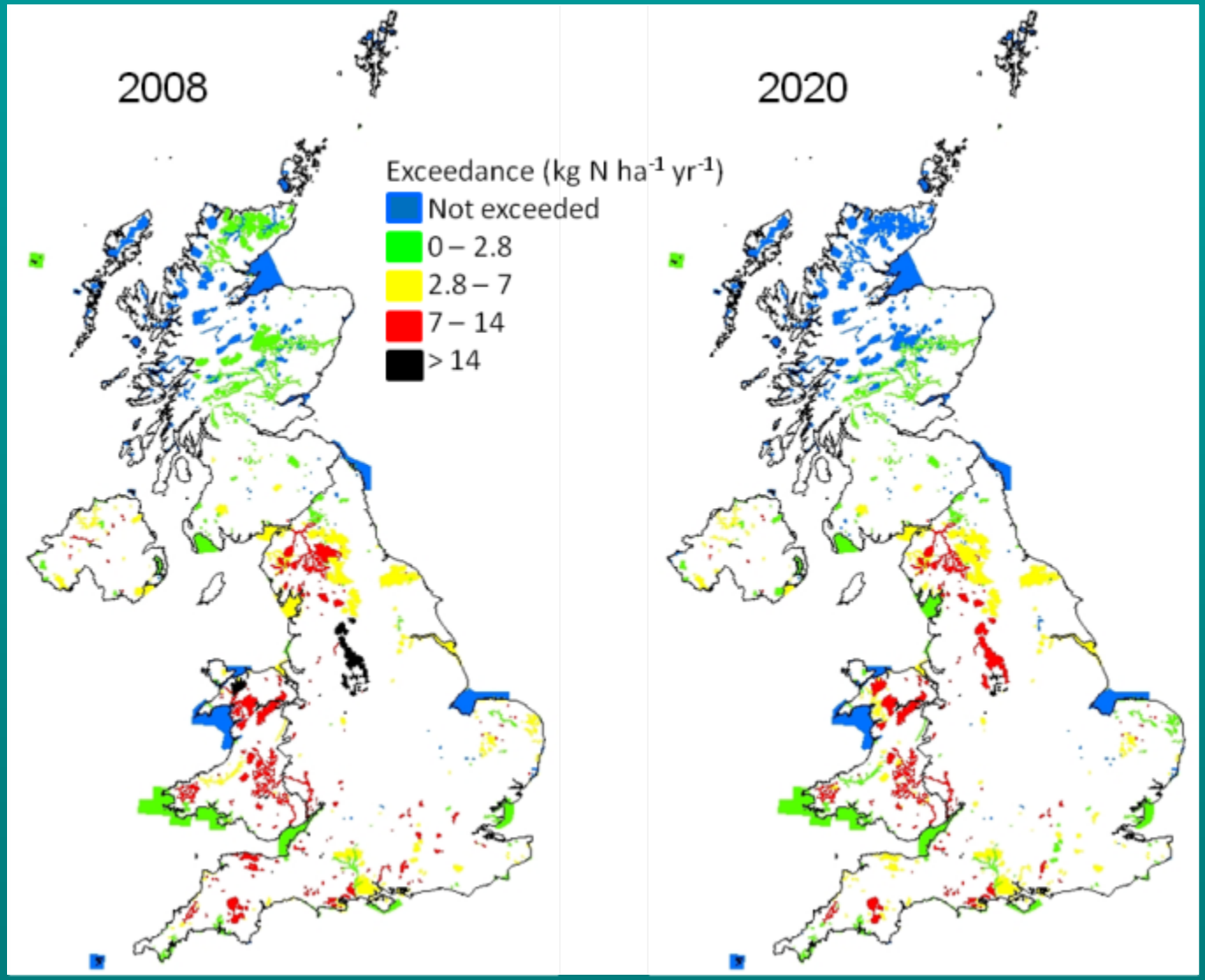
The innocent polluters

Feedlots with 100,000 cattle
Chicken farms with 2,000,000

UK NH_3 emissions



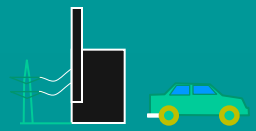
SACs: Exceedance of N critical loads 2008 - 2020



- **based on the UK CL mapping values**
- **takes into account magnitude of exceedance & area exceeded**

CEH

Simplified view of the Nitrogen Cascade



High temperature combustion & industry

Fertilizer manufacture

Crop biological nitrogen fixation

Intended N flow

Unintended N flows

N form in the cascade

Environmental concern from N_r

Greenhouse gas balance

Stratospheric ozone loss

Nitrous Oxide (N_2O)

Tropospheric ozone formation

Urban air quality

Particulate Matter

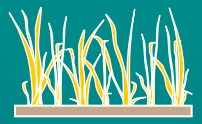
Nitrogen oxides (NO_x)

Ammonium nitrate in rain (NH_4NO_3)

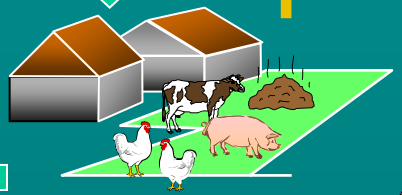
Ammonia (NH_3)

Further emission of NO_x & N_2O carrying on the cascade

N_r

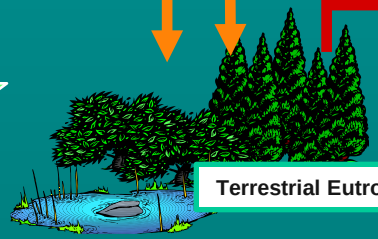


Crops for food & animal feed



Livestock farming for food

N_r in manure



Natural ecosystems

Terrestrial Eutrophication

Eventual denitrification to N_2

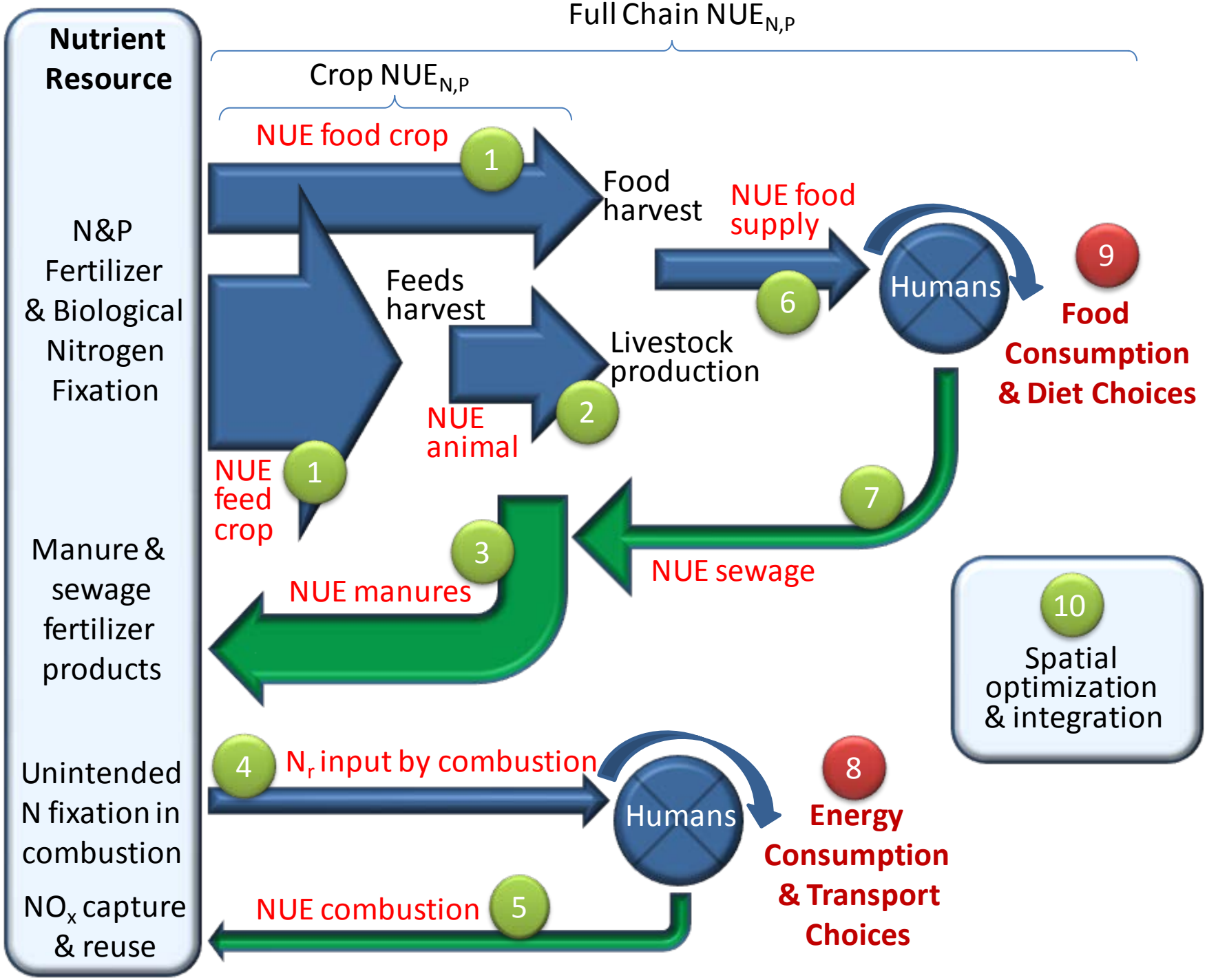
Soil acidification

Leached Nitrate (NO_3^-)

Nitrate in streams, groundwater & coastal seas

Freshwater Eutrophication

Marine Eutrophication


Nutrient Resource
N&P Fertilizer & Biological Nitrogen Fixation
Manure & sewage fertilizer products
Unintended N fixation in combustion
NOx capture & reuse
Full Chain NUEN,P
Crop NUEN,P
NUE food crop
1
Food harvest
NUE food supply
6
Humans
9
Food Consumption & Diet Choices
Feeds harvest
Livestock production
2
NUE animal
NUE feed crop
1
7
3
NUE manures
NUE sewage
10
Spatial optimization & integration
4
Nr input by combustion
Humans
8
Energy Consumption & Transport Choices
NUE combustion
5

Emission Focused Remedies

- **Nitrogen Oxides (NO_x) emissions**
  - Combustion technologies in electricity generation (SNCR etc)
  - Combustion technologies in transport

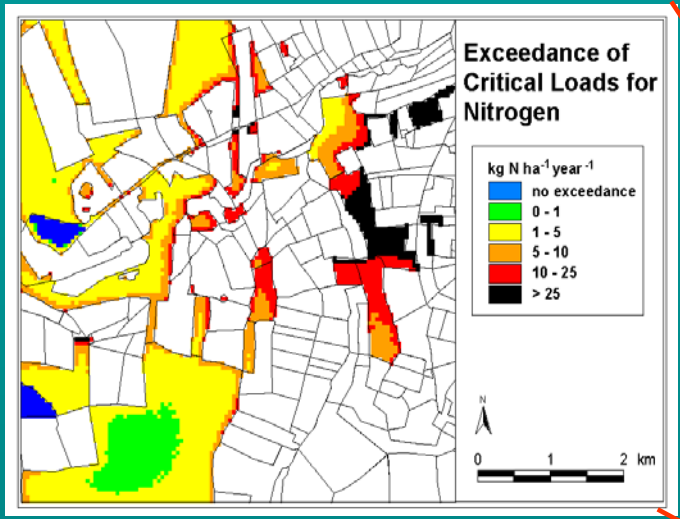
Ammonia (NH_3) emissions

- Livestock measures
- Fertilizer measures
- Combustion technologies in transport
- Miscellaneous sources (e.g. Anerobic digestion)

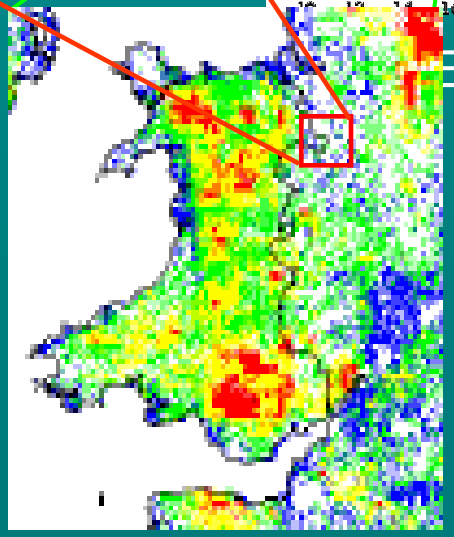
Landscape focused measures

- Targeted application of the classical mitigation methods (e.g. Buffer areas)
- Planning location of new and existing sources (roads, factories, farms)
- Application of landscape features to facilitate targeted dispersion and deposition

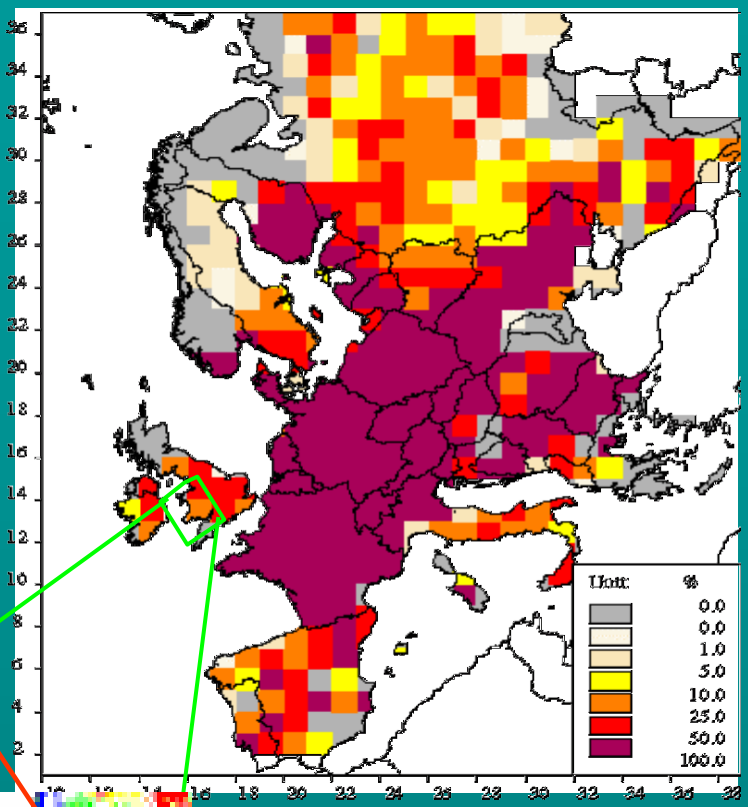
Dealing with spatial scale



Ecosystem protection



National targets and policy



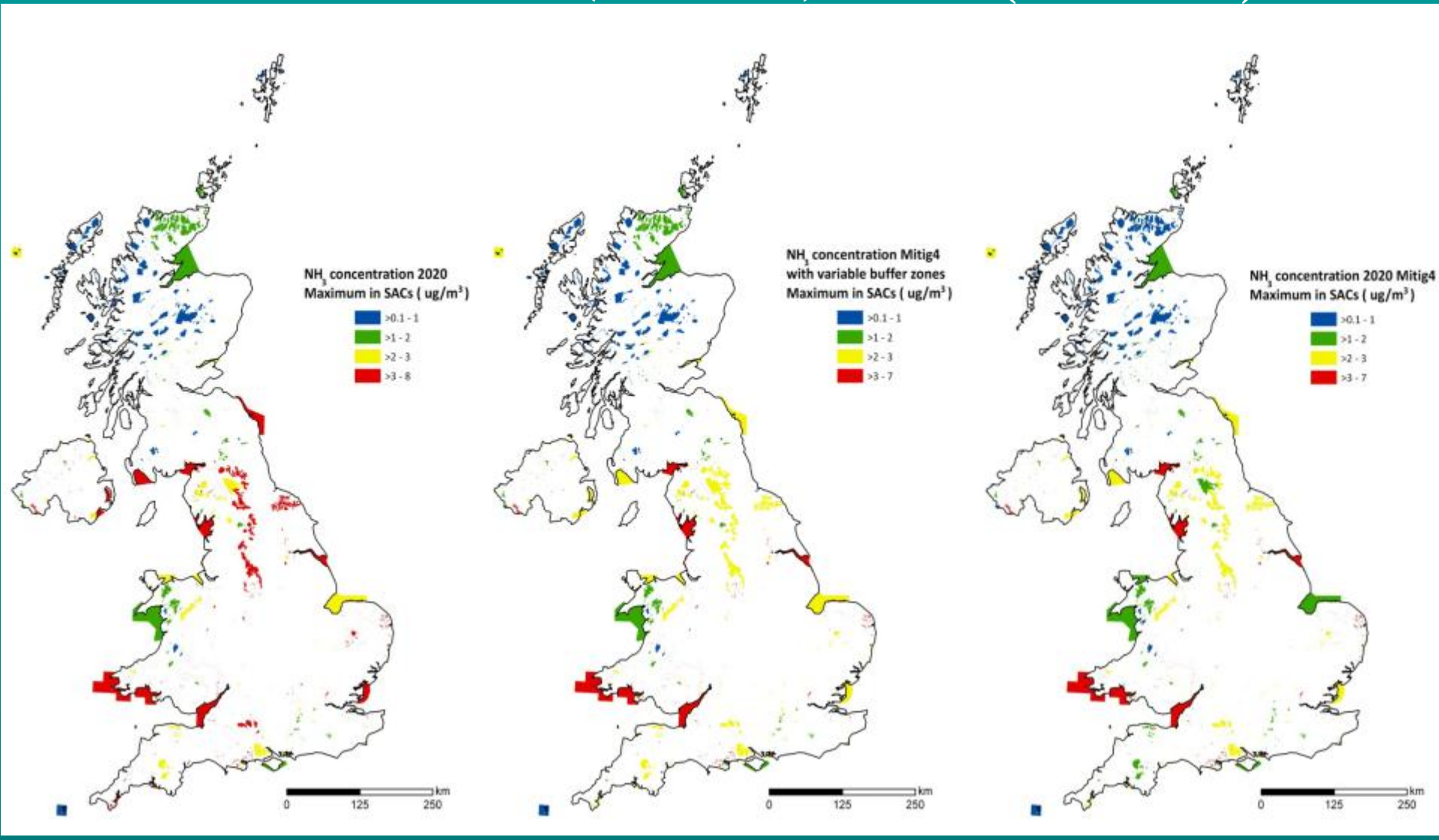
European exceedances of the critical load for nitrogen

