Geophysical Research Abstracts
Vol. 18, EGU2016-1134, 2016
EGU General Assembly 2016

Understanding sediment sources in a peri-urban Mediterranean catchment using geochemical tracers

Carla Ferreira (1,2), Rory Walsh (3), Ryunosuke Kikuchi (4), and Will Blake (5)

(1) Research Centre for Natural Resources, Environment and Society (CERNAS), College of Agriculture, Polytechnic Institute of Coimbra, Coimbra, Portugal, (2) Centre for Environment and Marine Studies (CESAM), Department of Environment and Planning, University of Aveiro, Aveiro, Portugal, (3) Department of Geography, College of Science, Swansea University, Swansea, United Kingdom, (4) Faculty of Science and Technology, Ryukoku University, Otsu, Japan, (5) School of Geographical and Earth Sciences, Plymouth University, Plymouth, United Kingdom

One of the main physical environmental impacts of urbanization is an increase in suspended sediment concentrations and loads, particularly in the constructional phase. Impacts in peri-urban catchments characterized by a mosaic of urban and non-urban landscape elements with varying roles in acting as sources and sinks of overland flow and slope wash have received little attention, particularly in Mediterranean environments.

The present study uses a sediment 'fingerprinting' approach to determine the main sediment sources in the peri-urban *Ribeira dos Covões* catchment (6.2km^2) in Portugal and how they change during storm events following contrasting antecedent weather. The catchment, rural until 1972, underwent discontinuous urbanization in 1973-1993, followed by an urban consolidation phase. Currently, its land-use is a complex mosaic of woodland (56%), urban (40%) and agricultural (4%) land parcels. Distinct urban patterns include some well-defined urban residential centres, but also areas of discontinuous urban sprawl. Since 2010, a major road was built and an enterprise park has been under construction, covering 1% and 5% of the catchment, respectively. The catchment has a Mediterranean climate. The geology comprises sandstone (56%), limestone (41%) and alluvial deposits (3%). Soils are generally deep (>3.0m), but shallow (<0.4m) on steeper limestone terrain. The catchment has an average slope of 9˚, but includes steep slopes of up to 46˚.

The sediment fingerprinting methodology involved characterizing the chemical properties of sediments from individual upstream sub-catchments and comparing these to the properties of downstream transported fluvial material. Three fine bed-sediment sampling surveys were carried out after (i) a long dry period (21/09/2012), (ii) a winter storm of relatively high rainfall intensity (23.2mm day^{-1}) (19/02/2015), and (iii) after several storms in Spring (22/04/2015). All samples were oven-dried (at 38˚C) and sieved to obtain different particle size fractions (0.125-2.000mm, 0.063-0.125mm and <0.063mm). Seventeen stream sites were sampled plus a sample of sediment from a road surface immediately it entered the stream network. The elemental composition (40 elements) of each size fraction was assessed using a Niton X-ray fluorescence elemental analyser.

Results show that rock type has a profound influence on the geochemical properties of bed-sediments. Catchment outlet sediment collected after the summer and a storm of high rainfall intensity following dry weather displayed geochemical properties closer to those of sediment from sandstone sub-catchments, and in particularly sediment from the enterprise park under construction. After the storm that followed very wet weather, however, limestone areas became of much greater significance as sediment sources, probably because of the high soil saturation. At limestone stream sites receiving runoff from the newly constructed road, fine bed-sediment geochemistry was found to be similar to that of road sediment, indicating a high contribution of this source. These results are supported by spatio-temporal differences in streamflow and suspended sediment concentrations at instrumented monitoring stations.

It is concluded that this methodology represents a potentially useful tool to enable river managers to detect and assess sediment sources in urbanized and partly urbanized catchments, and to supporting them in designing and implementing effective land-use mosaics and site-specific measures to mitigate erosion.