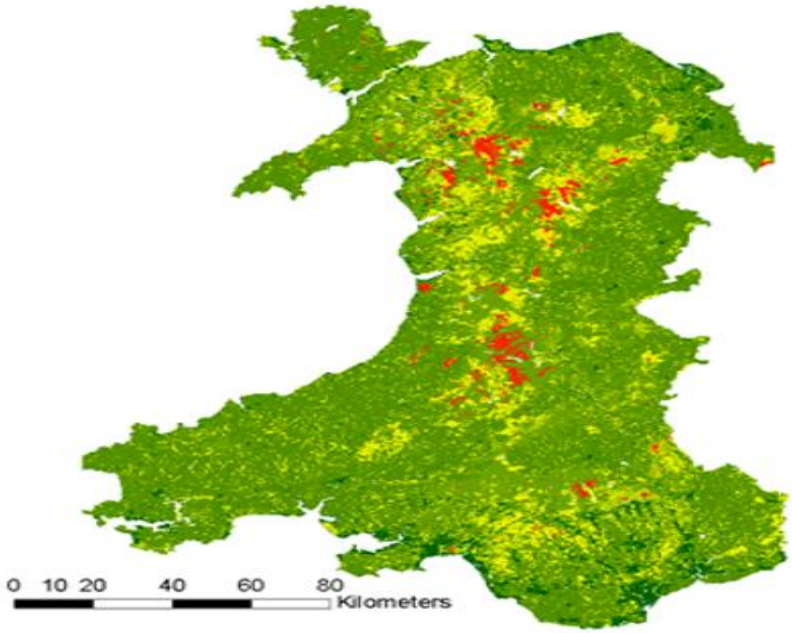
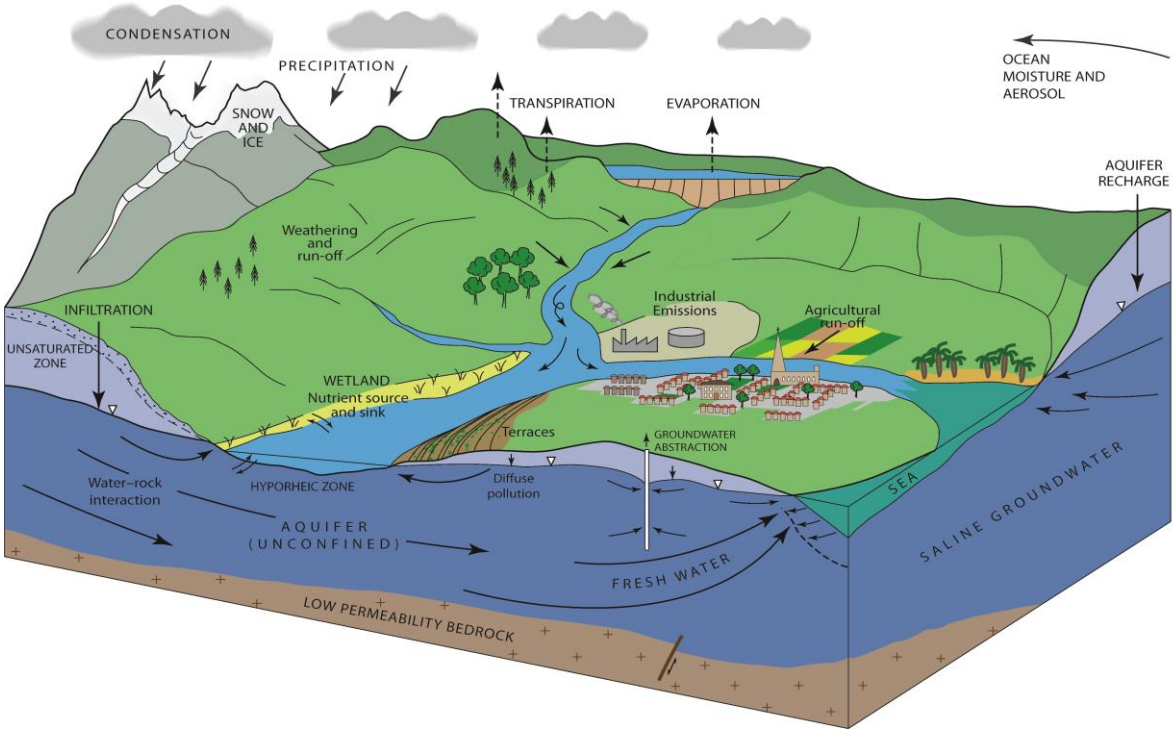
Estimating Nutrient and Pathogens Concentrations and Flux into coastal systems in Wales: Scenario analysis and Real-Time Forecasting