Rationale for spatial targeting of measures

2020 Baseline

2020 variable buffer (-6% emission)

2020 Mitig4 UK-wide (-26% emission)



Defra project NH3 Future patterns: effects of scenario 'Mitig4' on NH_3 Critical Level exceedance in S

Conclusions AC0109 – NH_3 Future Patterns

- 2020 predictions for SACs/SSSIs:
  - little change for NH_3 concentrations/CLE exceedance
  - NO_x deposition change has limited effect
- NH_3 mitigation needs to be ambitious to reduce CLE/CL exceedance substantially

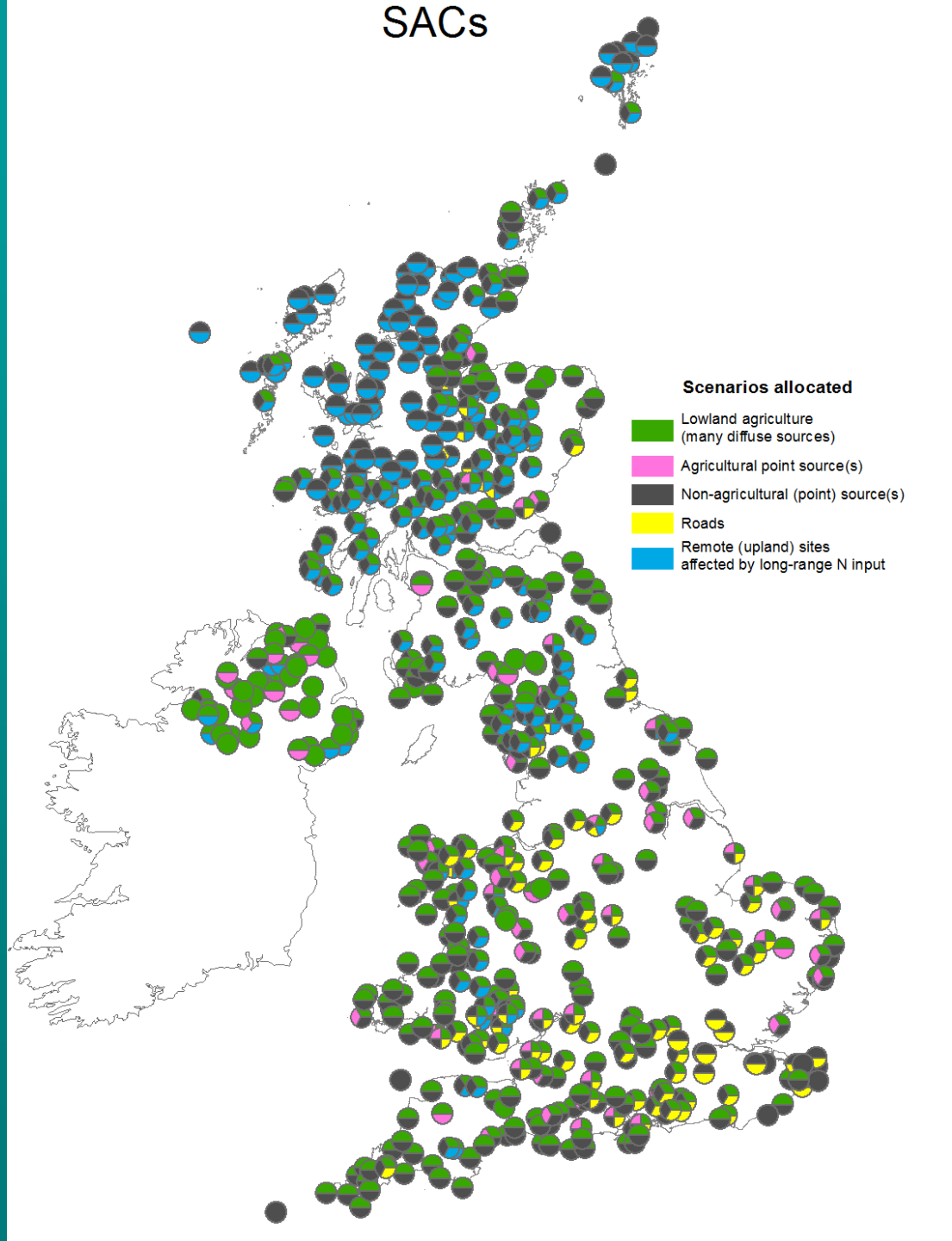
- Spatially targeted mitigation can be almost as effective on CLE exceedance as UK-wide mitigation and therefore provide a cost-effective solution

- Spatially targeted measures could be implemented locally via existing (or new) schemes, with existing options being adapted and targeted appropriately

RAPIDS source attribution *'scenarios'*

Wide range of N sources summarised into five key scenarios:

1. Lowland agriculture (many diffuse sources)
2. Agricultural point source(s)
3. Non-agricultural (point) source(s)
4. Roads
5. Remote (upland) sites affected by long-range N inputs



Types of measures considered - overview

Measure category	Target impact	Effectiveness, % emission reduction†	Scenario	
Modify livestock diet (match protein intake to requirement)	NH_3 emission	10-30	Lowland agriculture (diffuse), Agricultural point source	Remote (upland) sites affected by long-range N input
Modify/improve livestock housing facilities/practices	NH_3 emission	30-80	Lowland agriculture (diffuse), Agricultural point source	
Modify/improve manure storage facilities/practices	NH_3 emission	50-90	Lowland agriculture (diffuse), Agricultural point source	
Modify manure application practices	NH_3 emission	30-90	Lowland agriculture (diffuse)	
Modify fertiliser application practices	NH_3 emission	40-80	Lowland agriculture (diffuse)	
Combustion measures	NO_x emission	10-70	Non-agricultural (point) source	
Road transport	NO_x emission	10-90	Roads	
Consumer behaviour measures (transport, energy, dietary choices)*	NO_x and NH_3 emission	20-45	Roads	
Buffer strips (low-emission agriculture or conversion to semi-natural vegetation)	NH_3 and N deposition	5-40	Lowland agriculture (diffuse), Agricultural point source	
Agroforestry for NH_3 abatement	NH_3 and N deposition	5-60	Agricultural point source	

Cost-effectiveness of measures

NH_3 measures more cost-effective than further NO_x measures (in addition to those already implemented), with environmental benefits exceeding the costs by 3 times for reduction of NH_3 than for NO_x (GAINS modelling).

Agricultural NH_3 measures – currently very little implementation, representing 'low-hanging fruit' in terms of emission reduction potential.

Main groups of NH_3 deposition measures (in order of cost-effectiveness):

- Livestock manure spreading & mineral fertiliser application
- Livestock slurry & manure storage
- Livestock housing.

Slurry spreading:
a wide range of low-emission techniques are available


Splash Plate Spreader
- 1950s technology

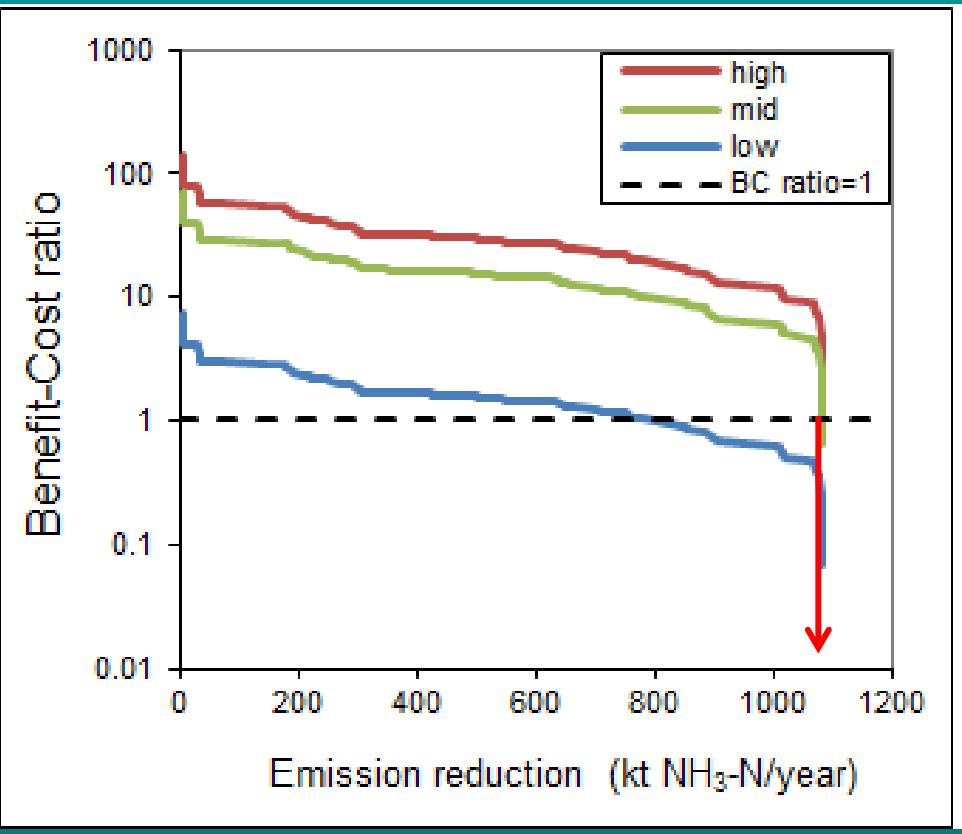

Trailing Hose

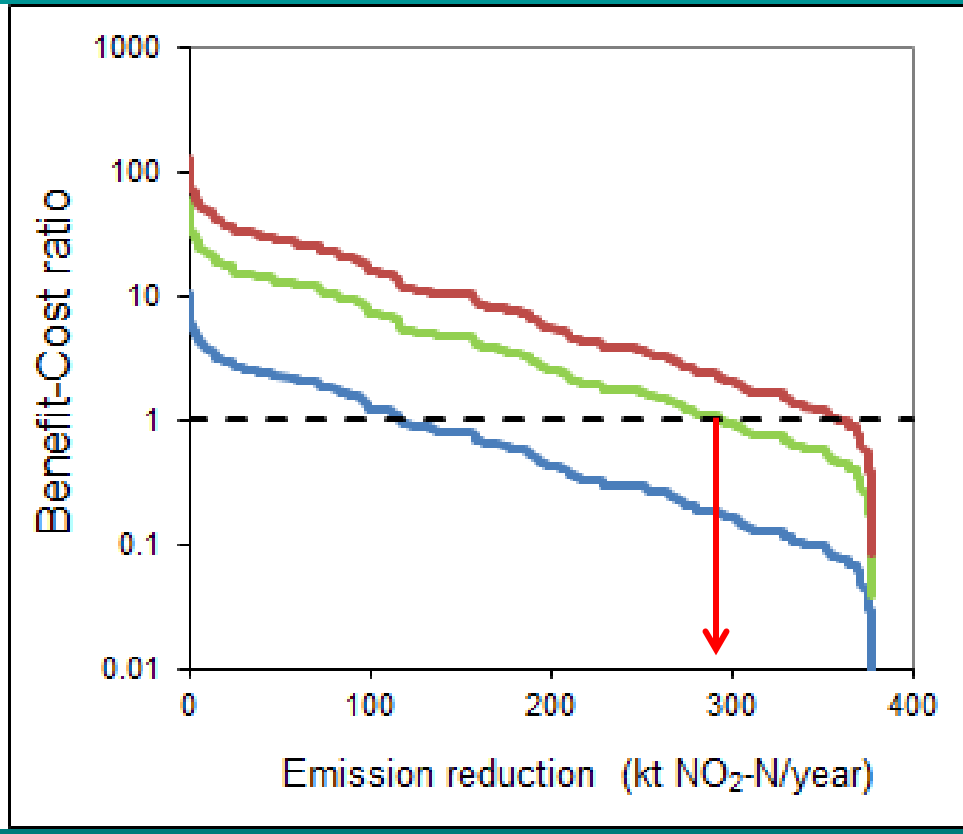

Trailing Shoe


Slot Injector

The car and the exhaust pipe…

EU benefit-cost ratios for NH_3 and NO_x mitigation





From N trade-offs to N efficiency

- **Stage 1:** Ignore the interactions
- **Stage 2:** Highlight the trade-offs at field scale (pollution swapping: NH_3 vs N_2O)
- **Stage 3:** Discover that swapping is net neutral at the regional scale (NH_3 deposition effects)
- **Stage 4:** Start listing the co-benefits (low NH_3 emission, reducing fertilizer inputs and net N_2O savings)
- **Stage 5:** Quantify the climate benefits of reducing N losses and improving NUE.

Current & potential future delivery mechanisms

Wide range of mechanisms are relevant : incentive, advice & regulatory.

Most incentive schemes lack options for atmospheric N, but could be built in (e.g. environmental stewardship, catchment sensitive farming, woodland grant schemes)

Emphasis on voluntary approaches for UK agricultural NH_3 mitigation - very slow uptake of measures (in contrast to mandatory mechanisms elsewhere).

Restriction of the IED to large farms - gap in agriculture-related mechanisms, with plans or projects often not assessed regarding the Habitats Directive
(cattle, medium size pig/poultry farms, arable farms).

Regional/international scale - increased vehicle usage, international shipping, consumption of animal products and energy

RAPIDS draft framework for site action plans

An 8-step draft framework was developed under RAPIDS:

- Identifying major atmospheric N sources for each designated site
- Selecting suitable measures for each site, for local conditions
- Checking local availability of spatially targeted instruments (e.g. agri-environment schemes)
- Detailed assessment of measures or, for sites remote from sources or with substantial medium/long-range N input, referral for higher-level actions.

No single ‘one size fits all’ solution, and spatial considerations of relevant N sources at sites are needed for cost-effective mitigation.

Gaps to address for the future

- If there were to be emissions regulation- how to make it as efficient as possible? e.g. Excluding small farms, small equipment
- There is currently no AQ limit value for ammonia. How could this be integrated into local AQM for designated sites?
- How to bring the Habitat requirements alive – when is an action a “plan or project”

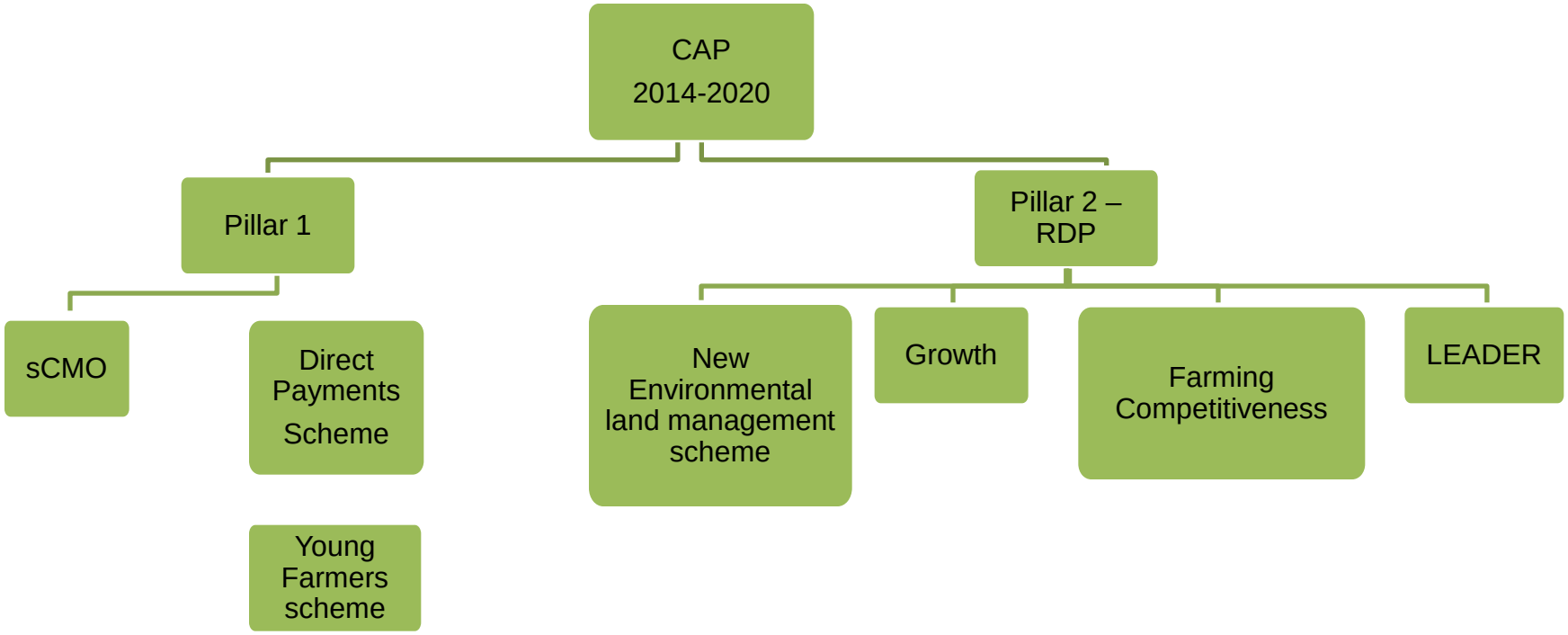
Department
for Environment
Food & Rural Affairs

Measures and Delivery Mechanisms:

Measures in the Rural Development Programme

Presented by: Richard Findon
Date:22 September 2014

What is RDPE?


