Assessment of soil erosion using RUSLE model, LiDAR remote sensing and GIS in Oborasawa Watershed, Kanagawa, Japan

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Soil erosion is a serious problem arising from agricultural intensification, land degradation and other anthropogenic activities. Assessment of soil erosion is useful in planning and conservation works in a watershed or basin. Modelling can provide a quantitative and consistent approach to estimate soil erosion and sediment yield under a wide range of conditions. In the present study Revised Universal Soil Loss Equation (RUSLE) integrated with GIS has been used to model and compute the soil erosion loss, to estimate the accurate value of soil erosion that must be predicted several factors of its model. The study conducted in the Oborasawa watershed in the eastern part of Tanzawa Mountains, Kanagawa, Japan. Spatial distribution of the annual average rainfall was computed using the monthly rainfall data (2010-2016) at the rainfall station of the Oborasawa Watershed. The average R-factor was observed to be 24,988.36 MJ mm ha^{-1} h^{-1} $year^{-1}$. Variability of relevant soil properties for the basin was obtained from the Soil Grids of the Open Database License and can be downloaded from www.soilgrids.org. The K factor of the Oborasawa Watershed is ranged from 0.0349 to 0.040 t h MJ^{-1} mm^{-1}. Land cover and the DEM (5 x 5 m resolution) for the watershed were obtained from the Kanagawa Prefecture. The slope of the watershed varies 0 to 89.74 degree and the LS factor value varies from 0 to 13.853. Land cover maps of the Oborasawa Watershed obtained from the data for the forest species inventory of the Kanagawa Prefecture and were used to create the C factor map using ArcGIS clipping tool. Then the literature-based C factor values were assigned for different land cover types. The C value of 0.016 for the Broad-leaved forest (Sekine, 1994); 0.0049 for the *Crypmmeria japonica* (Japanese cedar) middle-aged (SCFW, 1993); 0.010 for the *Chamaecyparis obtusa* (Japanese cypress) middle-aged (Sekine, 1994); 0.0084 for the other coniferous species (Kitahara et al., 2000) and 1.0 for landslide sites (scars of landslide including debris deposits) (Dhakal et al., 2006). Then the C factor raster map with a 5m resolution was generated for the Oborasawa Watershed. Conservation practice factor (P) factor value was taken as 1 because the majority of the study area is covered by forest. The estimated average annual soil loss using the factors for RUSLE is catchment based. The GIS analysis has been carried out for RUSLE to estimate annual soil loss on a pixel-by-pixel basis and the spatial distribution of the soil erosion in the study area. The mean annual soil loss was 6.32 ton/ha/year and the gross amount of soil loss accounts for 186,501.28 ton/year by RUSLE model. Using this severity information developed with RUSLE along with its individual parameters can help to design land use management practices. This allowed us also to better understand the impact of each erosive factor, assess its contribution to soil loss and establish the decisive factors that control water erosion in the watershed in order of importance, slope, soil erodibility and vegetation cover.

Keywords: DEM, GIS, Modelling, RUSLE, Soil erosion

