Water Temperature and eutrophication

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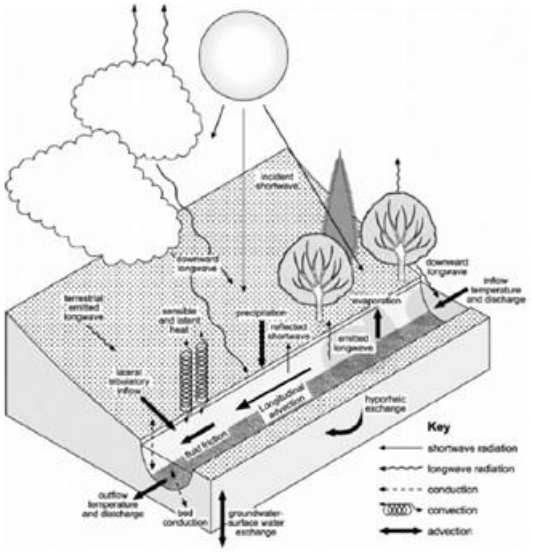
Challenges

- Fundamental understanding underpins decisions about water quality and ecosystem management



- Gap between research activity and information that directly supports decision makers

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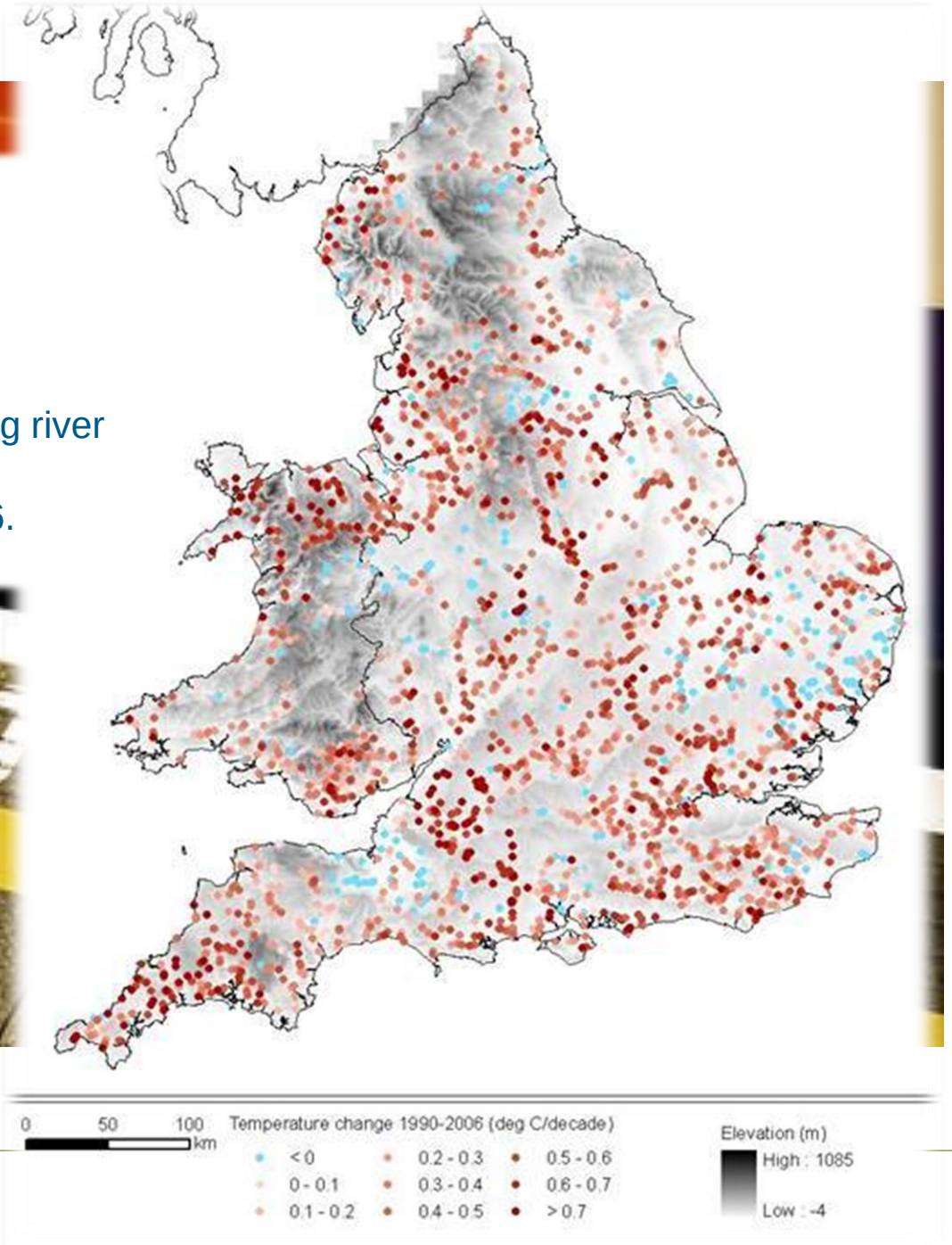
Rivers warmed 1990-2006