CAP
2014-2020
Pillar 1
Pillar 2 – RDP
sCMO
Direct Payments Scheme
Young Farmers scheme
New Environmental land management scheme
Growth
Farming Competitiveness
LEADER

The Rural Development Programme in 2014-2020 will support three main areas.

- **Environment:** *Restoring, preserving and enhancing our natural environment*
- **Productivity:** *Increasing the competitiveness and efficiency of our farming, forestry and land-based sectors*
- **Growth:** *Delivering rural economic growth*

The RDPE programme for 2014 – 2020 in England will have a budget of £3.5bn

- **Main focus on environment [87%]**
  - £2.155bn on existing agreements
  - £925m for new Environmental Land Management scheme (NELMS)
- £177m focussed on Growth [**5%**]
- £140m focussed on Productivity [**4%**]
- £138m delivered via LEADER [**4%**]
- Schemes open to applicants from January 2015
- Huge Demand

How RDPE can help to tackle emissions

- Ammonia is an objective in the Rural Development Regulation
- This means we can incorporate measures for ammonia into RDPE schemes
- Workshop with industry and experts in 2013 to identify potential measures
- Important to identify synergies with other environmental outcomes e.g.water and forestry
- Advice and targeting will be key and we are considering how best this can be achieved.

NELMS will deliver multiple environmental outcomes (but can take a single focus where most effective)

Biodiversity

Soil and water quality

Landscape

Flood Risk Mitigation

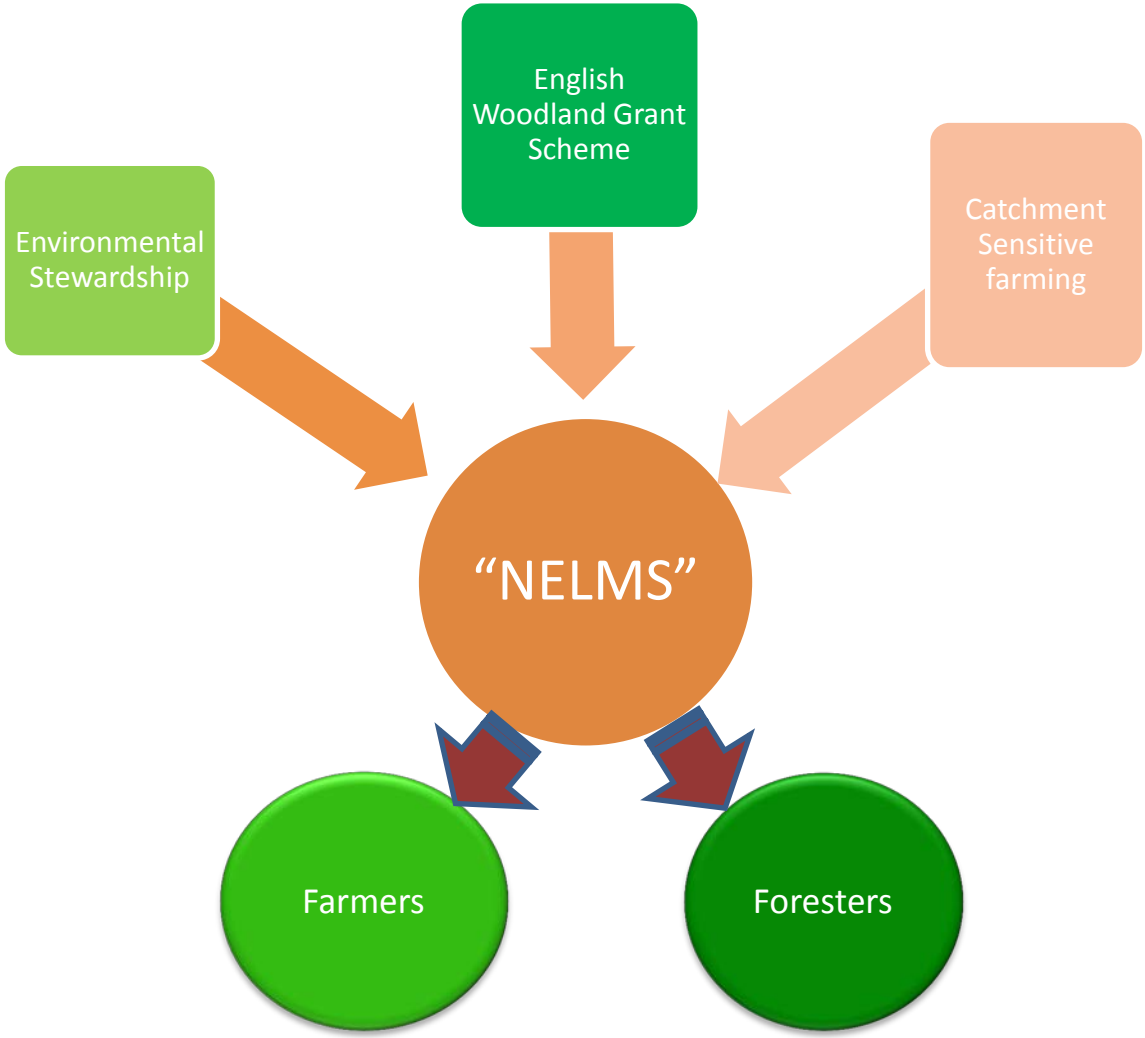
Genetic Conservation

Carbon Storage Climate Change

Historic Environment

Secure public benefits and more sustainable land management

New Environmental Land Management Scheme (NELMS) design



Why:
- Advocacy
- Incentives (£)

How:
- Advice
- Support

The main elements of NELMS

Higher Tier

- Targeted to **specific sites**
- **Invitation** (Delivery body develops an invitation list/pipeline for each annual application window)
- Online guidance plus access to **1-2-1 technical support**
- Access to **more complex** management options e.g. habitat creation
- Ability to **tailor prescriptions** to site

Middle Tier

- **Area focus** to targeting
- Open to all, **competitive**
- **Appraisal** system to decide entry for each annual application window
- **Online guidance**
- Support via land manager's existing network of 'trusted advisers'
- **Fixed option prescriptions**

Small Scale Capital Grants

Limited range of boundary management and planning grants. **Open to all**, untargeted, **unsupported**

How NELMS can help to tackle emissions

- **Tree planting around sources of emissions as part of the woodland creation options**
- **Capital grants**: Capital grants will be available for forestry as well as targeted grants with associated advice for water quality, both of which have the potential to help with ammonia mitigation
- **But a number of uncertainties still to be worked out**

Farming and Forestry Productivity Scheme (FFPS)

Four priorities:

- help farmers innovate, use new technology and use the latest research
- improve skills and training
- co-operate and collaborate with other farmers, foresters and others in the land-based sectors
- support projects that benefit the environment and improve the amount or quality of agricultural produce

How FFPS can help tackle emissions

- Potential to include innovative measures that could help farmers reduce emissions and improve nitrogen use efficiency
- Ministers deciding on what should be included in the scheme in terms of capital items and projects
- But budget is small so need to be realistic
- We are exploring whether CSF could play a role in delivering advice on measures to tackle ammonia emissions.

LEADER

- **Priority areas**
  - Farm productivity
  - Micro and small enterprises and farm diversification
  - Rural tourism
  - Rural services
  - Culture and heritage
  - Forestry
  - 70% of projects directly support the rural economy, with the remaining 30% all needing to make a contribution.

- **Local decisions on content, not a universal offer..**

RDPE alone cannot deliver all the solutions

- **So how can we make the most of the relatively small amount of funding available and raise awareness of best practice and benefits?**

- **And what other initiatives and sectors have a role?**
  - Farmers –can be a win-win but need support and greater awareness
  - Industry – GHG action plan (due for review); other measures under CFE etc.

Next steps

- **RDP Programme Document** (containing NELMS design) submitted to European Commission (EC) in early June. Programme sign-off ideally December 2014, but could slip to early 2015.
- NELMS:
  - Finalise scheme design details during September
  - External scheme updates via CAP 'Factsheets'
  - Online guidance from early 2015
  - Application window expected summer 2015
  - Some preliminary grants available during early 2015 (TBC)
  - **First contracts live from January 1st 2016**
- FFPS: More information will be confirmed later in 2014
- Later (2017) – RDPE mid term review and review of modulation rate (currently 12%).

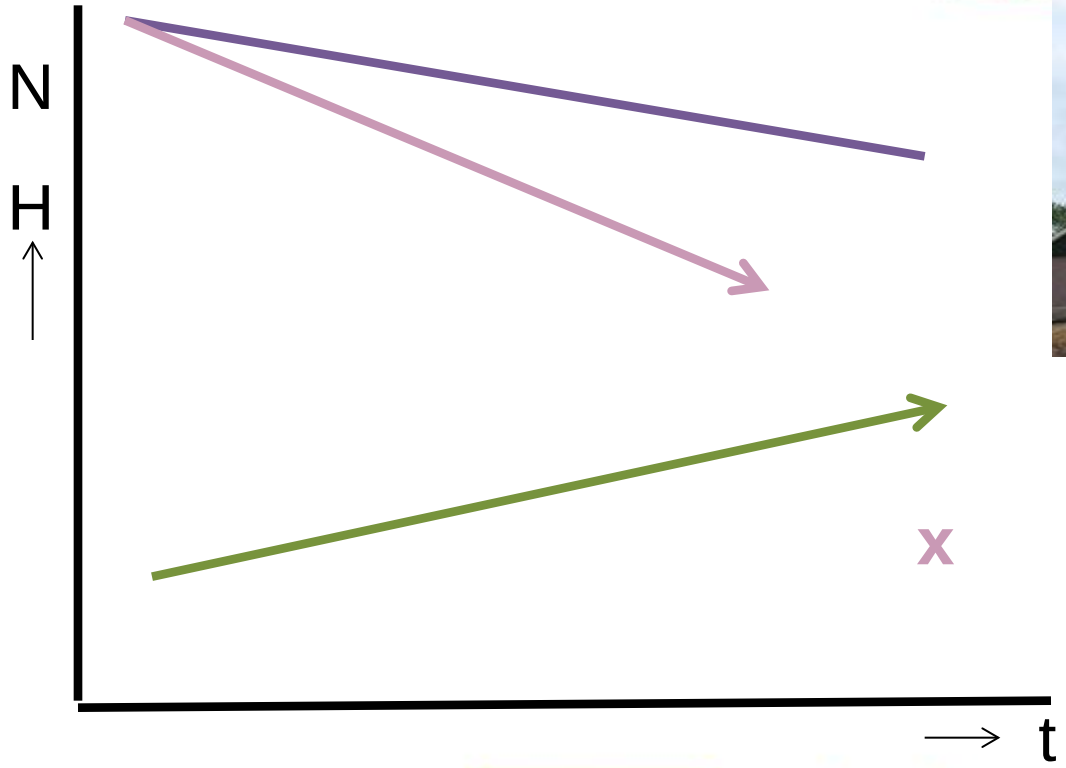
Improvement Programme for England's Natura 2000 Sites (IPENS)

Towards Site Nitrogen Action Plans

Wilbert van Vliet

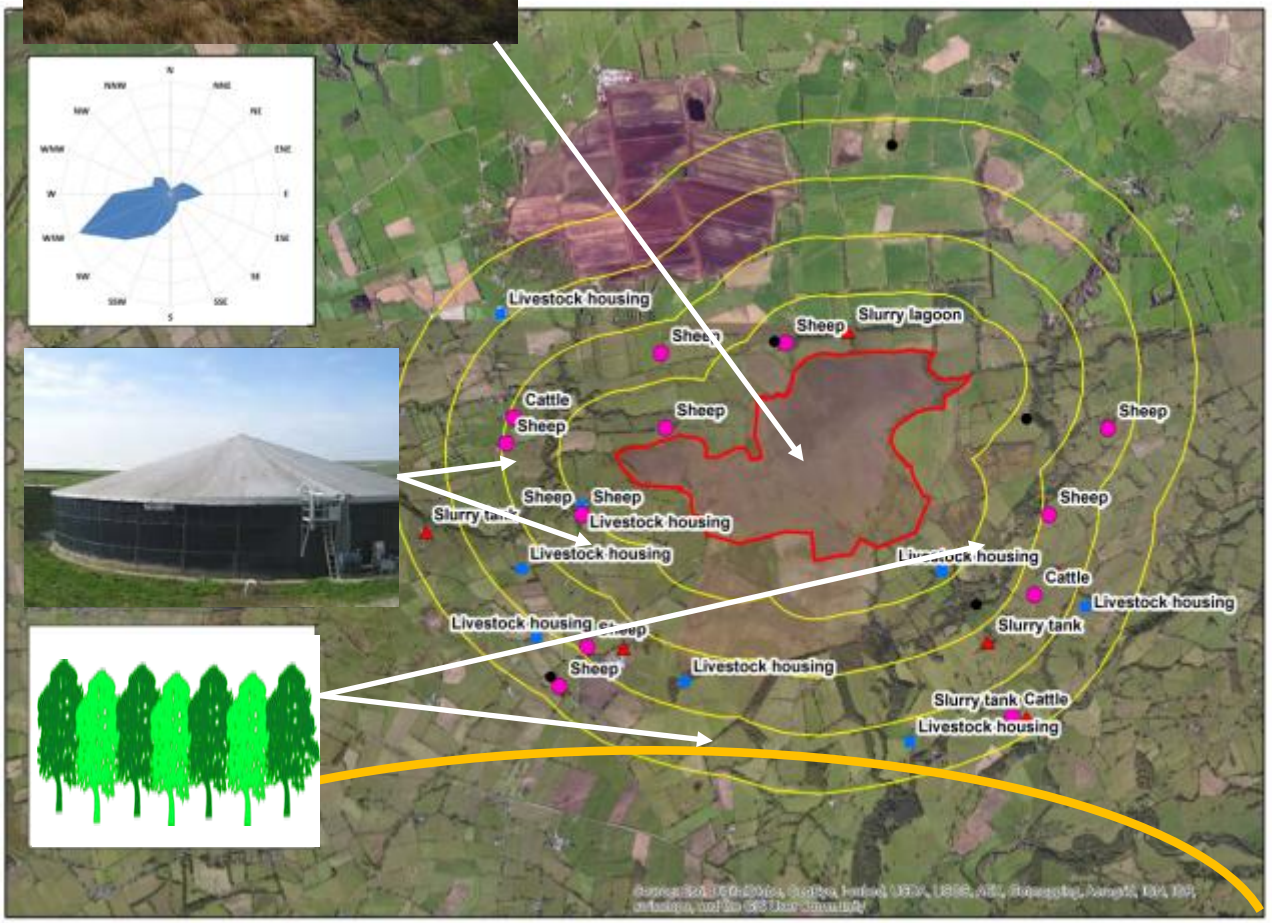
www.naturalengland.org.uk/ipens2000

Site nitrogen action plan: concept



www.naturalengland.org.uk/ipens2000

Site nitrogen action plan: theoretical example



Spatial variability

Multiple sectors

Integrate national and local measures

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Developing site nitrogen action plans

1) Translate national measures to site deposition
   - Current concentration/ deposition
   - Expected reduction based on confirmed national measures
2) Agree additional local source measures
   - Local source attribution
   - Identify implementable measures and delivery mechanisms
   - Delivery bodies, funding timescales
3) Agree habitat mitigation measures
   - identify effective measures and delivery mechanisms
   - Delivery bodies, funding, timescales
4) ' Ecological audit' to prove that the package will lead to habitat improvement

Developing Site Nitrogen Action Plans

- To be developed in partnership
  - Local authority
  - Natural England
  - Environment agency
  - Local sector representatives
  - ……..
- To make use of existing delivery mechanisms and roles
- To be piloted on a few sites in first instance

Challenges

- Evidence
  - Deposition modelling
  - Contribution of activities and impacts
  - Effectiveness of habitat restoration measures
- Resources & commitment of delivery bodies & partners
- Implementing measures
- Links to related processes & timing
  - Conservation objectives
  - Rural Development Programme
  - Site condition & monitoring

Questions for discussion

- Is this a good way forward?
- Is it feasible?
  - What are the challenges
  - How can they be overcome?

