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The Impact of Land Use Changes on Soil Erosion and Sediment Cycle Using Distributed Modeling in A Tropical Watershed in Indonesia

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High precipitation amount in tropical rainforest such as in West Java, Indonesia, results a massive run off and increase the possibility of erosion, sedimentation and floods. These conditions are aggravated by improper land use management such as deforestation. The objective of the present study is to identify the effect land use change on erosion and sediment. In order to shed more light on the problem, a distributed hydrological-sediment model, called TETIS, has been implemented. The model used 30 years of Hydro meteorological data. The required parameters were estimated using GIS. Three historical land uses (LU 1994, LU 2009 and LU 2014) and three scenarios (Indonesian government plan, conservation and natural vegetation) have been implemented. The return period of flood quantiles were calculated by the Maximum-Likelihood-method. Annual historical bathymetries in the reservoir were used to calibrate and validate the sediment sub-model involving Miller's density evolution and trap efficiency of Brune's equation. The actual evapotranspiration from 1994 to 2014 has reduced 11.0%, the overland flow has increased 17.5%, and meanwhile water yield has increased from 853.8 mm/yr to 963.6 mm/yr. The range of potential erosion was vary from 0 to 16.690 t/ha/yr with 37.26% of area higher than tolerable erosion (TE = 13.5 t/ha/yr). The percentage of actual erosion rate based on Hammer classification for low, moderate, high and severe were recorded as follow: 67, 8, 5 and 20% for LU 1994; 65, 9, 6 and 21% for LU 2009; 66, 8, 5 and 21% for LU 2014; 77, 7, 4 and 13% for Indonesian government plan scenario; 83, 9, 6 and 2% for conservation scenario and 98, 2, 0 and 0% for natural vegetation scenario, respectively. Meanwhile, the percentage of actual erosion rate that higher than tolerable erosion for LU 1994, LU 2009, LU 2014, Indonesian government plan, conservation and natural vegetation were 17,81%, 18.68%, 18.68%, 11.3%, 0.01% and 0%, respectively. The sediment yield increment in reservoir was recorded from 3,354,321 t/yr (14.5 t/ha/yr) to 4,410,699 t/yr (19 t/ha/yr) for LU 1994 and LU 2014, respectively. This increment decreased the expected life of reservoir from 243 to 185 year. The highest probability (5 year) of maximum discharge's return period increased 7,9% for LU 2014 if compared to LU 1994, meanwhile for the three land use scenarios decreased 4-31% compared to LU 2014. The results of the study showed the changes of land use shift the erosion and sediment rate. Forest denotes as the best land use on combating erosion and sedimentation.