0.3°C per decade

Orr HG et al (2015) Detecting changing river temperatures in England and Wales. Hydrological Processes 29(5) 752-766.



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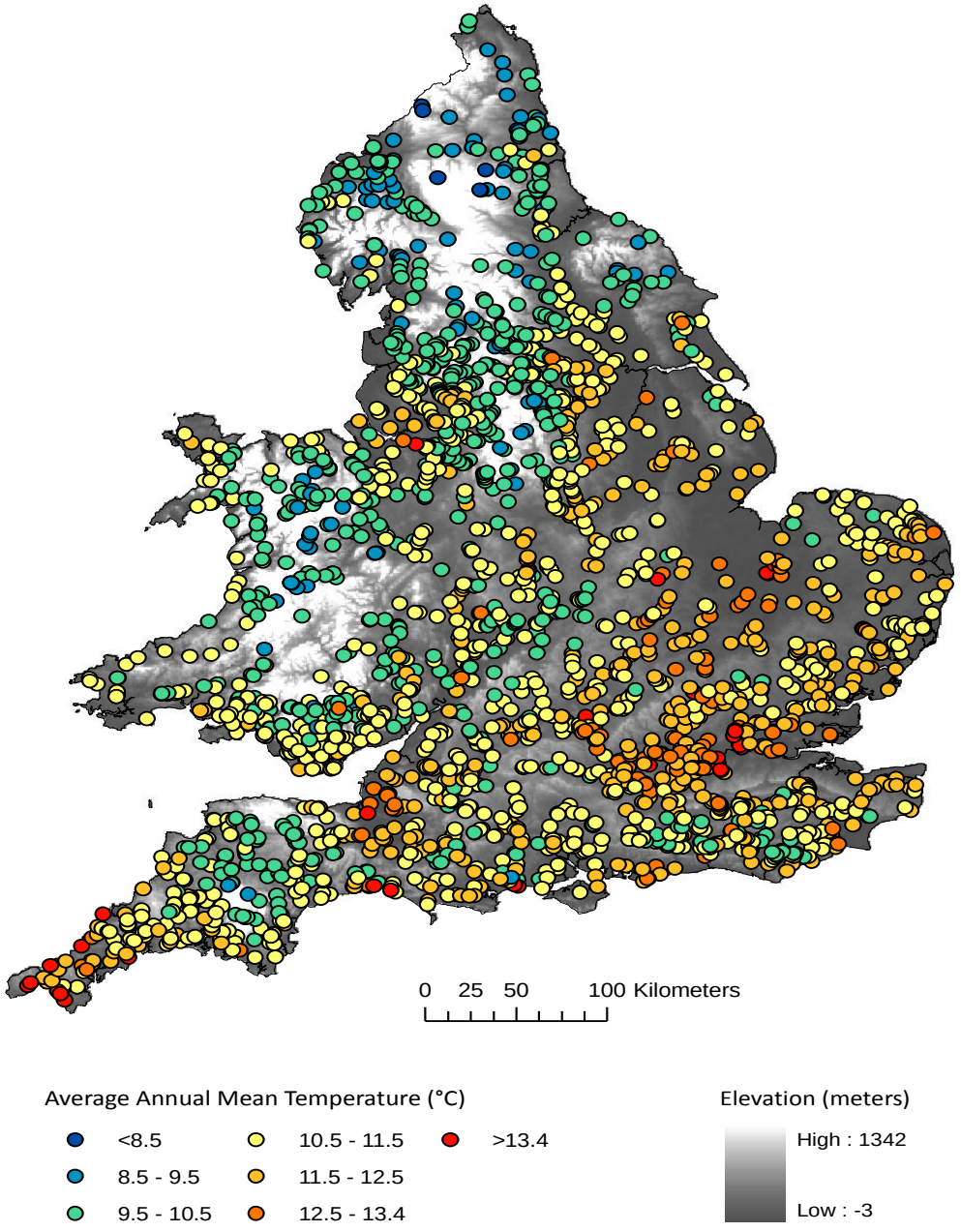
Current thermal regimes