Limiting air quality impacts on protected sites

Sarah Watkins
E&B Regulated Industry, Air Quality Advisor
23 September 2014

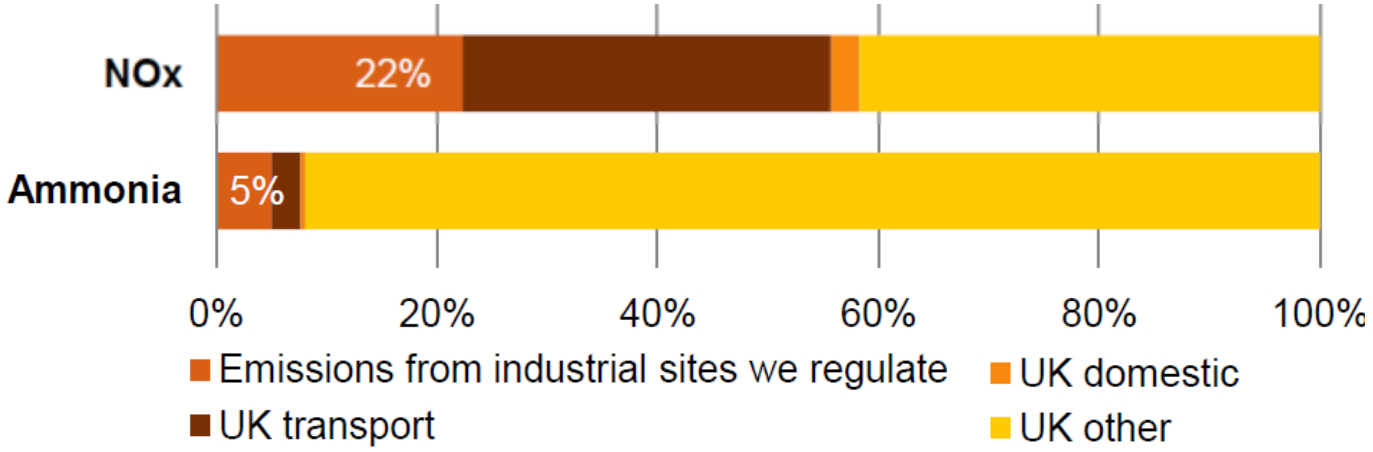
Environment Agency

Contents

- Our role in air quality
- Our regulatory contribution
- Measures for limiting impacts
- Permitting and supporting SNAPs

Environment Agency

Our role / regulatory contribution



		Intensive farming [1]	Cement, lime and other minerals	Chemicals	Power	Food and drink	Metals	Paper and textiles	Refineries and fuel production	Energy from waste	Biowaste	Landfill	Waste storage, treatment, transfer and use	Water companies
№	Number of permits [2]	1086	231	528	149	350	185	80	82	139	888	2026	7907	32000 [3]
Releases to air (Percent of load from sites that report into the Pollution inventory)	Greenhouse gases [4]		3	4	69	1	6	1	7	4	0	5		1
	Sulphur oxides (SOx)		4		69	1	13		13					
	Nitrogen oxides (NOx)		6	2	75	1	5	1	5	2		2		
	Ammonia	69	3	24		1								1
	PM10	31	4		34	3	24		4					

Permitting and supporting SNAPs

- Existing permitting measures
  - Assessment against EQS
    - Standard rules
    - Bespoke permits
  - Imposing conditions beyond BAT
  - Permit review
- SNAPS: benefits and support
  - Action on other sources
  - Better understanding of source attribution
    - Permit assessment (e.g. in combination)
  - Permit reviews

Environment Agency

Transport Sector

Clare Warburton, Senior Environmental Specialist Transport,
Natural England

Transport Sector

- Road
- Rail
- Aviation
- Ports and Shipping

Road Transport

- **Emissions from road transport make the largest contribution to the UK total NO_x emissions.**(Defra 2011) (RoTAP 2012).

- **NO_x emissions are raised close to transport networks** (RoTAP 2012).

- **Maximum NO_x levels from road traffic are much smaller than from point sources**. (RAPIDS).

- **The levels of emissions are predicted to fall in all areas including transport.** (RoTAP 2012).

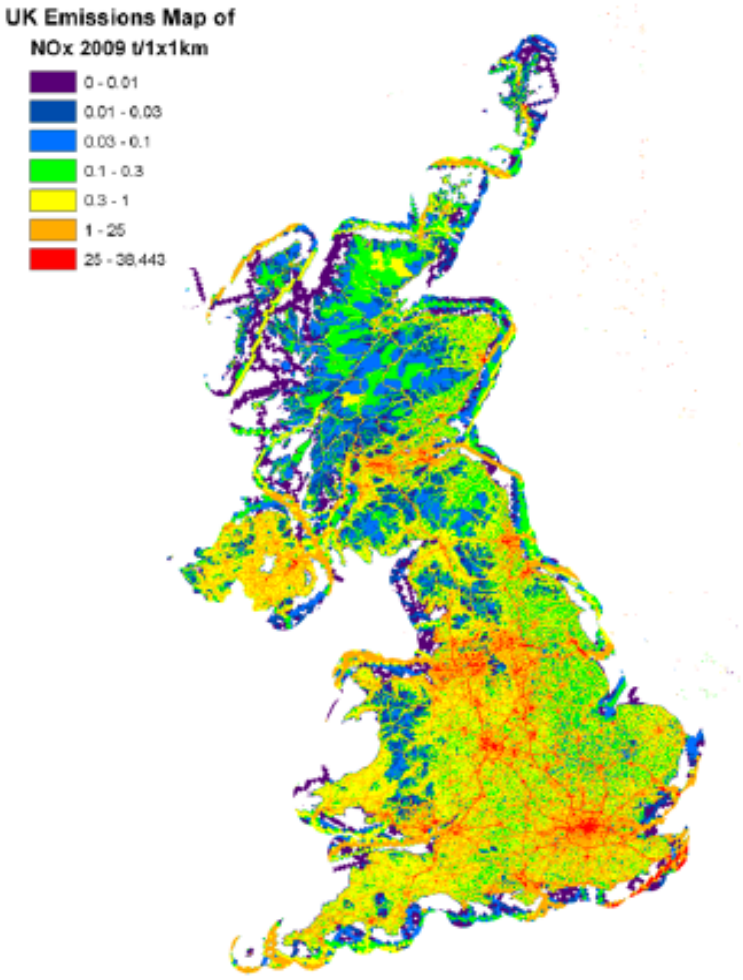


Figure 2.9: Mapped emissions of NO_x (expressed as tonnes NO_2 per km^2) (NAEI, 2011).

Road Transport

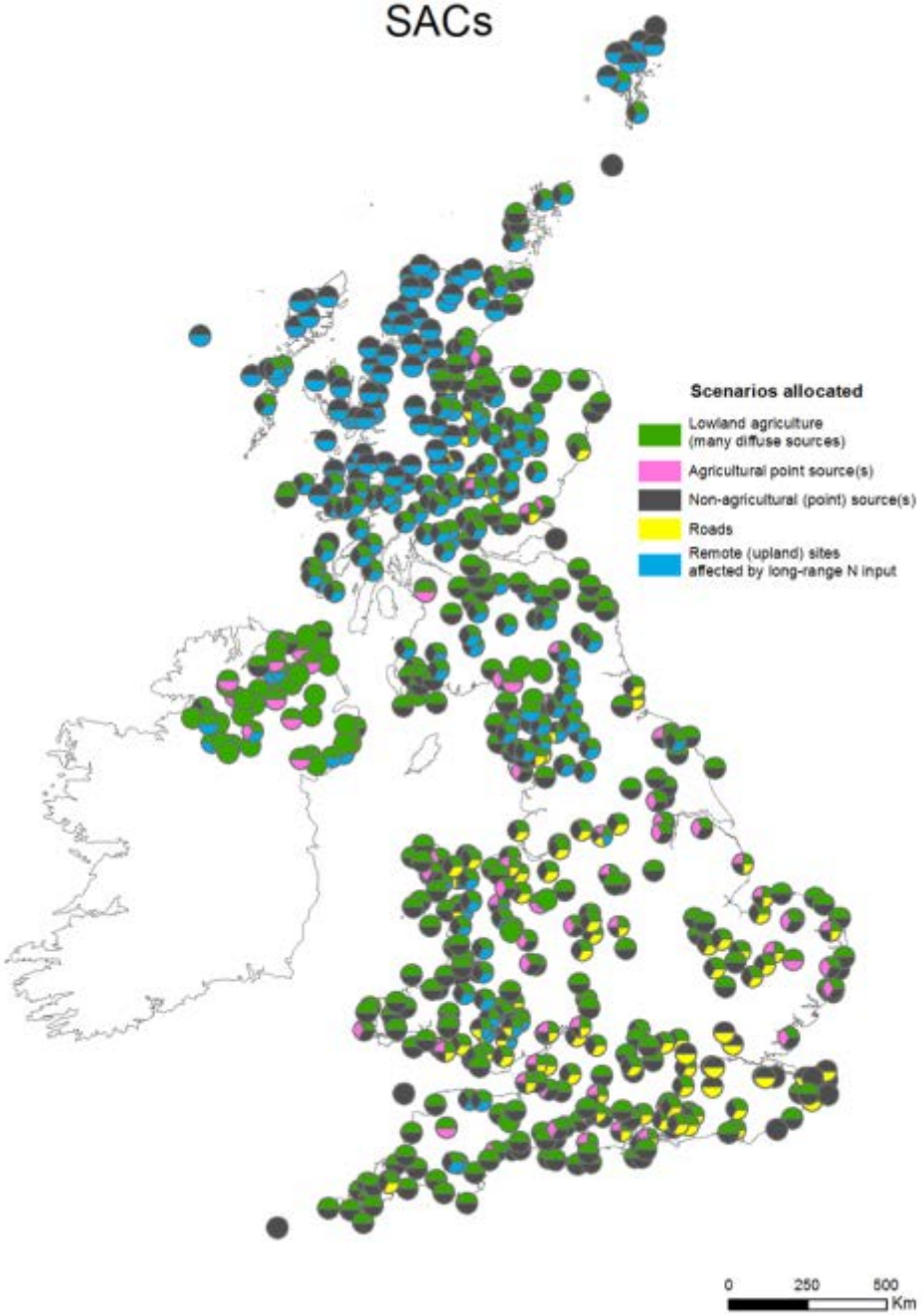
- **Local scale air pollution impacts** from existing busy roads and proposed road developments

- **Impacts on designated sites** limited to areas in close proximity of a major road, around 200 m.

- **NO_2 from road traffic emissions, rather than other forms of dry or wet nitrogen deposition,** is most likely driver of changes in the composition of roadside plant communities (unpublished AEA 2014).

- **Source allocation** undertaken for RAPIDS identifies transport as a significant pollution source

SACs



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Reducing Nitrogen Impacts from Road Transport

Current Research

1. **Literature Review:** The ecological effects of air pollution from road transport: an updated review *with supplementary summary of measures for reducing emissions through road-traffic measures* (Ricardo AEA unpublished).
2. **RAPIDS** (Remedies for Air Pollution (nitrogen) Impacts on Designated Sites)
3. **Designated Site Risk assessment**: *An assessment of the potential risk of impacts on designated sites from exposure to No_x from road traffic*. (Ricardo AEA, unpublished)

Remedies for Air Pollution Impacts from Road Transport

1. Mitigation Measures

2. Reducing Emissions

Mitigation Measures

- Planning to avoid impacts on sensitive locations
- Measures to reduce the pollution threats:
  - road redesign
  - installation of roadside barriers/shelterbelts
  - use of buffer areas
  - compensation/habitat creation
  - habitat management
- Importance of spatially targeted measures

Mitigation

Mitigation	2004 findings	2014 findings
Shelterbelt	Particulates: Wooded shelterbelts effectively capture particulates, thereby reducing transport to sites further away from the road. Gaseous pollutants: Role of shelterbelts less clear. Some evidence to suggest that they act as a physical barrier to NO_2 transport, changing dispersal patterns rather than taking up the pollutant.	Particulates: Evidence more equivocal particularly in relation to finer particles. Gaseous Pollutants: One study which agreed with 2004.

Mitigation

Mitigation	2004 Findings	2014 Findings
Buffer Zone	Provide a physical distance between the road and the protected site, rather than an area of vegetation that is able to remove pollutants .	New road building and road expansion should avoid a buffer zone of up to 100–200m from sensitive sites, particularly where bryophytes are an important feature.
Compensation / habitat creation	Possible but requires ongoing management and should be located to minimise the impact of air pollution from roads	Biodiversity offsetting may be relevant, particularly when new roads are proposed.
Habitat Management	Not covered	The majority of management practices do not remove significant quantities of nitrogen (with the exception of removing biomass or topsoil). Further Research needed.

Traffic Measures

- **Reducing traffic flows**
  - Traffic restrictions and relocation
  - Influencing travel behaviour
  - Promoting public transport
- **Improving traffic flow and efficiency**
  - Traffic control systems
  - Road space design and management
  - Driver education
- **Promoting low emission vehicles**
  - Low Emission Zones
  - Planning and infrastructure
  - Partnership working and promotion

Implementation

- Implemented through Air Quality Management Areas and the Design Manual for Roads and Bridges for new road projects

- Mitigation: strategies based on shelterbelts can take 10-20 years to become effective, depending on the type of trees used.

- Emission Reductions: Technological advances filtering through the vehicle fleet over periods of 5 to 10 years.

- Behavioural change: Developing new cultural norms in such areas may typically take a generation.

Overcoming Barriers

- International/national policy eg to address issues of rising traffic levels
- Using regulatory frameworks eg ensuring uptake of low emission techniques in vehicles. Mainly controlled at European level.
- Technological advances to further reduce NO_x emissions from traffic sources
- Managing the distribution of traffic sources in relation to receptors
- Managing the drivers of emissions, e.g. transport choices
- More research on the effectiveness of shelterbelts and buffer zones is required.

Assessment of the potential risk of impacts on designated sites from exposure to No_x from road traffic.

- Exposure: Sites were classified in terms of their exposure to NO_x from road traffic, taking into account other background sources of NO_x.

- Sensitivity: The next step was to classify sites in terms of their sensitivity to NO_x from road traffic.

- Risk: The potential risk of impact categorised by inter-relating exposure and sensitivity through development of a matrix.

- 2011 and 2020

Exposure to NOx from road traffic

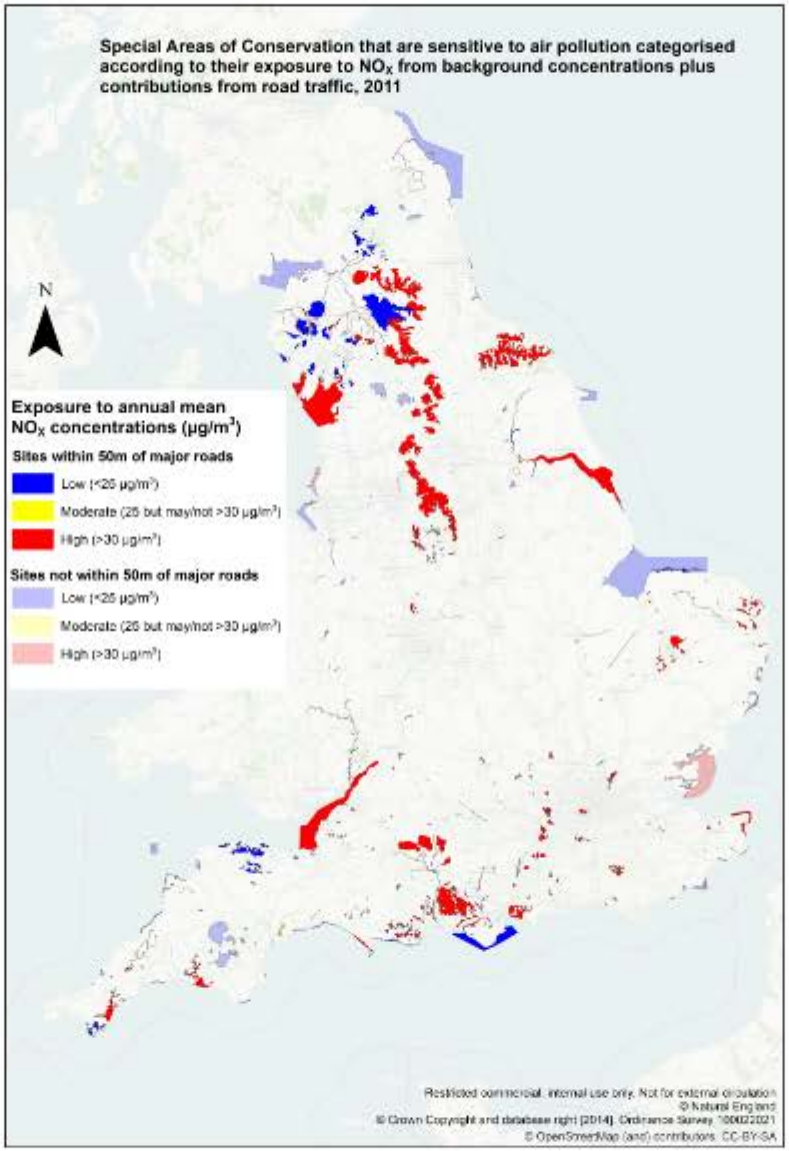
Set levels of exposure

- CL = 30 µg/m3
- Classified on NOx concentrations attributable to road traffic and then took account of background.