Prof Paul Whitehead
Water Resource Associates and Oxford University

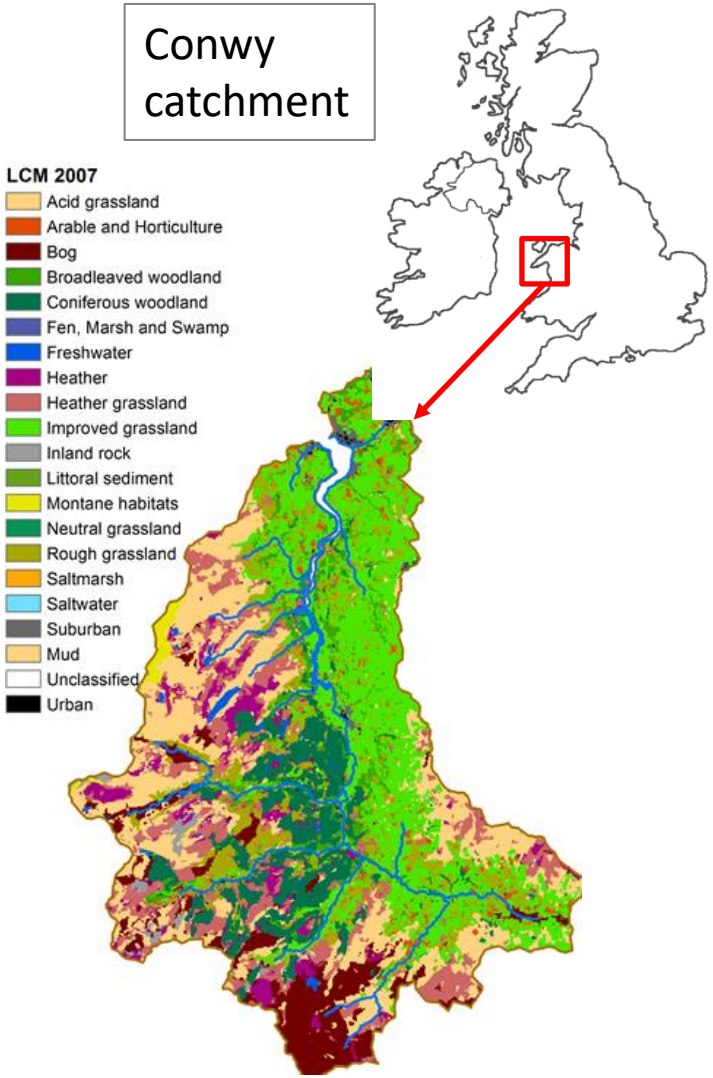


Sources and Sinks of Nutrients (N and P) and Pathogens across Wales



Case Study Conwy Catchment

Conwy catchment

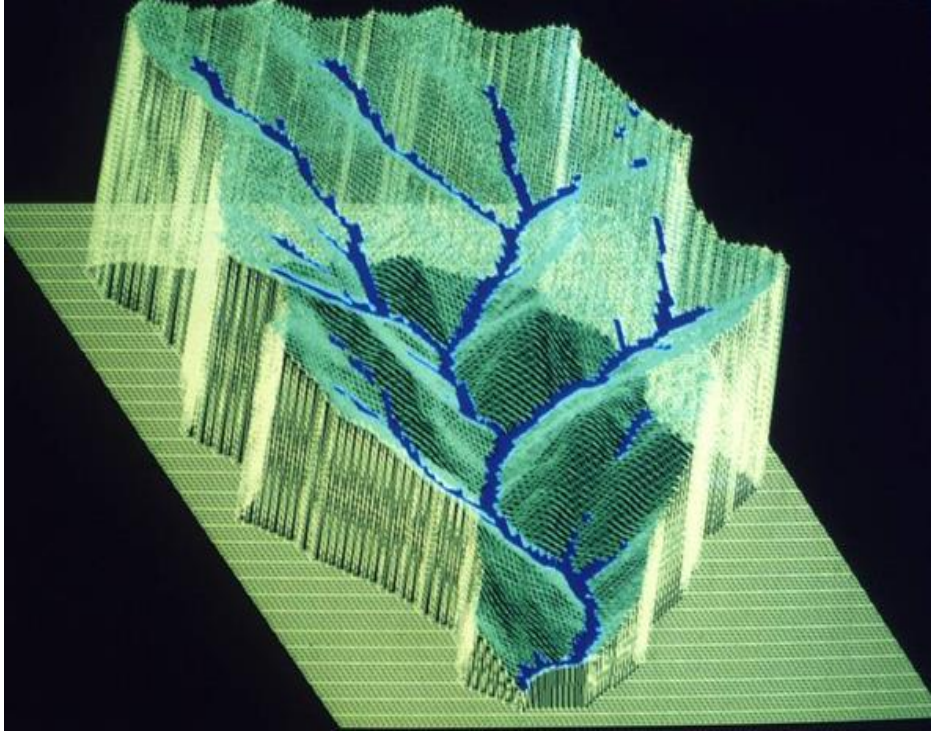


Diversity of Landscape and Integrated soils, plant production, biodiversity, and water quality measurements (including FIO's)

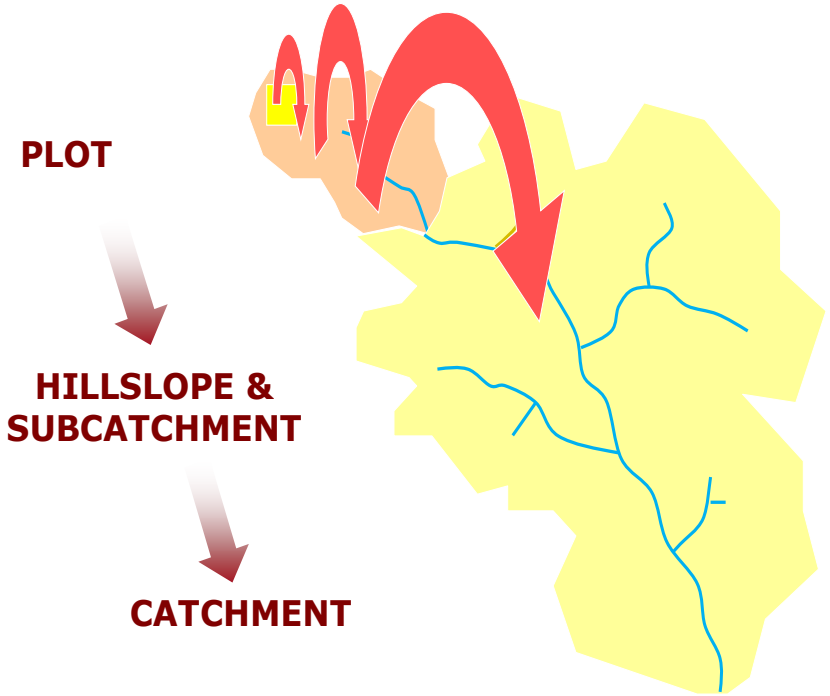
ADAS ATKINS Centre for Ecology & Hydrology NATURAL ENVIRONMENT RESEARCH COUNCIL crew centre of expertise for waters The James Hutton Institute University of Reading ROTHAMSTED RESEARCH UEA University of East Anglia Water Resource Associates

