

# UK Freshwater Quality Research Programme

## Objectives:

- Strengthen our understanding of the sources & behaviour of pollutants within river systems
- Increase knowledge & understanding of how pollutants are changing or accumulating within the environment and the impacts of those changes
- Help to reduce the pollutant loading to river systems
- Inform policy in connection with regulations for e.g. local agricultural practices, wastewater organisations, industries, and domestic use
- Inform improvements to the ecological status of UK rivers
- Inform better adaptation and mitigation of risks which will improve essential ecosystems services



# Five projects plus co-ordination team

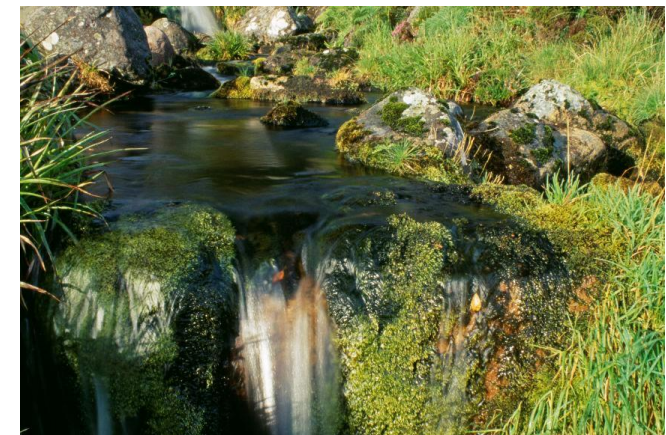
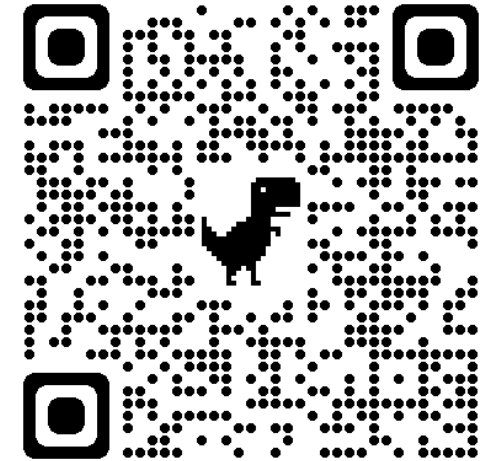
- **QUANTUM**: Quantifying the combined nutrient enrichment, pathogenic, and ecotoxicological impacts of livestock farming on UK rivers – Penny Johnes, Bristol, Lancaster, Exeter, Bangor & Bath
- **PACIFIC**: Pathways of Chemicals Into Freshwaters and their ecological Impacts – Daniel Read, CEH, Bath, Oxford & EA
- **LTLS-FE**: Long-Term, Large-Scale Freshwater Ecosystems: analysis and future scenarios of long-term and large-scale freshwater quality and impacts – Vicky Bell and Steve Lofts, CEH, Rothamsted, BGS & Cardiff
- **MOT4Rivers**: Monitoring, modelling and mitigating pollution impacts in a changing world: science and tools for tomorrow's rivers – Andrew Tyler, Stirling, Glasgow, Hutton, CEH.
- **ECOMIX**: Assessing and managing the impacts of mixtures of chemicals on UK freshwater biodiversity in a changing world – Alistair Boxall, York, Sheffield & Durham

# Ultimately the programme seek to use science evidence to inform improvements to UK freshwater quality

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<https://water.leeds.ac.uk/fwq-programme>

@FreshwaterQual1





Natural  
Environment  
Research Council



# Assessing and Managing the Impacts of Mixtures of Chemicals on UK Freshwater Biodiversity in a Changing World





# The State of English Rivers

- One in ten freshwater and wetland species in England are threatened with extinction and two thirds of existing freshwater species are in decline
- Only 16% of England's surface water bodies having good ecological status
- All English rivers monitored for compliance with the Water Framework Directive (WFD) currently fail to meet the criteria for good chemical status
- Around 40% of English rivers are under pressure from pollution from rural activities, 36% from wastewater emissions and 3% from emissions from abandoned mines
- "rivers in England are in a mess. A 'chemical cocktail' of sewage, agricultural waste, and plastic is polluting the waters of many of the country's rivers"

