Soil transport on hillslopes under winter forage crop grazing

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Farming intensification has lead to greater use of forage cropping systems over winter, and a push of these systems onto sloping topography in some regions. Grazing of forage crops leaves soils exposed and vulnerable to erosion, and their use during winter coincides with when soil is typically at high water contents and has low structural stability. These factors, combined with intensive stocking rates, results in soils under winter forage crop grazing being susceptible to structural degradation and erosion.

While effects such as compaction and erosion by overland flow are relatively well-understood, the volume of soil that is pushed downslope beneath cow hooves has received little attention. This study developed a novel technique to quantify this form of soil transport under winter forage crop grazing, and determined a relationship between soil transport and slope gradient. Downslope soil transport under conventional cultivation during pasture re-establishment was also investigated.

A linear relationship was found between soil transport under grazing cows and slope gradients up to 0.25, allowing a soil erosion map of our research area to be produced. Soil transport rates on slopes steeper than 0.25 had greater uncertainty, due to formation of stock tracks causing high variability in soil transport rates. No clear relationship was found between gradient and downslope soil transport under cultivation. Variation in direction of tractor movement relative to contour is indicated as a possible reason for the lack of relationship found, compared to overseas cultivation research. Despite the lack of relationship with gradient, mean transport rates identified cultivation as playing a large role in soil erosion of agricultural landscapes. Key areas of soil loss are identified using our soil erosion map, and these losses are put into context by comparing soil erosion under forage cropping systems with published natural soil erosion and soil production rates.