Much more information available on hydrology than water temperature

Ecologically significant thresholds around daily temp



Orr, et al. 2010. Changing water temperatures: a surface water archive for England and Wales. Proceedings of the British Hydrological Society International Conference, July 2010, Newcastle.

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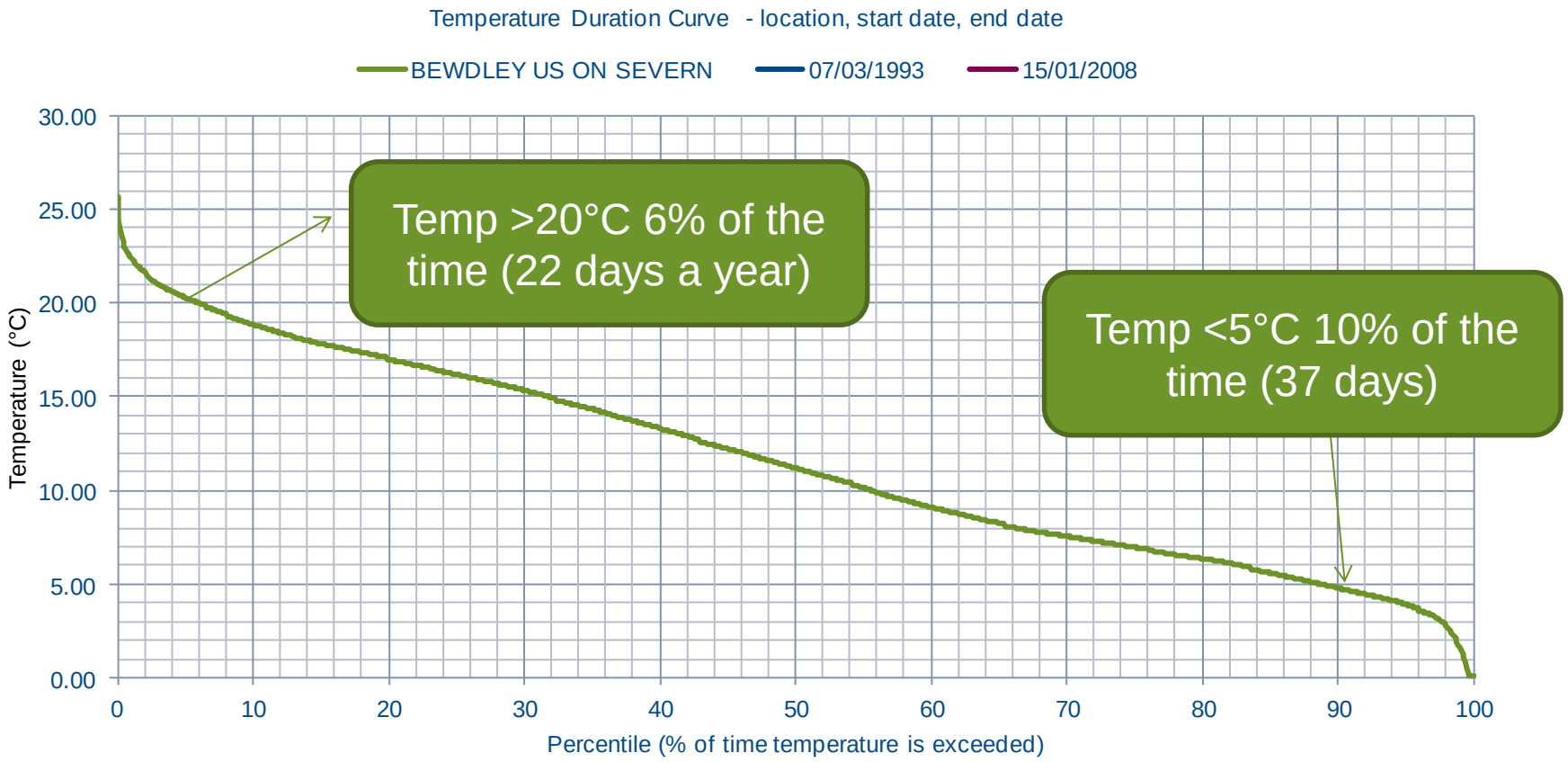
Temperature duration curves