Impacts of Nutrients and Pathogens- – special issues in Wales

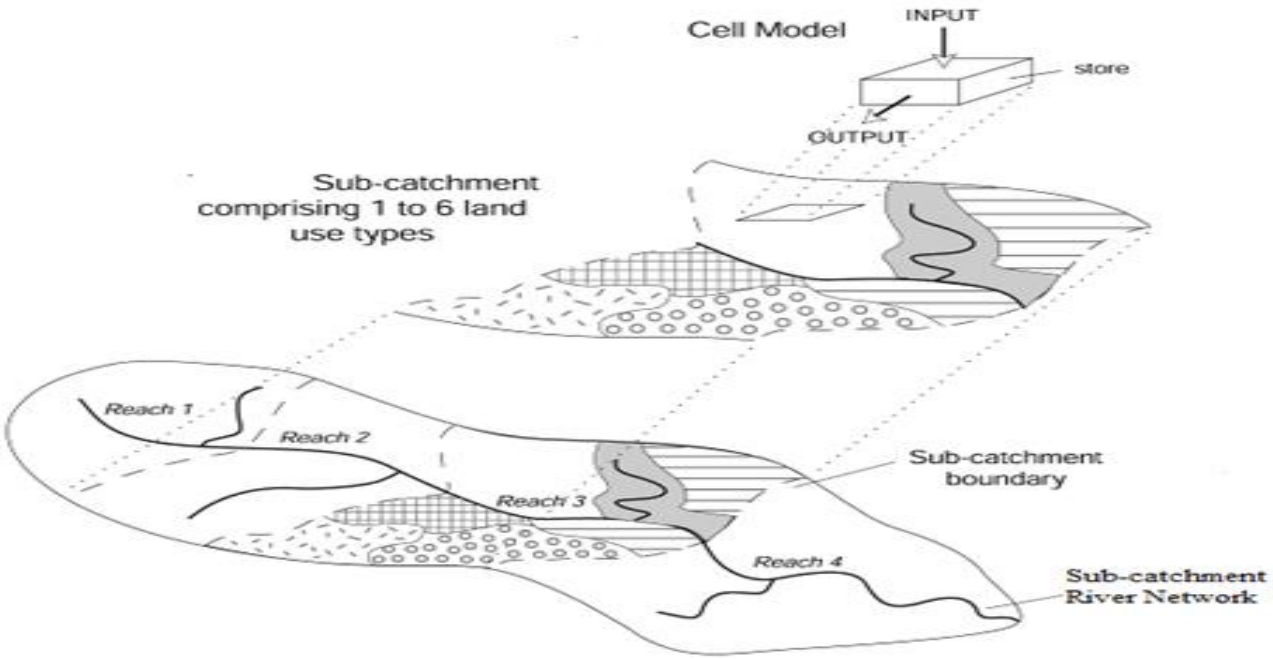
The Wye & Usk Foundation

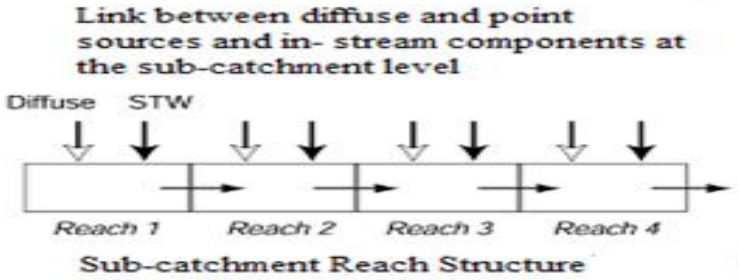


INCA- Process based, dynamic model, for flow, nutrients (N, P), Pathogens, sediments, carbon, metals, POPS, ecology, contaminants



