

Understanding modelled air quality risk assessments and site specific responses to ammonia pollution

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Background

- Intensive livestock units over a certain size need to apply to EA for an Environment Permit
 - EA model emissions and deposition of Ammonia (NH_3)
 - NE and CCW are consultees in this process
 - the application triggers an assessment under either Habitats and Species Regs. (2010) [Natura 2000 sites] or CROW Act (SSSI's)
- Between 2008 and 2010 NE conducted or commissioned botanical surveys at 56 SSSIs located close to intensive pig/poultry units
 - many of these reported some evidence of effects consistent with NH_3
 - a significant proportion reported no evidence of effects detectable despite modelled NH_3 critical load/level exceedance
- In 2011 NE issued a tender for a project to investigate the factors that might lead to differences between the modelled risk assessment and site survey results

Aim and Objectives

Aim:

- to improve our understanding of the site-specific pollution response and to determine whether individual site surveys are a useful and reliable tool in air pollution impact assessments/environmental permitting

Objectives:

- 1) review the findings of the 56 ecological surveys
- 2) categorise the sites into those with and without evidence of effects consistent with ammonia impacts
- 3) investigate the quality and attributes of site surveys, together with the site and farm characteristics to see if the difference in survey outcomes could be explained
- 4) appraise the use of modelling assessments and site surveys in environmental permitting

Methodology

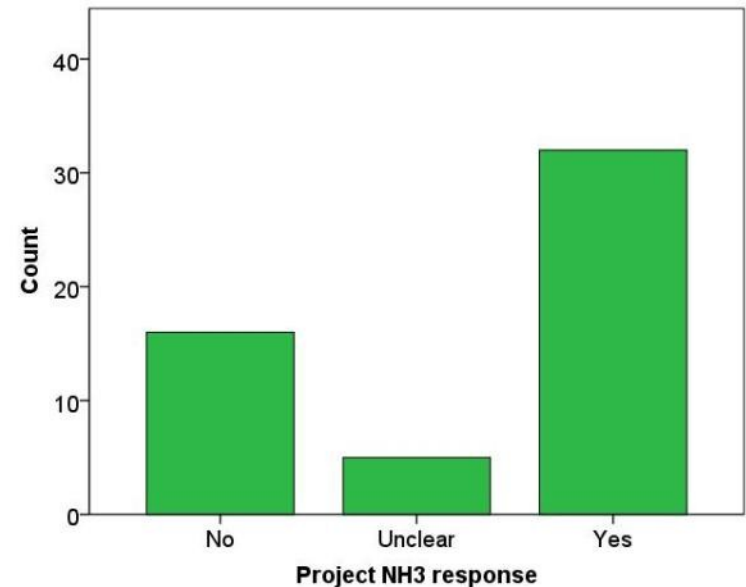
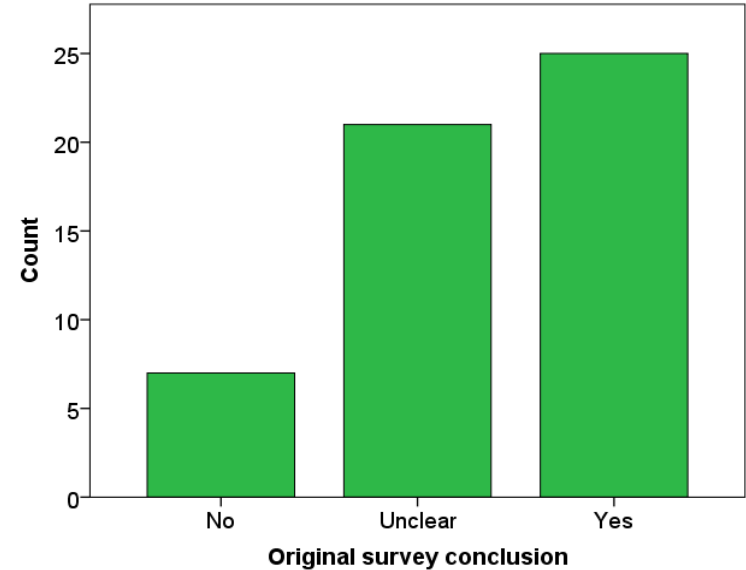
- Review the surveys undertaken
 - split into specialist habitats to 5 scientists
 - QC of 20% of reports & discussion across group
- Review site modelling of Process Contribution, Predicted Environment Concentration at site, calculate area-weighted mean $\text{NO}_x + \text{NH}_y$ concentrations and deposition
- Collate metadata consisting of survey details, farm, site and pollutant data, expert summary of survey

Methodology cont...

