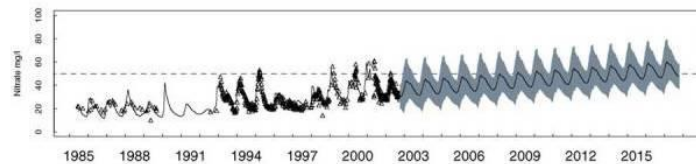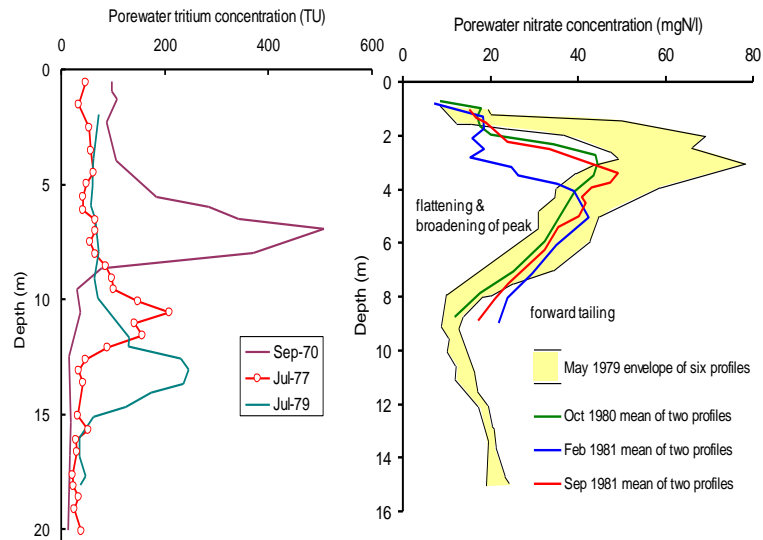MATTHEW ASCOTT, DAN LAPWORTH, LEI WANG, MARCO BIANCHI, BEN MARCHANT

Nitrate in groundwater
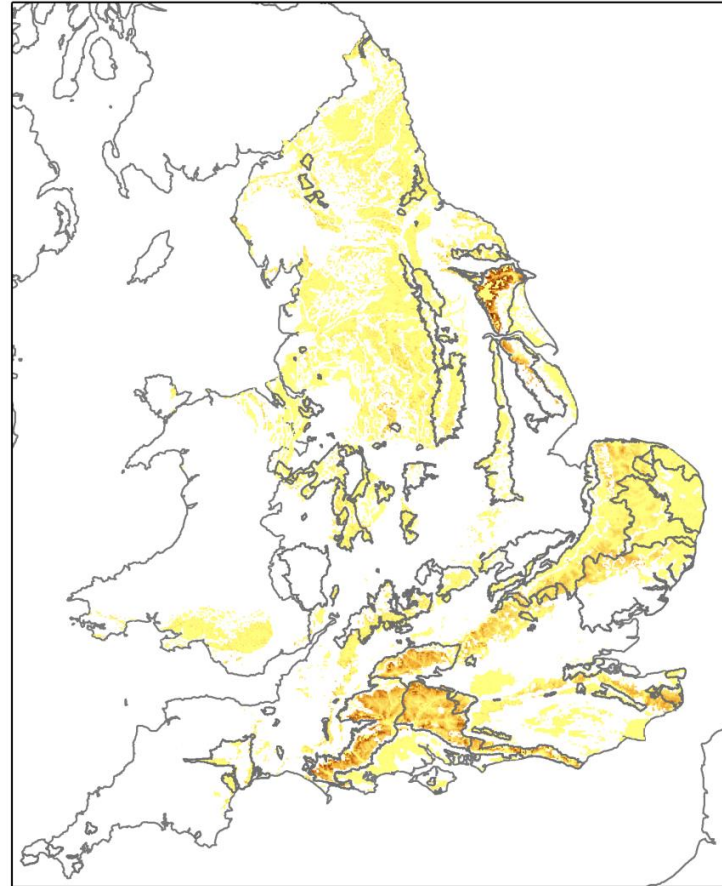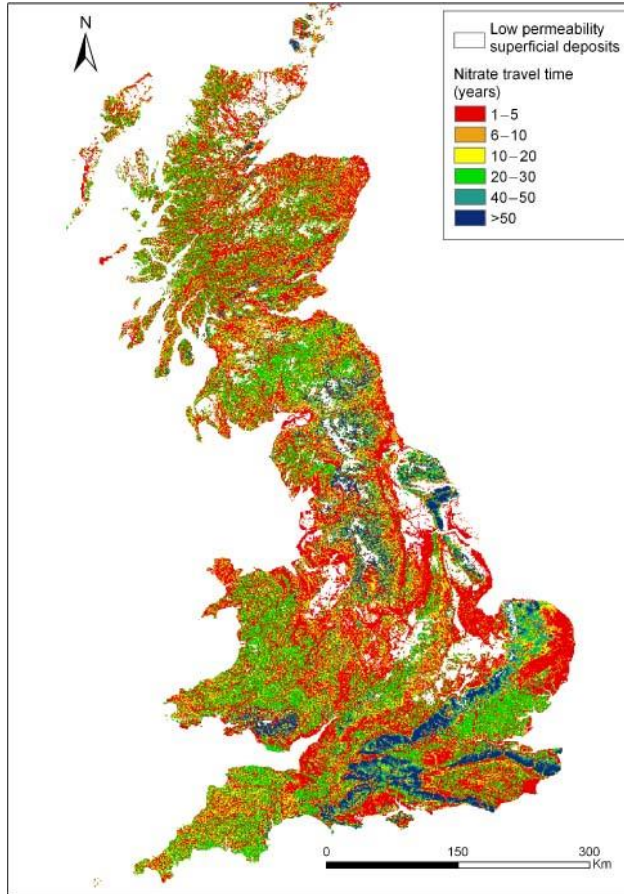
British Geological Survey