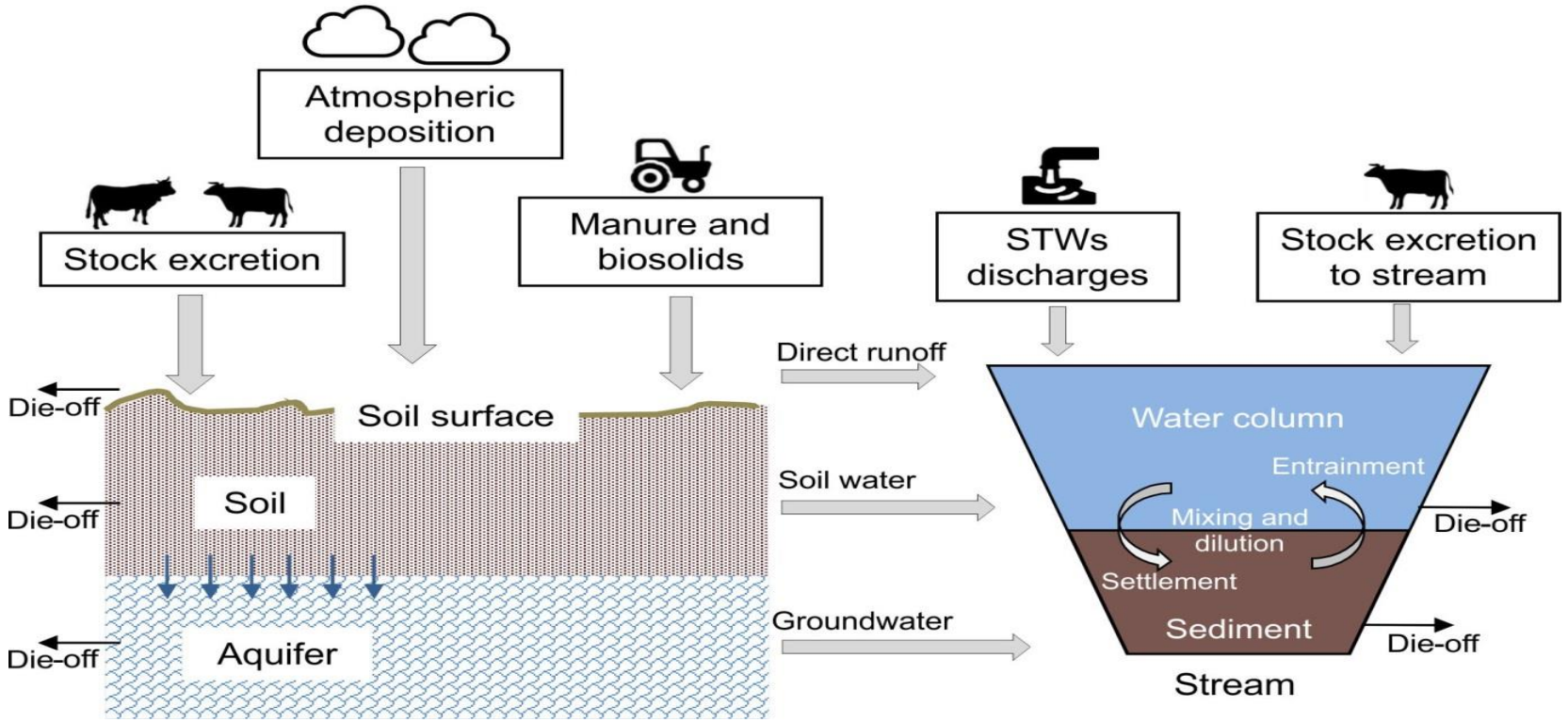
Catchment and River Structure



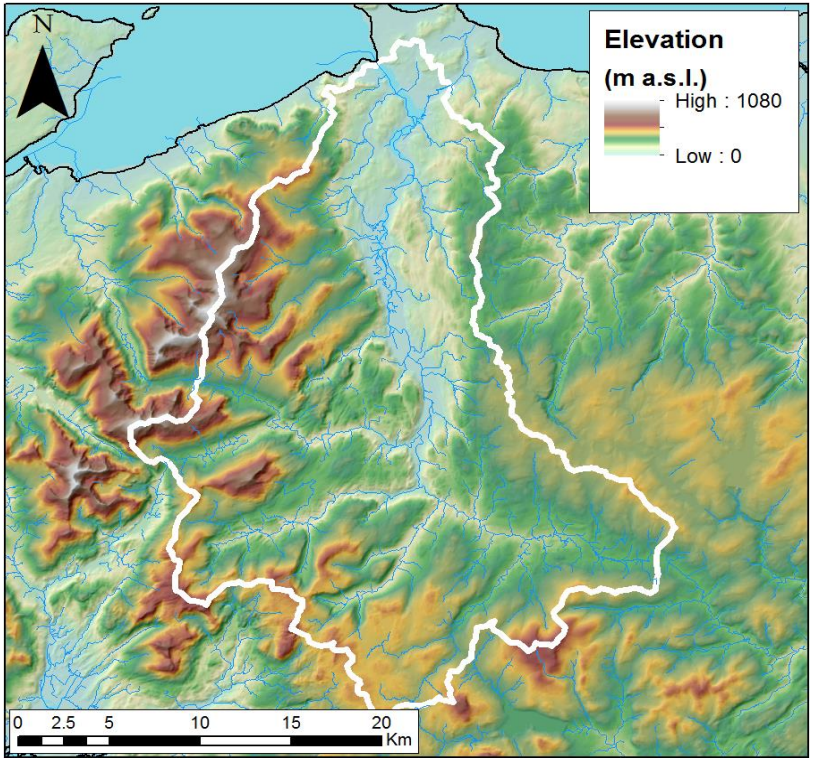


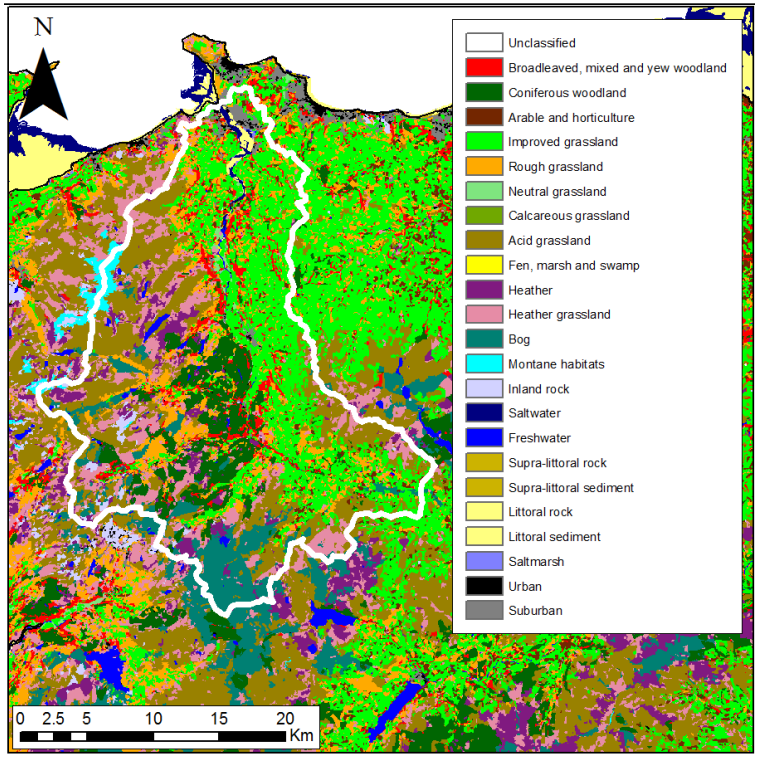
INCA Pathogens

Pathogens transport from land to rivers accounting for natural loss processes such as surface runoff, soil water transport, groundwater interaction, die off and decay, adsorption, deposition onto sediments and resuspension. through soils, into river systems and transport down rivers.

