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Quantifying soil erosion with GIS-based RUSLE in La Baells Reservoir (Llobregat River Basin), SE Pyrenees, Spain

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Sediment yield in mountain areas is a matter of concern not only because of the loss of the fertile topsoil but also due to its off-site effects such as sediment deposition in reservoirs and damage to aquatic life. There are few soil erosion estimates at the river basin for non agricultural areas, and the uncertainty of estimates is scarcely assessed. This research was conducted in the Llobregat river basin at the headwaters of La Baells Reservoir which supplies water to Barcelona city. This basin ($504 km^2$) is located in the South Eastern Pyrenees, land cover is mainly coniferous forest and pastures with some intensely eroded areas (bad lands). Annual average soil erosion was quantitatively estimated with an integration of geographic information system (IDRISI) and the Revised Universal Soil Loss Equation (RUSLE). Maps for each of the factors involved where obtained with a 20 m resolution. Rainfall dataset from eight weather stations and spanning 14 years, soil properties, land cover inventory, land management features and digital elevation model were used as resource datasets to generate each of the RUSLE factor maps. Annual average sediment yield was computed by applying a sediment delivery ratio to the results obtained by RUSLE, and this result was compared with existing bathymetric survey results for the same reservoir. Uncertainty and sensitivity analyses were undertaken for each of the RUSLE factors, in order to assess its magnitude and determine which of the factors influences the most the soil loss estimate. Results show that the annual average sediment yield was 2.9 $Mg\ km^{-2}y^{-1}$ and its confidence interval lied between 1.1 $Mg\ km^{-2}y^{-1}$ and 7.5 $Mg\ km^{-2}y^{-1}$ with 90% confidence. These results are in agreement with results from reservoir bathymetric survey (4.3 $Mg\ km^{-2}y^{-1}$). Additional comparisons of estimated sediment yield were done with empirical methods such as PSIAC, Factorial Scoring Model and Drainage Area; the results of these methods are within the confidence interval estimated for results obtained by RUSLE. Erosion risk maps were obtained and showed that there are spots were erosion is very high because 5% of the area generated 50% of soil loss. These areas are located in steep slopes and coincide in many cases with bad lands which are near the streams.