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Conceptualization of GIS field prediction regional soil-erosion Mediterranean models, case study Lebanon

R. Bou Kheir, C. Abdallah

National Council for Scientific Research/Remote Sensing Center, P.O. Box 11-8281, Beirut, Lebanon.(raniabk@cnrs.edu.lb / Fax: +961 4 409 847 / Phone: +961 4 409 845/6)

Soil erosion by water is a major cause of landscape degradation in semi-humid to semi-arid Mediterranean environments. Those terrains particularly susceptible to the phenomenon witness a combination of unconsolidated rock type, erodible soils, steep slopes, heavy rainfall, active tectonic movement, rapid land use change and intense human interference. Current erosion models are based on assessment of factors, and their relative efficiency is questionable giving the assumptions made regarding the nature, influence and weight of causal factors. In addition, most of them were not validated. Therefore, a methodology is proposed in this study involving the production of sheet, mass and linear quantitative regional erosion actual risks in Lebanon based on pre-defined erosion indicators on the field, herein defined in erosion proxies derived from the structural classification of satellite imageries (Landsat TM) combined with the addition of several GIS thematic maps (rock type, soil type, land cover/use, drainage density, slope gradient, slope aspect and slope curvature). These indicators are independent from factors conditioning the soil vulnerability to erosion.

Sheet erosion map was produced under GIS environment through considering the mean occurrence of exposed tree roots and earth pillars dimensions in each proxy. Mass erosion map is built upon soil etching and soil movement measures. Soil loss due to sheet erosion is varying between 0.015 to more than 1.8 tons/ha; once mass erosion is considered, annual loss oscillates between 0.15 and more than 10.5 tons/ha; and a similar loss as mass erosion is retained for linear erosion. The coincidence values of overlap of erosion maps were found to be equal to 43% (sheet/linear), 48% (sheet/mass) and 49% (linear/mass). Six decision rules were applied in order to produce the overall erosion map reflecting all existing erosion processes, i.e. equality, dominance, bimodality, masking, aggravating, dependence and independence. Field

verification indicates that the total precision of the produced maps is varying between 76% (sheet erosion), 78% (mass erosion) and 78.5% (linear erosion).