



Effects of tree shelterbelts on the hydrology of upland areas

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Recent large flood events in the UK have focused attention on the effects of agricultural intensification and de-intensification on flood risk. Possible detrimental factors for these floods are thought to be the degradation of soil structure through compaction from grazing animals and agricultural machinery; while possible ameliorating factors may be the re-introduction of natural landscape features such as woodland and wetlands.

In order to address this issue in an upland setting a multi-scale experimental programme has been implemented at Pontbren, a sheep-farmed headwater catchment of the River Severn, UK. Primary aims are to develop understanding of the processes governing flood generation and the associated impacts of land management practices, and to bridge the gap between process understanding and ability to predict effects on downstream flooding. An integral component of this is to determine the role that native, broadleaf trees, planted as shelterbelts on intensively grazed pasture, may have in the reduction of flooding. Effects of trees on soil physical properties, soil moisture status and rainfall interception are investigated, including any 'rain-shadow' and edge effects. Three ungrazed tree strips, plus one woodland edge, have been instrumented with clusters of tensiometers, plus throughfall and stemflow collectors. Soil moisture measurements have been made with a neutron probe, and tracer tests and permeameter tests have been carried out. Overland flow has been collected at one tree site. Comparisons of soil hydraulic properties show significant increases in saturated moisture content and hydraulic conductivity of soil under trees compared to adjacent improved pasture. These effects, combined with increased interception and water use by the trees, have led to differences in soil moisture, with the soil under the trees being considerably drier than that under the pasture. The results show seasonal variation. Dye tracer tests reveal preferential flow along living tree roots. Overland flow results show substantial differences in surface runoff between the grazed pasture and the ungrazed tree-planted area.

The results suggest that these effects of land management can improve soil structure and reduce rapid runoff, with consequent implications for reducing flood hazard.