Micro-field sssessment of soil erosion and surface runoff using mini rainfall simulator in upper River Njoro watershed in Kenya

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Introduction Soil erosion and surface runoff are consequences of integration of several factors and processes within a catchment. The use of a rainfall simulator and run off plots provides a valuable research tool and are often used in soil erosion and surface runoff studies. Cheruiyot (1984) used this approach to study infiltration rates and sediment yield in Kiboko, Kenya. The present study used the same method but with a mini-rainfall simulator (Kamphorst, 1987) to study the effects of different land use treatments on soil loss and surface runoff.

Materials and method The study was carried out on run-off plots, which were used to assess soil erosion and surface runoff in the River Njoro watershed in Kenya. The watershed is currently suffering from severe degradation due to increased settlement and subsequent human activities. There was a randomised block design with five land use treatments and three replicates (sites) per treatment. The site plots were mapped using GPS and plotted in a GIS environment. On every study site, rainfall was applied at an average rate of 10 mm/h on the three plots using the rainfall simulator. This had dimensions of 0.4 m x 0.25 m to give a plot size of 0.1 m^2. Soil erosion and surface runoff generated from the five plots of different land uses were measured. The soil characteristics bulk density, texture, organic matter content and pH were measured at each experimental site.

Results and discussion Table 1 shows a summary of soil loss from every land use type and other soil properties. Soil erosion decreased in the order agricultural land, deforested areas, grazing land, exotic trees and least in indigenous forest. The values of mean soil loss from each area were 86, 31, 18, 2 and zero g/0.1 m^2 respectively. There were no significant differences ($P<0.05$) in soil loss between the following land use areas: deforested, grazing, exotic and indigenous forest. However, there were significant differences between agriculture land use and all the other land use areas. The highest surface runoff was on grazing and the values decreased in the order agriculture, deforested areas, exotic trees and indigenous forest land use. The respective values of mean surface runoff from these areas in ml were 1200, 920, 860, 380 and 20. Statistical analysis at ($p<0.05$) revealed that there were significant differences between surface runoff from all land use areas except between agriculture and deforested areas and agriculture and grazing lands.

Table 1 Mean soil loss and soil properties for the five land use types in Upper River Njoro watershed

	Bulk density (g/cm^3)	Organic matter (%)	Soil pH	Soil texture	Mean soil loss (g/0.1 m^2)	Mean surface runoff (ml)
Agriculture	0.85	5.7	6.2	Clay loam	86	920
Grazing	1.05	5.0	5.9	Clay loam	18	1200
Exotic	0.95	6.2	6.4	Clay loam	2	380
Deforest	0.78	10.1	5.8	Sandy clay loam	31	860
Indigenous forest	0.74	9.4	6.2	Sandy clay loam	0	20

Conclusion and recommendation Soil erosion increased in the order of indigenous forest, exotic trees, grazing land, deforested areas and agricultural land whilst surface runoff increased in the order of indigenous forest lands, exotic trees, deforested areas, agricultural land and grazing lands. Since soil erosion and surface runoff depend on rainfall, several watershed characteristics and management practices, many of which could not be investigated with the mini simulator, the results obtained are considered quite preliminary and give only a general impression of relative soil loss and surface runoff. It is recommended that more detailed studies be carried out with a simulator that can generate different rainfall intensities.

References

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