Markers and indicators of nitrogen enrichment

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Pollution Markers

Predictable change in physiology or chemical composition of organisms

Predictable change in ecosystem processes

Pollution Indicator Species

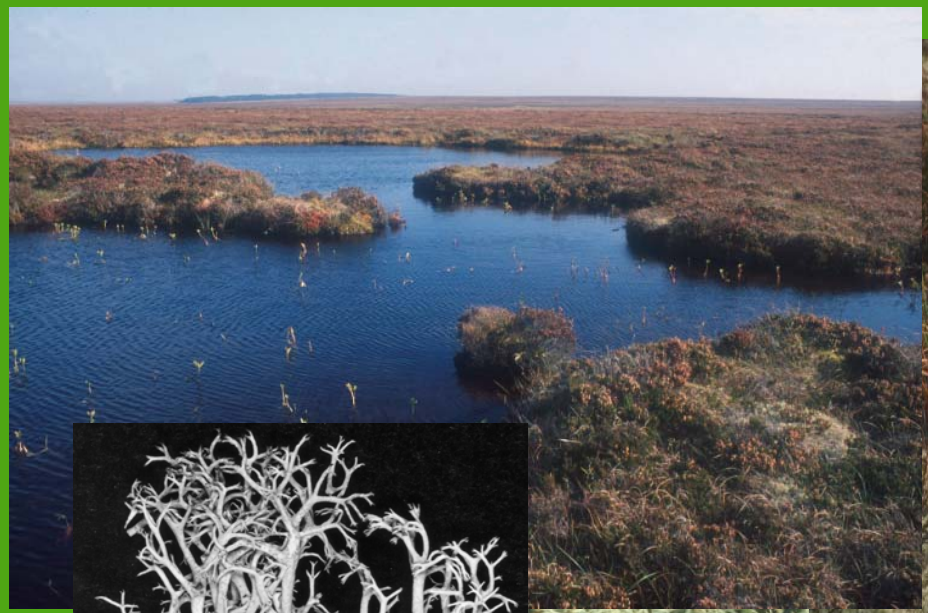
Predictable change in geographical distribution

GANE research theme:

Effects of nitrogen deposition in remote regions where there may be little data on deposition rates

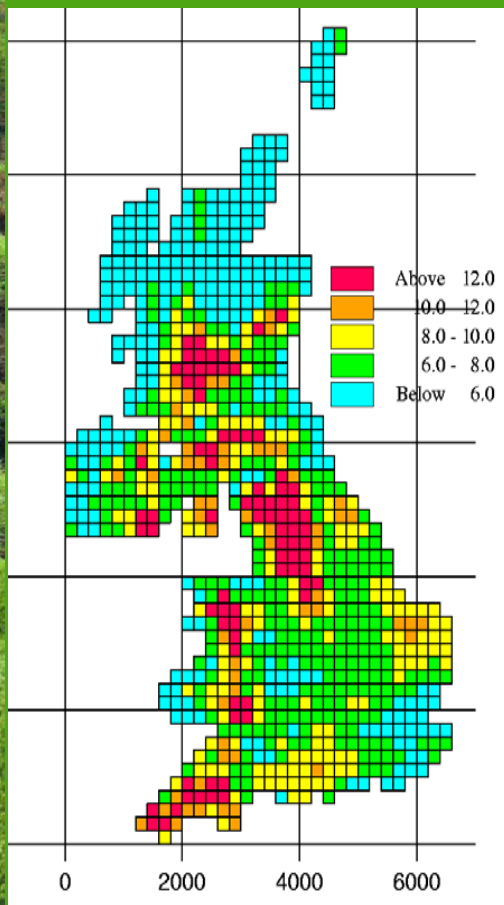
GLOBAL NITROGEN ENRICHMENT

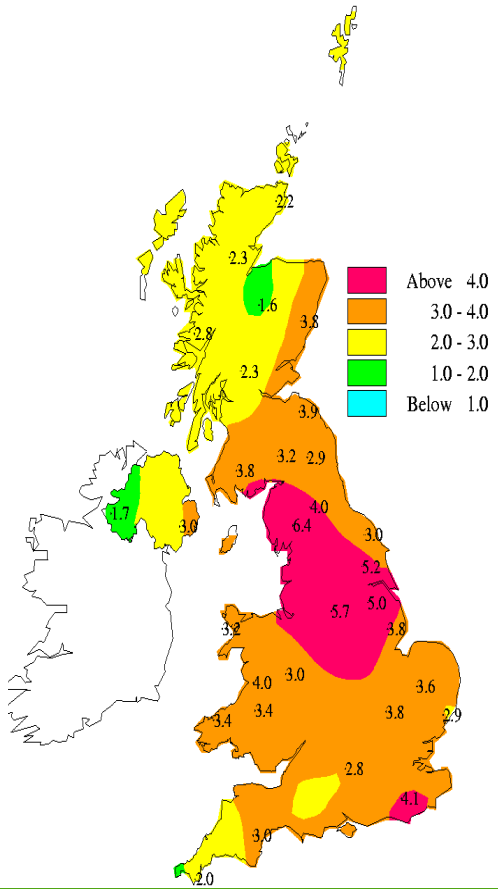
The heathland lichen *Cladonia* provides a marker for N deposition



