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APPRAISAL OF SOIL EROSION RISK IN THE EASTERN HIMALAYAN REGION OF INDIA FOR SOIL CONSERVATION PLANNING

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ABSTRACT

Management practices to minimise soil erosion can be effectively carried out if the magnitude and the spatial distribution of soil erosion risk areas are known. Prioritisation of soil erosion risk areas is a challenging task, especially in the developing countries because of non-availability of relevant data and analytical tools for such an assessment. As a result, it becomes difficult to establish appropriate soil conservation measures on the risk-prone areas to reduce soil loss and ensure development of a sustainable management of soil resources. Such a database can be better generated and analysed in a geographical information system (GIS) environment to delineate and prioritise the soil erosion risk areas at state or regional level. Therefore, a methodology was developed to assess the soil erosion risks in eastern Himalayan region by integrating spatial data on prevailing erosion rates and soil loss tolerance limits in GIS environment. By comparing the potential erosion rates with permissible rates, we observed that about 58·94 per cent of total geographical area (TGA) of the region requires different degrees of erosion management and 28·38 per cent of TGA falls under no treatment category because of higher values of permissible erosion limits. It can be successfully applied to assess and prioritise soil erosion risks in any region or country and identify best management practices to bring the erosion losses within the permissible limits. Copyright © 2011 John Wiley & Sons, Ltd.

KEY WORDS: erosion risk; soil sustainability; prioritisation; Himalayan region; India

INTRODUCTION

According to Pimentel (1993), between 30 and 50 per cent of the world's arable land is significantly degraded by soil erosion, which adversely affects agricultural productivity and rural livelihoods (Lal, 1985; Kerr, 1997). Soil erosion is widely considered to be the most serious form of soil degradation undermining the long-term viability of agriculture in many parts of the world (Lal, 1994), which poses a significant threat to the world's food security in the context of an increasing global population. Soil erosion risk is generally assessed on the basis of either prevailing soil erosion rate or sediment yield index (Sreenivas and Venkataratnam, 2005; Rahman *et al*., 2009; Bewket and Teferi, 2009). This approach, however, takes into account only the susceptibility of the soil without considering its degree of resilience or recovery at a given location. Scientific evidences based on long-term field experience imply that the soil has an inherent capacity to tolerate a maximum level of erosion depending upon its location specific attributes and still keep up its long-term productivity and sustainability (Mandal *et al*., 2010). The permissible soil erosion rate or the soil loss tolerance limit (SLTL) (*T*-value) is a function of the relationship between the processes of soil formation and soil degradation. NRCS (1999) proposed a typical range of *T*-values in integer steps varying from 2·5 to 12·5 $t\,ha^{-1}$ for different types of soils. Hence, permissible soil loss or *T*-value should also be taken into account in conjunction with the prevailing rate of erosion while planning any conservation programme based upon soil erosion risks in a given area. Such a database can be better generated and analysed in a geographical information system (GIS) environment to delineate and prioritise the soil erosion risk areas at state or regional level.

The Eastern Himalayan Region is very vulnerable to soil erosion because of its undulating topography, steep slopes and high rainfall. Moreover, the land encroachment and agricultural activities on forest areas have further aggravated the problems of land degradation in the region especially on steeply sloping land with no conservation measures (Sharma, 2004). Indiscriminate deforestation and practice of **Jhum** cultivation (slash and burn agriculture or shifting agriculture) lead to accelerated erosion for which proper conservation measure need to be established especially on very steep slopes (Sen *et al*., 2006; Sharma, 2004). These practices not only accelerated the soil erosion but also have resulted in low fertility. Effective planning and execution of soil conservation programmes are absolutely necessary as cultivation has been extended to marginal lands through

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