# But.....

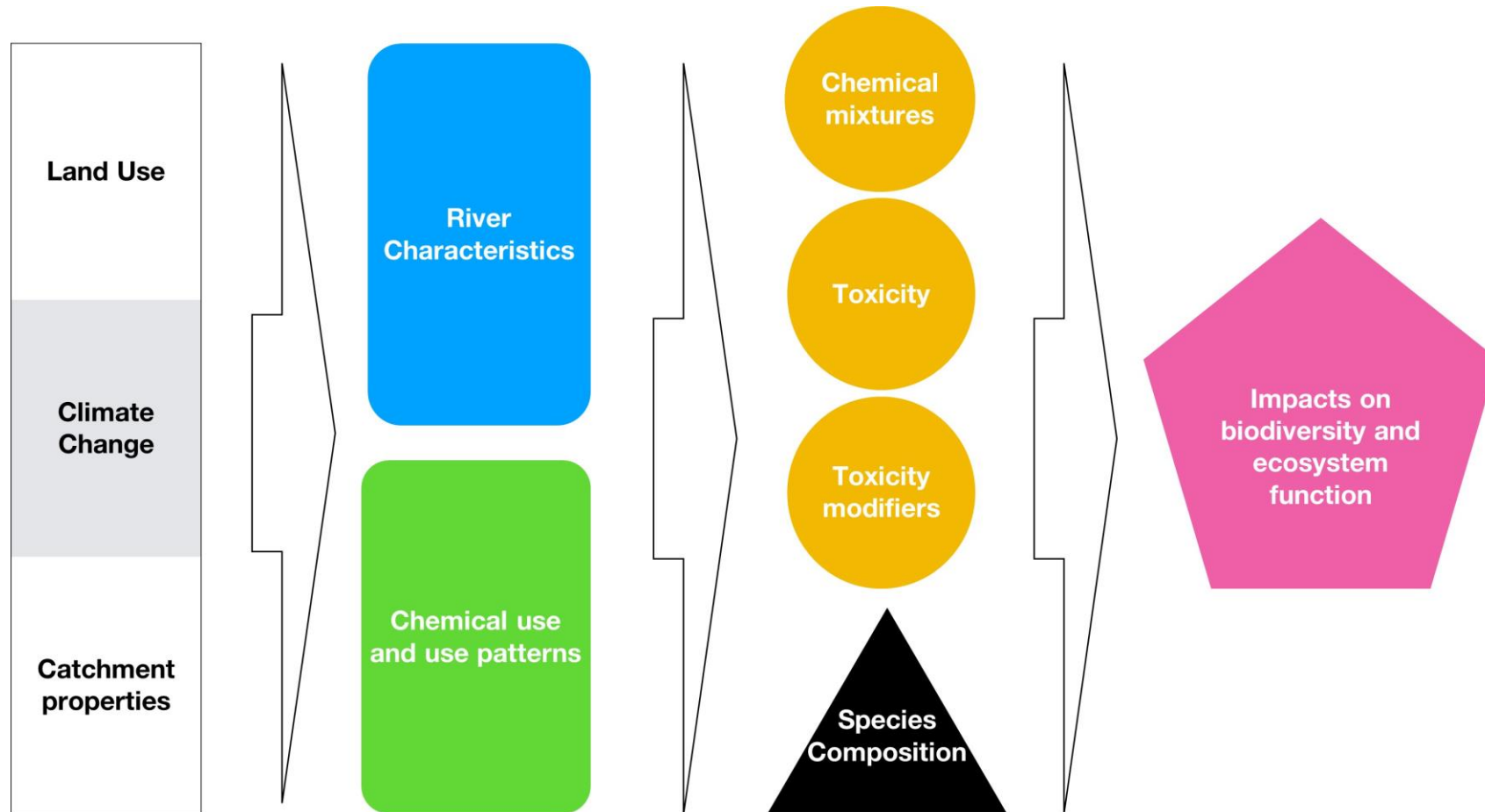
Previous assessments:

- Consider only a small fraction of chemicals in use and assess these one-by-one
- Are based on quality standards derived from standard ecotoxicological laboratory tests and arbitrary assessment factors
- Ignore the fact that catchment characteristics vary over space and time
- Largely ignore the effects of co-stressors