GLOBAL NITROGEN ENRICHMENT

Chemical markers in *Cladonia portentosa* for nitrogen deposition





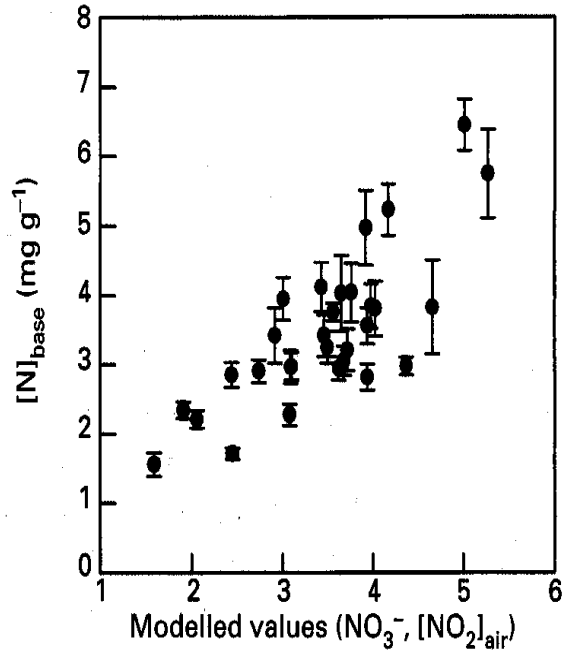


Figure 6. The relationship between measured $[N]_{base}$ and values predicted from NO_3^- deposition and $[NO_2]_{air}$ (Table 5: $[N]_{base} = 1{\cdot}07 + 5{\cdot}15 \times (NO_3^-$ deposition g N $yr^{-1}) + 0{\cdot}15 \times ([NO_2]_{air}$ ppb)). Plotted values are means ± 1 SE (n = 5–10).

