Geophysical Research Abstracts
Vol. 15, EGU2013-4756, 2013
EGU General Assembly 2013

Influence of land use on rainfall simulation results in the Souss basin, Morocco

Klaus Daniel Peter (1), Johannes B. Ries (1), and Ali Ait Hssaine (2)

(1) Physical Geography, Trier University, Trier, Germany (peterk@uni-trier.de), (2) Department of Geography, University Ibn Zohr, Agadir, Morocco

Situated between the High and Anti-Atlas, the Souss basin is characterized by a dynamic land use change. It is one of the fastest growing agricultural regions of Morocco. Traditional mixed agriculture is replaced by extensive plantations of citrus fruits, bananas and vegetables in monocropping, mainly for the European market. For the implementation of the land use change and further expansion of the plantations into marginal land which was former unsuitable for agriculture, land levelling by heavy machinery is used to plane the fields and close the widespread gullies. These gully systems are cutting deep between the plantations and other arable land. Their development started already over 400 years ago with the introduction of sugar production. Heavy rainfall events lead to further strong soil and gully erosion in this with 200 mm mean annual precipitation normally arid region. Gullies are cutting into the arable land or are re-excavating their old stream courses.

On the test sites around the city of Taroudant, a total of 122 rainfall simulations were conducted to analyze the susceptibility of soils to surface runoff and soil erosion under different land use. A small portable nozzle rainfall simulator is used for the rainfall simulation experiments, quantifying runoff and erosion rates on micro-plots with a size of 0.28 m^2. A motor pump boosts the water regulated by a flow metre into the commercial full cone nozzle at a height of 2 m. The rainfall intensity is maintained at about 40 mm h^{-1} for each of the 30 min lasting experiments. Ten categories of land use are classified for different stages of levelling, fallow land, cultivation and rangeland.

Results show that mean runoff coefficients and mean sediment loads are significantly higher (1.4 and 3.5 times respectively) on levelled study sites compared to undisturbed sites. However, the runoff coefficients of all land use types are relatively equal and reach high median coefficients from 39 to 56 %. Only the rainfall simulations underneath mandarin trees in a plantation show with 10 % low coefficients. The results are stronger differentiated for the sediment loads. On levelled areas, the simulations reach median sediment loads of 41 and 61 g m^{-2} respectively. In spite of high runoff coefficients, the lowest sediment loads of around 4.5 g m^{-2} are measured on old fallow land (>5 y.) and rangeland which are both protected by biological crusts. The same low result is found on the mandarin plantation. On other younger fallow land (1-2, 2-5 y.) as well as on stone covered badlands and sundry anthropogenic influenced soils medium soil losses between 18 and 25 g m^{-2} are reached. On sparsely vegetated grain fields, soil erosion is because of initiated crusting despite lower runoff coefficients with 30 g m^{-2} still high.

Land-levelling measures have the greatest influence on rainfall simulation results. Although runoff coefficients on almost all land use types are similar, clear differences of soil erosion due to different land use can be identified.