



Tropentag, September 16-18, 2015, Berlin, Germany

“Management of land use systems for enhanced food security:
conflicts, controversies and resolutions”

Exploring Effects of Aboveground and Belowground Biomass on Soil Erosion During Rubber Development by Applying USLE Model

HONGXI LIU, SERGEY BLAGODATSKIY, GEORG CADISCH

University of Hohenheim, Institute for Plant Production and Agroecology in the Tropics and Subtropics, Germany

Abstract

Aboveground and belowground biomass can both contribute to soil conservation in forestland. However, quantitative linkage among tree canopy, plant and litter cover, roots and their changing roles with growth of plantation has been rarely studied. Universal Soil Loss Equation (USLE) model has been widely used in soil loss prediction in agriculture but rarely applied in woodland system. This study applies USLE model for prediction of soil loss during rubber plantation development and identifies the major factor controlling water erosion. Soil erosion was measured in rubber plantations of 2, 10, 18, 25 and 36 years age. Rainfall, soil texture and carbon content at top 5 cm, density of fine roots, canopy radius for each age of rubber plantation, understory plant cover and litter cover were determined using Gerlach troughs, soil coring, photography, respectively. Soil loss of rubber plantation with different ages varied from 52 g m^{-2} to 277 g m^{-2} with highest soil loss of mid-age (10 and 18 years) and lowest of old (18 and 36 year) rubber. Cover and management factor of rubber plantation represents erodibility of system in USLE model. It was equal to 0.02, being thus much higher than in forest (0.005). Though canopy of tree expanded during its growth, erodibility change of the system turned out to increase from 0.01 of young rubber to 0.03 of mid rubber and decrease to 0.008 of old rubber. Erodibility of rubber system was little affected by tree canopy, however, mainly controlled by root system from trees and plant cover from understory vegetation. Fine root density and plant cover were introduced into USLE model with expression of $C_{pc} = e^{-0.023pc}$ and $C_{root} = e^{-0.004fRD}$ respectively. During rainy season, highest erodibility of rubber system was found in August due to herbicide application. It is recommended that understory plant cover should be kept over 70% for young rubber, over 90% for mid and 55% for old rubber in order to maintain good soil conservation function of rubber plantation.

Keywords: Fine root, plant cover, rubber plantation, soil erosion, USLE model