Contents

- Background

- Recent completed BGS work on nitrate in groundwater in the UK

  - How has nitrate in groundwater been affected by climate variability and change?

  - How might alternative land use futures affect groundwater quality?

- Ongoing and planned work related to nitrate in groundwater in the UK under LTLS-FE

  - Nitrate travel times in groundwater (to feed into LTLS-FE IM)

  - Where is nitrate attenuated in groundwater?
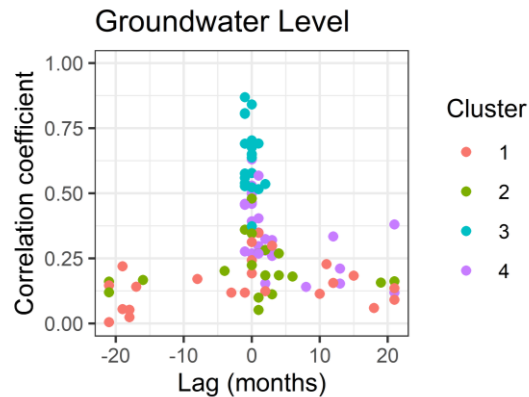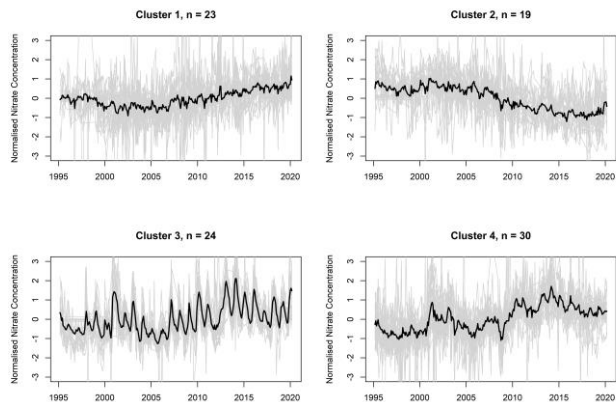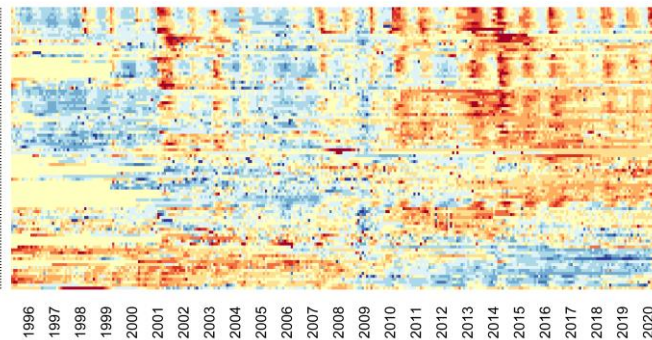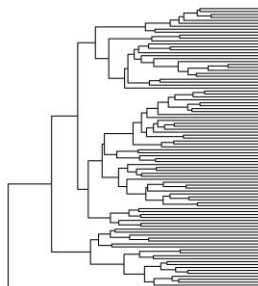
  - Other work