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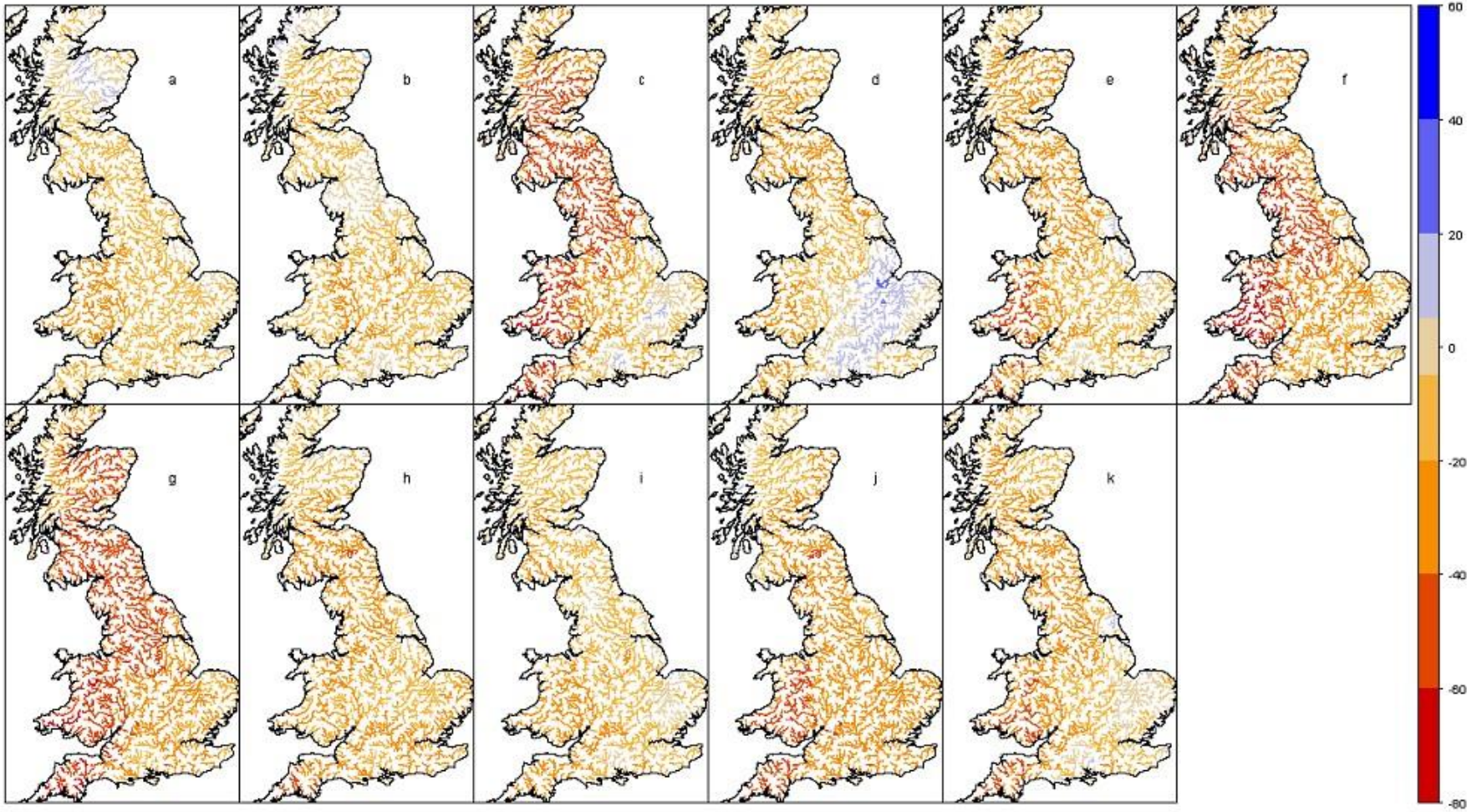
What information do we really need?

