



40 years of rising nitrates and future concentrations in UK groundwater

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Abstract no. 1868

- 1. Introduction
- 2. Historical nitrate trends
- 3. Current nitrate concentrations
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- 5. Modelling risks and trends
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Historical nitrate trends – 1962-1973

Nitrate applied as fertiliser

Nitrate in abstracted groundwater

43rd

AH

congress

25-29th September 201

Montpellier,



From Foster and Crease, 1974

27/09/2016

The hills are alive with nitrates

Historical trends 1980s

- 1980 Drinking Water Directive set limit of 50 mg/l as NO₃
- At first UK interpreted this
 as an average, but applied to any sample late 1980s
- 1991 Nitrates Directive 10 Nitrate Sensitive Areas, (increased to 32). Advice to farmers on reducing nitrate loss



New Scientist, 10/12/1987



Nitrates now

- Nitrate Vulnerable Zones cover 58% of England
- Catchment based approach to minimise water treatment requirements
- Collaboration between water companies and farmers initially successful with point sources and spikes







Fertiliser application, 1980-2014



From British Survey of Fertiliser Practice, 2015





Conceptual Model – sandstone aquifer



Sherwood Sandstone

Chalk aquifer



UK's 2nd most important aquifer, in northern and central England

Slightly cemented red sandstones

Significant primary porosity & permeability

Dual permeability where fractured

UK's most important aquifer, in southern and eastern England

Soft white limestone, dual porosity

Matrix - high porosity, low permeability

Fractures – low porosity, high permeability



Nitrate trends – Sherwood Sandstone aquifer





Nitrate trends – Chalk aquifer



Predicted trends and catchment management - Sandstone





Predicted trends and catchment management - Chalk





Travel times through Unsaturated Zone





Sensitivity map based on USZ thickness, land use and recharge



Cost Benefit Analysis





Conclusions

- Ongoing inputs of nitrates from agriculture
- Sandstone aquifer shows lower rise and future decrease
- Catchment management can be effective in the long term
- BUT not in the short-medium term, due to unsaturated zone thickness and aquifer properties, eg Chalk
- Practical considerations and cost limit the extent of catchment management measures
- GIS based approach allows selection of priority areas, most promising for catchment management
- This was combined with modelling to estimate the rate and amount of changes in concentrations.





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