# ***A new transformative catchment-based approach that:***

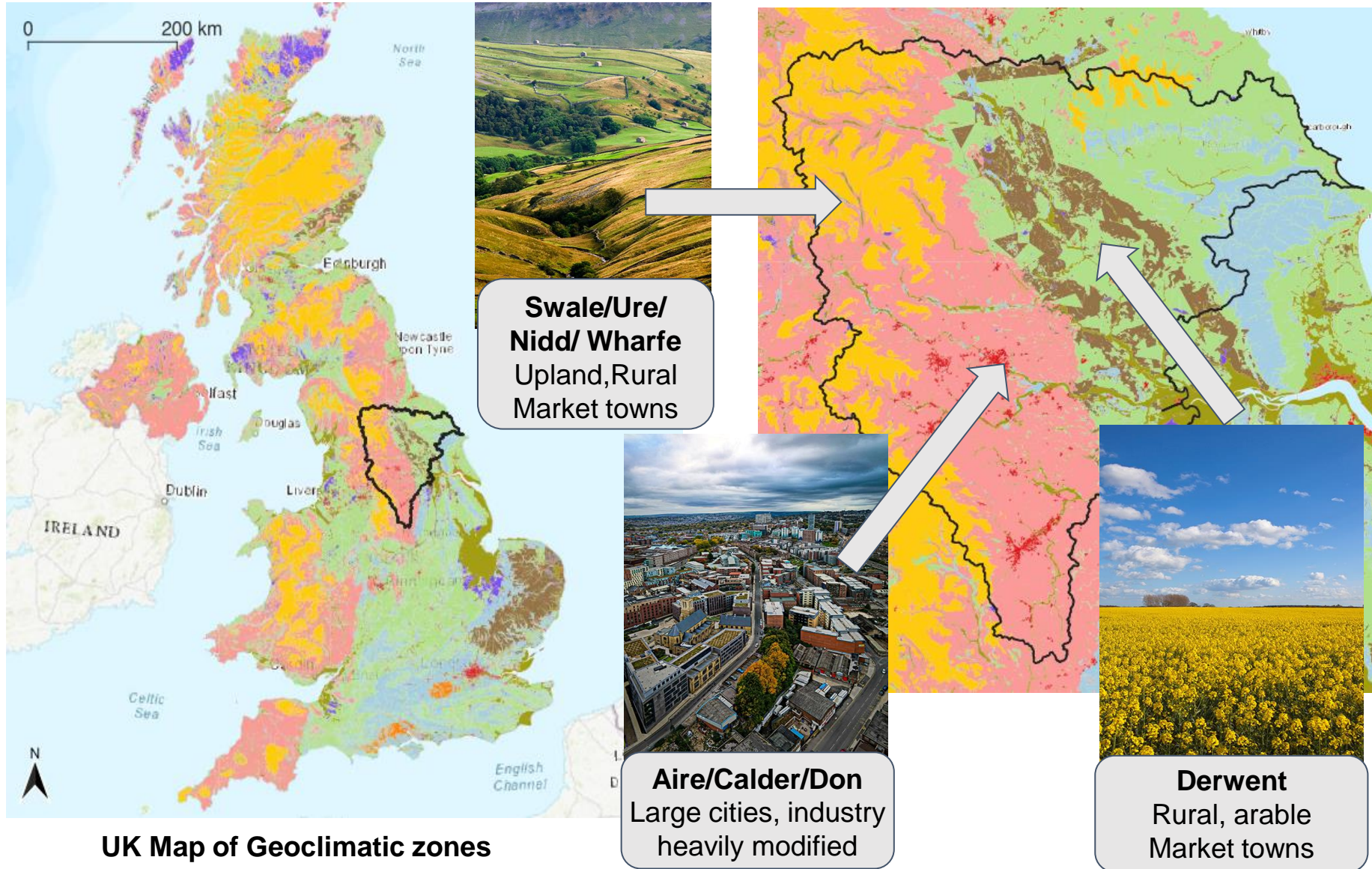
- Assesses impacts of mixtures of chemicals and co-stressors on the structure and functioning of species assemblages at high spatial resolution
- Considers the current situation and looks to the future to account for the effects of global megatrends on chemical sources, fate processes, exposure and effects
- Allows us to target interventions where they are going to have maximum impact allowing us to benefit from the use of chemicals while protecting biodiversity