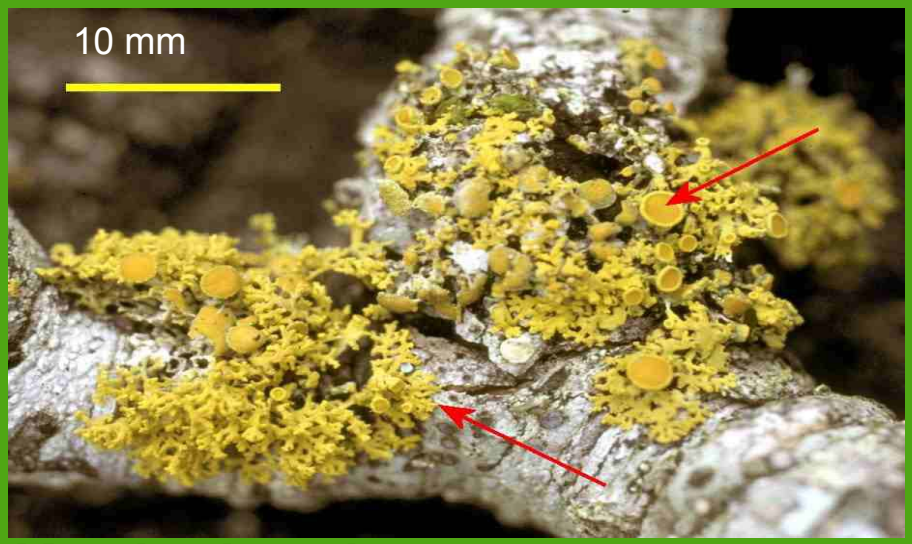
Total inorganic N deposited in rainfall

Interpolated N concentration in lichens

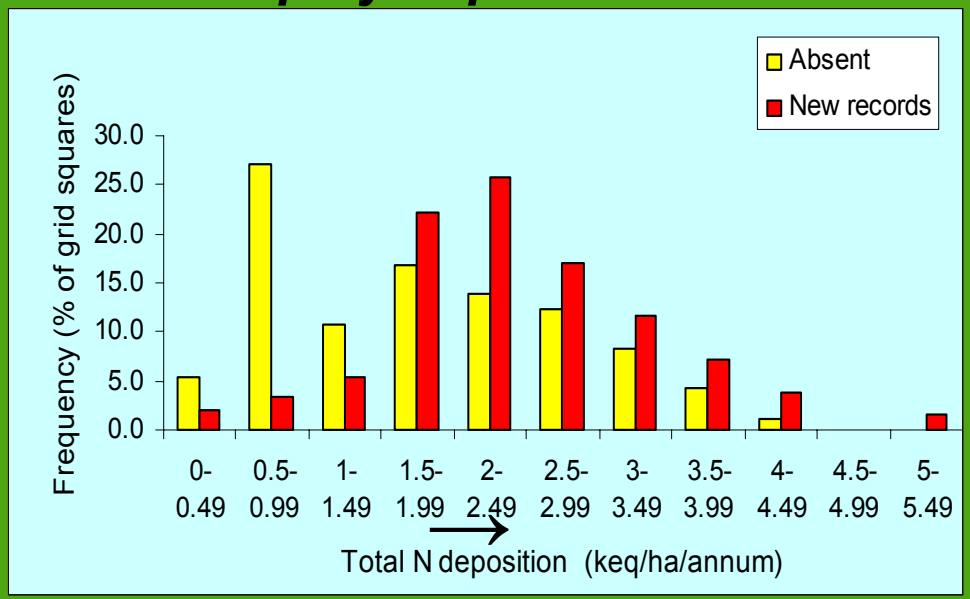
Observed vs predicted N values in lichen