Class	Road NOx	Background
Large	> 10 µg/m3	> 25 µg/m3
Medium	5 – 10 µg/m3	20 – 25 µg/m3
Small	< 5 µg/m3	< 20 µg/m3

Exposure	Qualifying scenarios
High (background concentration + road contribution >30 µg/m3 in all cases)	• High or moderate background + large contribution • High background + large or medium contribution • Low background + large contribution (where total >30 µg/m3)
Moderate (background concentration + road contribution > 25 µg/m3 but may or may not exceed 30 µg/m3)	• High background + small contribution • Moderate background + medium contribution • Low background + large or medium contribution (where total >25 µg/m3 and <30 µg/m3)
Low (background concentration + road contribution <25 µg/m3 in all cases)	• Low background + small contribution • Low background + large or medium contribution (where total <25 µg/m3)

* Same approach used for all sites with/without major roads within 50m


Special Areas of Conservation that are sensitive to air pollution categorised according to their exposure to NO_X from background concentrations plus contributions from road traffic, 2011
N
Exposure to annual mean NO_X concentrations ($\mu g/m^3$)
Sites within 50m of major roads
Low (<25 $\mu g/m^3$)
Moderate (25 but may/not >30 $\mu g/m^3$)
High (>30 $\mu g/m^3$)
Sites not within 50m of major roads
Low (<25 $\mu g/m^3$)
Moderate (25 but may/not >30 $\mu g/m^3$)
High (>30 $\mu g/m^3$)
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Site Sensitivity

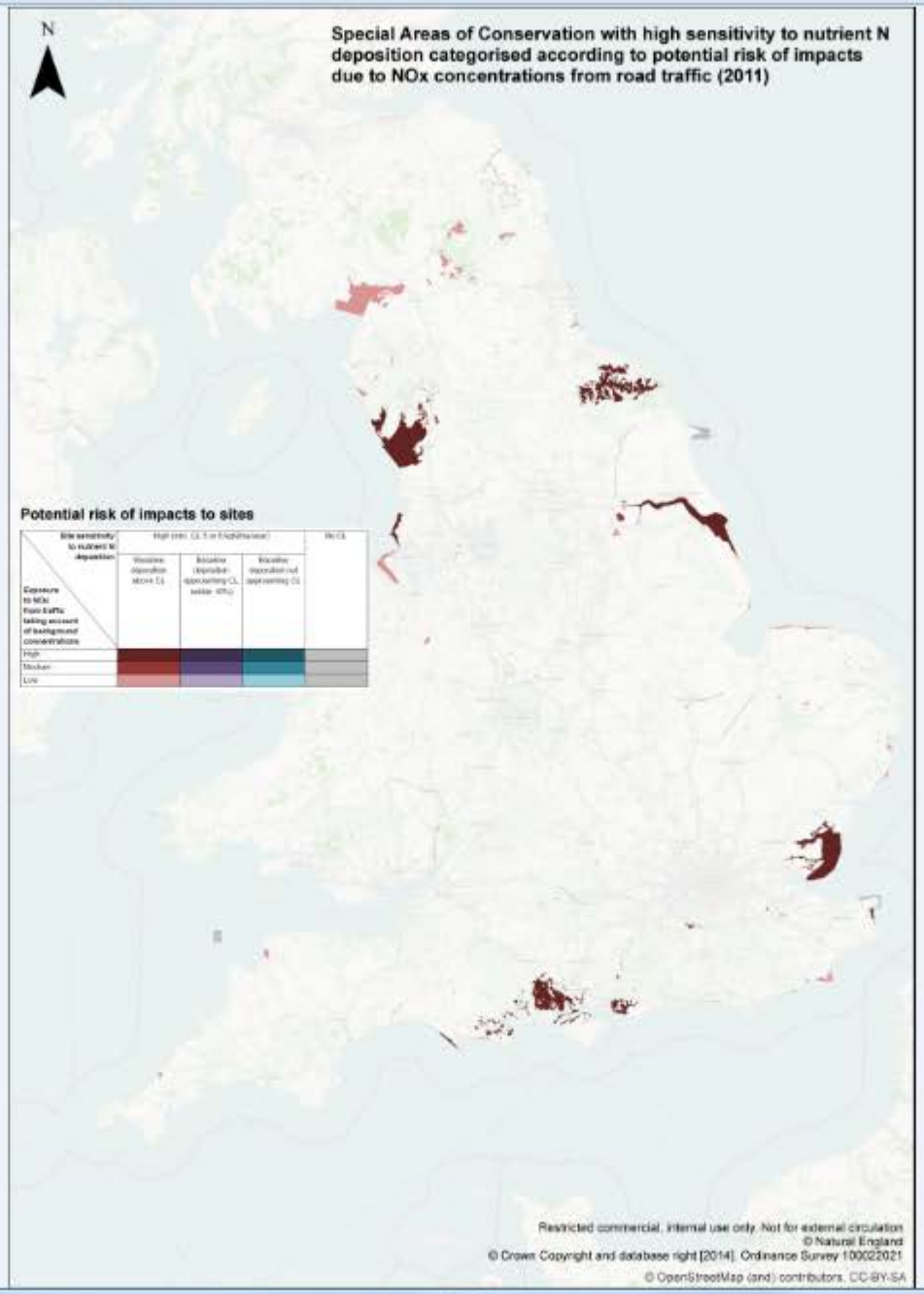
Sensitivity	Nutrient N	Acid (minCLmaxN)
High	5 or 8 kgN/ha/year	0.3 to <1.0 kEq/ha/year
Medium	10 or 15 kgN/ha/year	1.0 to <2.0 kEq/ha/year
Low	20 kgN/ha/year	2.0 to 14.0 kEq/ha/year

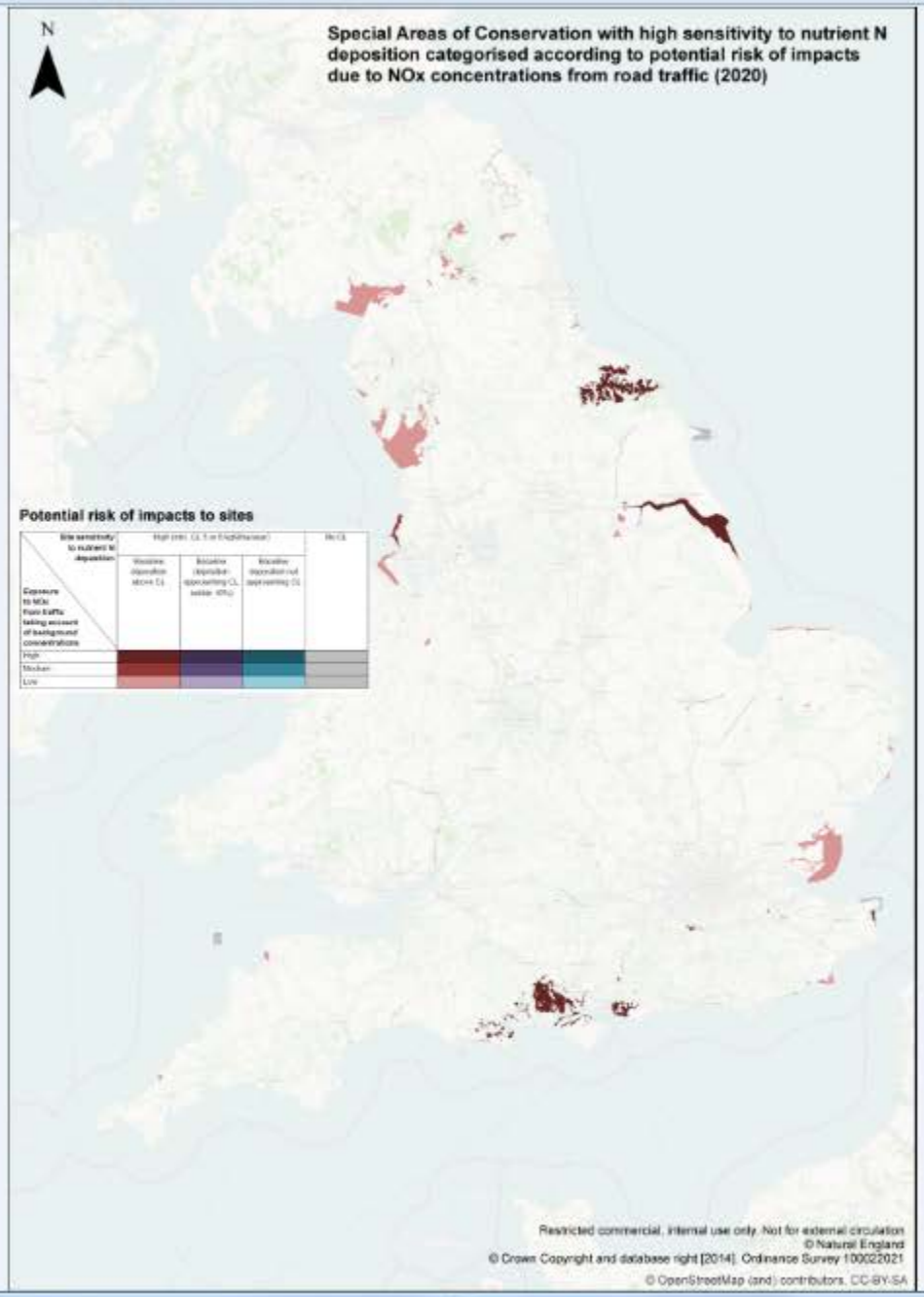
- Above (>100%) the Critical Load
- Approaching (90% – 100%) the Critical Load
- Not approaching (<90%) the Critical Load.

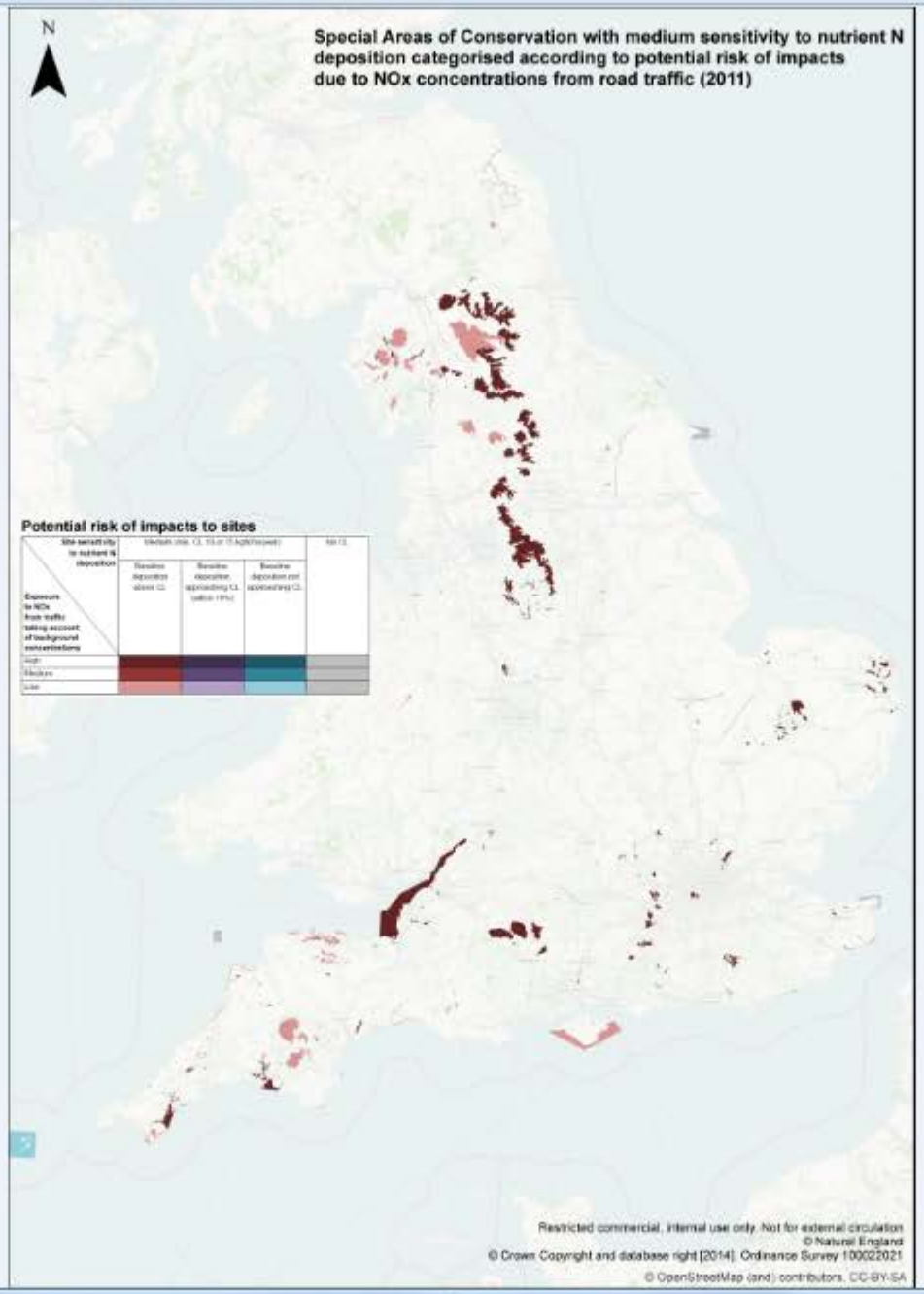
Site Sensitivity Matrix

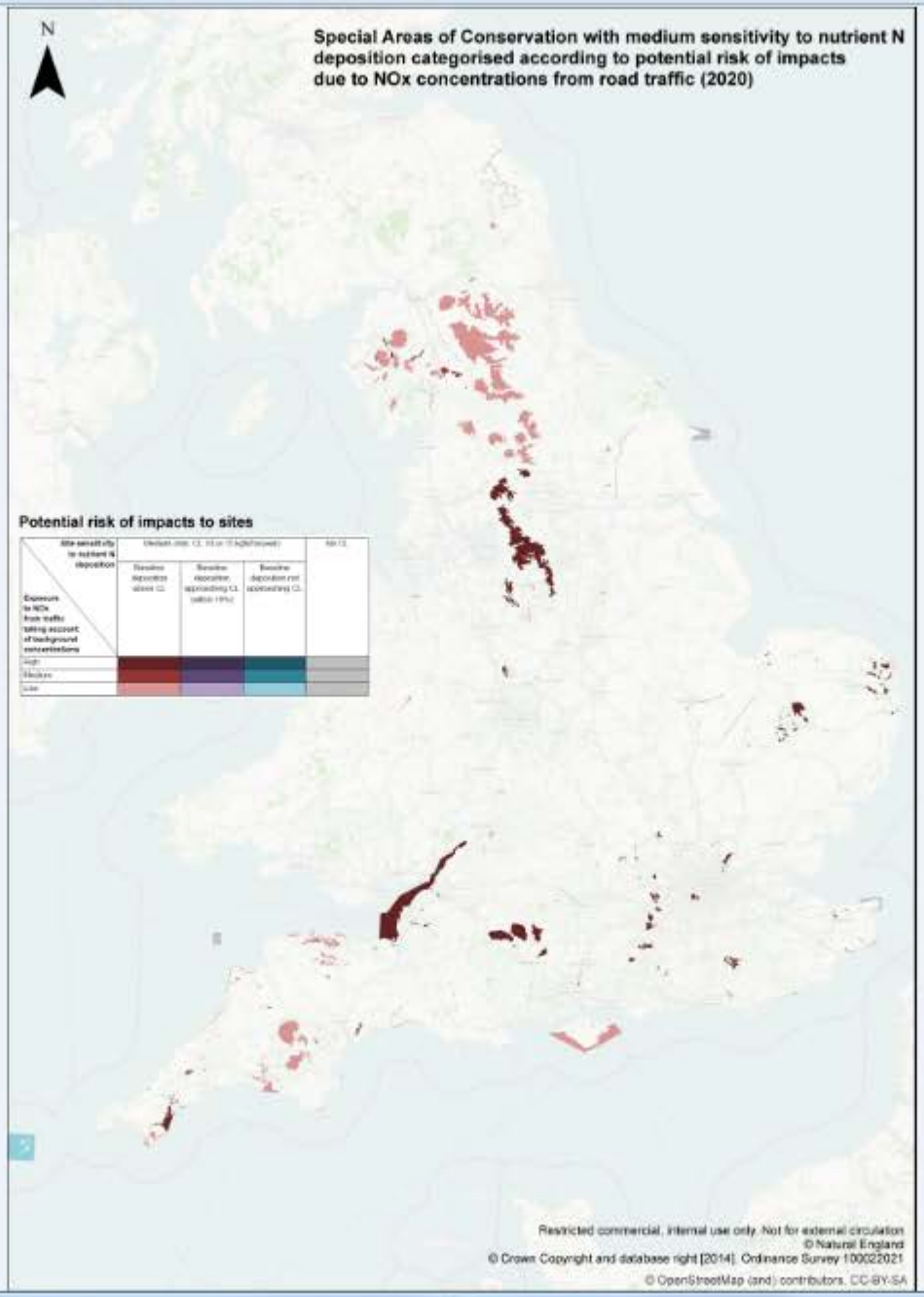
Site sensitivity to N deposition **Exposure to NO_x from traffic taking account of background concentrations**	High (min. CL 5 or 8 kgN/ha/year)			Medium (min. CL 10 or 15 kgN/ha/year)			Low (min. CL 20 kgN/ha/year)			No CL
	Baseline deposition above CL	Baseline deposition approaching CL (within 10%)	Baseline deposition not approaching CL	Baseline deposition above CL	Baseline deposition approaching CL (within 10%)	Baseline deposition not approaching CL	Baseline deposition above CL	Baseline deposition approaching CL (within 10%)	Baseline deposition not approaching CL	
High										
Moderate										
Low										

Site sensitivity to acid deposition **Exposure to NOx from traffic taking account of background concentrations**	High (minCLmaxN 0.3 to <1.0 kEq/ha/year)			Medium (minCLmaxN 1.0 to <2.0 kEq/ha/year)			Low (minCLmaxN 2.0 to 14.0 kEq/ha/year)			No CL
	Baseline deposition above CL	Baseline deposition approaching CL (within 10%)	Baseline deposition not approaching CL	Baseline deposition above CL	Baseline deposition approaching CL (within 10%)	Baseline deposition not approaching CL	Baseline deposition above CL	Baseline deposition approaching CL (within 10%)	Baseline deposition not approaching CL	
High										
Moderate										
Low										







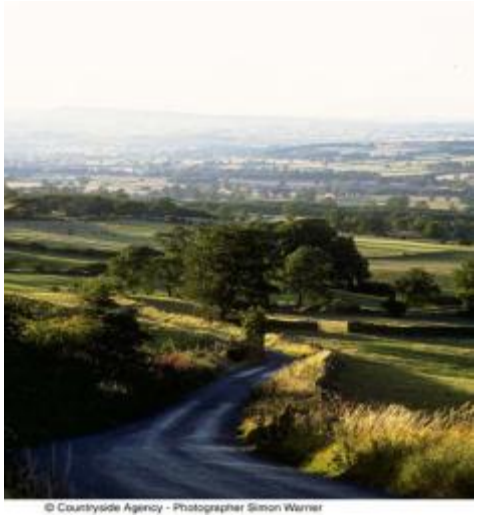


Findings

- In 2011 100 SACs with high or medium exposure to Nox from traffic:
  - 26 SACs are highly sensitive sites that are already over their N dep critical load - affecting 9000ha.
  - 53 SACs are medium sensitivity sites and are over their N dep critical load - affecting 15,500ha
  - Represents around 30% of all SACs
- Used for targeting remedies, such as mitigation and traffic measures.