- What is the decision?
- What metrics and spatial scale are needed?
- What level of precision, accuracy and uncertainty is ok?
- **Sensitivity of the decision**
- **Risks from getting it wrong**

“Action based on imperfect observations, with unknown outcomes”

Matt Charlton and Harriet Orr (Environment Agency)
Mike Bowes, Mike Hutchins (CEH)
AMEC Foster Wheeler Consultants

Future River Flows – summer (JJA) 2050s



Prudhomme et al. 2012.The drying up of Britain? A national estimate of changes in seasonal river flows from 11 Regional Climate Model simulations“. Hydrological Processess Today

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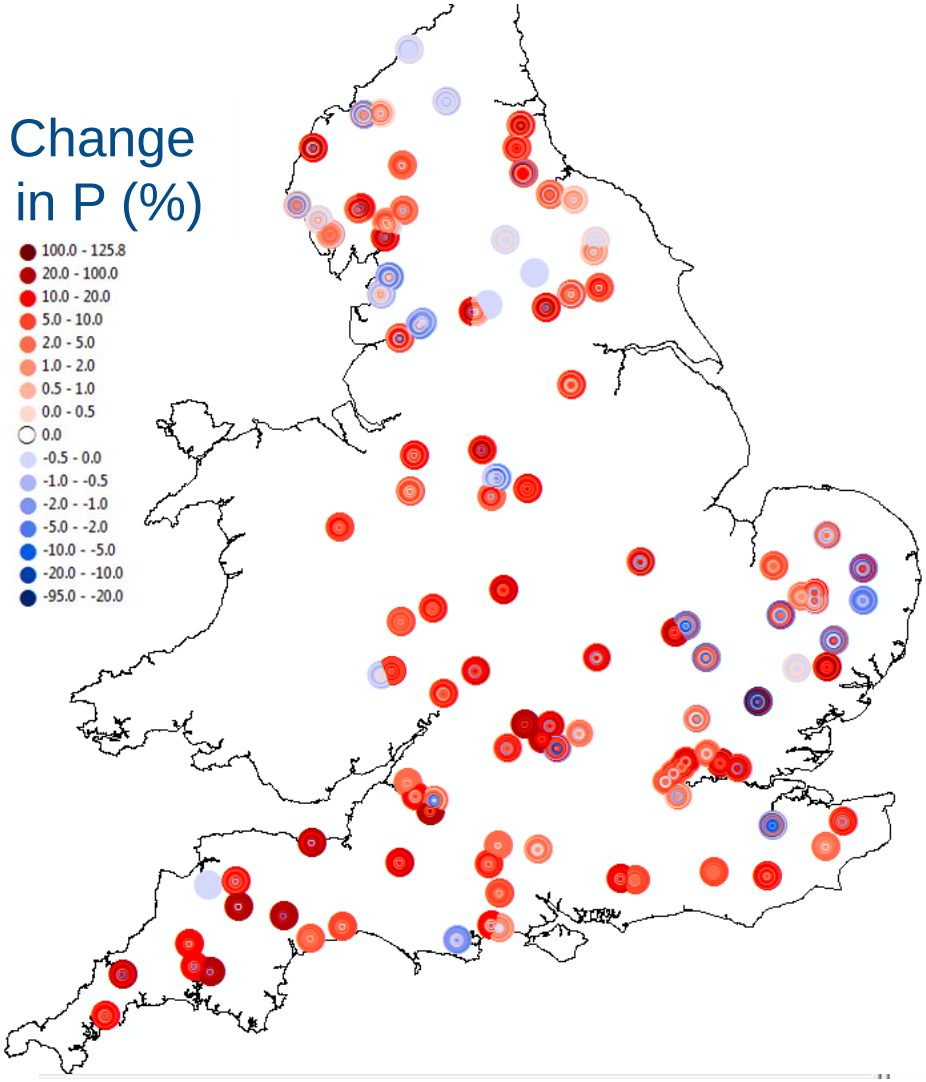
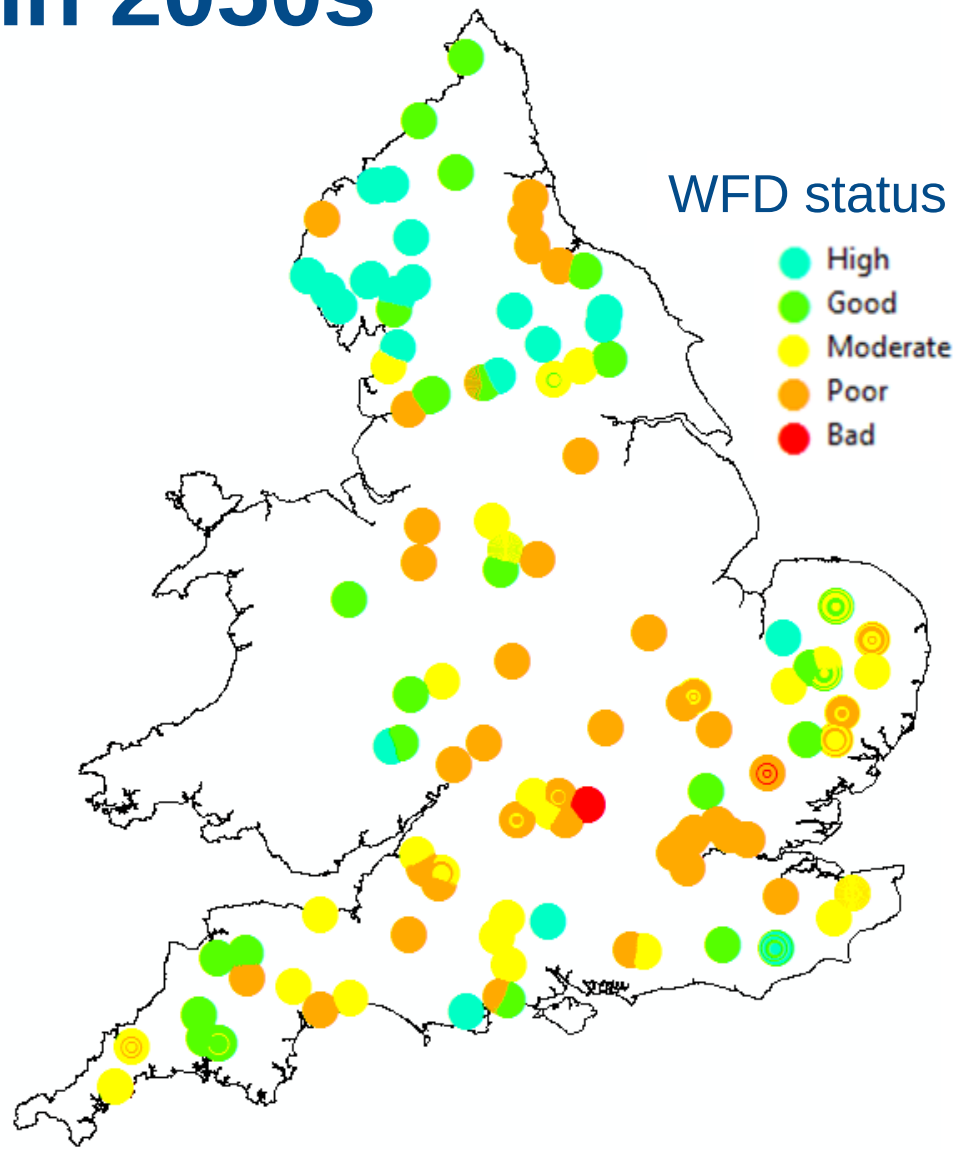
P and WFD status in 2050s