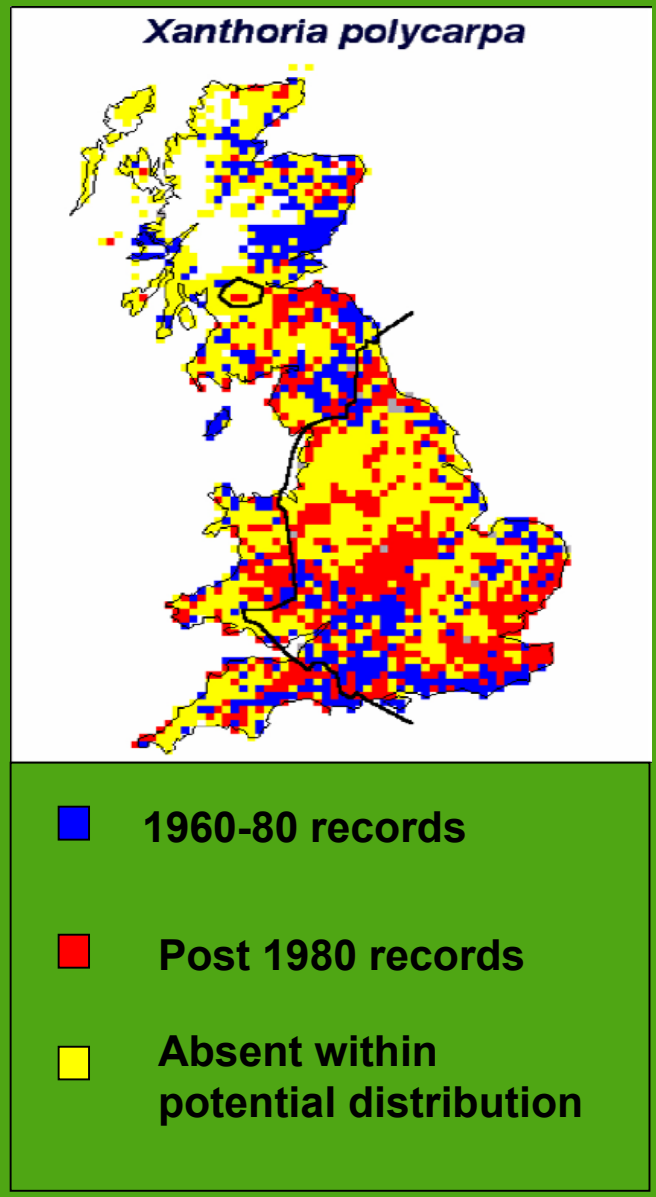
GLOBAL NITROGEN ENRICHMENT

Lichen bioindicators of N enrichment



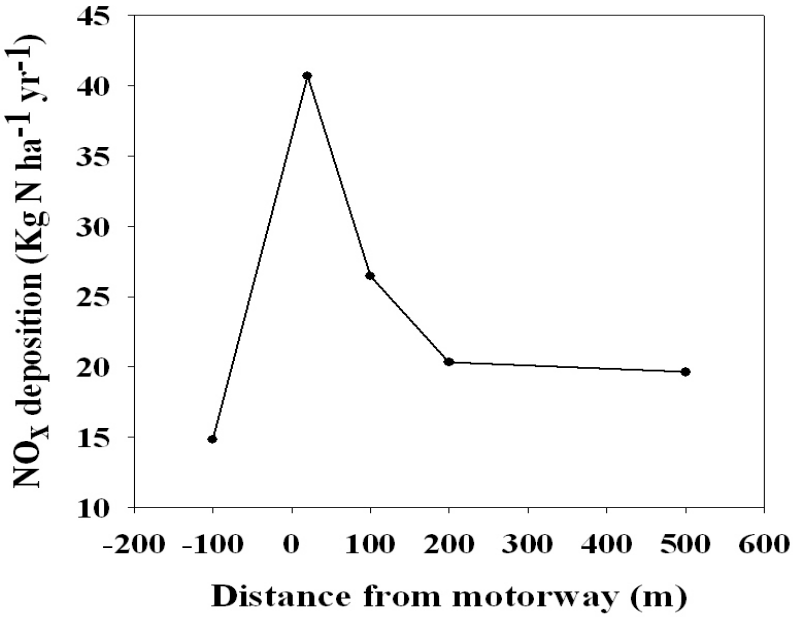
Xanthoria polycarpa

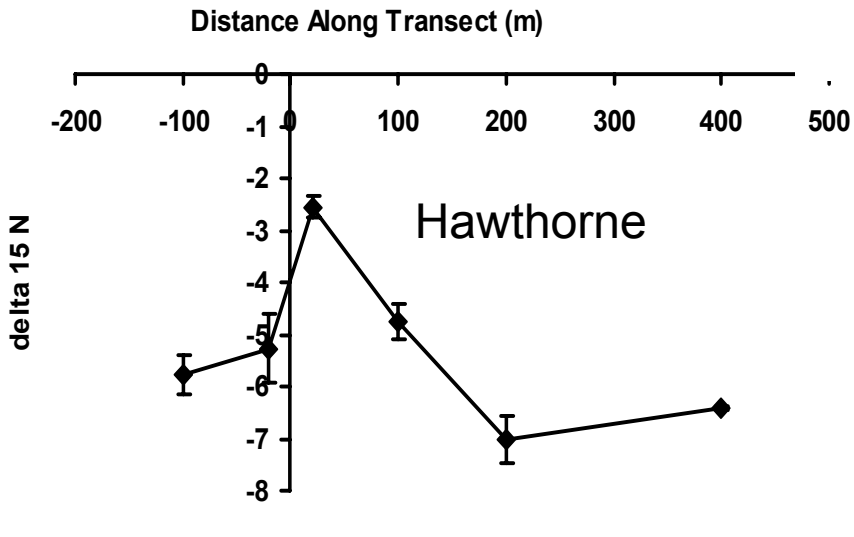




GLOBAL NITROGEN ENRICHMENT

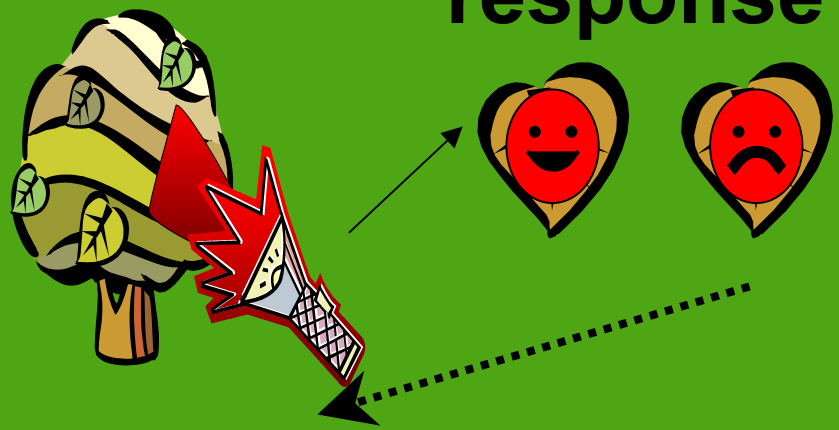
N emissions from road traffic – tree biochemical markers

