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APPLICATION OF THE ^{137}Cs TECHNIQUE FOR SOIL EROSION ASSESSMENT IN TOBACCO PLANTATIONS IN CUBA

Authors: Gil Castillo R. H.[a], Peralta Vital J.L[a], Carrazana Gonzáles J.[a], Riverol Rosquet M.[b], Aguilar Pantoja Y.[b], Capote Ferrera E.[a], Malagón Morejón Y.[c], Oliveira Acosta J.[d], Fleitas Esteves G.[a]   E-mail:gesr@cphr.edu.cu

a. Center for Radiation Protection and Hygiene (CPHR), Calle 20 No. 4113 e/ 41 y 47 Playa. CP. 11300, La Habana, Cuba.
b. Soil Science Institute (IS), Autopista Costa–Costa Km. 8½, Capdevila, Boyeros, La Habana, Cuba.
c. Direction of Soil of Pinar del Río (DSPR) Avenida Borrego y Calle Los Pinos, Final, Pinar del Río, Cuba.
d. Geophysics and Astronomy Institute (IGA), Calle 212 No. 2906 e/ 29 y 31. Reparto La Coronela. La Lisa, La Habana, Cuba.

INTRODUCTION

Soil erosion as a relevant factor in land degradation, causing several negative impacts on the environment, and the effects go from decreasing crop yields to eutrophication and silitation of downstream water bodies. For the implementation of a strategy for sustainable land management the key element is to be able to quantify the losses of soil in order to support or establish policies for soil conservation. The nuclear techniques have advantages in comparison with the traditional methods to assess soil erosion and have been applied in different agricultural settings worldwide. In this study the ^{137}Cs technique was applied to characterize the soil erosion status in a farm with tobacco plantations located in the south-western plain of Pinar del Rio province.

MATERIALS AND METHODS

The study area, see figure 1 is located in the farm “Jesus Suárez Soca” in the Municipality of Consolacion del Sur, Pinar del Río province. The 42% (113.79 ha) of total area is affected by soil erosion and also each year is exposed to the influence of extreme weather events. The main cultivation in the site is the tobacco plantations on soils ”FCAL” (Plinthustalf, Soil Taxonomy), with high susceptibility to water erosion. Additionally, the topography and poor agricultural practices have generated a land highly degraded.

