Geophysical Research Abstracts
Vol. 14, EGU2012-11151-1, 2012
EGU General Assembly 2012

The effect of riparian forest management on flood risk and flood hydrology

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Riparian forests are a source of in-stream Large Wood. In-stream Large Wood has been shown to produce complex in-stream hydraulic patterns which can act to dissipate flood energy and attenuate flood peaks. Furthermore riparian forest are also commonly characterised by a complex flood plain surface which acts to slow overbank flow. Increased channel and floodplain flow resistance in forested catchments has the effect of increasing the duration and height of overbank inundation locally, but also, and significantly, can potentially increase flood wave travel time and reduce flood peak magnitude at downstream locations. River restoration programmes can include riparian afforestation of headwater stream and increases to in-stream hydraulic roughness; there is a need for research to quantify the effect of such changes on flood hydrology.

This study uses a loosely coupled modelling approach to investigate the response of flood behaviour to catchment wide forest management strategies. A USDA Riparian Forest growth model (NE-CWD) calibrated for UK forests using Forestry Commission Biometrics data is used to deliver predictions of in-stream wood loads under different forest management scenarios over time. Scenarios include continuation of plantation management with harvesting/thinning, hands-off management with no harvesting and reforestation of cleared areas of the catchment. Wood load predictions from NE-CWD are translated into predictions of logjam frequency and values for channel hydraulic roughness based on field data collected over two field seasons.

Flood modelling is conducted using OVERFLOW, a model developed for the simulation of flood events where the magnitude and travel time of a flood peak to a downstream location are of interest. Predictions linking land use to flood behaviour can be delivered by varying the forest management scenarios within NE-CWD and the associated channel and floodplain roughness. The output of OVERFLOW includes individual contributions from sub-catchments to flood peak travel-time and downstream flood magnitude, facilitating assessment of which sub-catchment(s) are most sensitive to land use change in respect of downstream flood risk. The project is in collaboration with the UK Environment Agency and Forestry Commission and it is hoped the finding will have implications for flood defence and river restoration policy.