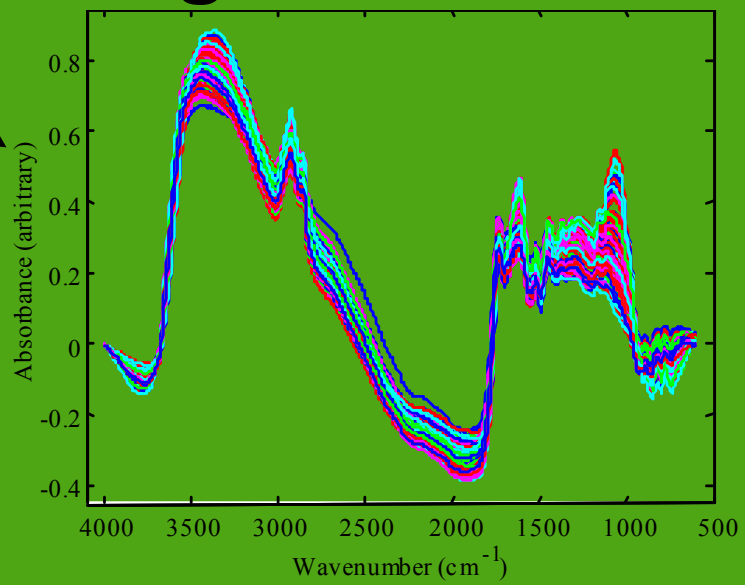


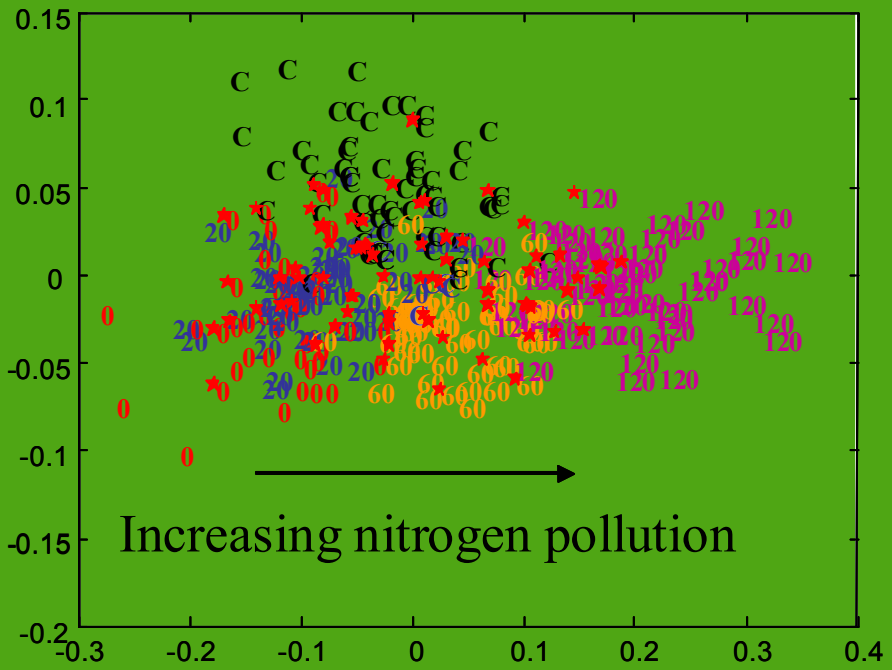


GLOBAL NITROGEN ENRICHMENT

Metabolic fingerprinting for plant response to nitrogen







- Metabolic fingerprinting can detect increasing levels of nitrogen pollution in heather shoots.
- Numbers correspond to quantity of nitrogen pollution the plant receives (kg ha^{-1} yr^{-1}).

GLOBAL NITROGEN ENRICHMENT

Markers for N enrichment in freshwater lakes

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Markers for N enrichment in freshwater lakes

