A FIELD EXPERIMENT TO MONITOR WATER, SEDIMENT AND NUTRIENT FLUXES FROM SEMI-ARID HILLSLOPES ON INTRA- AND INTER-EVENT TIMESCALES

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ABSTRACT

A suite of hillslope and small catchment scale monitoring experiments was set up to characterize the behaviour of water, sediment and nutrients (Nitrate – NO_3-N, Ammonium – NH_4-N and Dissolved Organic Nitrogen - DON) from highly erosive areas within the semi-arid south-west of the USA. Observed data from these experiments were collected over a two year period encompassing thirteen, discrete, high intensity rainfall events that generated significant levels of overland flow, high sediment yields and nutrient concentrations at all scales.

Monitoring occurred throughout the monsoon season to capture the high levels of variability in fluxes from the first event of the season, with respect to those that occur later on, when vegetation cover is well developed, antecedent moisture contents may be higher and surface crusting may be more influential. Observations were made at five different scales from $21m^2$ to $1200m^2$. Results show that concentrations of sediment and nutrients are typically high for early-season events, particularly the first events of the season, though runoff coefficients may be lower. Such behaviour is attributed to the poor compaction of the soil surface after repeated diurnal cycles of temperature around 0^0c throughout the winter, as well as the presence of large amounts of organic matter associated with leaf-fall from the previous autumn. Sediment yields tend to decrease with increasing slope lengths and decreasing runoff coefficients. Nutrient loads are broadly controlled by event hydrographs, though notable exceptions occur when organic matter contents of the soil are high, or when exhaustion effects are present during long duration events.

A comparison of fluxes throughout the 2002 monsoon at both the hillslope plot and catchment season is also presented, wherein a large storm with a return period of approximately 5 years was observed. The position of this large magnitude event in the midst of the season provides a good demonstration of the significance of event timing, as well as event magnitude, in producing high rates of sediment and nutrient delivery to adjacent channels. Implications of the results are discussed in light of the potential for such high sediment and nutrient loads to pollute water bodies and provide short-lived, but potentially significant contributions to larger catchment sediment and nutrient budgets.