Erosion mapping and sediment yield of the Kabul river basin, Afghanistan

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Abstract. Soil erosion by water is a serious issue in Afghanistan. Due to the geographic landscape, soil and climatic conditions, and the latest deforestation activities, there has been intensive soil erosion which has resulted in prolonged and great impact on social and economic development of the region. In fact, a recent environmental assessment shows that decades of war and continuous drought have resulted in widespread environmental degradation throughout the country; therefore, mapping of soil erosion at the basin scale was urgently needed. The Kabul River Basin was selected for the purpose of erosion and sedimentation modeling due to its great socio-economic impact. The Revised Universal Soil Loss Equation (RUSLE) model combined with Geographic Information System (GIS) techniques were used to analyze the gross soil loss rates and the spatial distribution of soil loss rates under different land uses. Digital elevation model (DEM), average annual precipitation data, land cover map and soil type map were used to define the parameters of the RUSLE model. The annual average soil loss rate of the Kabul River Basin was estimated to be 19 tons/acre/year (4700 tons/km^2/year), and the gross mean annual soil loss rate found to be 47 million tons/year. By producing 57 % of the total annual average soil loss, rangelands were the primary contributor to the basin. In case of the spatial distribution of erosion rates at the Kabul River Basin, the relationships between probability and annual average soil loss rates were also analyzed. The analysis indicated that up to sixty percent of the mean annual soil loss rates are in the range of tolerable soil loss rate (0 - 5 tons/acre/year). Moreover, the northern part of the basin is prone to extensive erosion due to steeper slopes and higher precipitation. The sediment delivery ratios for the basin's rivers ranged from 2.5% to 10.8 %. Based on this evaluation, the sediment delivery ratio for the sediment gauging stations in the basin were in the similar range of predicted values by the methods of Boyce and Renfro.