

QUANTUM

Quantifying the nutrient enrichment, pathogenic, and ecotoxicological impacts of livestock farming on UK rivers

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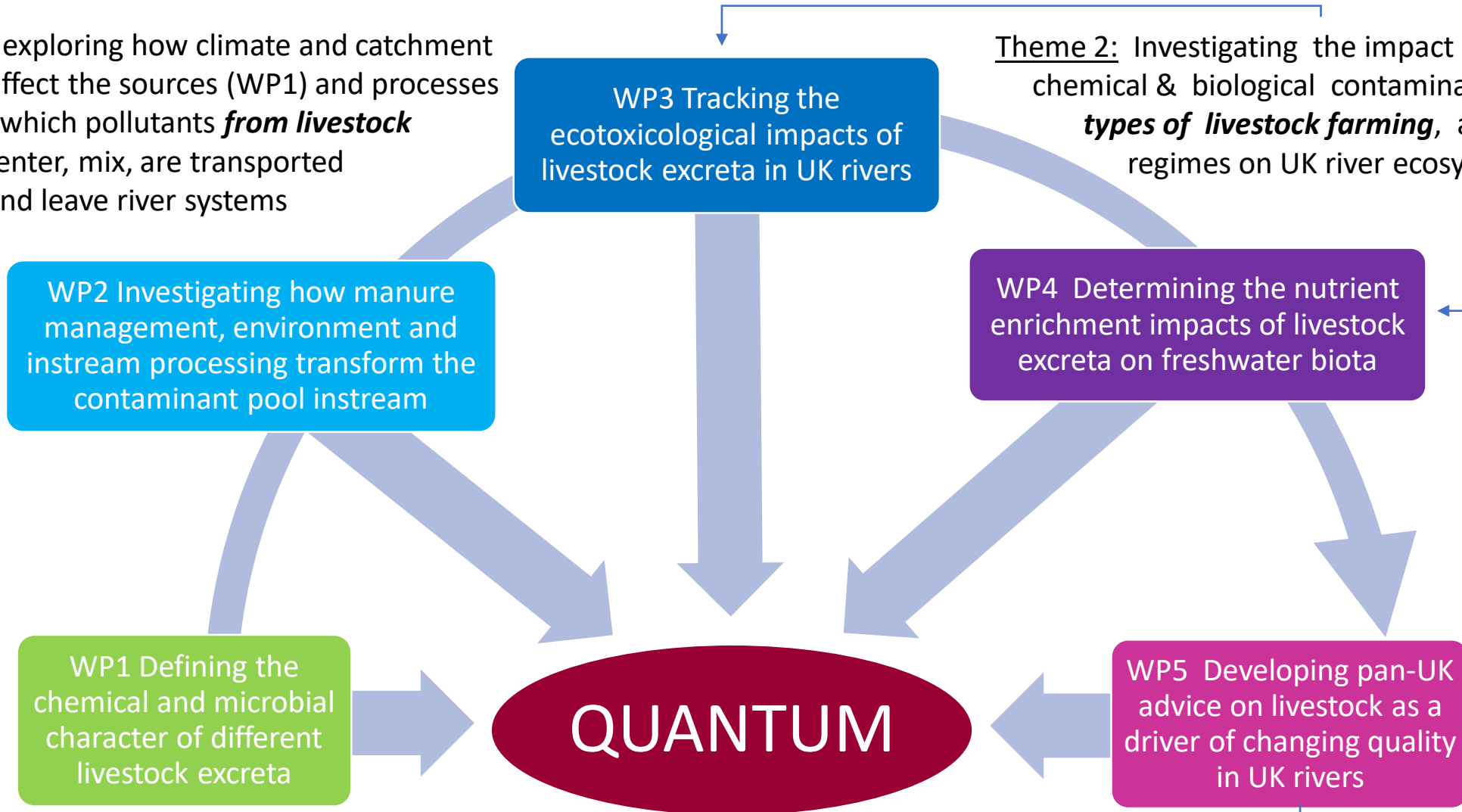
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and our regulatory, industry and academic Project Partners:

The QUANTUM programme

Theme 1: exploring how climate and catchment changes affect the sources (WP1) and processes (WP2) by which pollutants **from livestock farming**, enter, mix, are transported through and leave river systems

Theme 2: Investigating the impact of the mixtures of chemical & biological contaminants **from different types of livestock farming**, and their exposure regimes on UK river ecosystems (WP3, WP4)



Theme 3: Enabling and informing the development of better plans for adaptation, mitigation and detection of the risks **of livestock farming** as a key driver of declining river quality, both now and in the future (WP1-4, WP5).

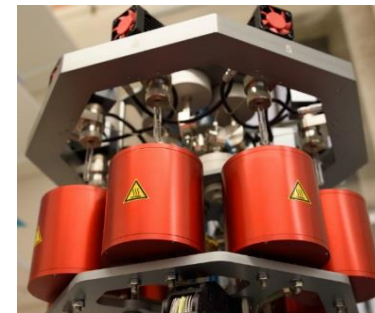
Novel sensing, sampling and analytical approaches

Capitalises on novel approaches for DOM characterisation using targeted and non-targeted methods, together with bulk and compound specific stable isotope probing developed in our prior UKRI funded research.

(a) Automated water samplers, telemetered sensor networks and novel chemical monitoring techniques (e.g. POCIS)



(b) Sample analyses using our suite of novel high resolution mass spectrometry, stable and radio isotope techniques



Anticipated outcomes: *highlights*

WP1

Diagnosis of the nutrient, pathogen and ecotoxin contaminant mixtures exported to UK rivers from different types of livestock farming, using state of the art field/lab techniques recently developed in our prior UKRI funded programmes.

e.g. NERC DOMAINE, 2014-19, EPSRC ReNEW, 2017-20, NERC AMR, 2016-18, NERC EMHH, 2012-15, 2015-18, NERC Urgent Grant, 2020-21

WP2

Evidence of the impact of livestock production methods on the stressor portfolio to which stream biota are exposed, under different environment environmental conditions, as it is processed instream, together with tools to distinguish between livestock- and human-derived faecal matter in UK rivers.

WP3

Evidence of the combined ecotoxicological impacts of livestock farming on cyanobacteria, macroinvertebrates and fish, under controlled laboratory (using standard methods) and ambient (and variable) environmental conditions

WP4

Evidence of the compound-, environment- and multi-stressor mix impacts of LDOM nutrient enrichment on stream biota under varying ambient and climatically-altered conditions, for epilithon, bryophytes, macroinvertebrates, fish.

WP5

Pan-UK understanding of the impacts of differing livestock production systems as drivers of changing quality in UK rivers, under ambient and climatically altered conditions.

Connections with other projects

ECOMIX: target pharmaceuticals, biological exposures to environmental vs lab-simulated conditions

WP3 Tracking the ecotoxicological impacts of livestock excreta in UK rivers

PACIFIC: target pharmaceuticals, separating the relative impacts of human sewage vs livestock sources as drivers of ecosystem damage; PACIFIC microbial focus links to QUANTUM pathogens focus.

PACIFIC: Tier 1 site sharing potential (Chew/Midford Brook)

WP2 Investigating how manure management, environment and instream processing transform the contaminant pool instream

WP4 Determining the nutrient enrichment impacts of livestock excreta on freshwater biota

WP1 Defining the chemical and microbial character of different livestock excreta

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WP5 Developing pan-UK advice on livestock as a driver of changing quality in UK rivers

LTLS-FE, MOT4RIVERS: scenario design and testing, notably for climate change, but also land use change

From **QUANTUM** to all other projects: potential to build livestock farming indicators into monitoring/modelling planned in other projects

Potential to include some 'other' project field sites in our Tier 2 selection; exchange molecular scale **QUANTUM** data with high temporal resolution data from **PACIFIC** and **MOT4RIVERS**