Summary

- Roads are one source of nitrogen, many other contributors;
- Remediation is challenging
- Targeting of remediation measures to highest priority sites may be a way forward



Actions to reduce Atmospheric Nitrogen impacts at Natura 2000 sites in England

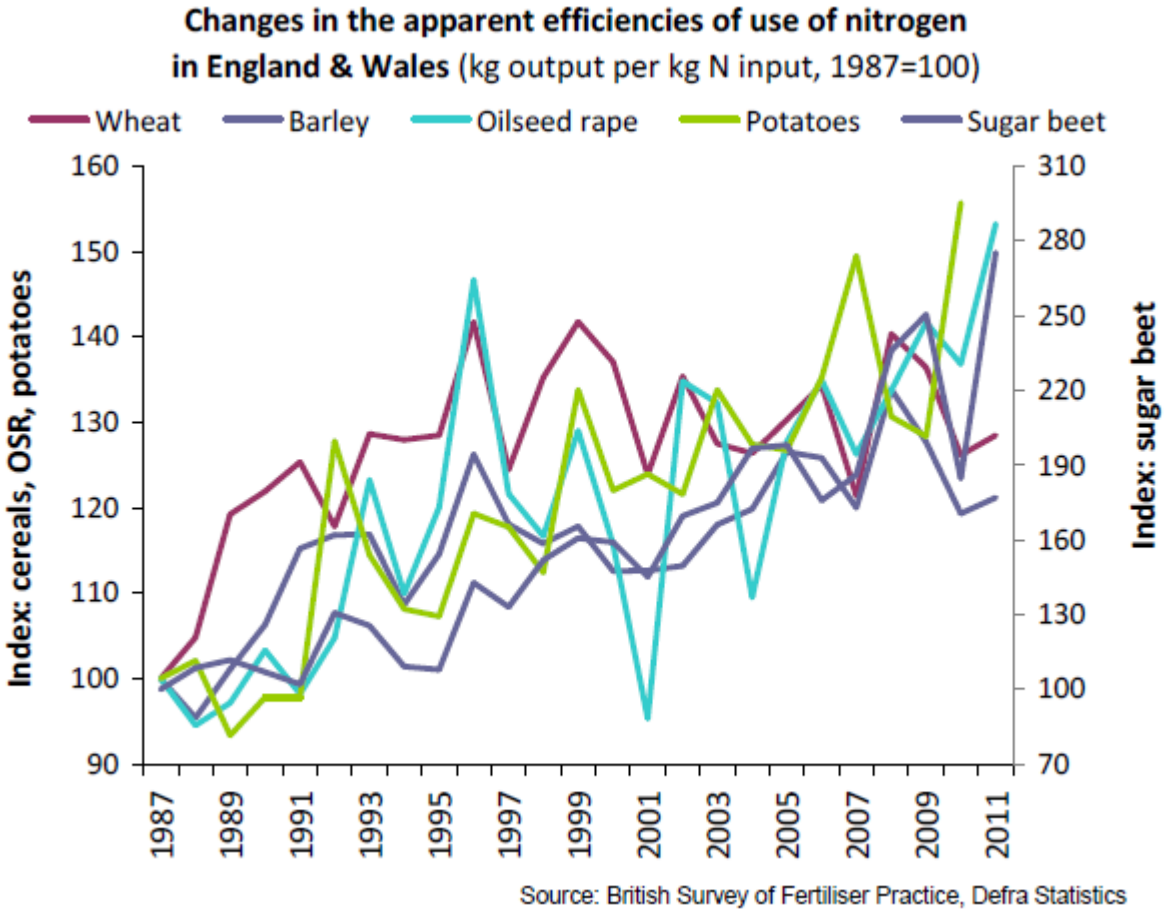
Diane Mitchell

Chief Environment Adviser

Trends & industry activity

- Ammonia emissions fell by 21 per cent between 1980 and 2010.
- The proportion of farmers with nutrient management plans increased from 50% in 2009 to 60% in 2014.
- The demand for tray-testing fertiliser spreading services has doubled and routine soil samples have increased by more than 15% since 2009.
- Nitrogen use efficiency in major crops has increased steadily over the past 25 years or so.
- Over 1000 AIC members have signed-up to the Feed Advisers Register since its launch in 2013.
- Over 2200 FACTS Qualified Advisers have taken intensive additional crop Nutrient Management Planning training.
- **The trends are going in the right direction & farmers recognise that there are possible win-wins but progress needs to be manageable and affordable.**

Changes in the apparent nitrogen use efficiency of major crops in England and Wales



SNAPS

- What status do these have? How do these relate to other plans?
- Data. Activity and success data is key but also accessing the right data to enable identification of local sources (fertiliser spreading, etc) may be difficult.
- Agri-environment schemes & CSF grants. These are of help but unlikely to cover the full cost (such as structural changes to buildings). And measures 'beyond BAT' would be particularly costly.
- Timescales. What are the timescales of implementation and do these take investment cycles into account?
- Affordability. Improvements need to be at a pace that the industry can afford and achieve. We recognise the need for progress but we should not stifle growth.
- Barriers to change to be addressed. These include investment, planning, R&D and knowledge exchange.
- Engagement. We would encourage early discussions with farmers, particularly on possible measures.
- **It is absolutely right to pilot & test the approach :- how to identify sources & the possible measures, costs & affordability and farmer engagement.**

Case study
Birklands & Bilhaugh SAC
Suburban/rural site in the Midlands

IPENS-049 Site categorisation for nitrogen measures

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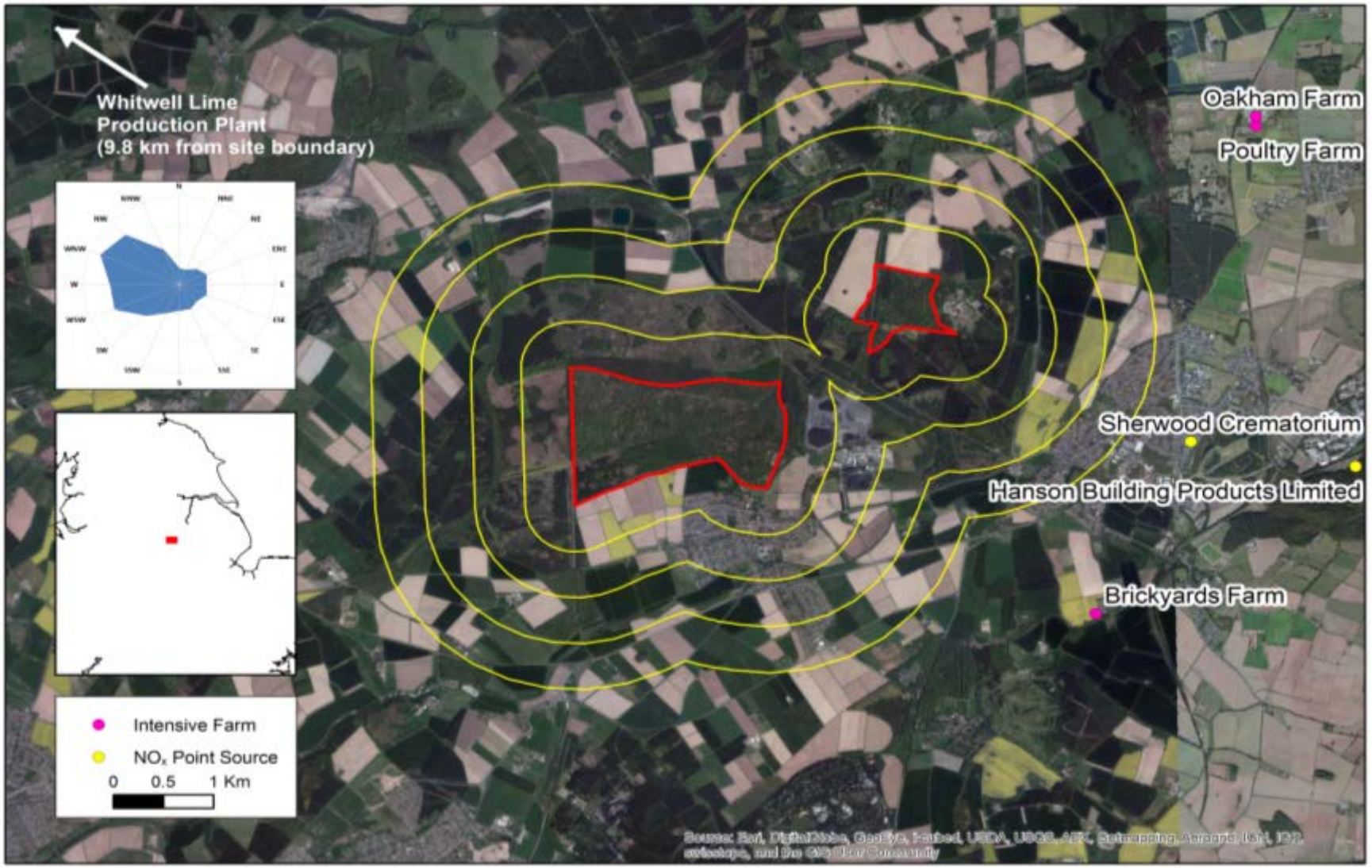
Birklands and Bilhaugh SAC



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Designated Features & CL Exceedance

Interest Code	Interest Lay Name	Interest Name
H9190	Dry oak-dominated woodland	Very sensitive (Mapping CL ≤ 10 kg N ha^{-1} yr^{-1})

N Deposition exceeds CL by up to 23 kg N ha^{-1} yr^{-1}

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Data sources:

- *UK N Deposition 5 km grid 2010 – 2012 (CBED)*

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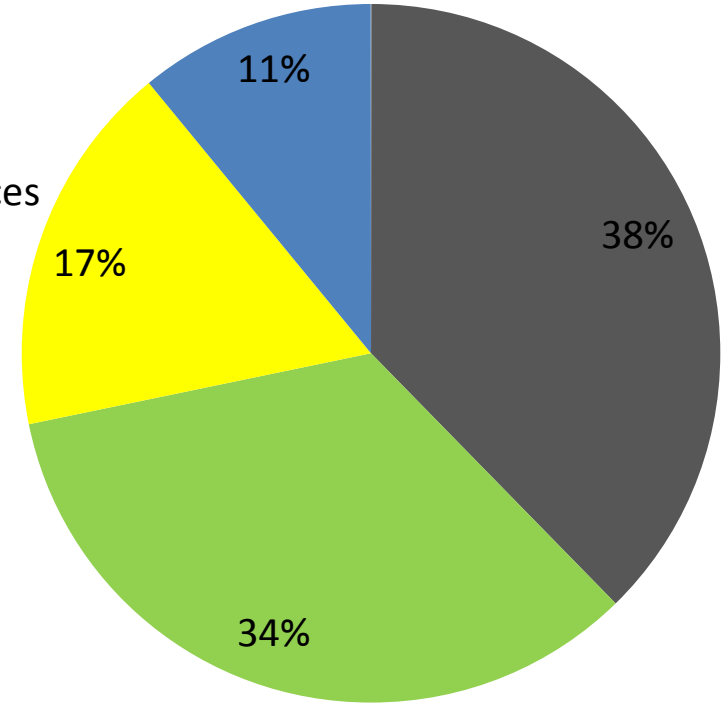
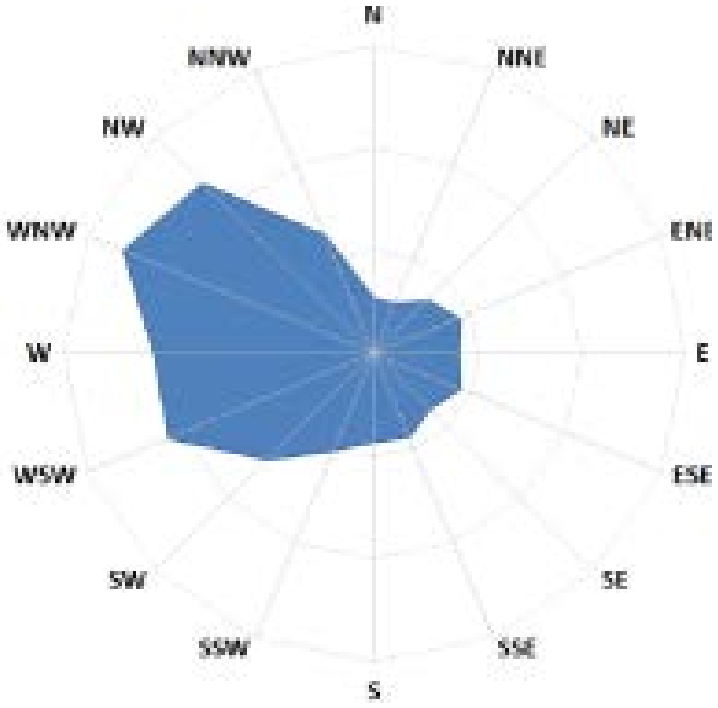
Initial RAPIDS Source Attribution

- Non-agricultural sources (Sc 3)
- Agricultural sources (Sc 1 & 2)
- Road Transport (Sc 4)
- Other sources* (Wet deposition included in Sc 5)





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Data sources:

- *RAPIDS Scenario allocation (2014)*
- *Windfinder.com (Selston, ~25 km SW)*

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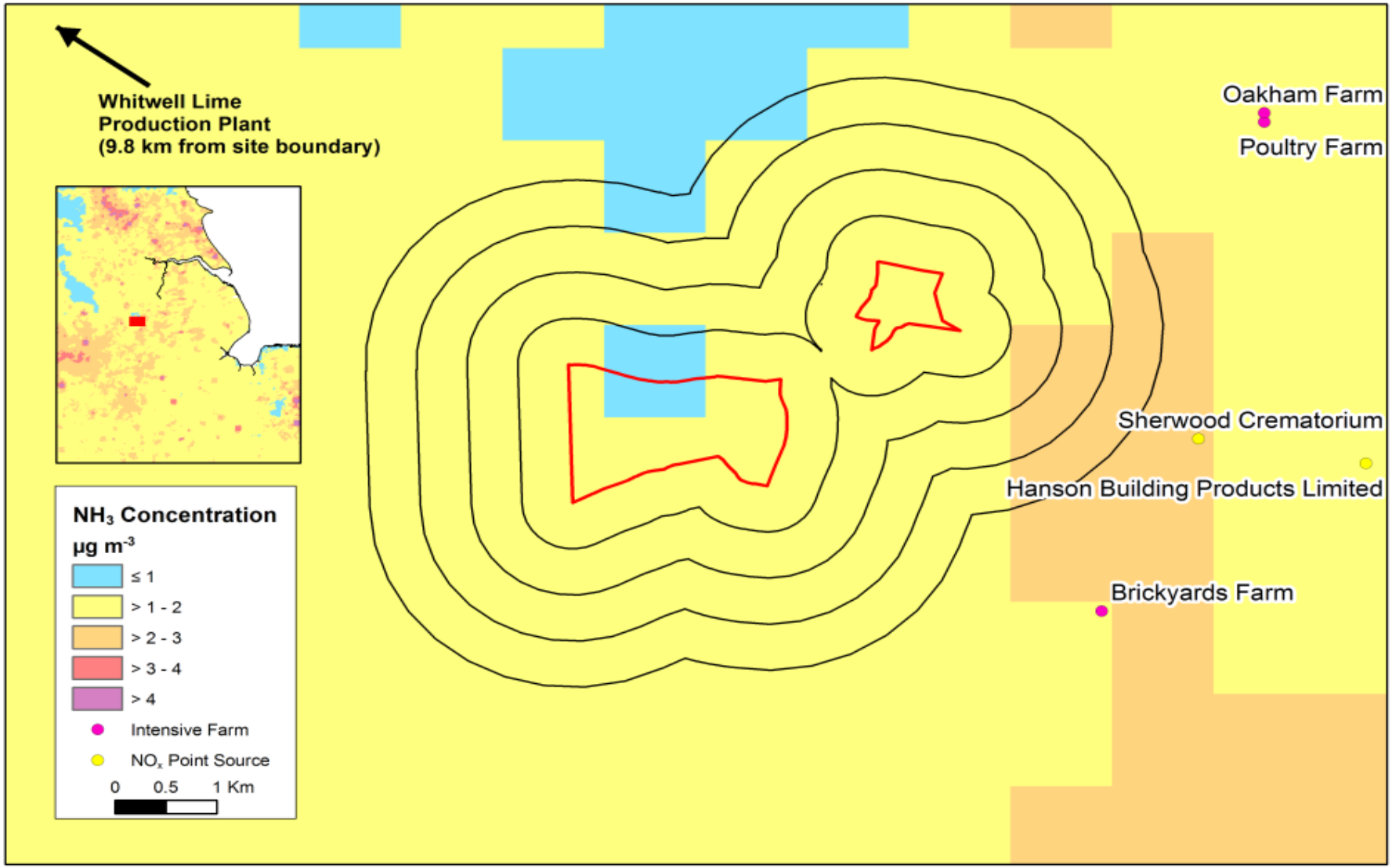
NH_3 Concentrations



