Predicting N,P,K and organic carbon depletion in soils using MPSIAC model at the Merek catchment, Iran.

ABSTRACT

Land degradation is the loss in the productivity of land resources due to many factors, especially soil erosion. Nutrient depletion and soil organic carbon (SOC) loss are the main impacts of erosion which not only cause declining crop yield, but also induce off-site impacts, such as eutrophication and greenhouse gas (GHG) emission. The main objective of this study was to estimate the depletion of N, P, K and SOC due to soil erosion prevailing in the three agro-ecological zones within the Merek catchment, Iran. The erosion rate and eroded plant nutrients (N, P and K) as well as SOC were estimated using MPSIAC model. The results showed that the most important factor affecting land degradation in the Merek catchment is inter-rill erosion, covering an area of about 20%, which in turn is promoted by deforestation and overgrazing. The erosion rate in the agriculture area, rangeland and forest is 14.47, 16.60 and 18.57 t ha− 1 yr− 1, respectively. The respective predicted annual N depletion by erosion is 23.5, 26.6 and 32.8 kg ha− 1 yr− 1 in agriculture area, rangeland and forest zone, while that of P is 0.230 and 0.290 and 0.220 kg ha− 1 yr− 1. The depletion of K in agriculture area is 7.01, rangeland is 6.25 and forest is 6.36 kg ha− 1 yr− 1. The highest loss in SOC is in the forest with a value of 414 kg ha− 1 yr− 1 while the lowest is in the agriculture area with a value of 213 kg ha− 1 yr− 1. The high loss of SOC in the forest zone is due to serious soil erosion, which is accelerated by sloping land. It is concluded that the MPSIAC model used in this study is able to satisfactorily predict soil erosion rate and the loss of N, P, K and SOC at the catchment scale in the semi-arid region of Iran.

Keyword: Land degradation; Soil erosion; Soil nutrient; Organic C; MPSIAC model.