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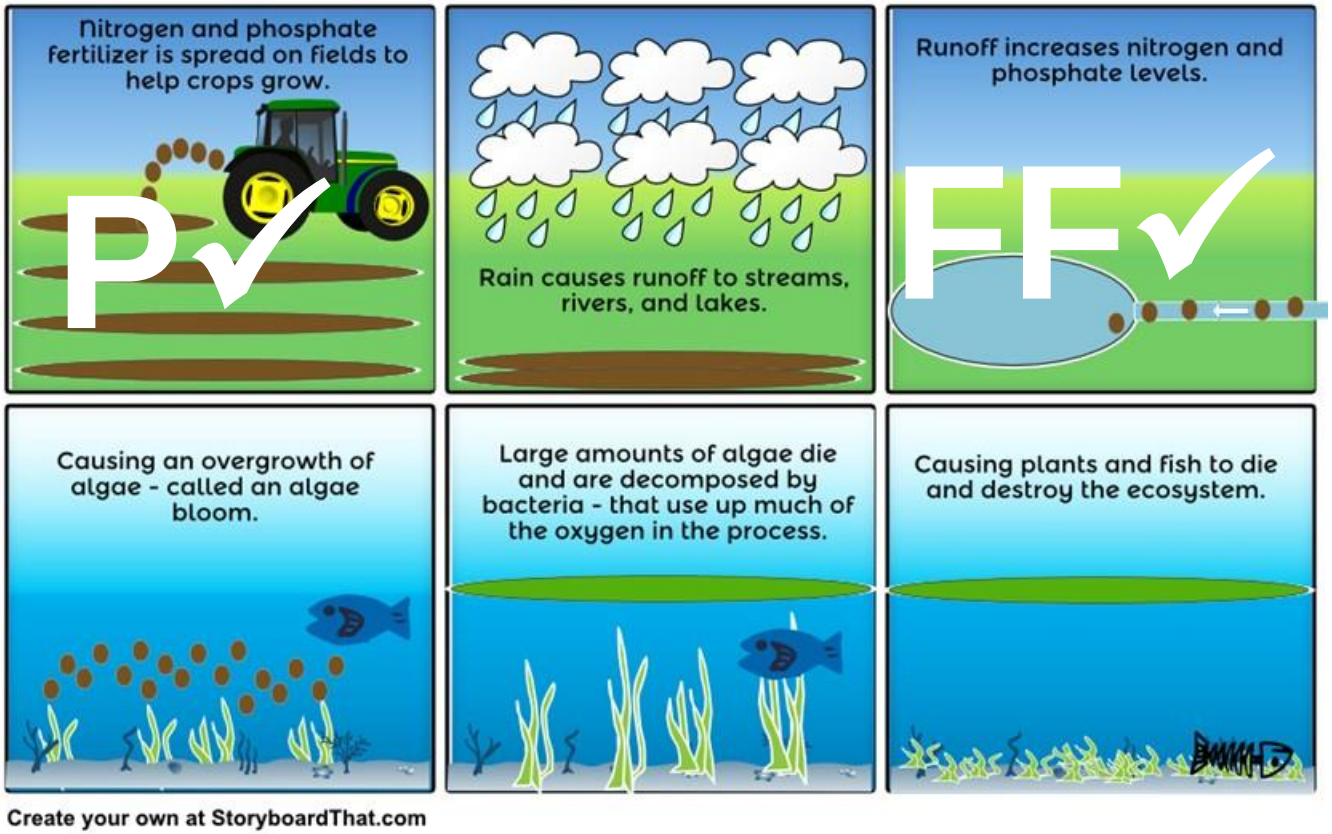
https://www.gov.uk/government/publications/climate-change-and-eutrophication-risk-in-english-rivers