Lake macrophytes: algae, bryophytes, charophytes

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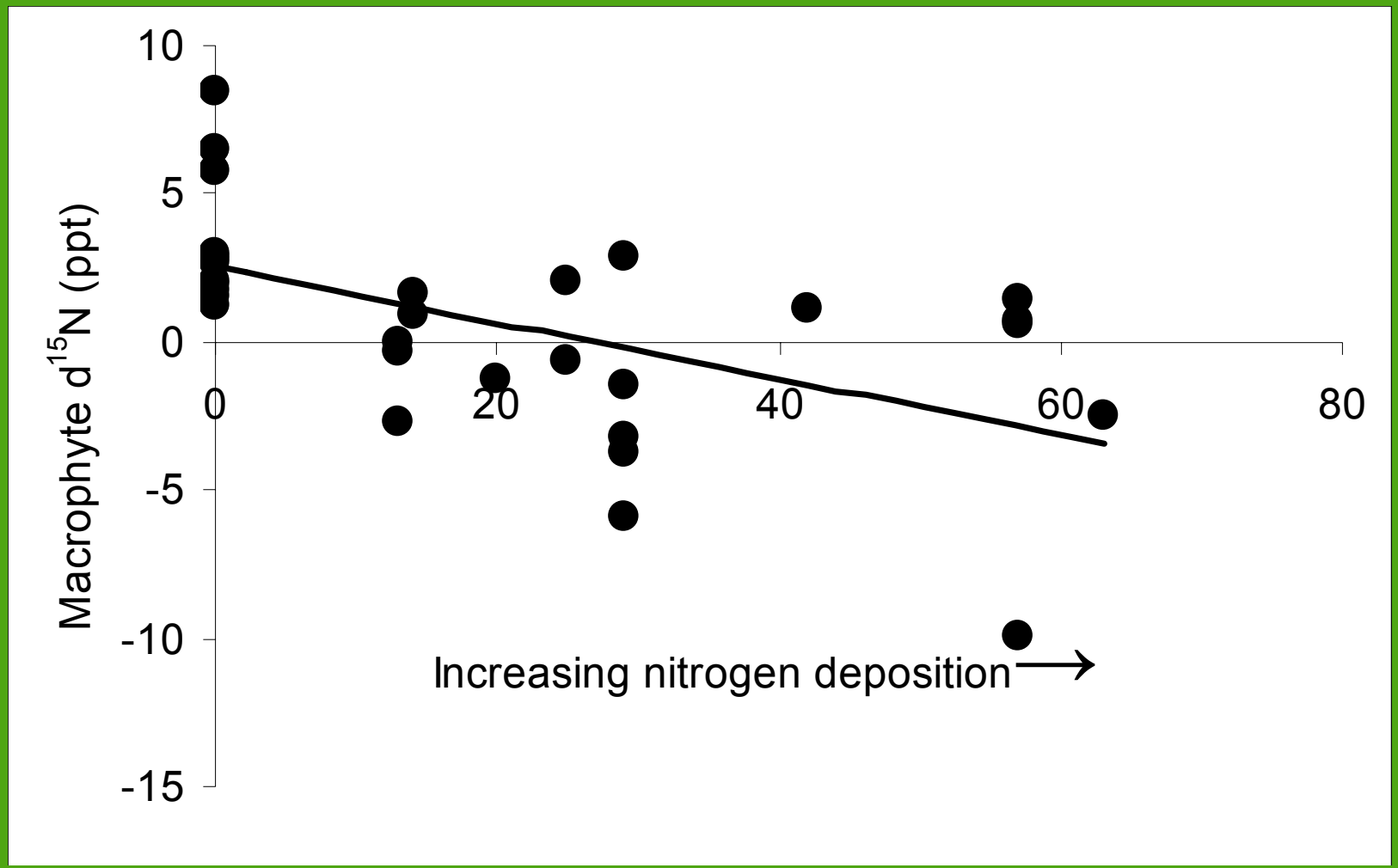
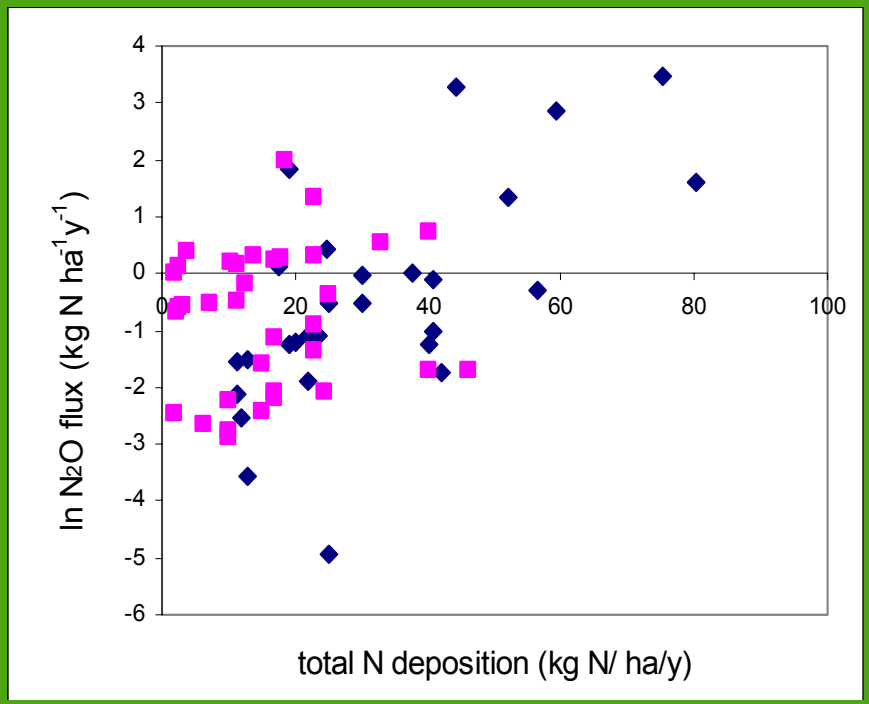
Markers for N enrichment in freshwater lakes



