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Catchment systems science and management: from evidence to resilient landscapes

Paul Quinn
Univeristy of Newcastle, Civil Engineering and Geosciences, Newcastle upon tyne, (p.f.quinn@ncl.ac.uk)

There is an urgent need to reassess both the scientific understanding and the policy making approaches taken to manage flooding, water scarcity and pollution in intensively utilised catchments. Many European catchments have been heavily modified and natural systems have largely disappeared. However, working with natural processes must still be at the core of any future management strategy. Many catchments have greatly reduced infiltration rates and buffering capacity and this process needs to be reversed. An interventionist and holistic approach to managing water quantity and quality at the catchment scale is urgently required through the active manipulation of natural flow processes. Both quantitative (field experiments and modelling) and qualitative evidence (local knowledge) is required to demonstrate that catchment have become 'unhealthy'. For example, dense networks of low cost instrumentation could provide this multiscale evidence and, coupled with stakeholder knowledge, build a comprehensive understanding of whole system function.

Proactive Catchment System Management is an interventionist approach to altering the catchment scale runoff regime through the manipulation of landscape scale hydrological flow pathways. Many of the changes to hydrological processes cannot be detected at the catchment scale as the primary causes of flooding and pollution. Evidence shows it is the land cover and the soil that are paramount to any change. Local evidence shows us that intense agricultural practices reduce the infiltration capacity through soil degradation. The intrinsic buffering capacity has also been lost across the landscape. The emerging hydrological process is one in which the whole system responds too quickly (driven by near surface and overland flow processes). The bulk of the soil matrix is bypassed during storm events and there is little or no buffering capacity in the riparian areas or in headwater catchments.

The prospect of lower intensity farming rates is highly unlikely owing to a growing world population and future climates may be driven by more intense rainfall. Together these will increase runoff rates further, generating more erosion, water pollution and floods. A reduction in recharge to the deeper soil and aquifers also increases the chance of droughts as the natural groundwater reservoirs are not replenished. Hence the urgent need to put back the infiltration and buffering capacity for whole catchments. A strategic plan for where, what and how we grow crops and rear animals within catchments is the first step. Example case studies will be presented that provide evidence that intense farming activities can be offset by the creation of soft engineered wetlands, runoff attenuation ponds, buffer strips and high infiltration zones. A fresh look at how our catchments work and an assessment of what is a healthy food and water dynamic for that system is reviewed. Through gathering local evidence of problems and solutions we can demonstrate how healthy catchments should function for the long term.