Background

Porewater tritium concentration (TU)

Sep-70
Jul-77
Jul-79

Porewater nitrate concentration (mgN/l)

flattening & broadening of peak

forward tailing

May 1979 envelope of six profiles

Oct 1980 mean of two profiles

Feb 1981 mean of two profiles

Sep 1981 mean of two profiles

Aquifer
- Chalk
- Middle Jurassic limestone
- Permo-Triassic sandstone
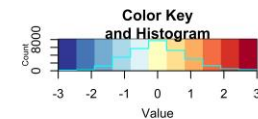
Data source
- BGS
- Locar
- WRc
- SWA
- University of Birmingham
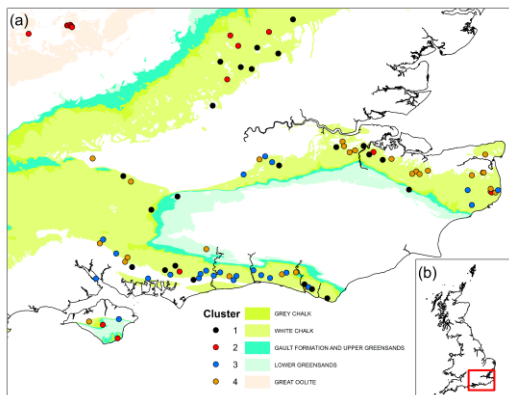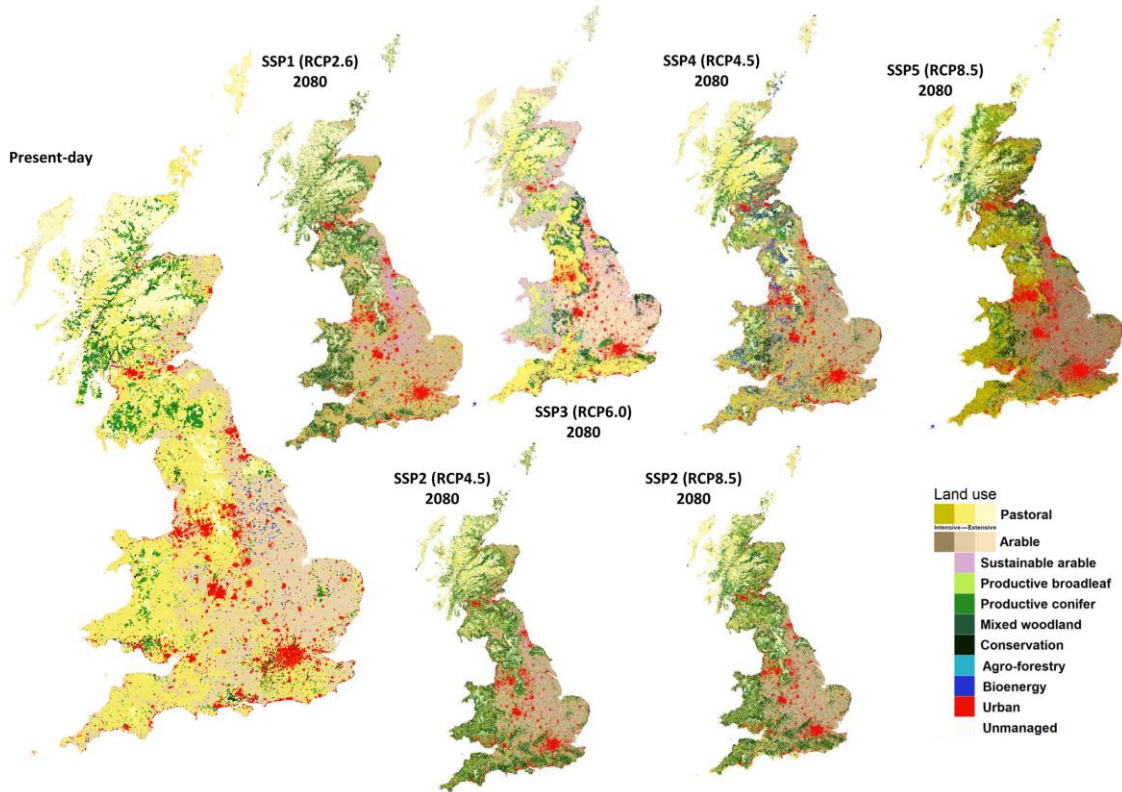
Background