- Categorisation of sites:
 - sites with evidence of impact consistent with the effects of ammonia (Group A)
 - sites with no evidence of impact (Group B)
- Analysis of metadata and common factors to determine if any influenced the likelihood of finding a eutrophication response

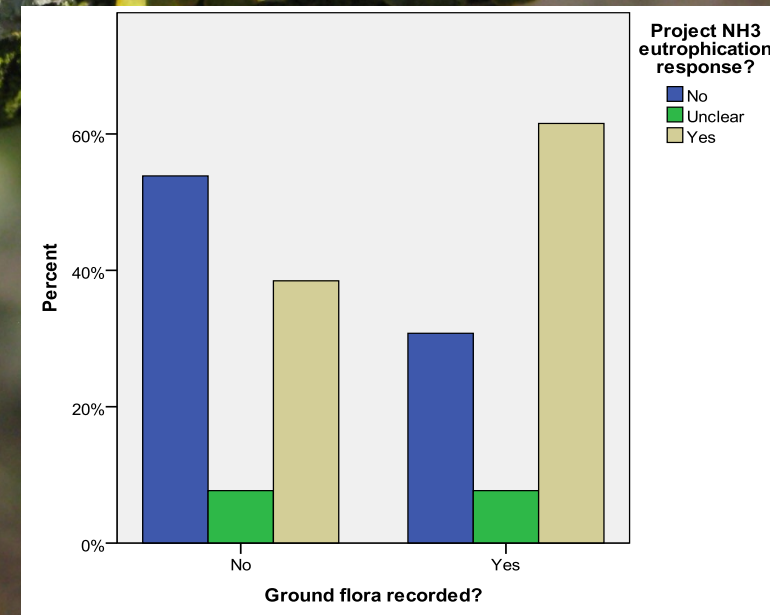
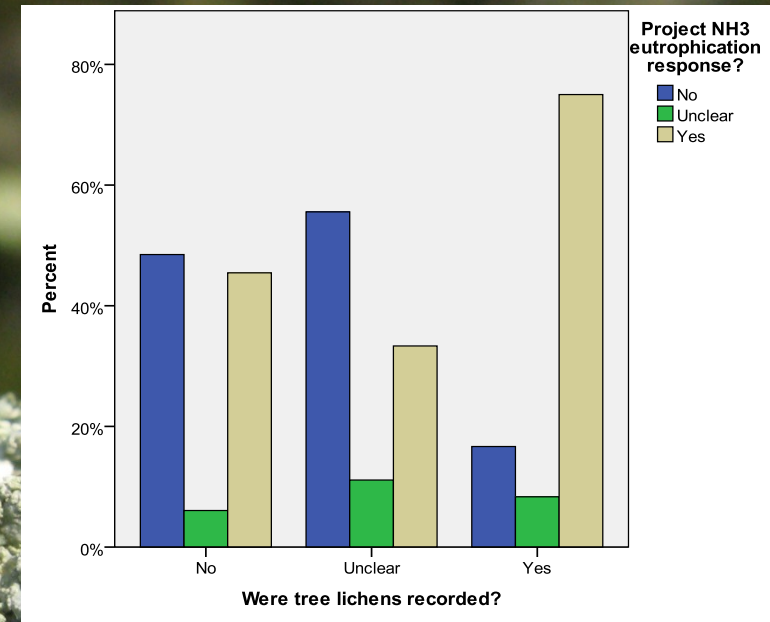
Site categorisation

