

Hedge your bets on Flood Risk: How do Hedgerows modify hillslope and catchment scale hydrological response?

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A dominant feature in the agricultural landscape in the UK are field boundaries. Two thirds of England has been continuously hedged for over a thousand years although most modern hedges were planted during the Enclosures Acts 1720-1840. However, the use of larger agricultural machinery has resulted in the removal of some field boundaries and the subsequent increase in field sizes over the 20th Century. The multiple benefits of hedgerows in ecology have been extensively studied, but the impact of these widespread features on hydrology and flood risk has seen very little attention.

Nature-based solutions are increasingly being seen as a complementary approach to hard engineered flood defences. It is hypothesised that hedgerows play a part in this through modifying hillslope hydrological processes, including (a) changing the spatial distribution of precipitation due to sheltering effects; (b) biological loss of water through transpiration; (c) infiltration increased through improved soil structure at the boundaries; and (d) throughflow effected by modified hydraulic gradients.

An extensive monitoring programme of a 20m transect through a hedgerow in the Skell Catchment, Northern England occurred from April 2014 to October 2015. The holistic hydrological cycle was monitored, including precipitation and soil moisture at different distances from the hedgerow, leaf wetness interception, stemflow collars, and throughfall gauges, and transpiration losses from the hedgerow.

Results indicate that hedgerows modify precipitation volumes at different distances along the transect, but that relationships are complex, probably related to event specific weather conditions such as wind direction and speed and rainfall intensity. Soil moisture levels are significantly ($p < 0.001$) lower along the hedgerow compared to 1, 3 and 10m away from it in all seasons. It has also been shown that hedgerows modify hydrological connectivity at the catchment scale.