# *Our assessment framework*

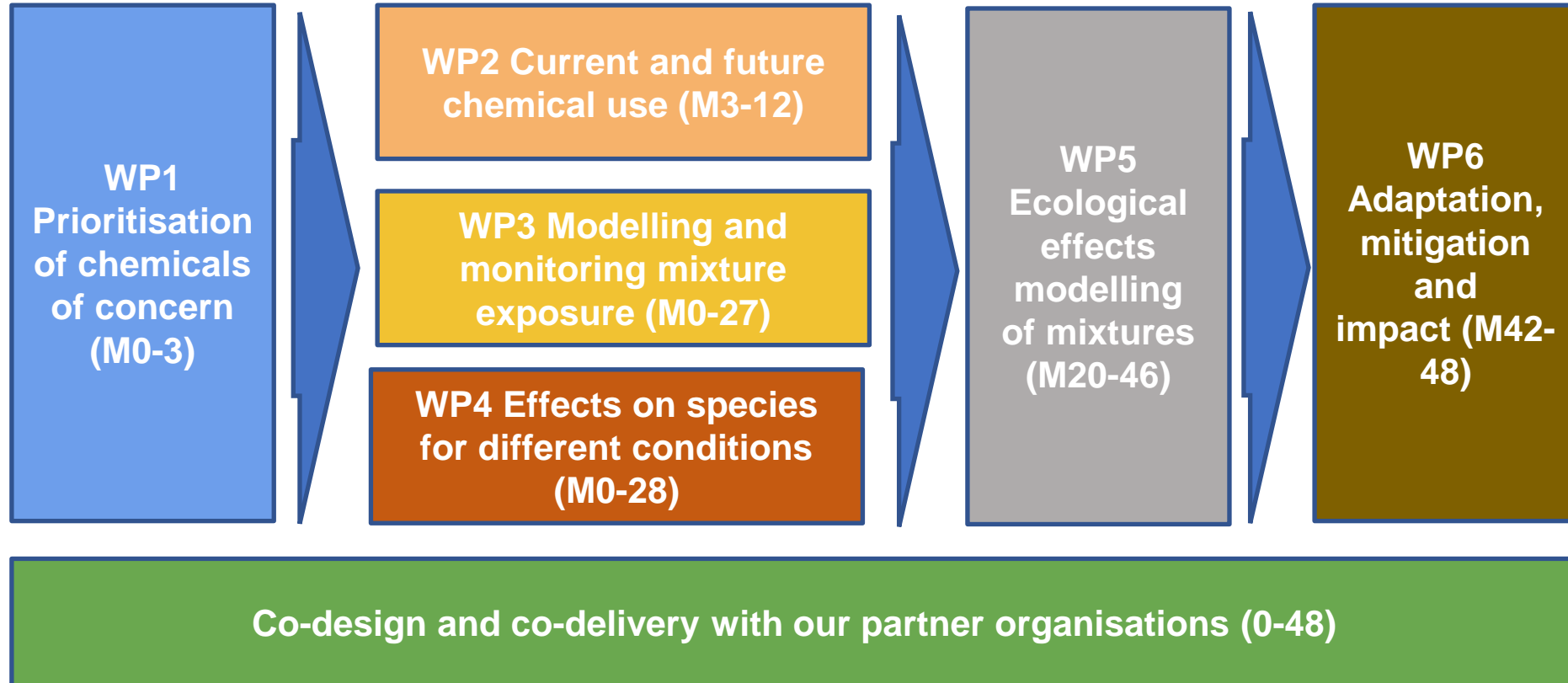




# 9 catchments (10,770 km<sup>2</sup>) – Representing 86% of the UK



# *Delivered over 4 years through 6 Work Packages*



# Our Chemical Mix



Fipronil, Imidacoprid,  
Permethrin, Moxidectin,  
Deltamethrin



Tebuconazole, Azoxystrobin,  
Triallate, Metazochlor,  
Cypermethrin, Trifloxystrobin,  
Pyraclostrobin, Dimoxystrobin,  
Difenoconazole, Cu, Flufenacet



Ivermectin, Doramectin,  
Eprinomectin, Moxidectin,  
Deltamethrin, Tylosin,  
Lincomycin, Cu, Zn



Miconazole, Fluconazole,  
Azithromycin, Erythromycin,  
Diclofenac, Ibuprofen,  
Venlafaxine, Metformin

