Geophysical Research Abstracts
Vol. 17, EGU2015-3508-2, 2015
EGU General Assembly 2015

A tag and trace approach to assess the potential contribution of earthworm casts to soil erosion on hillslopes under permanent pasture

Philip (Phil) Greenwood (1,2), Desmond Walling (2), and Timothy Quine (2)

(1) Department of Environmental Sciences, University of Basel, Switzerland (philip.greenwood@unibas.ch), (2) Geography, College of Life & Environmental Sciences, University of Exeter, UK

This communication presents preliminary results from a tag and trace experiment to assess the potential contribution of earthworm casts to soil erosion on a gentle (i.e. 4%) hillslope under permanent pasture using artificial radionuclides, caesium-134 (134Cs) and cobalt-60 (60Co). A rapid and repeatable laboratory-based procedure was devised for tagging groups of intact, air-dried casts by immersion into solutions containing a known activity concentration of either 134Cs or 60Co, each mixed in 2 l of water. For the tracing component of the work, fifteen intact casts representing the equivalent of 203 g of sediment were labelled with 216 Bq of 134Cs activity and evenly distributed across the upslope half of a 0.6 m long * 0.5 m wide bounded area of pasture, at a distance of $\geq$ 0.3 m from a plot outlet. A further fifteen intact casts representing the equivalent of 190.7 g of sediment were labelled with 224 Bq of 60Co activity and evenly distributed across the downslope half of the plot, at a distance of $\leq$ 0.3 m from the plot outlet. Over the following 76 days, all casts were exposed to natural weather events, during which time, 186.3 mm of rainfall generated 16 separate storm runoff samples. Sediment was recovered from the runoff, assayed by gamma spectrometry and a simple mixing model was used to partition the sediment into labelled material and unlabelled surface material. Provisional results indicate that a total of 26.8 g of 60Co-labelled sediment, equivalent to 14.1% of the total mass deployed, was recovered from a distance of $\leq$ 0.3 m from their original position. In contrast, 9.1 g of 134Cs-labelled sediment, equivalent to 4.5% of the total mass deployed, was recovered from a distance of $\geq$ 0.3 m from their original position. This presentation discusses key findings, with a particular focus on the temporal changes in sediment-supply, as well as a number of uncertainties associated with the technique. Despite these uncertainties, however, the essentially unique findings from this tag and trace experiment represent an exciting and innovative use of sediment tracers. They also make a compelling argument that dispersed earthworm casts may be fuelling an ongoing, yet largely unstudied, sediment transfer mechanism during runoff events on hillslope areas where surface casts are abundant.