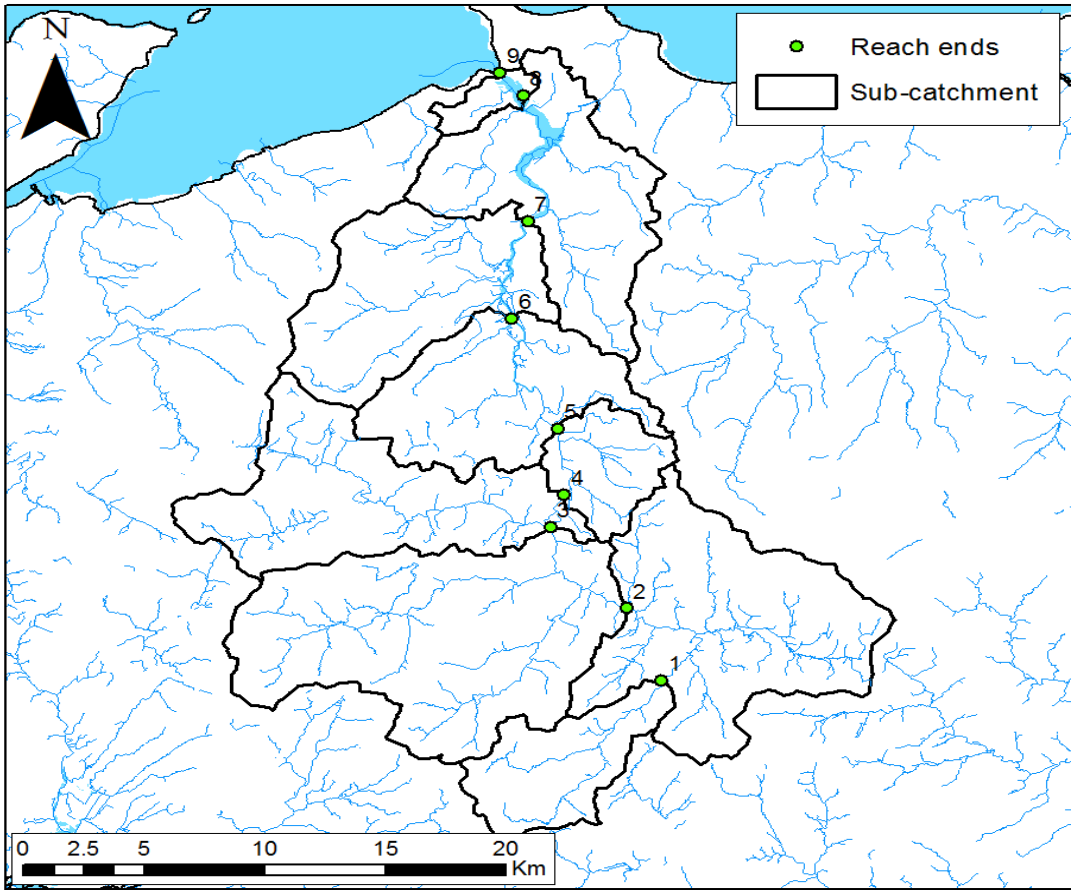


INCA Applied to the Conwy to simulate Nutrients and Pathogens and assess fluxes



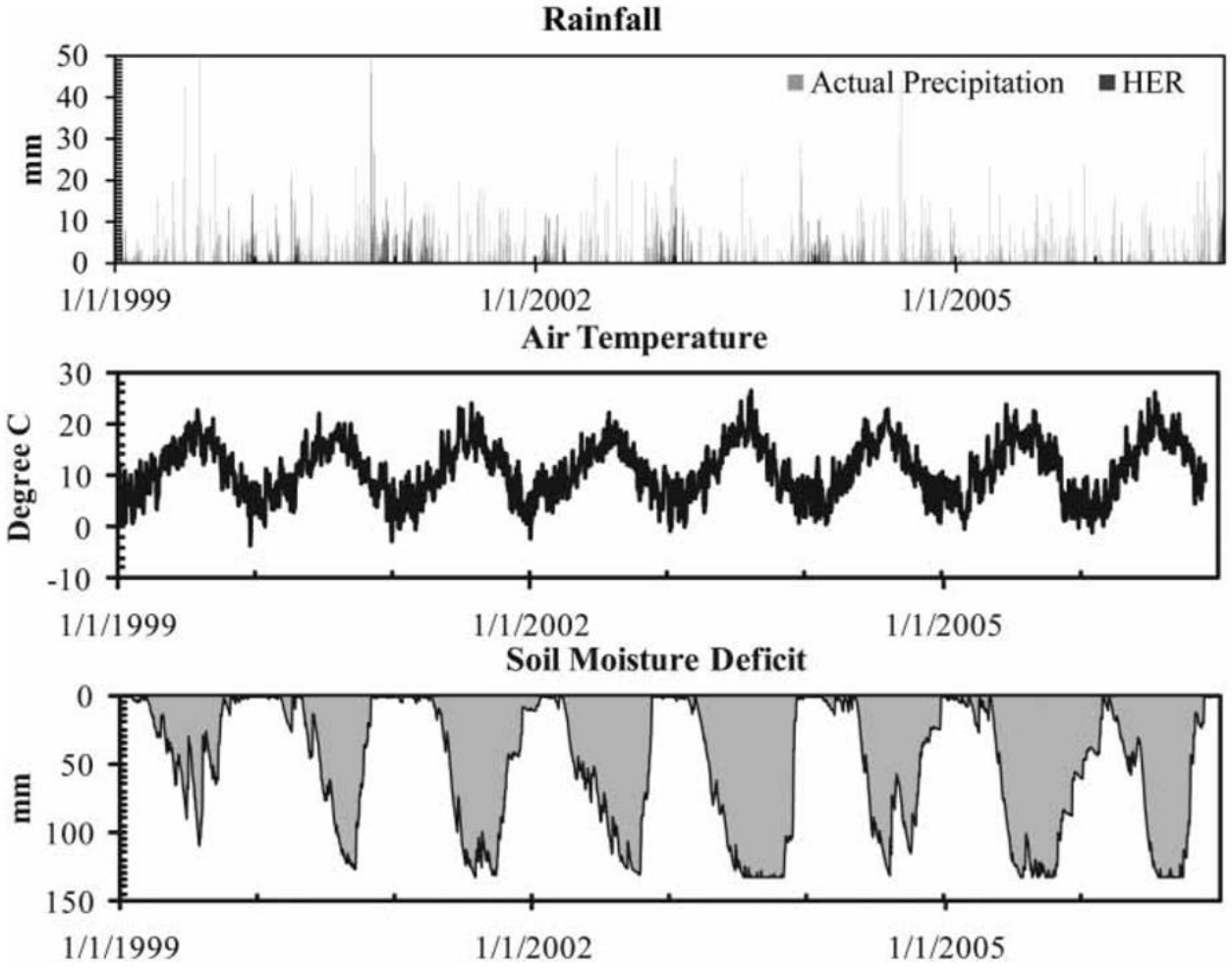


Conwy Sub Catchment Structure/Land Use

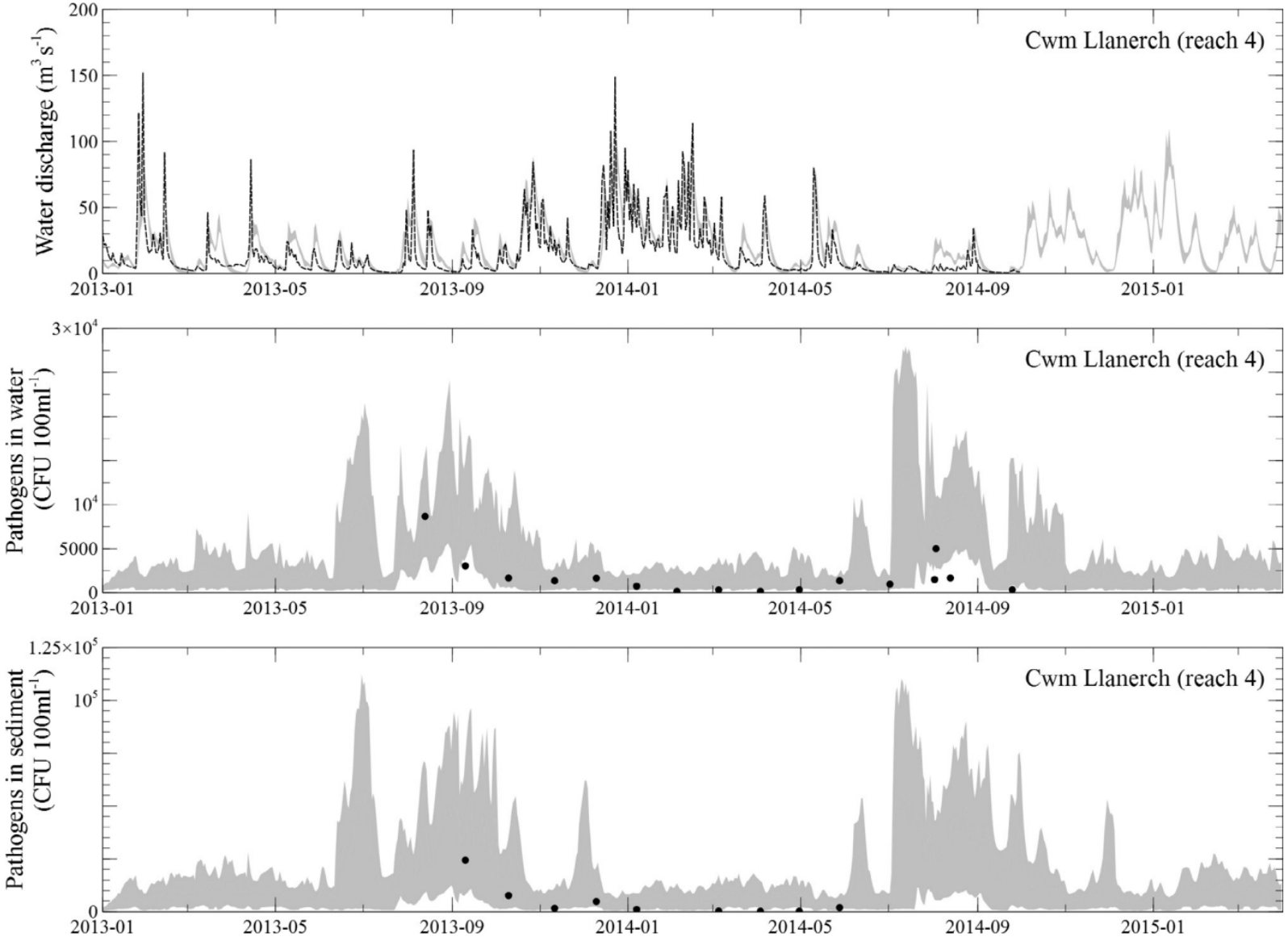


Sub-catchment	1	2	3	4	5	6	7	8	9
Urban, bare and wetlands	1.13	0.26	3.49	6.17	2.16	4.74	7.84	10.97	37.83
Forest	1.04	2.48	29.37	20.42	16.61	20.97	6.26	10.08	7.58
Grassland	27.29	51.91	43.45	55.80	15.23	36.34	64.15	21.37	33.64
Improved grassland	5.12	36.71	8.14	3.23	65.00	29.00	15.11	55.51	18.37
Shrubland	63.75	4.97	14.92	14.20	0.15	7.89	5.63	0.06	0.32
Arable	1.65	3.66	0.63	0.18	0.85	1.06	1.00	2.01	2.25

