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Development of Rainfall Erosivity (R) In Revised Universal Soil Loss Equation (RUSLE) For An Equatorial Region Of Sarawak.

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---*ABSTRACT*---
The Revised Universal Soil Loss Equation (RUSLE) was developed for the Department of Agriculture of USA for predicting top soil erosion rate and sediment yield from agricultural areas or plantations located in temperate region, with extremely low annual rainfall (1,000 mm/year), as compared to equatorial region of more than 4,000 mm/year such as Sarawak whereby a great portion (>25%) of land area covered with peat. The primary objective of this research was to develop the factors of Rainfall Erosivity (R) for an equatorial region of Sarawak. In order to achieve the objective of this study, soil samples were collected from Sri Aman, Sarawak. The soil samples were tested for physical properties. A rainfall simulator was constructed to conduct six simulated rainfalls on three types of hill slopes; a cone, a pyramid, and a plateau. Photos of raindrops were taken with a high speed camera during simulated rainfalls to determine raindrop sizesand consequently to determine kinetic energy of the raindrops. Runoff samples were taken to determine sediment concentration. From the experimental results, it was observed that the median drop diameter for simulated rainfalls on the plateau-shape hill slope and cone-shaped hill slope was 2.0 mm. For simulated rainfall on pyramid-shaped hill slope, the median drop diameter was 2.5 mm. Values of total kinetic energy of raindrops on plateau-shaped hill slope, cone-shaped hill slope, and pyramid-shaped hill slope were 0.287 MJ/ha.mm, 0.332 MJ/ha.mm and 0.317 MJ/ha.mm, respectively. The rainfall intensities for simulated rainfalls on plateau-shaped hill slope, cone-shaped hill slope and pyramid-shaped hill slope were 142.96 mm/h, 142.78 mm/h, and 151.17 mm/h, respectively. An equation of Total Kinetic Energy of rainfall for an equatorial region of Sarawak (E_{eqt}) was derived from correlations of kinetic energy of rainfall and rainfall intensity. The values of Equatorial Rainfall Erosvity (ER) were determined from multiplication of 30-minute rainfall intensity and Equatorial Kinetic Energy of Rainfall (E_{eqt}). Results of Equatorial Rainfall Erosivity (ER) and Rainfall Erosivity (R) were compared for the rainfall station of Kuching in the year 2014.

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I. INTRODUCTION

Rainfall is one of many factors that cause soil erosion, where raindrops and runoff break the bonds among soil particles (Elbasit et al., 2010,; Baharudin, 2007; Dijk et al., 2002; Ali and Tew, 2006; Wischmeier and Smith, 1978). Rainfall erosivity was defined as the ability of rainfall to cause soil erosion (Goh and Tew, 2006). Rainfall intensity and rainfall drop size distribution (DSD) have unique correlation that determines rainfall characteristics including rainfall erosivity (Elbasit et al., 2010; Best, 1949; Baharudin, 2007).

Rainfall Erosivity factor (R) is one of the factors embedded in the Revised Universal Soil Loss Equation (RUSLE) (Wischmeier and Smith, 1978).An R-factor for a given rainfall period is a number, which indicates the erosivity of the rain expressed as the index of EI_{30}. The factor of E is the total energy for a rainfall and I_{30} is the rainfall's maximum 30-minute intensity. According to Wischmeier and Smith(1978b), rainfall with depthof less than 13mm and separated from the other rain periods by more than 6 hours are not included in the computation of R-factor, except for 6mm of rain falls in 15 minutes. The index of EI_{30} is the product of the total energy for a rain and the rainfall's maximum 30-minute intensity (Wischmeier and Smith, 1978; Tew, 1999).

The Revised Universal Soil Loss Equation (RUSLE) has been used to predict an annual erosion rate of a field slope that based on rainfall pattern, soil type, topographical factor, crop system and management practices(Renard et al., 1997). The equation applied to calculate soil loss in Equation 1.

$$A=R \times K \times L \times S \times C \times P \qquad (1)$$

The equation includes Soil Loss (A), Rainfall Erosivity (R), Soil Erodibility (K), Slope Length (L), Slope Steepness (S), Cover Management factor (C), and Erosion Control Practice factor (P). Since the publication of the Universal Soil Loss Equation (USLE) in 1959 by Wischmeier and Smith and the Revised Universal Soil Loss Equation (RUSLE) by Renard et al.(1997), the equations have been widely used worldwide and are the