MODELING OF EROSION AND SEDIMENTATION PROCESS

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Soil erosion is one of the major environmental problems in tropical regions. It causes negative impacts including the removal of nutrient-rich topsoil, destroys aquatic habitat, dams, and pond siltation, clogs rivers by deposition of sediment, and causes water pollution in the rehabilitation process. Soil texture is an important factor affecting soil erosion. The productive soil surface is detached, transported, and accumulated at a distant place from the initial place by a complex dynamic process called soil erosion. Soil erosion can be grouped into two different stages as geologic erosion and accelerated erosion. Formation and loss of soil by natural processes to maintain the balance of soil-forming processes can be identified as geological erosion. Accelerated erosion consists of deterioration and loss of soil by anthropogenic activities. Climatic changes (rainfall/precipitation or wind), landscape relief, soil and bedrock properties, vegetation cover, and human activities are the main factors that are influencing the soil erosion process.

In this study, an artificial rainfall experiment in the laboratory scale was conducted to investigate the mechanism of soil erosion under the different soil compositions. Revised Universal Soil Loss Equation (RUSLE model) is the most common one to estimate soil loss. These experiments were done to study how the amount of soil loss varying with slope angle and rainfall intensity which are the most influencing factors in the RUSLE model. Three soil samples were taken from different places such as Bathalagoda, Gedarakumbura waththa, and Siyabalanga around Kurunegala District such that different soil mineralogy can be obtained. Maximum dry density and optimum moisture content were calculated by the Proctor compaction test. According to those values, soil samples were compacted in a wooden tray and exposed to an artificial rainfall. The tray was exposed to rainfall for 30 minutes and after that soil loss was calculated. Soil loss was calculated while changing slope angle and then changing rainfall intensity. Then the soil loss variation with the RUSLE model was studied.

Results of this study indicate that there are some deviations between the RUSLE slope steepness factor with the experimental values when clay particles are present. Although there is a linear relationship between slope angle and amount of soil loss in the RUSLE model when there are clay particles present in the soil that relationship deviates reasonably. After the slope angle increases up to a certain level, there is a sudden increase in soil loss even with a considerable amount of clay particles. Hence the presence of clay particles provides some resistance to soil particles to erode below a certain slope angle. When there is less amount of clay particles, soil loss with the increase of slope angle behaves similar to the RUSLE model. With the increase of rainfall intensity, there is an exponential increase in soil loss as in the RUSLE model. Less soil erosion occurs if fine particles are very low, due to high infiltration at low rainfall intensities. It was observed that when the percentage of clay particles increases, the amount of soil loss decreases.

Keywords: soil erosion; artificial rainfall experiment; RUSLE model

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