Geophysical Research Abstracts
Vol. 17, EGU2015-368, 2015
EGU General Assembly 2015

Managing multiple diffuse pressures on water quality and ecological habitat: Spatially targeting effective mitigation actions at the landscape scale.

Hannah Joyce (1) and Sim Reaney (2)

(1) Geography Department, Durham University, Durham, United Kingdom (hannah.joyce@durham.ac.uk), (2) Geography Department, Durham University, Durham, United Kingdom (sim.reaney@durham.ac.uk)

Catchment systems provide multiple benefits for society, including: land for agriculture, climate regulation and recreational space. Yet, these systems also have undesirable externalities, such as flooding, and the benefits they create can be compromised through societal use. For example, agriculture, forestry and urban land use practices can increase the export of fine sediment and faecal indicator organisms (FIO) delivered to river systems. These diffuse landscape pressures are coupled with pressures on the in stream temperature environment from projected climate change. Such pressures can have detrimental impacts on water quality and ecological habitat and consequently the benefits they provide for society. These diffuse and in-stream pressures can be reduced through actions at the landscape scale but are commonly tackled individually. Any intervention may have benefits for other pressures and hence the challenge is to consider all of the different pressures simultaneously to find solutions with high levels of cross-pressure benefits. This research presents (1) a simple but spatially distributed model to predict the pattern of multiple pressures at the landscape scale, and (2) a method for spatially targeting the optimum location for riparian woodland planting as mitigation action against these pressures.

The model follows a minimal information requirement approach along the lines of SCIMAP (www.scimap.org.uk). This approach defines the critical source areas of fine sediment diffuse pollution, rapid overland flow and FIOs, based on the analysis of the pattern of the pressure in the landscape and the connectivity from source areas to rivers. River temperature was modeled using a simple energy balance equation; focusing on temperature of inflowing and outflowing water across a catchment. The model has been calibrated using a long term observed temperature record. The modelling outcomes enabled the identification of the severity of each pressure in relative rather than absolute sense at the landscape scale.

Riparian woodland planting is proposed as one mitigation action to address these pressures. This planting disconnects the transfer of material from the landscape to the river channel by promoting increased infiltration and also provides river shading and hence decreases the rate of water heating. To identify the optimal locations for riparian woodland planting, a Monte Carlo based approach was used to identify multiple mitigation options and their influence on the pressures identified. These results were integrated into a decision support tool, which allows the user to explore the implications of individual and a set of pressures. This is achieved by allowing the user to change the importance of different pressures to identify the optimal locations for a custom combination of pressures. For example, reductions in flood risk can be prioritized over reductions in fine sediment.

This approach provides an innovative way of identifying and targeting multiple diffuse pressures at the catchment scale simultaneously, which has presented a challenge in previous management efforts. The approach has been tested in the River Ribble Catchment, North West England.