Recent nitrate work – nitrate and climate variability

Recent nitrate work – Land use futures

| Land Use Class	Agricultural N load (mg/L)	Nitrate
Mixed Woodland	-	1
Native Woodland for Conservation	-	1
Productive Native Broadleaf	-	1
Productive Native Conifer	-	1
Productive Non-Native Broadleaf	-	1
Productive Non-Native Conifer	-	1
Very Extensive Pasture	1.52	1
Extensive Pasture	1.81	1
Agroforestry	-	2
Extensive Arable	4.15	2
Intensive Pasture	5.72	2
Sustainable Arable	-	2
Bioenergy	-	3
Intensive Arable (Fodder)	12.62	3
Intensive Arable (Food)	12.62	3
Urban	-	3

Agricultural Contaminants
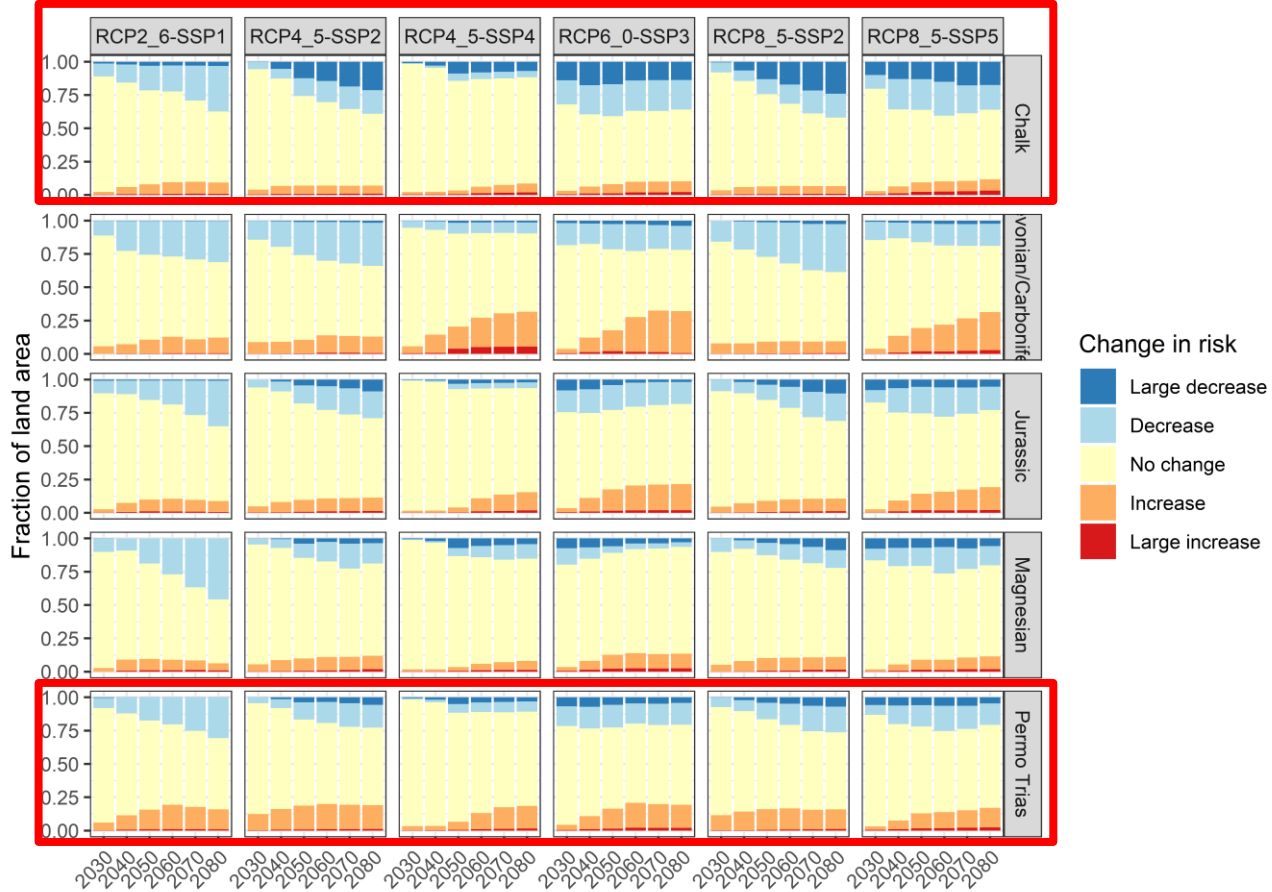
Groundwater nitrate work in LTLS-FE – Travel times from BGWM