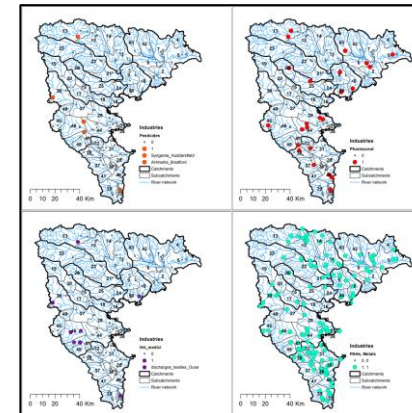
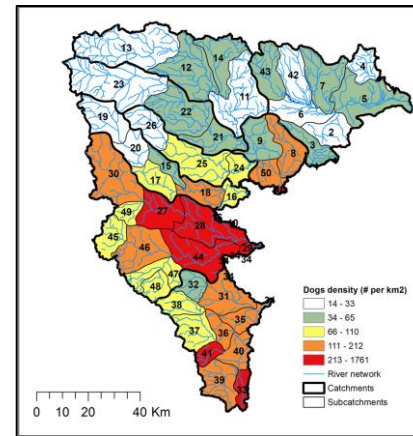
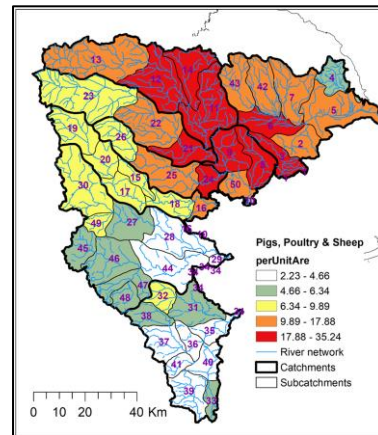
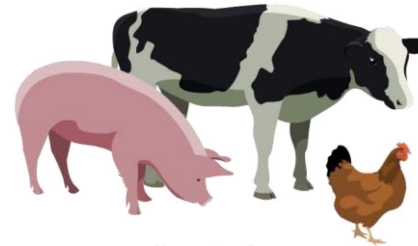
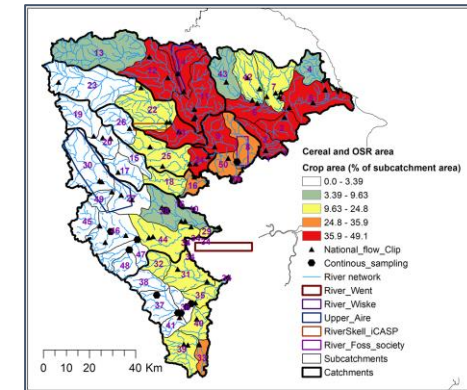
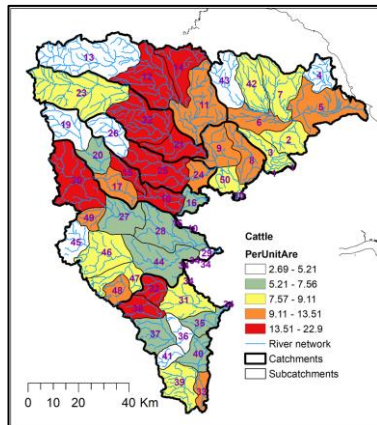
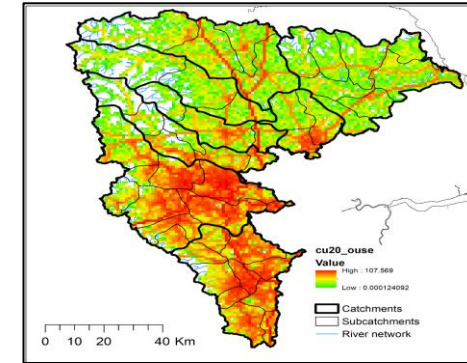
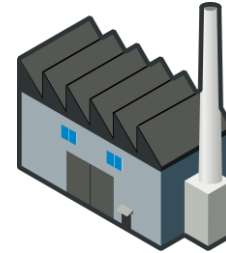
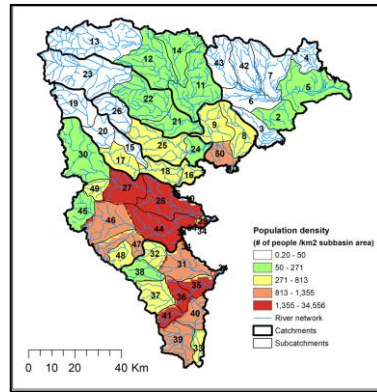