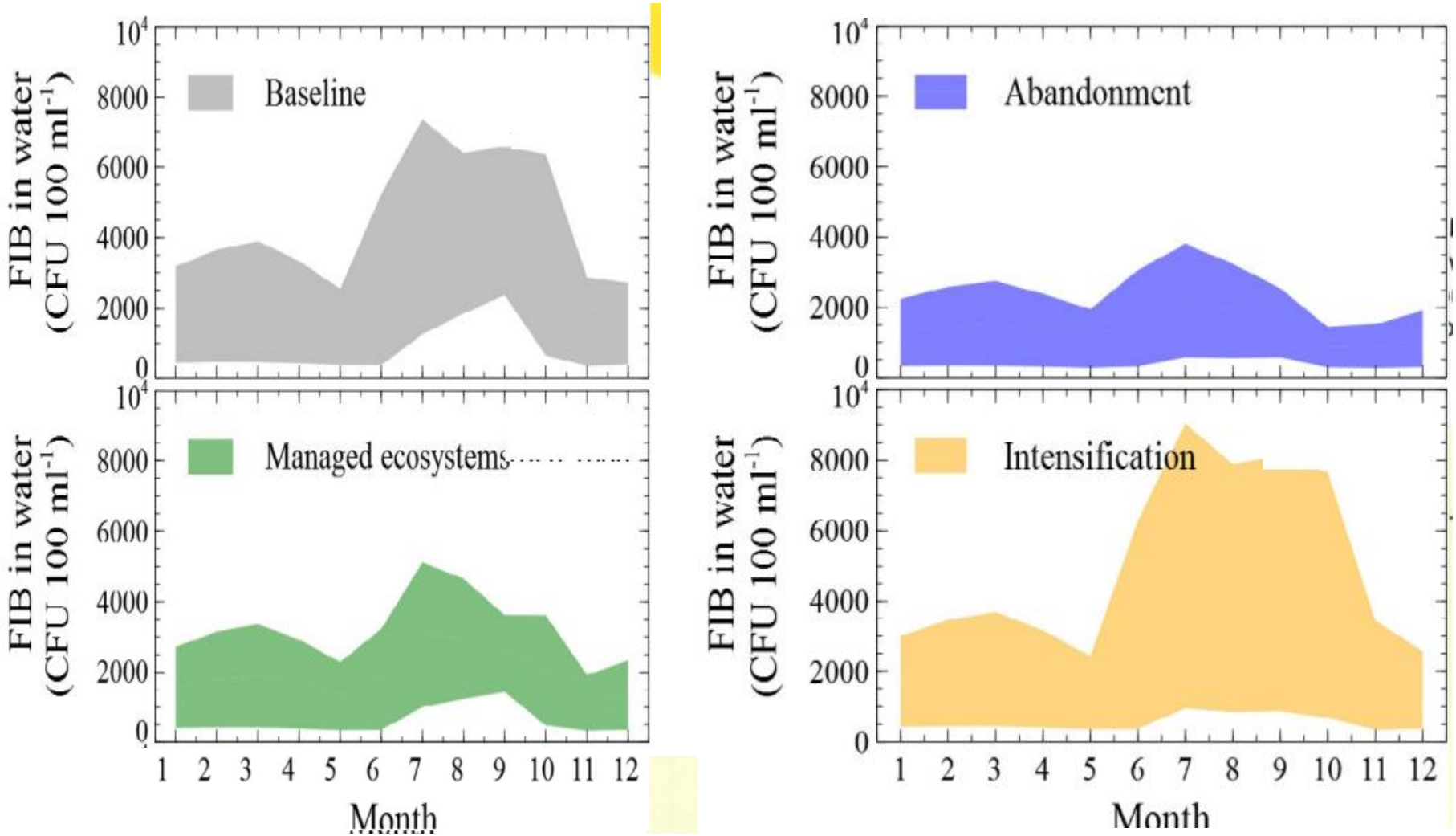
Input Driving Time Series



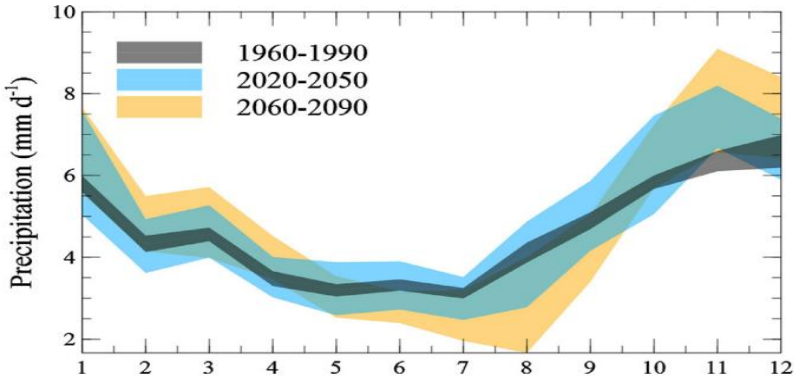
Pathogens Modelling

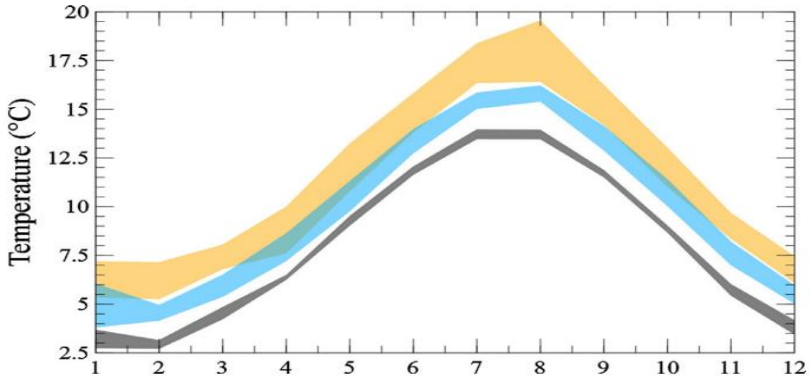


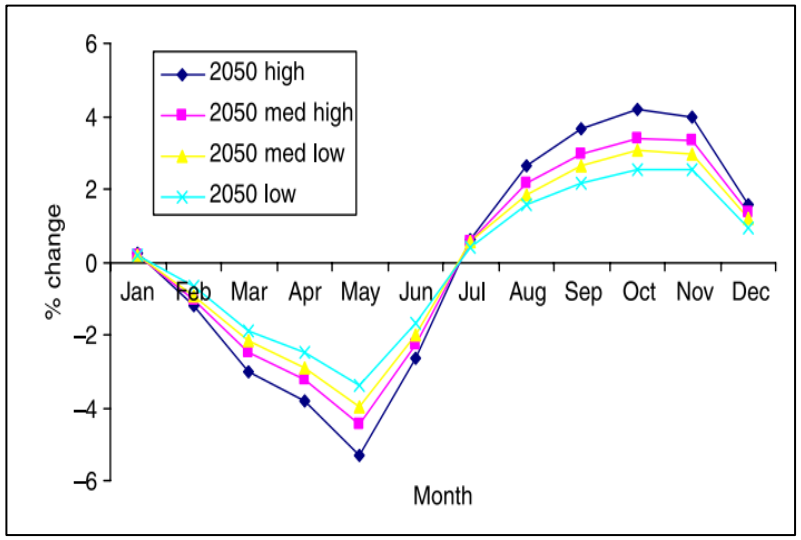
Impacts of Land Use Change on Pathogens

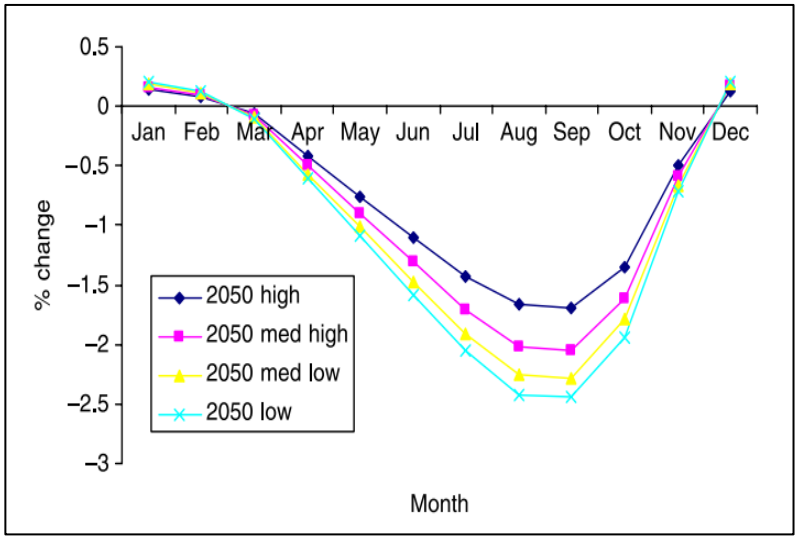


Impacts of Climate Change Across Wales– Rainfall and Temperature









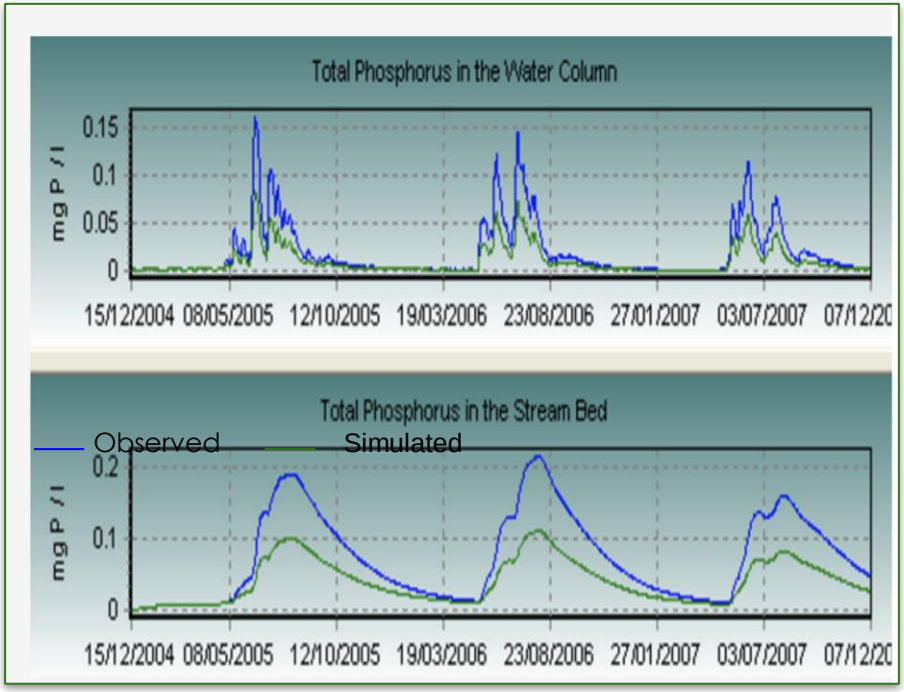
INCA & AQUASCOPE

AQUASCOPE

Problem: Increasing Phosphorus (P) and Nitrogen (N) and pathogens from increasing population & climate pressures increases risk to UK economy & health

Solution: **INCA** accurately simulates and predicts observed P & N and pathogen concentrations to apportion sources of point and diffuse Pollution

Value : Scale INCA and align with Satellite observations



Model outputs/applications

- Time series at key locations and Flux estimates to estuary systems
- Assessments of impacts on eutrophication/algal blooms, shellfish, fisheries, swimming, bathing, fishing etc
- Impacts of short-term events (eg storms)
- Long term impacts due to land use change or changing hydrology and climate change
- Applied in Wales to Conwy, Severn, Wye, Twyi
- Could apply to all Welsh Catchments