

Soil Erosion in Mauritius and its mitigation by sugar cane cultivation

EXECUTIVE SUMMARY

Soil erosion is a dynamic and natural process where soil exists in its natural environment under native vegetation; but man's activities can accelerate the process which will result in severe soil losses. Erosion by water involves the processes of detachment, transport, and deposition of soil particles. The erosion rate for a given site depends on the combination of several physical and management variables and can be predicted using models, e.g. the Revised Universal Soil Loss Equation (RUSLE), which would include factors such as rainfall-runoff erosivity, soil erodibility, slope length, slope steepness, cover-management and support practices.

A project was initiated in 2000 to study and measure soil erosion in five major soil groups of Mauritius and to validate the RUSLE under the local conditions. Two erosion plots, one with bare soil and the other planted with sugar cane, were established at five sites, namely Bel Ombre, Sans Souci, Le Val, St Felix and Etoile with soil groups of L, F, B, S and H respectively. For each plot, collecting devices for the bed-load, i.e. sediment moved along the soil surface, and the suspended load, i.e. sediment moved in suspension within run-off water, were installed as well as a pluviometer. All data were recorded through loggers operating with batteries and a solar panel.

The main findings of this project have been:

- Soil erosion varied significantly across sites and year. Highest soil loss (bare plots) was recorded at Bel Ombre and was followed by Sans Souci, Le Val, St Felix and Etoile with a mean of 37.6, 14.3, 9.5, 4.1 and 0.5 t ha⁻¹ yr⁻¹ respectively. Irrespective of year, the worst erosion measured from the bare plots was at Bel Ombre where an annual soil loss of 59 t ha⁻¹ was recorded during the period July 2004 and June 2005. The proportion of soil erosion associated to 'cyclonic' events was found, on average, to vary between 45% and 68% depending on sites.
- The most important factors influencing erosion in the bare plots were soil erodibility and rainfall erosivity. Soil erodibility factors (K) were calculated for the five sites; a mean K factor of 0.14, 0.05, 0.08, 0.03 and 0.01 was obtained for Bel Ombre, Sans Souci, Le Val, St Felix and Etoile respectively. These values may be used for soil loss prediction for other sites with similar soil groups.
- The use of a rainfall simulator to determine the soil erodibility (K) factor was found inappropriate although it showed differences among the soil groups tested.
- Rainfall erosivity factor (R) has been found to vary across sites due to different energy values obtained from rainfall intensity and amount; Bel Ombre and Sans Souci have an erosivity

factor of approximately 250, Le Val and St Felix of about 150, and Etoile with 41. In absence of good correlations between indices calculated for each site and their rainfall characteristics and altitude, etc., an R-value of 300 may be used to predict soil erosion in other parts of the island.

- Sugar cane reduced soil erosion by 80% to 99% depending on cane varieties and their stage of growth. Cane variety of the type R 570 was found to be more effective than varieties such as M 3035/66 because of a better canopy closure and amount of trash cover in ratoons.
- The RUSLE (RUSLE1) has been updated to give rise to RUSLE2 during the implementation of this project; the new version, RUSLE2, considers other factors and is based on daily computation compared to monthly data in the previous model. The validation of the RUSLE2, with the data available, may be considered as a future exercise, together with compilation of meteorological data for classifying different zones of the island into areas with varying (high, medium, low) rainfall erosivity indices.
- The main factors of the USLE, i.e. soil erodibility (K), rainfall erosivity (R) and crop-management (C) for sugar cane have been determined. The values obtained for these factors may explain the high amount of sediment load in some of our rivers and deposition in certain lagoons after a heavy rainfall event.
- With the rapid change in land use pattern, including replacement or abandonment of sugar cane cultivation, the outcome of this study highlights the need for an integrated national project to minimise soil erosion for ecological and environmental reasons, and for the sustainability of our agricultural lands. The benefits of such a project will be of invaluable importance to the national economy, particularly the tourism industry which is developing around some of the high erosion 'risk' areas.