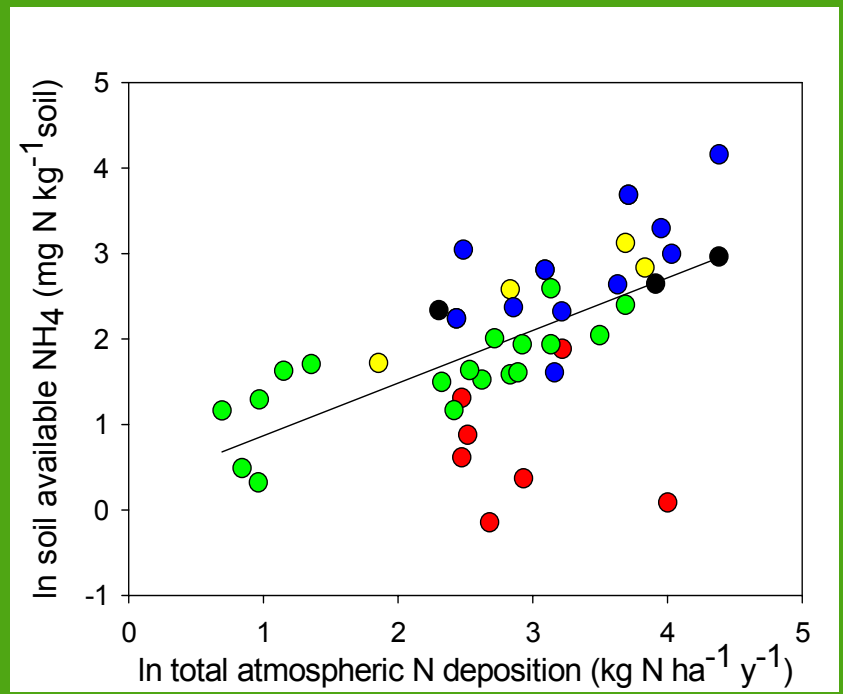
GLOBAL NITROGEN ENRICHMENT

Soil markers for N deposition

Enclosures to measure gaseous emissions from soil



Nitrous oxide (N_2O) production



Ammonium ion (NH_4+) concentration

Markers and indicators - Summary

Lichens

Chemistry of tree leaves

Metabolic fingerprinting

Chemistry of lake marcophytes

Soil processes / chemistry

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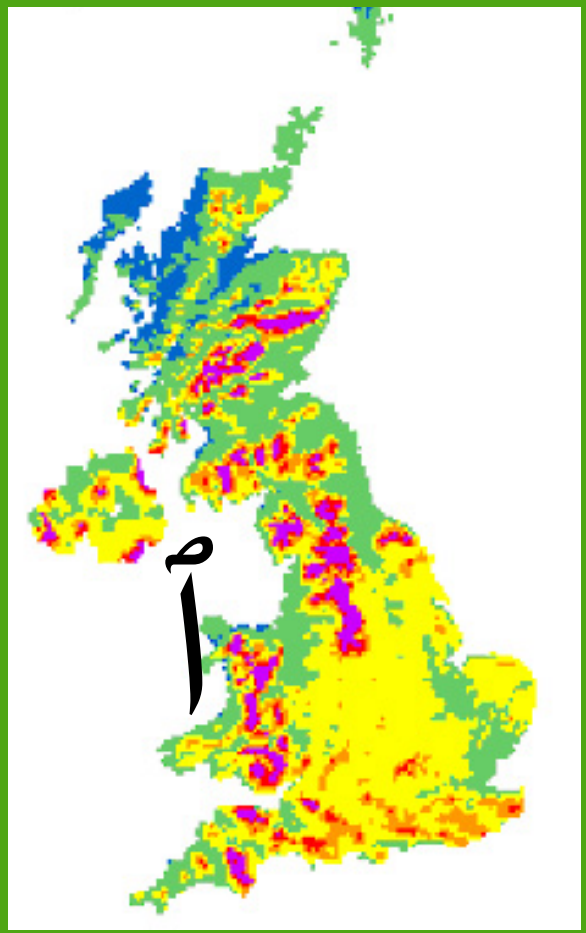
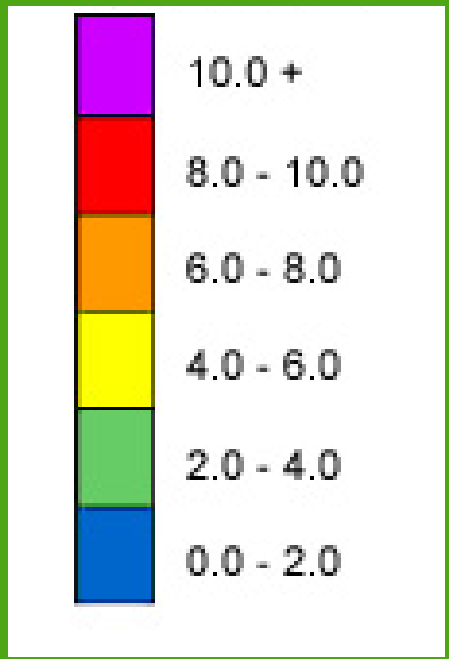
GLOBAL NITROGEN ENRICHMENT

