

Soil Erosion and Nutrient Transport from Lands under Intensive Agriculture in Upper Mahaweli Catchment Area in Sri Lanka

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Abstract

Mahaweli is the longest river of Sri Lanka which feeds four major reservoirs viz. Kothmale, Victoria, Randenigala, Rantambe and diversion pond at Polgolla. These reservoirs generate over 54% of the country's hydropower requirement and irrigate about 300,000 ha of agricultural lands. However, siltation and water quality deterioration of reservoirs are major issues when considering their sustainability. Farming exotic vegetables in terraces is the main livelihood of many households living in the Upper Mahaweli Catchment Area (UMCA). Most of these terraces are not properly managed hence highly vulnerable to soil erosion. This study presents the effect of surface runoff and soil erosion on sediment and nutrient transport from agricultural lands located in terraces in a sub catchment of UMCA. Runoff plots were established on well and poorly managed vegetable terraces, tea lands and natural forest to measure and compare the rates of sediment and nutrient transport. A linear relationship between rainfall and surface runoff were observed in all three land uses. The sediment transport rate was higher in vegetable plots on poorly managed terraces followed by well managed vegetable plots, tea land and natural forest. Nutrient removal with surface runoff is higher in vegetable plots compared to other land uses. A greater fraction of NO₃-N is removed as soluble form from farmlands but in the case of PO₄-P and NH₄-N removal of particulate fraction is prominent. Particulate losses are approximately 15 times higher than the dissolved losses for NH₄-N and approximately 100 times higher than the dissolved losses for PO₄-P. In the case of NO₃-N soluble fraction is approximately 1.5 times higher than the particulate losses. Results conclude that, greater amount of nutrients and sediments are transported from vegetable plots on poorly managed terraces. Hence, proper maintenance of vegetable growing terraces coupled with effective nutrient management is very important to reduce downstream siltation and nutrient pollution in surface waters.

Keywords: Soil erosion, sediment transport, particulate and soluble nutrients

1. Introduction

Mahaweli is the longest river of Sri Lanka which enormously contributes to economic development of the country. The Upper Mahaweli Catchment Area (UMCA) located 300 m above mean sea level, covers 3124 km² of the central highlands of Sri Lanka and feeds four major reservoirs viz. Kothmale, Victoria, Randenigala, Rantambe and diversion pond at Polgolla. These reservoirs generate over 54% of the country's hydropower requirement and irrigate about 300,000 ha of agricultural lands (Gamage, 1997). Soil erosion has been severe in the UMCA particularly on cropping lands due to a combination of various factors. Farming exotic vegetables is the main livelihood of many households living in the UMCA. In general, vegetable gardens are highly vulnerable to soil erosion. Most of these lands have reported annual erosion rates over 75 t/ha thus significantly increasing the sediment yield in runoff and stream water (Bandaratillake, 1997). Continuous growing of crops on steep slopes, without having proper soil conservation, may lead to washing off fine soil particles which help the retention of plant nutrients in the soil, thereby reducing the crop yield. However, most of the farmers do not ready to accept this natural phenomenon, but attempt to enhance soil chemical fertility by applying over dosage of fertilizers and manure (Rajakaruna, *et al.*, 2005). Kendaragama (2006) reported that most of the vegetable growers in the entire up country area apply inorganic fertilizers at the rates 2-3 times higher than the doses recommended by the Department of Agriculture. Soil erosion is the major process