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Data sources:

- *FRAME 2011, 1 km grid*

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Non-agricultural N sources

- No major NH_x or NO_x point emission sources <2 km of the site, according to the NAEI database.
- Nearest larger emission source with NO_x emissions ~7 t N yr^{-1} is Kirton Brickworks (~4 km SE).
- One very large source: **lime production plant** (9.7 km NW)
  - 2 long rotary kilns which heat dolomitic limestones up to 2200°C, powered by fossil fuels supplemented by solvent- and tyre-derived fuel
  - NO_x emissions of 1,610 t NO_2-N yr^{-1}.
  - Planning permission has been sought to fit a pre-heater to one of the kilns to reduce the NO_x emission from >3,000 mg NO_2 m^{-3} to <800 mg NO_2 m^{-3} (Steetley Dolomite Ltd, 2011). Measure only suitable for the smaller kiln however (the other kiln can produce in >5,000 mg NO_2 m^{-3})


Photo Geograph.co.uk
http://www.yourlocalweb.co.uk/derbyshire/whitwell/pictures/popup-1133257-steetley-dolomite/

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Data sources:

- NAEI (2011)

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Road Transport Emissions

Estimated total NO_x emissions

- A616 (235 m from site boundary): 0.5 t NO_x km^{-1} yr^{-1}
- A614 intersection: 1.2 t NO_x km^{-1} yr^{-1}

Data sources:

- *2012 AADT dataset (DfT)*
- *Emission Factor Toolkit v6.01 (Defra)*

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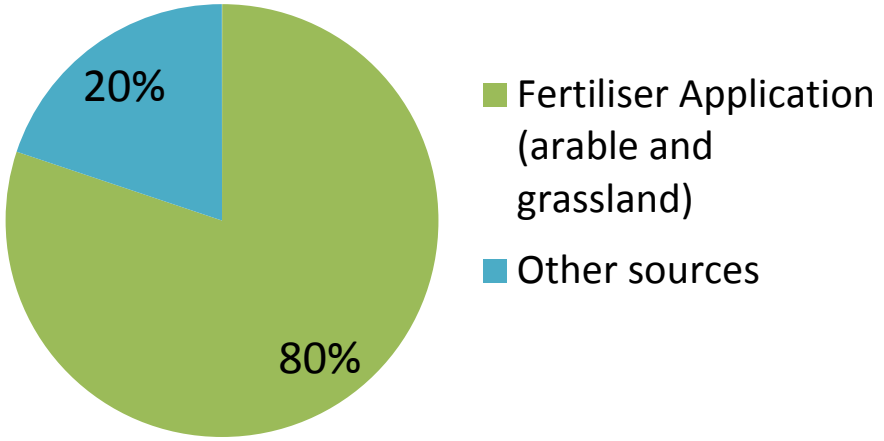
Agricultural Sectors (2 km radius)



Agricultural emission density:

0.3 kg NH_3-N ha^{-1} yr^{-1} for 2 km zone around SAC

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Data sources:

- *2012 Agricultural Census*
- *UK Agricultural emission inventory (Misselbrook et al. 2013)*

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Summary of Potential Measures

- **Combustion measures**
  lime plant – fit pre-heater to kiln to reduce emissions by 70%; explore solutions for 2nd (larger) kiln
- **Low emission zones around site boundaries**
  reduced emission fertiliser [and possibly manure] application for fields immediately on the site border
- **Road transport**
  introduce measures to improve traffic flows around the major junction to decrease road emissions in the wider area

Case study
Culm Grasslands
Intensive lowland agricultural landscape in SW England

IPENS-049 Site categorisation for nitrogen measures

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Culm Grasslands SAC sub-sites

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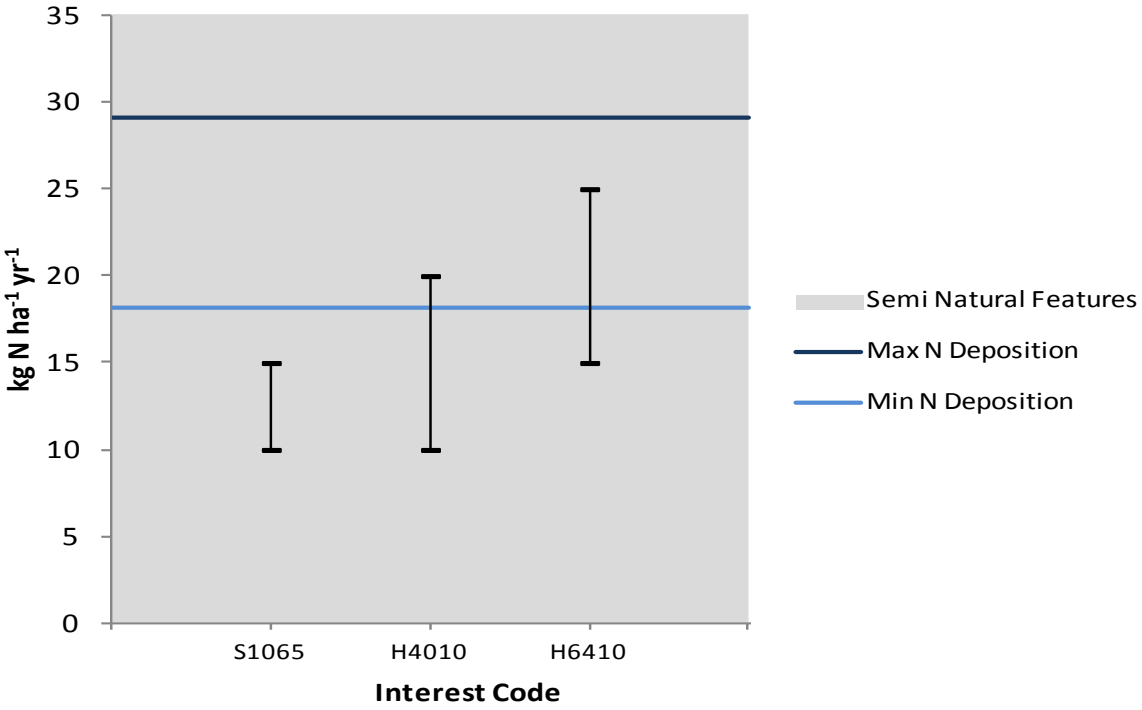
Designated Features & CL Exceedance

Interest Code	Interest Lay Name	Interest Name
S1065	Marsh fritillary butterfly	Euphydryas (Eurodryas, Hypodryas) aurinia
H4010	Wet heathland with cross-leaved heath	Northern Atlantic wet heaths with Erica tetralix
H6410	Purple moor-grass meadows	Molinia meadows on calcareous, peaty or clayey-silt-laden soils (Molinion caeruleae)



N Deposition exceeds CL by up to 19.1 kg N ha^{-1} yr^{-1}

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Data sources:

- *UK N Deposition 5 km grid 2010 – 2012 (CBED)*

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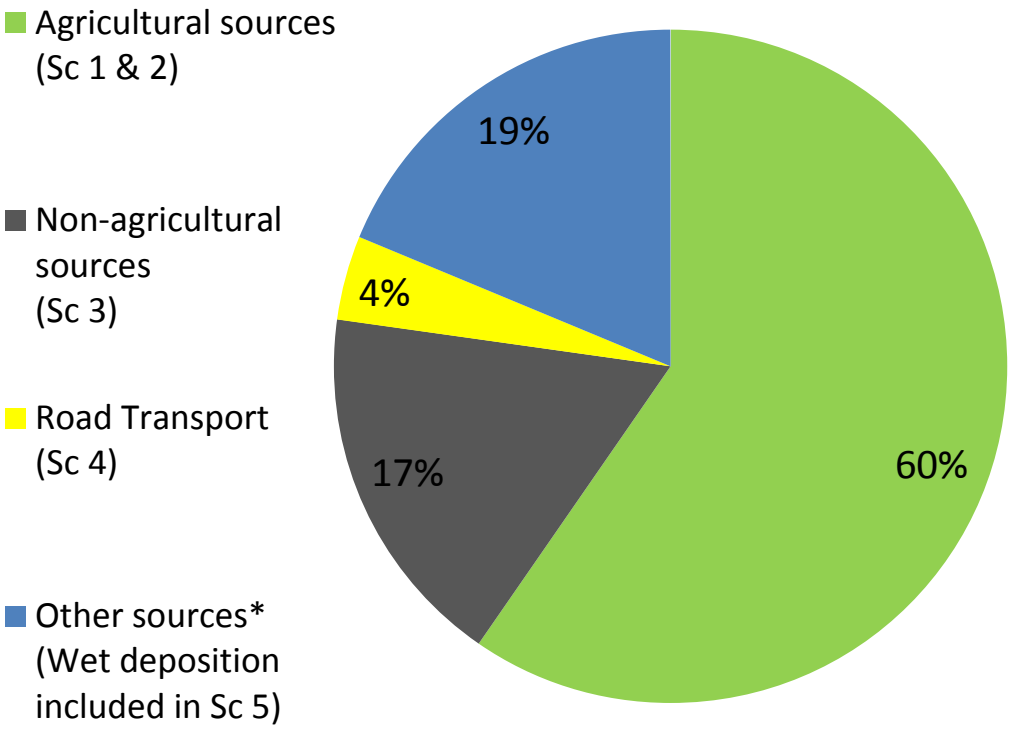
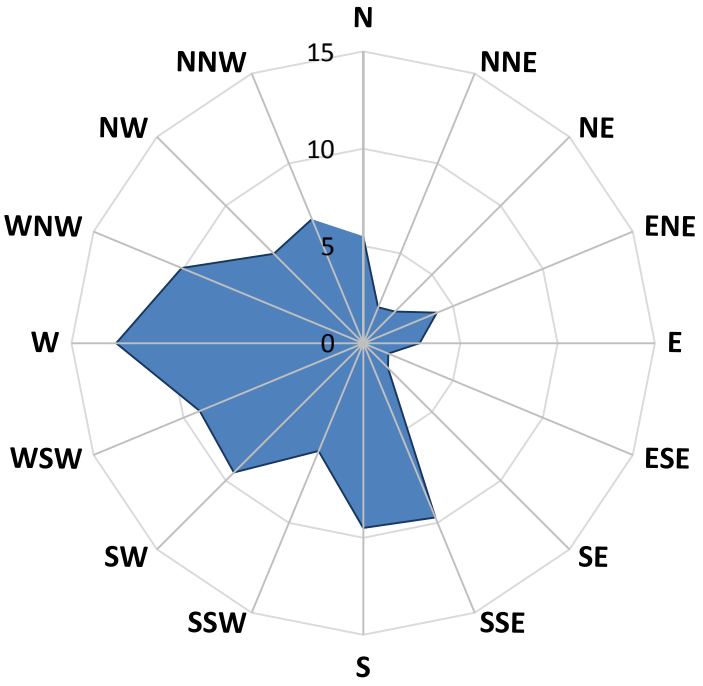
Initial RAPIDS Source Attribution





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Data sources:

- *RAPIDS Scenario allocation (2014)*
- *Windfinder.com (Holsworthy)*

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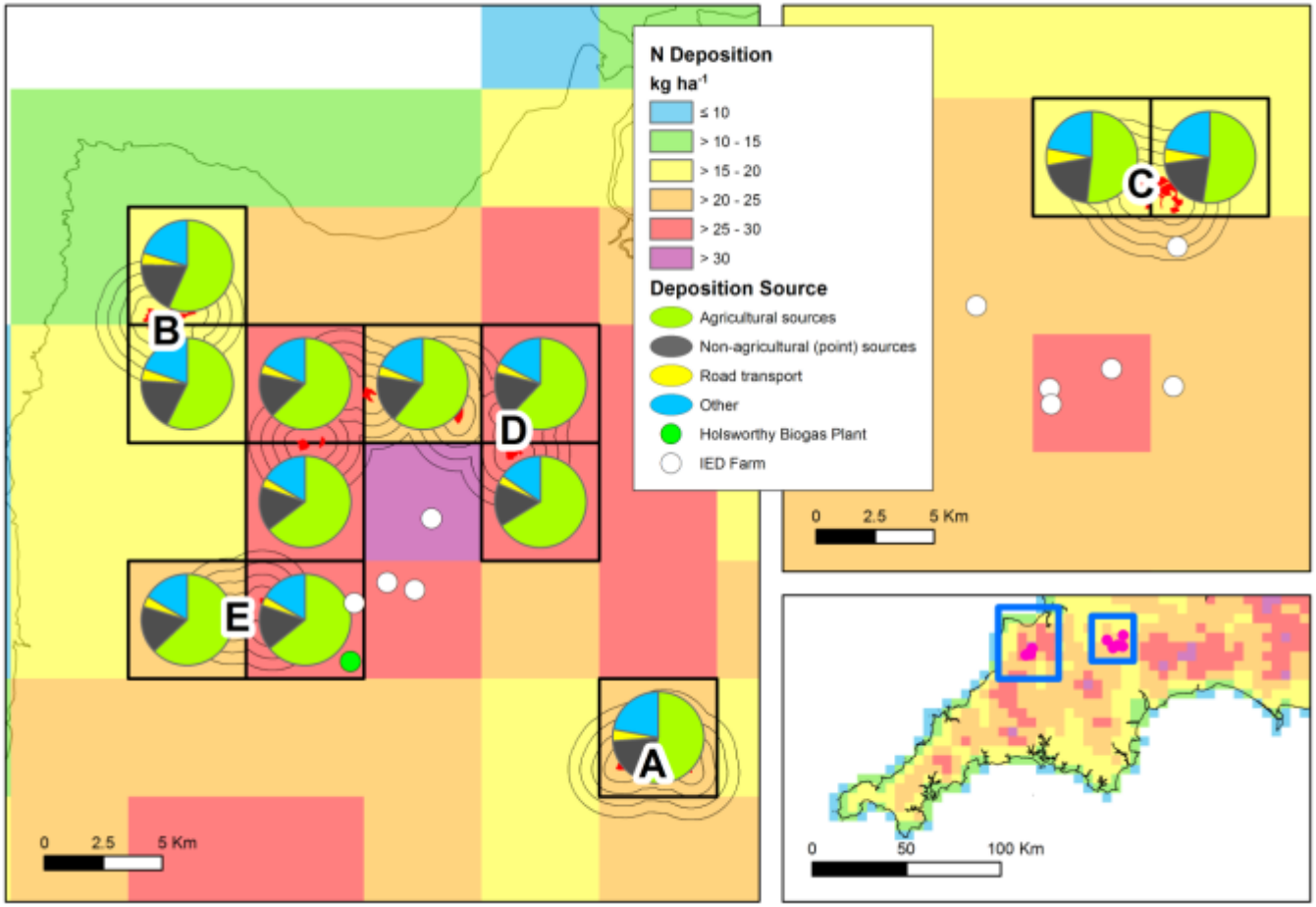
N Deposition & Source Attribution

Taking into account site variability for sub-sites



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Data sources:

- *UK N Deposition 2010 – 2012 (CBED)*
- *Source attribution 2005 (FRAME)*

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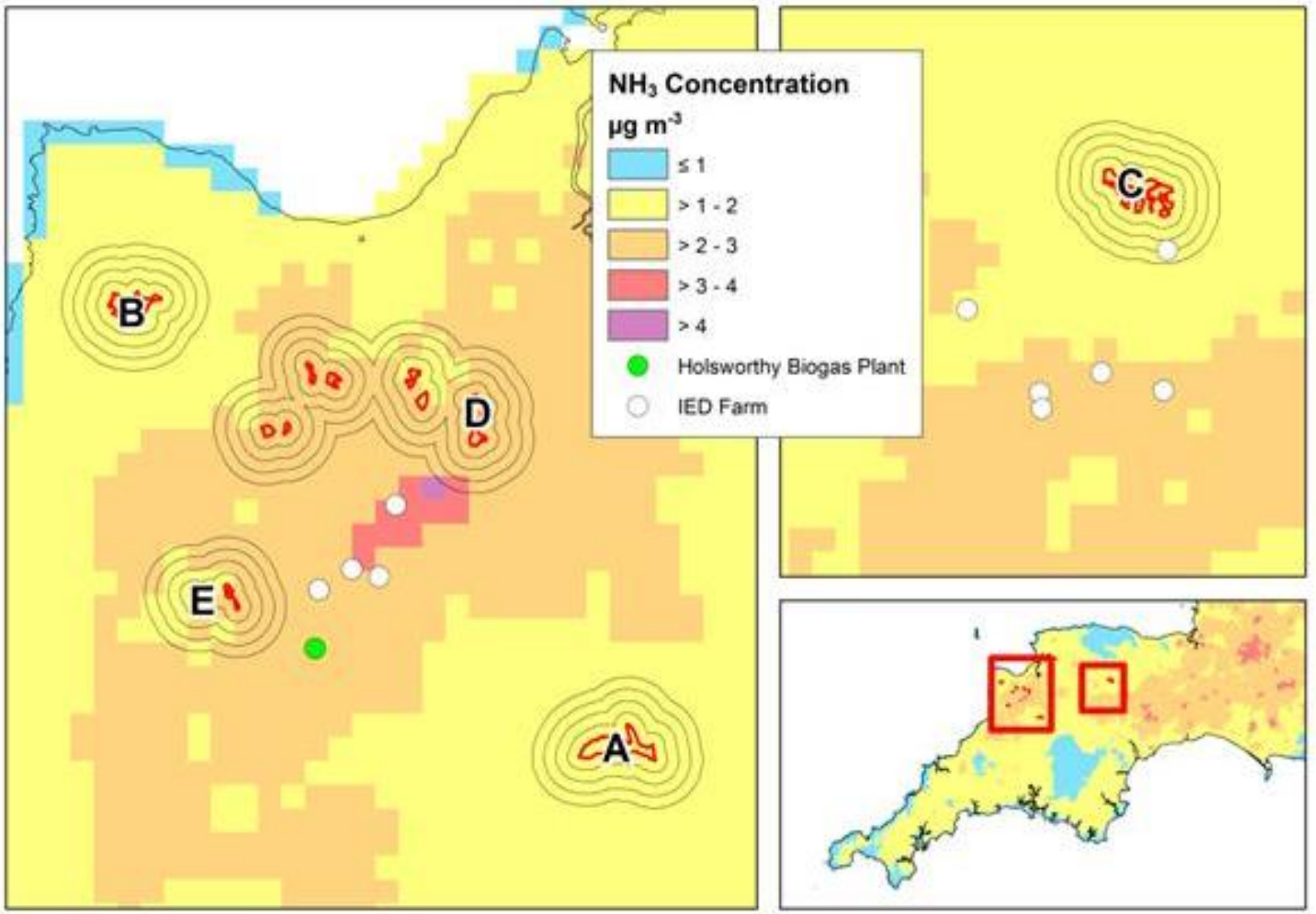
NH_3 Concentration



