

## Environmental change, flood hazard and management in 21<sup>st</sup> Century Britain.

In this talk, Don begins by outlining why the operation of the hillslope hydrological cycle is fundamental to thinking about the flood response of British rivers to human induced climate change.

The National Flood & Coastal Risk Management Strategy for England produced by the Environment Agency in 2020 outlines the headline climatic and sea level changes to be expected during this century and notes that in 2020 there are 5.2 million homes at risk from flooding. The recent history of flooding in the UK has seen frequent emergencies as the nation has experienced a 'flood rich period' from the late 1990's through to the present. Key data from the events of 2000, 2007, 2012, 2013-14, 2015-16 and February 2020 are considered. These events illustrate the inherent variability in the meteorological triggers of river flooding and are, latterly, consistent with what might be expected in a warming atmosphere. Hence the precipitation inputs to the hillslope hydrological cycle show recent high frequencies of 'extreme' events.

However, climate is not the only changing variable in the river flooding system. The response of the land surface to incoming precipitation is conditioned by land use changes over the past century. A good example is the change in the hydrological response of the rural landscape, conditioned by changes in farming practice intensity. Removal of hedgerows, larger fields, year-round cultivation, under-field drainage and increased livestock densities have increased the runoff potential of the landscape and increased the hydrological 'connectivity' of the catchment and river systems. Recent work has therefore focussed on thinking about ways in which farmers can adapt their practices to a) increase infiltration and reduce runoff from their fields, and b) reduce the connectivity between fields and rivers. Here, the idea is to reduce local flood levels. The impact of local changes on downstream flood hazard is less certain.

The talk goes on to outline the traditional 'hard' engineering approaches to flood defence and recent initiatives in expanding flood 'abatement'. These methods consider floods at source, by using riparian woodlands, wetland storage zones and 'slowing the flow' strategies to increase storage of incoming precipitation in the catchment, and to slow the runoff rates to rivers. By these methods it is hoped to reduce flood peaks in vulnerable settlements. Restoration of upland peat ecology is also seen as a means of storing water and preventing rapid runoff into rivers during extreme rainfall events.

Flood abatement strategies extend to urban areas and include Sustainable Urban Drainage Systems (SUDS) to 'slow the flow' and reduce the likelihood of 'surface water flooding'.

We cannot eliminate the flood risk increase however, and policy is also focussing on 'flood resilience'. This involves changes in house design, flood gates, raised electricity sockets and floor levels in new builds. The idea is to allow us to live with floods and recover more quickly. Place-making, protection, respond, recover as the Environment Agency (2020) puts it.

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