01 -   WaterFutures – Modelling drivers, pressures, impacts and mitigation measures that influence water quality in a changing Ireland

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Abstract

WaterFutures is multi-disciplinary research project (funded by the EPA and DAFM) that brings together expertise from a wide range of disciplines all relevant to the future responses of water quality, ecology and environment in Ireland to agents of change, particularly climate, economic, demographic, land use and other changes. Figure 1 shows a flavour of the key ideas and various disciplines involved and these may influence each other, forming an interactive dynamic system to be modelled and managed. While there are gaps in knowledge within each discipline, understanding and being able to model the interactions between the disciplines is a serious challenge. Ignoring one of the components or its interaction with the others risks losing an important driver or moderator of change and of making decisions based on an incomplete dynamic model, a key issue to be addressed in this project. It is novel in the sense that it has a large number of experienced researchers collaborating together and bringing their core expertise to the margins where their disciplines intersect with others.
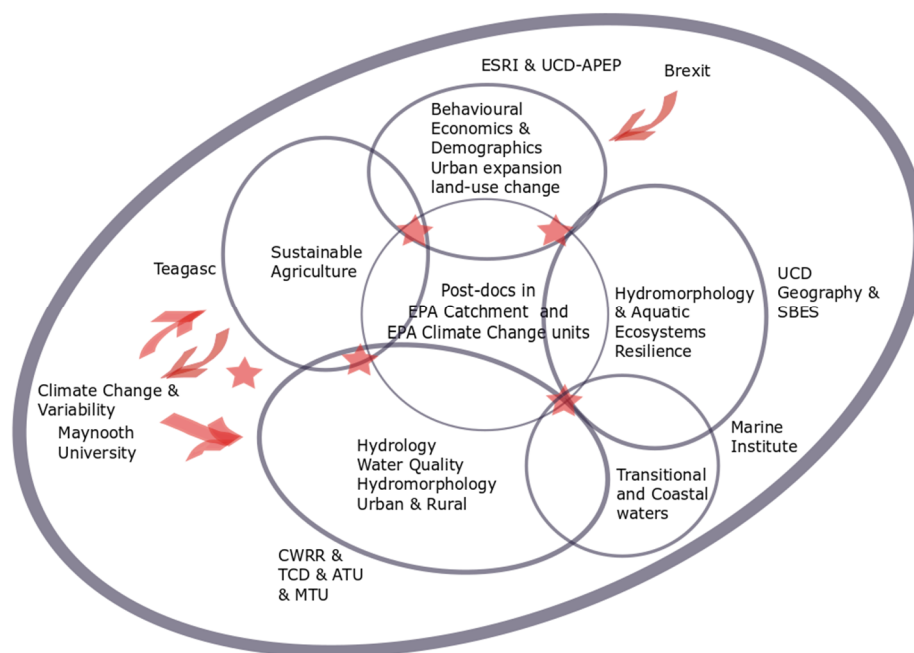

Figure 1: Organisation of Project Research Areas

Changes in climate, demographics, and food choices, as well as land use are all expected to impact on each other and on water quality and are modelled in the project. While each has been modelled separately, differences in modelling approaches and spatial and temporal scales and often paucity of key data make it difficult to link coherently the modelling efforts. The pressure to feed a growing, global, population set to exceed 9 billion people by 2050 represents one of the most significant challenges faced by society, and Ireland's contribution to meeting this challenge is likely to exert further environmental pressures in terms of water demand and quality, soil degradation and

greenhouse gas emissions. Public perception of the increasing danger from climate change may influence food choice and thus agriculture and land use practices. In addition, increased urbanisation and rural depopulation will affect water quality, both because of its changes to land use and the rural environment and because of the increased pollution and waste discharges from more and larger urban areas, with the impact of movement from the larger cities to smaller communities due to remote working an added uncertainty. The project is investigating – (i) how urban expansion and climate change may impact river flows and, hence, the flushing of diffuse pollutants or dilution of point effluents and (ii) How more intense future rainfall events might affect nutrients and sediments loads in urban and rural drainage systems, rivers, lakes and estuaries?

A good body of knowledge is already available on ecological responses to flow regime, nutrients, hydromorphology and sediments and other contaminants of emerging concern, but much of this lies in disparate sources and little has informed the type of modelling needed for practical integration of water quality and ecological sustainability in management. This not only applies to surface waters, but also subsurface waters, e.g. in karst systems and groundwater dependent terrestrial ecosystems.

An initial review of relevant research already done in Ireland has highlighted the difficulties in transforming the research into management tools. A subsequent review of available models in key areas shows a patchwork profile, with many models available for certain areas, for instance, catchment rainfall-runoff, but many do not easily link with the main issues of concern to water management, nor with the range of tools and datasets available to managers. A key focus of the project is to identify and implement the "really-useful" models if and where they are available and to develop new methodologies where needed. This paper will primarily discuss these challenges and the project's progress in addressing them.

Full script to follow shortly.