- From our review of the surveys we were able to reduce number of 'unclears'
 - by applying a consistent methodology
 - e.g. presence of lichen *Xanthoria* on trees was a +ve response
 - using expert knowledge from our experiments and survey work



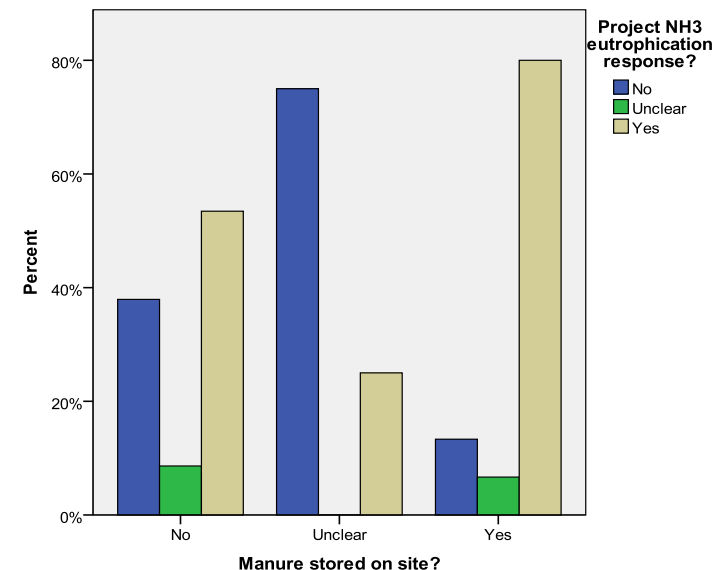
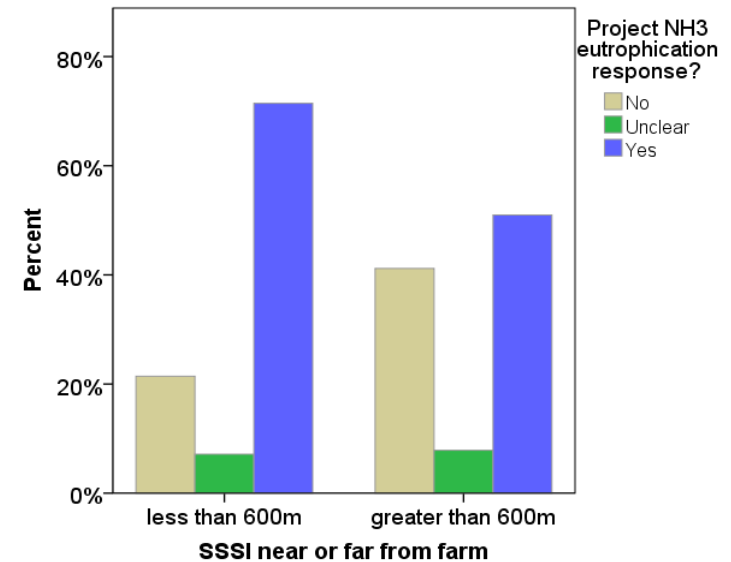
Analysis: Does it matter what is surveyed?

- were Epiphytic lichens recorded?
 - surveys which targeted lichens had a greater % chance of indicating eutrophication (Chi-square 10.2, df=4, $P < 0.05$)
- were ground flora observed?
 - possibly but NS
- Historical data
 - apparent response but NS
 - inconsistencies between surveys
- 'Gradient' surveys
 - some response but NS
 - true gradients rare
- one-off Ellenberg indices no response
 - needs a context of change



