Impacts of agricultural expansion and climate change on soil erosion in the Taita Hills, Kenya

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Land use change and soil erosion are closely linked with each other and with local climate, assembling a very complex system. Although many studies have been undertaken to separately understand each of these processes, scientists currently face the challenge to integrate these studies into more complex frameworks. Understanding these interconnected relations is an essential step for elaborating public policies that can effectively lead to the conservation of natural resources. This study aimed to evaluate how future changes in climate and land use can alter, in time and space, the variables inherent to a widely used soil erosion model, allowing an integrated assessment of the impacts of these changes for soil conservation. The study was carried out in the Taita Hills, which form the northernmost part of the Eastern Arc Mountains of Kenya and Tanzania. This area is considered one of the world's most important regions for biological conservation. Due to the expansion of agricultural activities during the last centuries, currently only 1% of the original vegetation remains preserved in the Taita Hills. These landscape changes, together with potential increases in rainfall volumes caused by climate change, offer a great risk for soil conservation. A modelling framework was assembled by integrating a landscape dynamic model, a soil erosion model and synthetic precipitation datasets generated through a Monte Carlo simulation. The results indicate that, if current trends persist, agricultural areas will occupy roughly 60% of the study area by 2030. Although these land changes will certainly increase soil erosion figures, new croplands will likely take place predominantly in the lowlands, which comprises areas with lower soil erosion potential. By the year 2030, rainfall erosivity is likely to increase during April and November, while a slight decrease tendency is observed during March and May. An integrated assessment of these environmental changes, performed using the modelling framework, allowed a clear distinction of priority regions for soil conservation policies during the next 20 years.