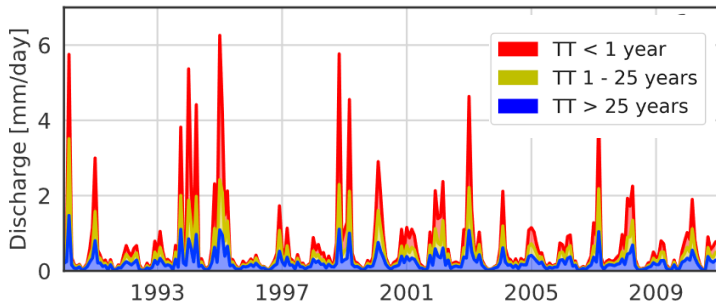Pathlines in the Great London Area

Example: Kaandorp et al. (2021)
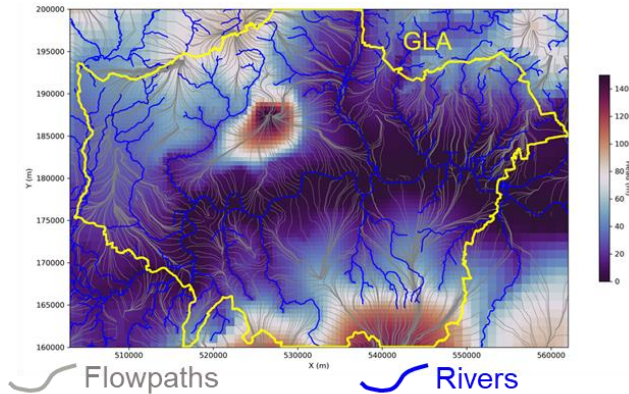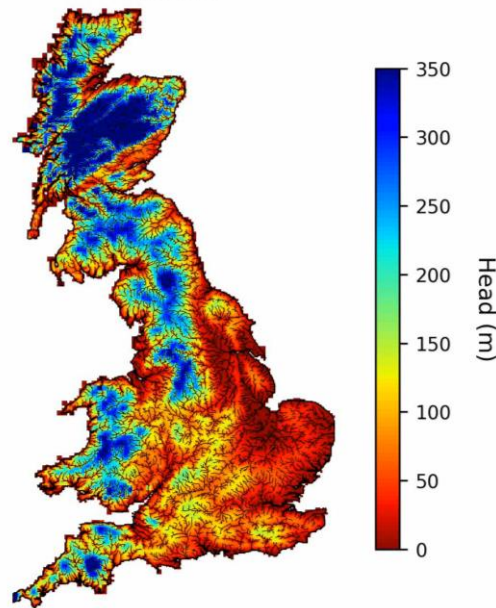
Simulated groundwater heads

Particle tracking (MODPATH) applied to the BGWM to calculate travel times (TT) of the groundwater contribution to streamflow:

- TT distributions in catchments
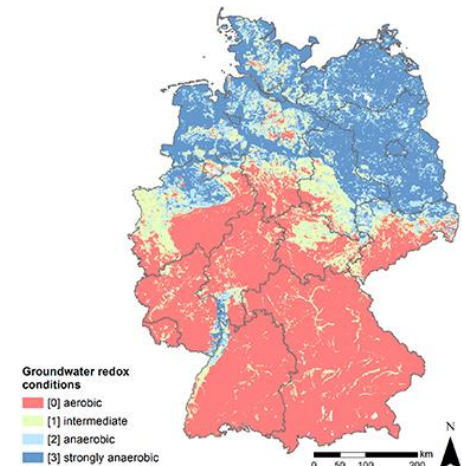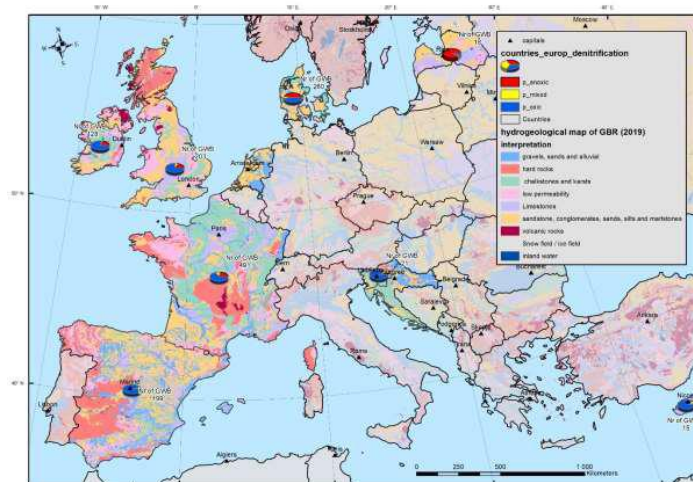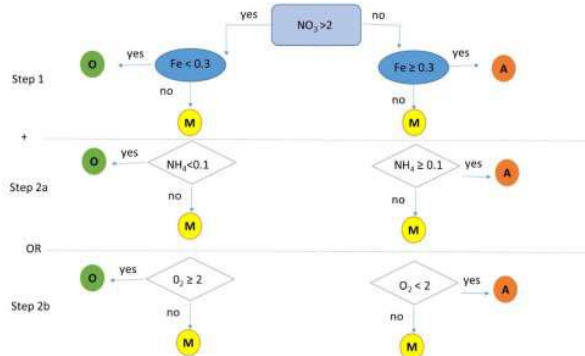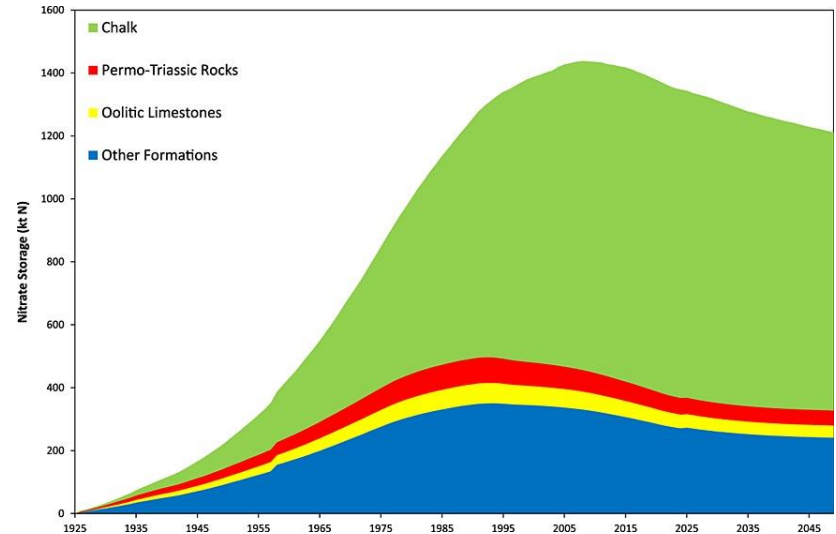
- Maps of advective GW velocity

Groundwater nitrate work in LTLS-FE – Nitrate and redox mapping

- Understanding where nitrate may not be conservative in groundwater
- EA WIMS data for groundwater
- Geostatistical and ML techniques

Groundwater nitrate work in LTLS-FE

- Further time series analysis
  - Changes in seasonality
  - Spatio-temporal statistical modelling of nitrate in groundwater and relationships to surface water nitrate

- Quantitative estimates of impacts of SPEED land use futures on nitrate in groundwater
  - RLM, BGS NTB and BGWM
  - Full subsurface nitrogen balance (including SGD?)

10

Questions

British Geological Survey