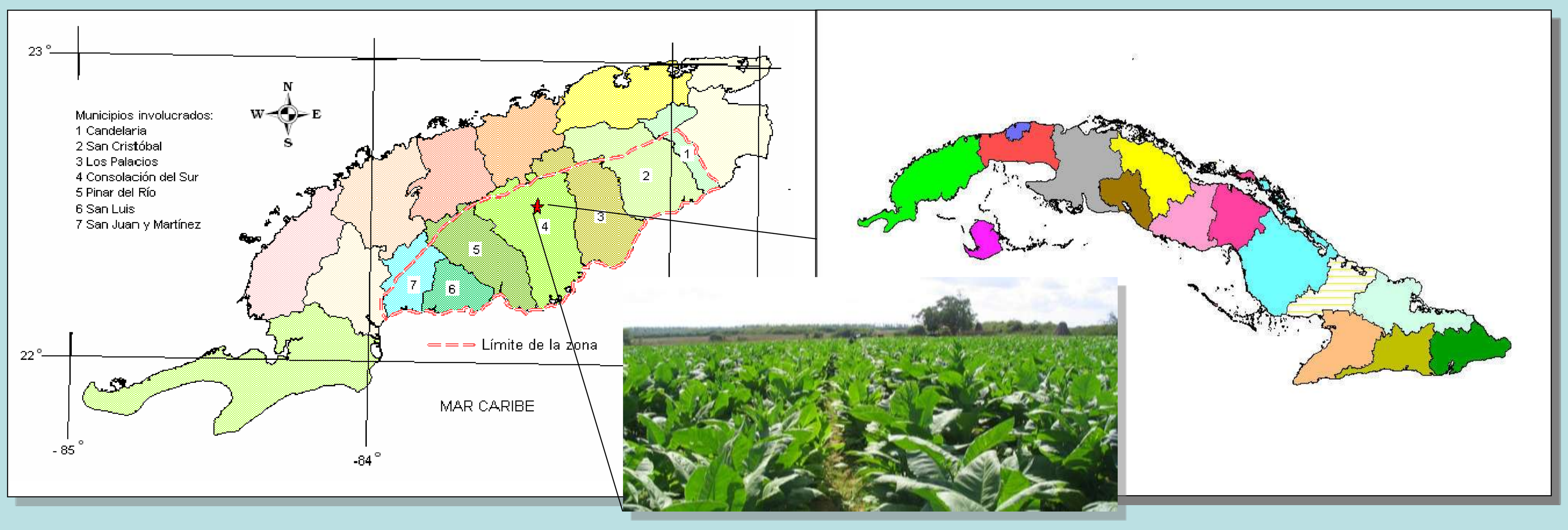

Figure 1. The study area

In the farm, a representative site (4 ha) with tobacco plantations was selected and divided in 2 sectors (North, South) with different soil degradation levels. The soil sampling strategy was implemented through transects across the site, the samples were measured with a gamma spectrometry detector to obtain the ^{137}Cs areal activity density. The soil redistribution rates were estimated using 3 different conversion models: the proportional model (**PM)**, and the mass balance models 1 and 2; (**MBM1**, **MBM2**).

RESULTS

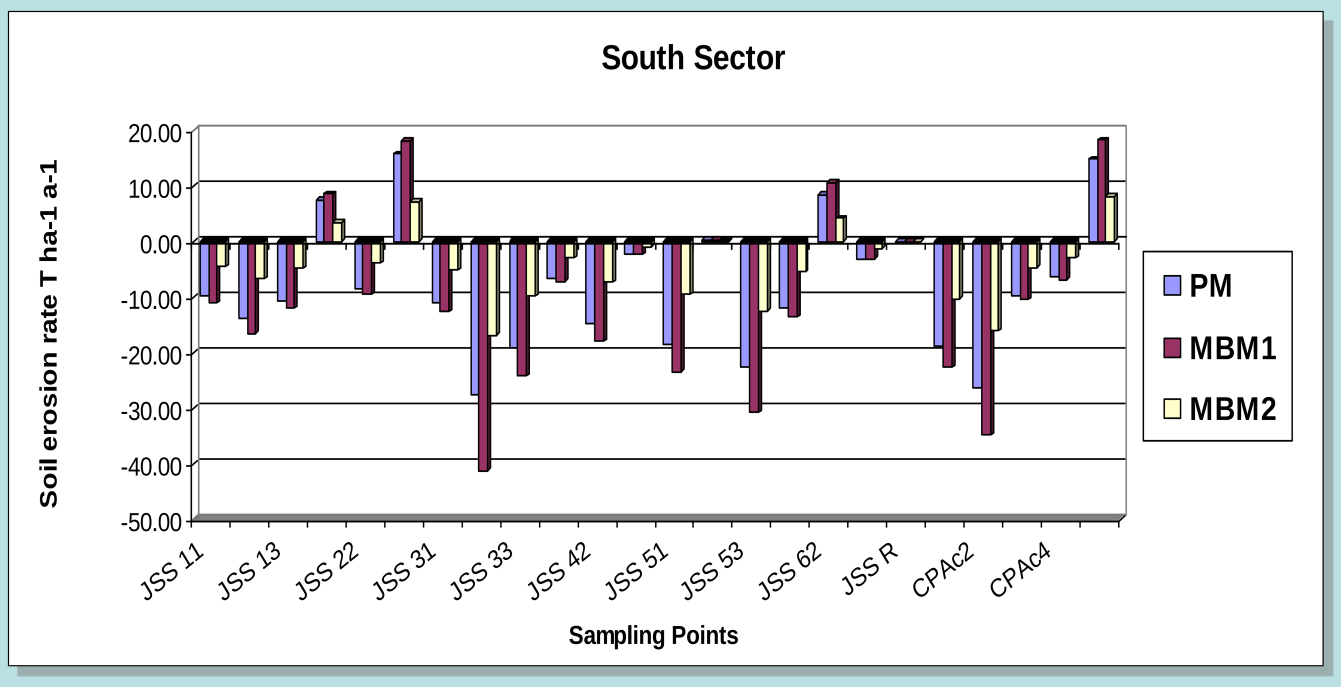

Figure 2. Results comparison for the 3 conversion models

The results for the South sector are shown in the figure 2 and the Mass Balance Model 2 provided results close to expected values for this type of soil and cultivation, according to previous studies. For this model the soil erosion rates varied from –0.9 to –16.9 t ha-1y-1. Also, a significant relationship between landform and the soil redistribution rate was identified (footslope-deposition, elevations-erosion), see figure 3. A summary of the main results for both sectors is given in Table 1.