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Data sources:

- *FRAME 2011. 1 km grid*

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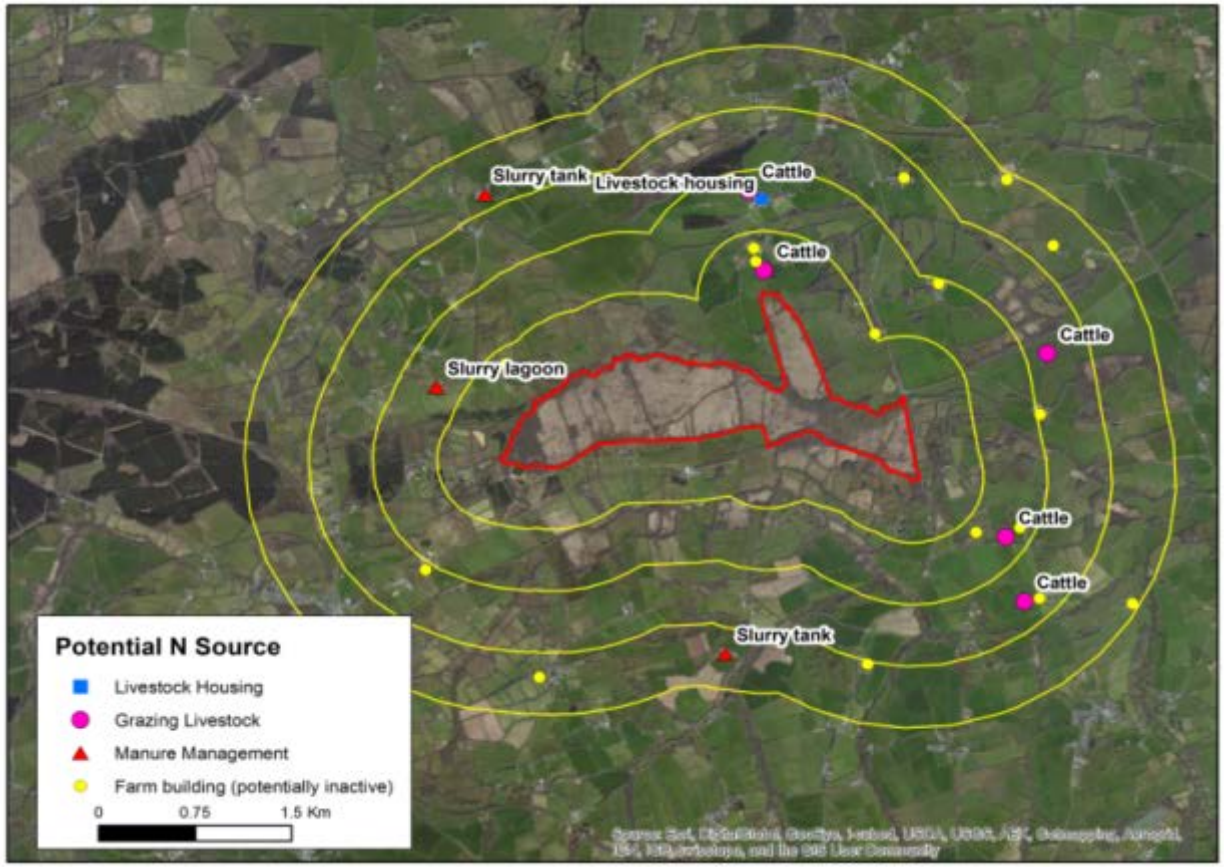
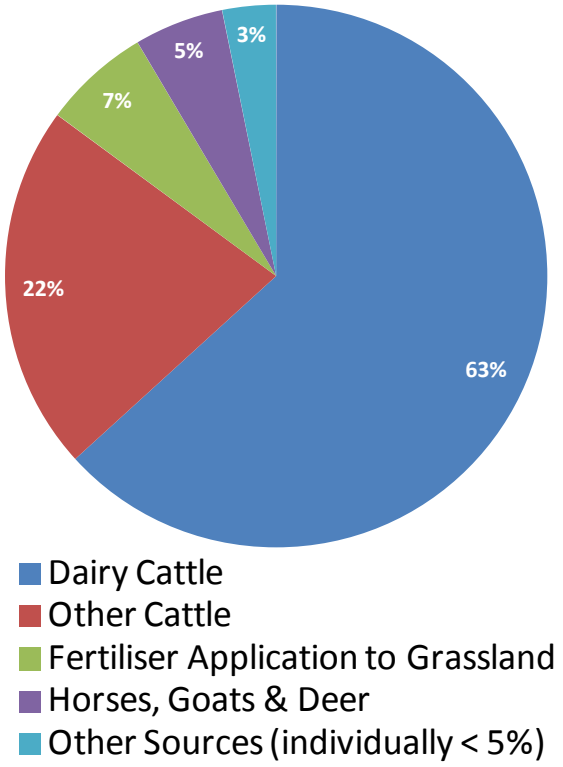
Agricultural Sectors (2 km radius) Sub-site A





Agricultural census data aggregated for 2 km zones around SAC to estimate agricultural NH_3 emissions

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Data sources:

- *2012 Agricultural Census*
- *UK Agricultural emission inventory (Misselbrook et al. 2013)*

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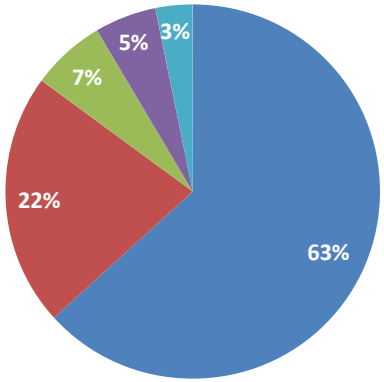
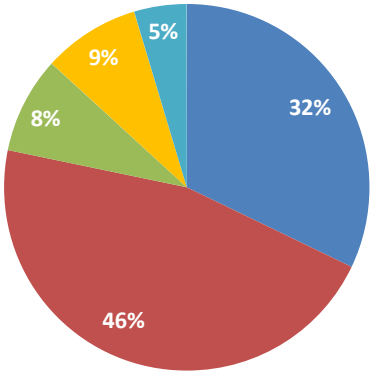
Agricultural Sectors (All Sub-sites)

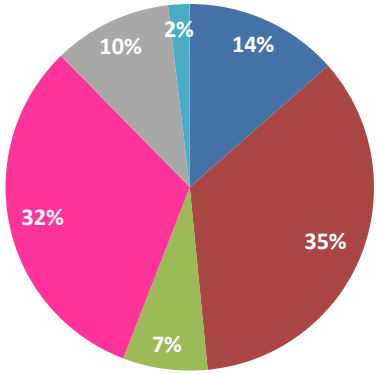
A
13 kg ha^{-1} yr^{-1}



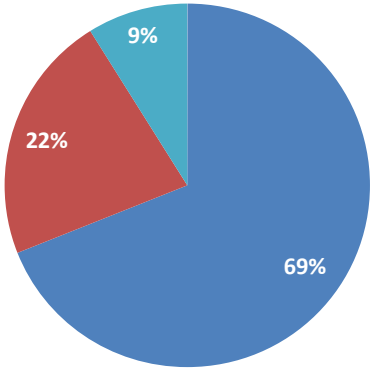
B
12 kg ha^{-1} yr^{-1}



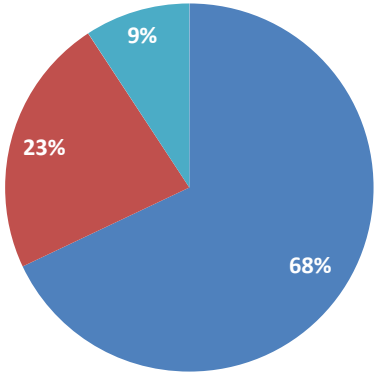
C
11 kg ha^{-1} yr^{-1}



D
34 kg ha^{-1} yr^{-1}



E
67 kg ha^{-1} yr^{-1}



- Dairy Cattle
- Other Cattle
- Fertiliser Application to Grassland
- Other Sources (individually < 5%)
- Horses, Goats & Deer
- Fertiliser Application to Crops
- Sheep
- Poultry

Data sources:

- *2012 Agricultural Census*
- *UK Agricultural emission inventory (Misselbrook et al. 2013)*

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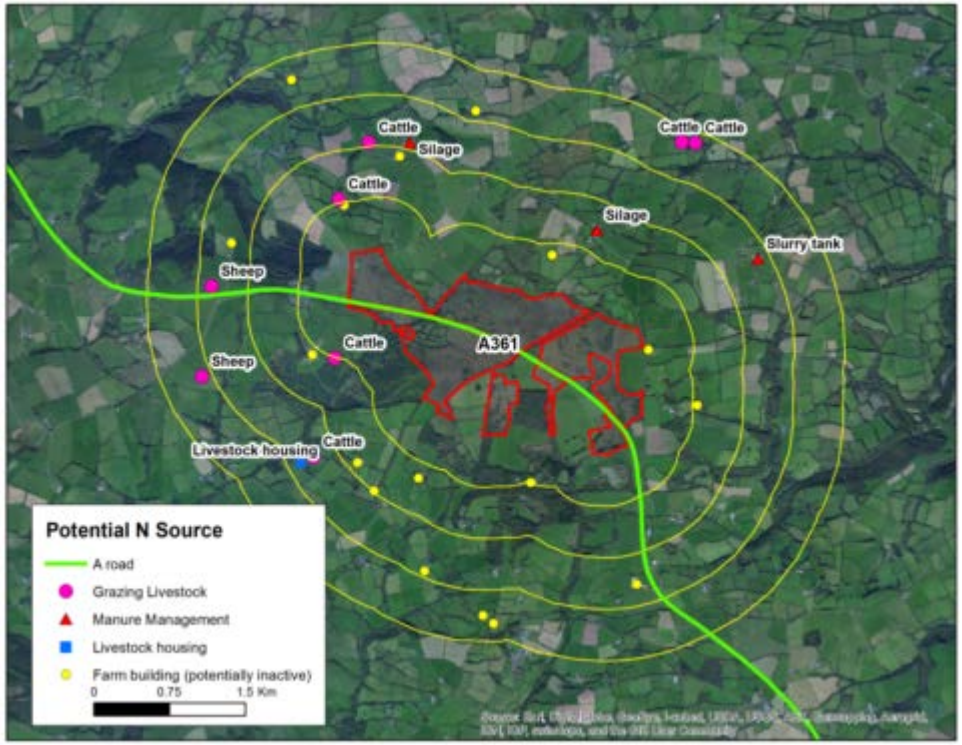
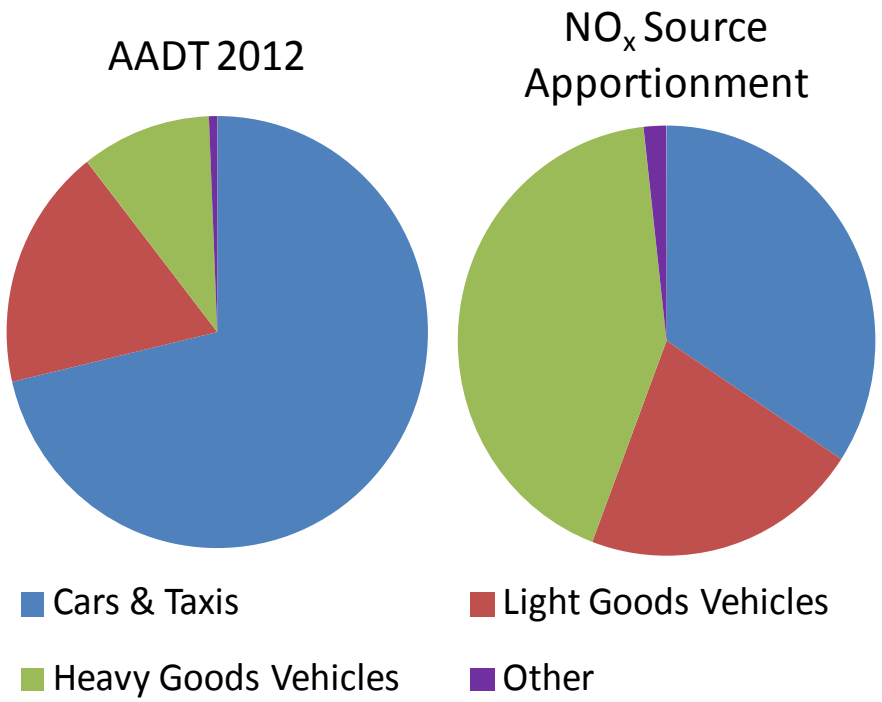
Road Transport Emissions (Sub-site C)

- Annual Average Daily Traffic (AADT) – 11,200 vehicles
- Estimated total NO_x emissions – 2.7 t NO_x km^{-1} yr^{-1}





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Data sources:

- *2012 AADT dataset (DfT)*
- *Emission Factor Toolkit v6.01 (Defra)*

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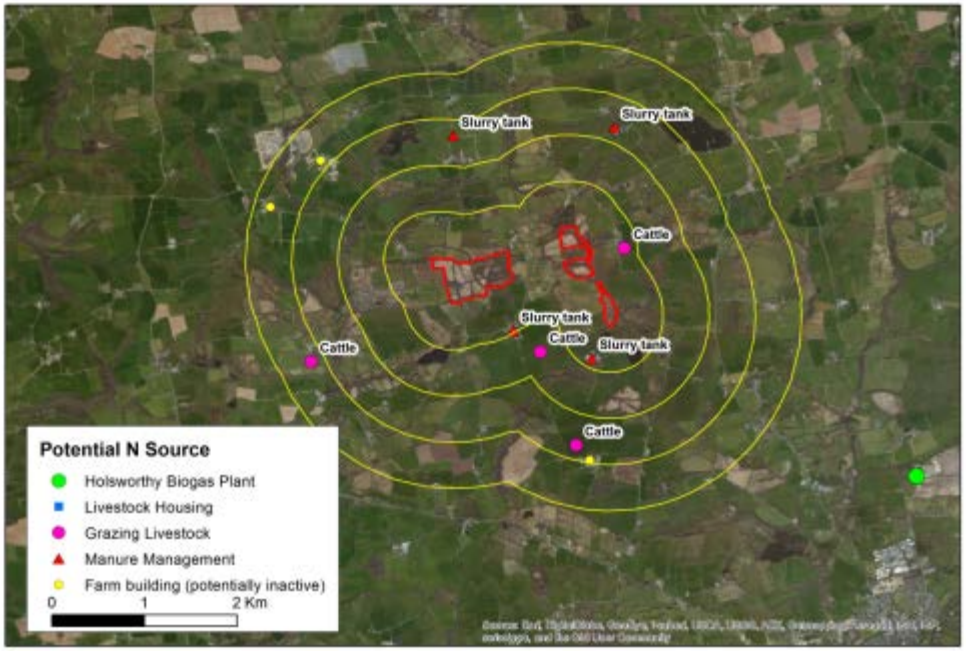
Non-agricultural N sources



- Anaerobic digestion plant at Holsworthy - ~ 3.6 km from site
- Storage and fugitive emissions > 40 t NH_3 - N yr^{-1} (equivalent to housing emissions of several thousand cattle)
- Land spreading of digestate >45 t NH_3 - N yr^{-1} up to 8 km from plant

Data sources:

- UK Non-agricultural NH_3 from AD (CEH, 2014)
- *Strathclyde University report: http://www.esru.strath.ac.uk/EandE/Web_sites/03-04/biomass/case%20studyhols.html*

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Summary of Potential Measures

- **Landspreading and storage of manures**
  (e.g. low emission manure spreading, covering manure stores)
  see IPENS-050 project for details
- **Low emission zones around site boundaries**
  (reduced fertiliser and manure spreading)
  e.g. potentially through successor to Higher Level Stewardship Scheme (NELMS)
- **Tree belts**
  downwind of large emission sources and/or next to SAC boundary upwind of prevailing wind direction (e.g. woodland grant schemes)
- **Acidification of digestate** from AD plant