Pollution mapping with biological markers/indicators



Kg N ha^{-1} y^{-1}



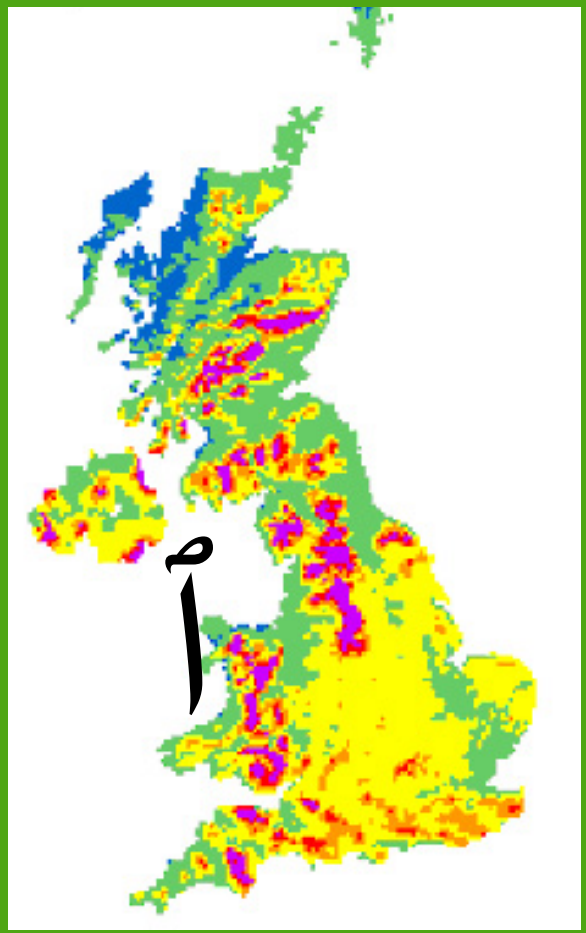
Annual nitrogen deposition in precipitation over the UK

(based on 32 monitoring stations)

Highly interpolated deposition maps could be verified using biological markers/indicators

GLOBAL NITROGEN ENRICHMENT

Pollution mapping with biological markers/indicators



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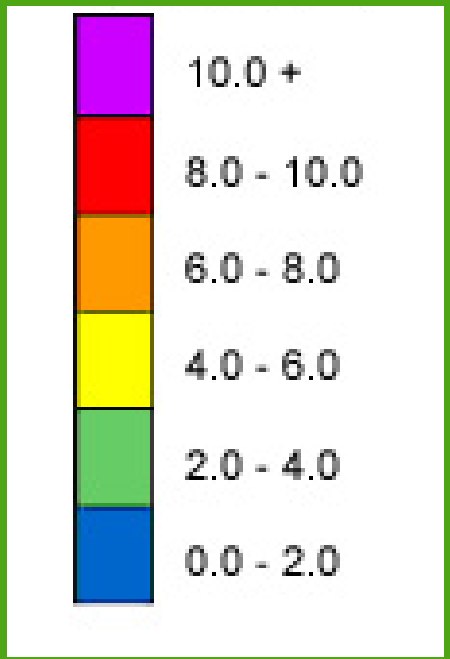

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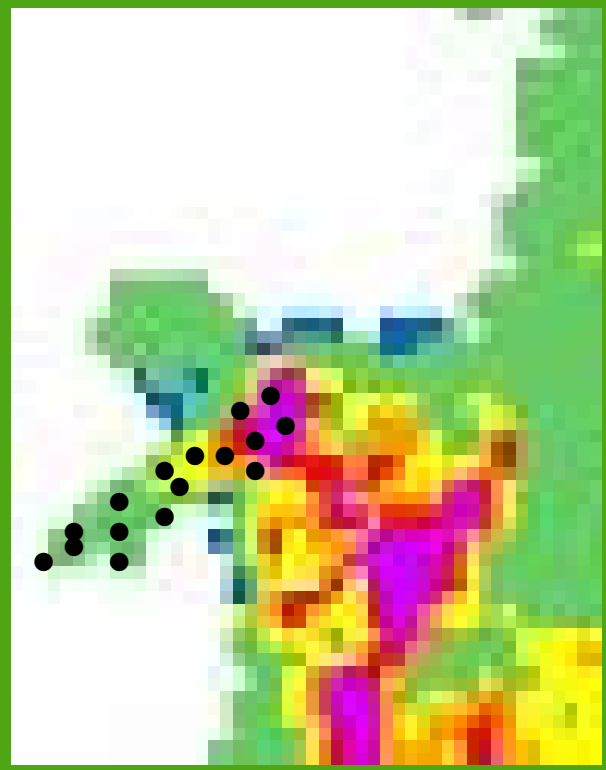

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