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Modifications to the Soil-Vegetation-Atmosphere Continuum by Hedgerows – Observations from a field site in Northern England

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UK farming practices have changed significantly over the past 100 years. This is evident in arable fields, where the use of larger machinery has led to the removal of hedgerows. In the River Skell catchment, in Yorkshire, UK this has led to a doubling in field size since 1892. The national-wide change is responsible for longer slope lengths, increased runoff velocities and greater potential for connectivity, which may be responsible for an increase in flood risk at the catchment scale. However there is a lack of physical evidence to support this theory. Hedgerows are a widespread, man-made boundary feature in the rural UK landscape. They play an important ecological role in providing shelter, changing the local climate, reducing erosion and have a strong influence on local soil properties. Their impact on hydrology has not been widely studied but it is hypothesised that their presence could alter soil moisture levels and the soil structure, therefore affecting runoff.

This paper presents observations of a hedgerow on the Soil-Vegetation-Atmosphere Continuum, through 15 months field monitoring conducted in the River Skell catchment. Firstly, to assess soil moisture levels TDR probes were installed at different depths and distances from the hedgerow. To assess the soil quality and therefore its infiltration capacity, soil cores were collected to determine soil horizons and root density. Also, laboratory tests were undertaken to determine the soil type and the porosity. Secondly, to assess the physical impact of the hedgerow plant on the partitioning of rainfall, gauges were installed to capture the spatial distribution of rainfall, along a transect perpendicular to the hedgerow, as well as stemflow. Throughfall gauges were also installed within the hedgerow and leaf area index calculated. Thirdly, to assess the impact of the hedgerow on the micro-climate, temperature sensors and four leaf wetness sensors were installed to determine evapotranspiration and interception rates.

Results from the TDR probes show that soil moisture levels next to the hedgerow rise earlier and fall quicker, than the probes further from the hedgerow, where levels rise gradually and fall slowly. Higher soil porosity (5-15%) next to the hedgerow, compared to 1-10m away from the hedgerow and roots extending 1m horizontally from the structure help the soil to drain better. Throughfall experiments along the hedgerow length showed large variations in leaf area index (4.5-0.8) correlating with 33-94% total rainfall capture. Results from the leaf wetness sensors show that the interception of rainfall occurs 10-30 minutes later on leaves inside the hedgerow, in comparison to leaves on the perimeter and that leaves dry much quicker (2-3 hours) inside the hedgerow.