Octenidine HCl, Kathon CG,  
Homosalate, Octocrylene,  
Tinosorb S, Zn

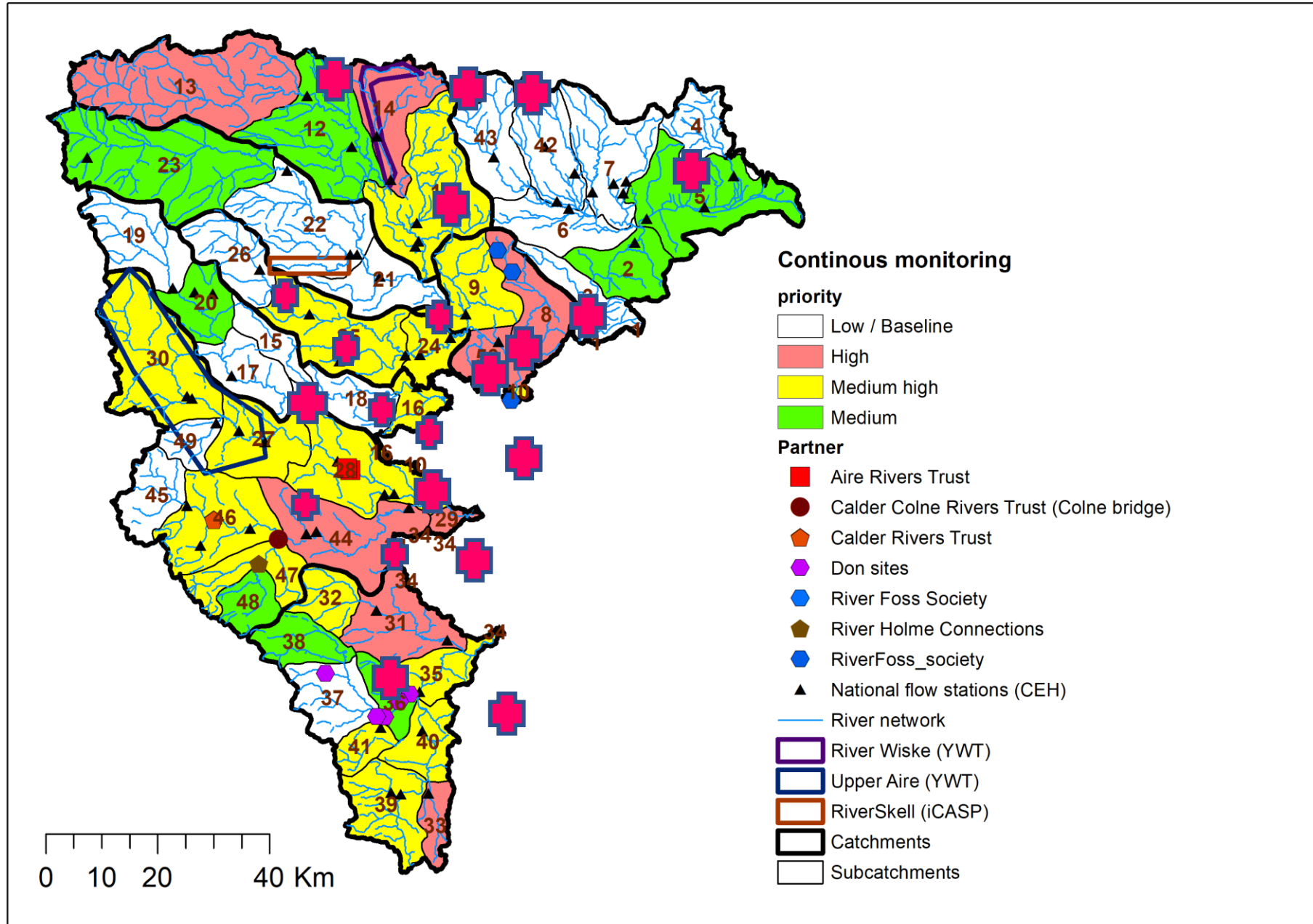


Fluoranthene, Benzo(a)anthracene,  
Pyrene, Fluoranthene, 6-PPD, Cu,  
Zn

# Use and Sources



# Mapping Sub-Catchments of Interest





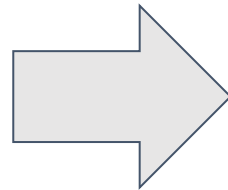
# Ecotoxicity Testing



- Metals, Azole fungicides, Pyrethroid insecticides
- Seasonal species (mayfly, stonefly, caddisfly larvae, leech)
- Eight diatom species running with tests to start imminently

# ***Delivering innovative science***

- Future chemical use scenarios
- A high-resolution, systems-based mixture exposure model
- Models for the effects of toxicity modifiers on bioavailability
- Read-across methodology to extrapolate mode of action related effects across species of interest
- Models for assessing the impacts of chemical mixtures and co-stressors on biodiversity



A new integrative assessment framework allowing mitigation/adaptation approaches to be targeted where they will have the greatest benefit



# Connecting with Yorkshire