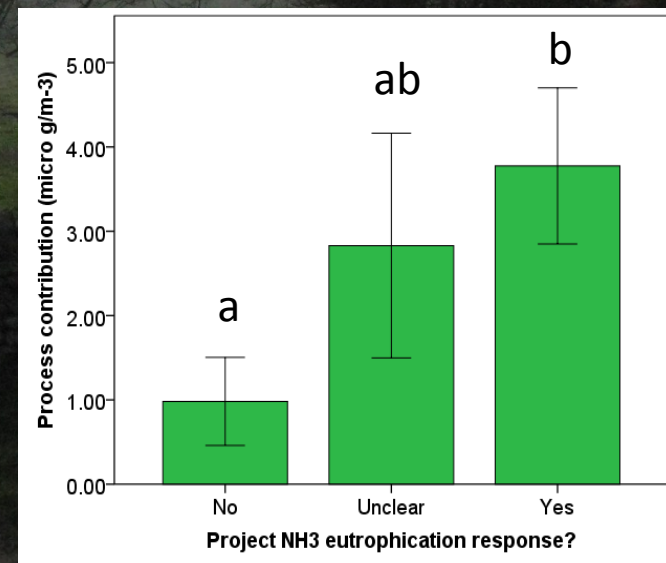
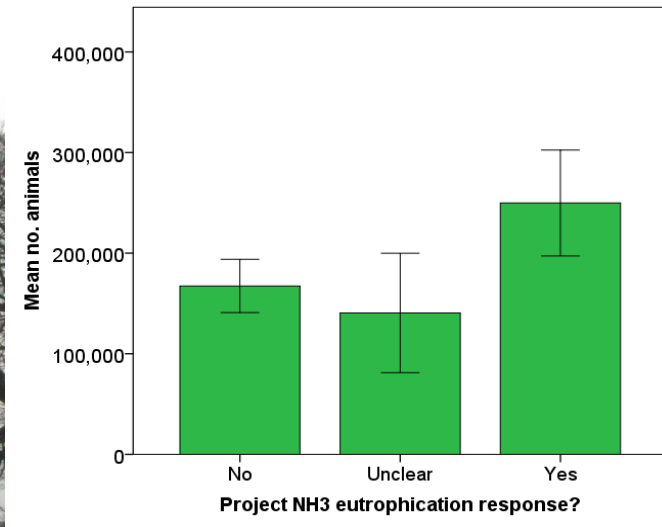
Analysis: Do SSSI site attributes influence outcome?

- Sites closer to a farm appear more likely to show a response (NS)
- On-farm manure storage
 - NS response
 - variation in storage/ventilation methods
- Angle (no response)
- Presence of a tree buffer
 - no response
- Management/Restoration
 - no clear response



Analysis: Pollution attributes

- Does no. of animals on farm change the response?
 - small response (NS)
 - different species and influenced by other factors – better shown by PC
- Process contribution (PC)
 - sites with +ve response had a significantly higher PC (mean $3.8 \mu\text{g NH}_3 \text{ m}^{-3}$) than those without ($0.98 \mu\text{g NH}_3 \text{ m}^{-3}$) (KW, test statistic= 10.0, df=2, P=0.007)
- PEC
 - response indicated but NS
- Other pollutant attributes
 - no response



Summary

- modelling of an exceedance of Critical loads or levels indicates a *risk* of damage, over the long-term
 - it doesn't provide evidence of damage
 - **however, sites with a higher PC were more often found to show evidence of eutrophication**
- one-off botanical surveys have limited value
 - need for baseline data – what was the site like before-N?
 - variation in survey methodologies meant direct comparisons between sites was difficult
- lower plants were particularly sensitive and a specialist should be used
- presence of confounding factors such as management makes interpretation difficult

Recommendations

- botanical surveys are useful and can be used to:
 - to identify the presence of sensitive habitats/species
 - surveys used as a baseline for future change and monitor over long-term
 - however, methodology must be consistent and tightly controlled
- a multi-indicator approach would provide a much more comprehensive interpretation of nitrogen eutrophication for site monitoring:
 - survey data and physical monitoring
 - risk assessment modelling
 - and preferably foliage or soil samples for nitrogen chemistry
 - however, difficult interpretation of surveys makes legal implementation difficult
- CSM could be modified to include a simplified air pollution impact assessment based on revised survey protocols

A scenic landscape featuring a dense field of purple heather in the foreground and middle ground. Interspersed among the heather are patches of bright yellow gorse. In the background, a line of trees is visible, including a prominent tree on the right with autumn-colored leaves. The sky is clear and blue. A white rectangular box with the text "Thank you!" is centered in the image.

Thank you!