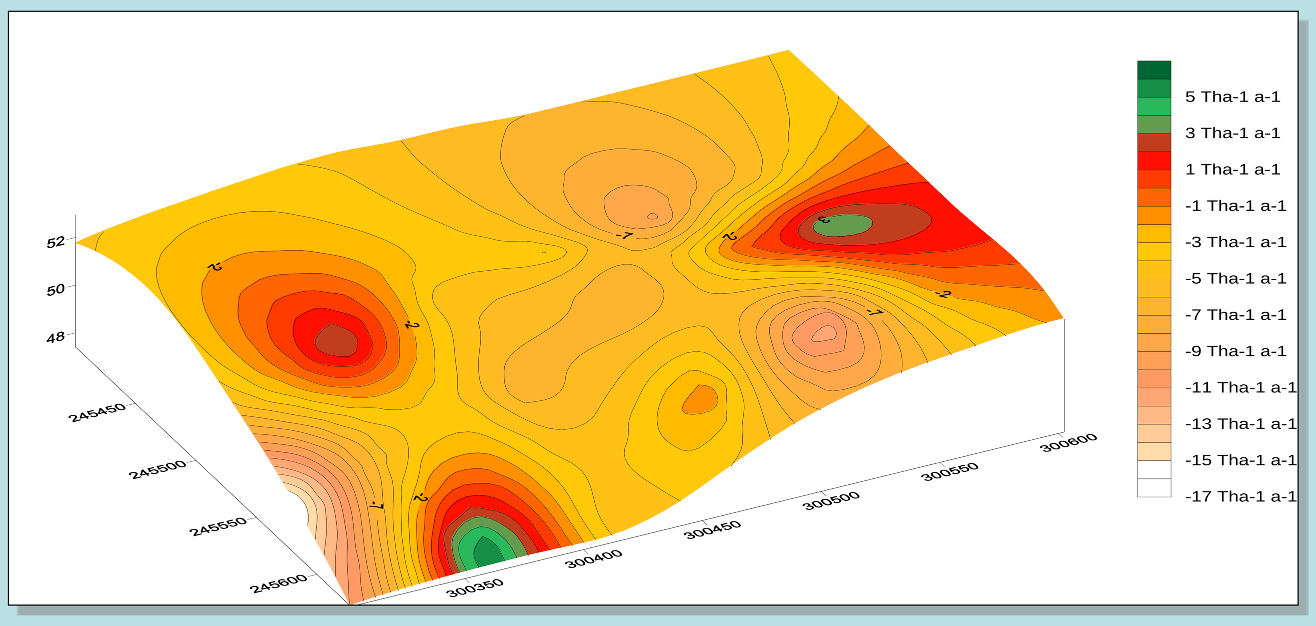

Figure 3. Spatial distribution of soil redistribution rates (t ha^{-1} y^{-1}) for the Mass Balance Model 2

Table 1. Sumary of the results (Mass Balance Model 2)

Parameters	North Sector	South Sector
Mean erosion (t ha^{-1}y^{-1})	–7.9	–7.6
Mean deposition (t ha^{-1}y^{-1})	2.2	6.3
Fraction area affected by erosion/deposition	0.8/0.2	0.8/0.2
Net erosion (t ha^{-1}y^{-1})	–5.9	–4.9
Sediment Delivery Ratio (%)	89%	80%

CONCLUSIONS

The application of the ^{137}Cs technique allowed the characterization of the soil erosion status in the study site, and the Mass Balance Model 2 provided the more representative results. Differences were identified for soil redistribution rates between the 2 sectors, the North Sector being more affected by soil erosion. The study site is highly erodable. The results of spatial distribution of soil redistribution rates show some relationship with landform shapes in the site.

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