

Geo-Spatial Analysis of Watershed Environment Using High Spatial Resolution Land Use Data for the Assessment of Soil Erosion in Upper Stream of Solo River, Indonesia

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Abstract: Sedimentation of soil into Gajahmungkur or Wonogiri Reservoir located in upper stream of Solo River has been noticed as one of critical environmental problems of the watershed. This could cause to deteriorate capacity of available water as well as to induce occurrence of flood in the lower stream. Soil erosion control is a key measure to decelerate sedimentation, so that attempts were carried out to estimate risk of soil erosion by utilizing geographical information by several agencies. One of the most significant factors of estimating risk of soil erosion should be a detail spatial distribution of land use, which could be associated with temporal pattern of land cover condition, and preferably, it would be provided by high spatial resolution raster format. But in the previous attempts, spatial resolution of land use data was coarse to express actual land cover condition in terms of risk of soil erosion. Then, we attempted to produce 2.5 meters pixel size land use data for the site of Keduan, which was the largest tributary located in upper side of the reservoir. Methodology of producing land use data was firstly to extract paddy field area from multi-temporal Landsat data by means of previously developed method by one of the authors and secondly to discriminate bare and seasonally bare land from multi-temporal pan-sharpened data obtained from ALOS/AVNIR2 and PRISM data. The third step was to overlay paddy field area on land use discriminated from ALOS data. The extracted land use data was proved to represent properly land condition at local scale and it was applied to estimate potentially high risked area of soil erosion in combination with steepness of slope at the pixel obtained from ASTER/GDEM2 data. We also installed rain gauges at the site to characterize pattern of rainfall. Records at one station measured in 2012 showed that there were 55 times of high intensity of rainfall, i.e. more than 10 mm/hour, and that most of rainfall was concentrated in the period of afternoon. Spatial characteristics of environmental conditions affecting soil erosion was analyzed by a unit of small watershed (average size: 14.4ha) obtained from ASTER/GDEM2 data in this study from the viewpoint of constructing management plan in harmonized with natural condition. It was shown that representation by this unit was adequate and effective for identifying location of hazardous area and also priority area to be introduced soil management measures.

Keywords: Soil Erosion, Land Use Data, Classification, Watershed, Resource Management