Creating the perfect storm



Residence time✓

Riparian shading✓

Algal growth thresholds (light and temperature) ✓
19°C

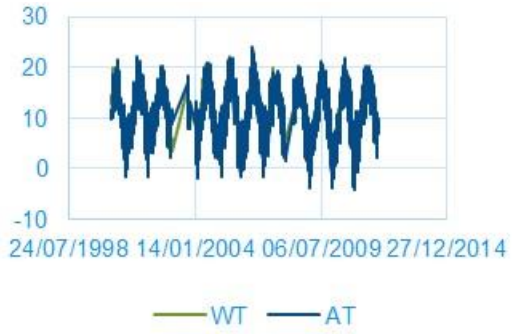
Water temperature?

Date of bloom

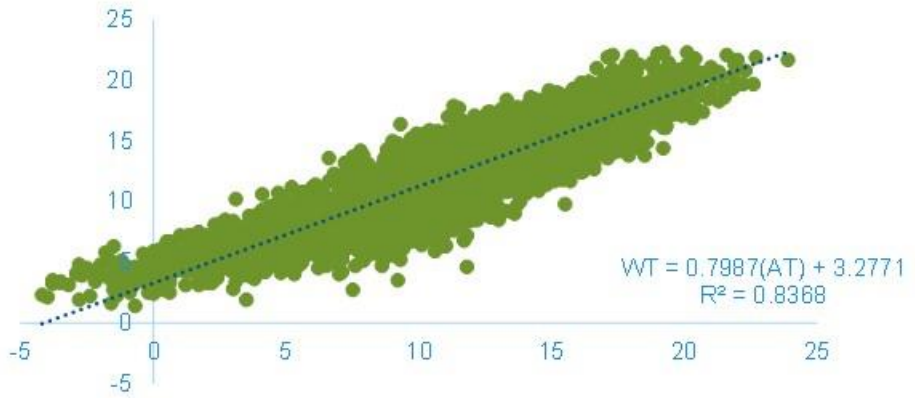
No. of days of risk

Determining mean daily temperature

Paired AT and WT



Annual regression (site-specific)



Errors in the estimate of daily temp

Differencing (AT-WT)
-8 to +7 °C

Factor (*0.9)
-6 to +8 °C

Annual regression
-8 to +6 °C

Seasonal regression
Not much better

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In summary

- Information about water temperature everywhere
- Models and tools to use anywhere
- Clarity about the accuracy/skill of info and tools
- More strategic level assessments of risk
- Better understanding about what works where