Application of the Land Degradation Neutrality Concept in Mediterranean watersheds, a case study of Nahr Ibrahim, Lebanon

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Soil erosion and land degradation (LD) have become some of the most pre-occupying threats for most Mediterranean countries. Loss of prime soils and degradation of productive lands threatens food security and sustainable development in the region. In response to the UNCCD's 2030 Agenda for Sustainable Development, this study aims to implement Land Degradation Neutrality (LDN) concept not only as a mean to neutralize land losses, but also as a tool for land restoration and gain. Land use and land cover (LU/LC) changes were quantified through time series of multispectral satellite imagery (5 datasets over 13 years), GIS mapping and field validation. LD was mapped through a model based on the modification of the USDA's Land Capability Classification (LCC) method, and erosion risk maps were built based on the CORINE approach in order to link soil erosion to loss of land quality. The LDN concept was applied by crossing LU/LC maps with the LCC results to reveal and analyze the driving forces and nature of mismanagement, and to prospect the potential to counterbalance or neutralize ongoing losses at the scale of mountainous Mediterranean basin: the 309 Km2 Lebanese Nahr Ibrahim Watershed (NIW). In addition, the LDN concept was also tested for its adoption as a counter-erosion preventive measure given its common LU/LC indicator's relevance to the CORINE's model framework through alternative land use planning. Results showed countable LU/LC changes and counted for 66 % LD and of 4 %, 40% and 56% low, moderate and high erosion risk rates respectively in a span of 13 years. Moreover, implementing the LDN concept after establishment of LCC maps allowed the reduction of LD from 65.7% to 2.5% (63.2% decrease). Additionally, through the proposed LDN scenario, optimization of LU/LC classes covering LCC soil groups IV and V (least optimal soil groups) representing 19.35% of the basin resulted in a decrease of high erosion risks by 13.9% and an increase of low and moderate risks by 3 and 10.8% respectively. The presented approach can be up scaled to the national scale in an effort to mitigate loss of productive lands and for safeguarding Lebanese soils by increasing their resiliency to erosion consequently promoting sustainable development. Further, it may be generalized and applied to other Mediterranean watersheds as a tool for soil conservation, land restoration and for enhancing food security.