Abstract

The Revised Universal Soil Loss Equation (RUSLE) is an empirical equation used to estimate soil loss in agricultural fields. It consists of five factors: rainfall and runoff (R), soil erodibility (K), length slope (LS), crop management (C) and support practice (P). However, the application of RUSLE can be problematic in large undulating landscapes with complex topography and a variety of land cover types. Of the factors, the C and LS factors are more variable, with the LS factor most sensitive in soil loss prediction. The LS factor is most commonly determined by taking field measurements, and thus is not easily done efficiently for larger landscapes. Therefore, a more resource efficient way to determine the C and LS factors must be determined. ArcGIS software and R programming language was used to estimate C and LS factors for two drainage size classes (sub-catchment (large scale) and land use area (medium scale)) in the South Carolina Botanical Gardens. The range for the C factor for the sub-catchments was more narrow (0.005 to 0.21) than for the land use scale (0.0001 to 1.0). The broad range in LS factor values computed at the land use scale resulted in greatest R (R-st) soil loss than when using the sub-catchment scale. Future research need to validate the proposed methodology with reliable field measurements, and to be repeated in other areas.

Introduction

- The Universal Soil Loss Equation and its derivative (RUSLE) have been used for local conservation planning at an individual farm field scale primarily for gently sloping cropland situations.
- Subsequent research has broadened the applicability of the model to rangelands, agricultural fields in undulating landscapes and steep slopes. When using USLE or RUSLE, the effects of topography on soil erosion is estimated by the slope length (L) and steepness (S) elements of the LS factor.
- In mountainous regions and urban landscapes the use of USLE and RUSLE has been limited due to lack of reliable estimates of LS factor as well as the R and C factors. Especially slope steepness, since it most sensitive in soil loss predictions with RUSLE.
- Values for the L and S factors are commonly derived manually using a GIS and an inlentermometer to quantify the slope length and the steepness for local landscape planning. These labor intensive field measurements are not feasible for soil erosion modeling on larger scales in urban and complex topographic landscapes.
- A procedure of estimating L, S and the C factors was developed for the conventional and organic farming fields in mountainous uplands in Haeae-Myeon, South Korea.

Goal and Objectives

- Develop a suitable methodology to estimate soil loss in urban / complex topographic environments.
- Determine how L, S and C factor values change for two drainage area sizes.
- Compare estimated annual soil loss (t/ha/yr) of an area when determined from two contrasting drainage area sizes.
- Data from each of the three DTM and the DEM were used to determine the C and LS factor for field drainage area scales: sub-catchment and by land use (medium), resulting in 23 land use area categories and 5 sub-catchments.
- The mean slope length and angle (Tab. 1) was determined by using the R algorithm (R Studio ver.0.95.258) developed by Arnald et al. (2016) and the three DTM.
- L and S factors were then calculated in Excel (Microsoft, 2007) using standard RUSLE equations and were used to calculate the L and S factors for both drainage area sizes.

Future Research Directions

- Establishment of soil erosion plots to compare simulated and actual soil loss (modified validation).
- Repeat analysis in other urban areas to allow for statistical analysis.
- Continuous collection of rainfall data to determine variability of R factor with distance from test sites.

Works Cited