



## **The role of Natural Flood Management in managing floods in large scale basins during extreme events**

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There is a strong evidence database showing the negative impacts of land use intensification and soil degradation in NW European river basins on hydrological response and to flood impact downstream. However, the ability to target zones of high runoff production and the extent to which we can manage flood risk using nature-based flood management solutions are less known. A move to planting more trees and having less intense farmed landscapes is part of natural flood management (NFM) solutions and these methods suggest that flood risk can be managed in alternative and more holistic ways. So what local NFM management methods should be used, where in large scale basin should they be deployed and how does flow propagate to any point downstream? Generally, how much intervention is needed and will it compromise food production systems? If we are observing record levels of rainfall and flow, for example during Storm Desmond in Dec 2015 in the North West of England, what other flood management options are really needed to complement our traditional defences in large basins for the future?

In this paper we will show examples of NFM interventions in the UK that have impacted at local scale sites. We will demonstrate the impact of interventions at local, sub-catchment (meso-scale) and finally at the large scale. These tools include observations, process based models and more generalised Flood Impact Models. Issues of synchronisation and the design level of protection will be debated. By reworking observed rainfall and discharge (runoff) for observed extreme events in the River Eden and River Tyne, during Storm Desmond, we will show how much flood protection is needed in large scale basins. The research will thus pose a number of key questions as to how floods may have to be managed in large scale basins in the future. We will seek to support a method of catchment systems engineering that holds water back across the whole landscape as a major opportunity to manage water in large scale basins in the future. The broader benefits of engineering landscapes to hold water for pollution control, sediment loss and drought minimisation will also be shown.