IMPACT OF GLOBAL CHANGE ON SOIL EROSION RISK - SCENARIO ANALYSIS FOR THE SEMI-ARID DRÂA CATCHMENT (SOUTH MOROCCO)

Anna Klose, Department of Geography, University of Bonn, Germany, aklose@geographie.uni-bonn.de
Bernd Diekkrüger, Department of Geography, University of Bonn, Germany, b.diekkrueger@uni-bonn.de

The Drâa catchment (30,000km²) reaching from the southern declivity of the High Atlas (up to 4,070 m a.s.l.) to the Saharan foreland (450 m a.s.l.) is highly vulnerable towards soil erosion. Relief energy is high in the mountainous areas of the High Atlas and Antiatlas, soils are generally shallow and feature low organic matter contents, precipitation events are extremely variable in time and space and vegetation cover is sparse due to the semi-arid to hyper-arid climate and substantial overgrazing. The catchment is hydrologically divided into two equally sized parts by a reservoir which acts as a sediment trap. Bathymetric surveys showed that this reservoir “El Mansour Eddahbi” has already lost approximately 25 % of its original capacity in the first 26 years of its existence due to siltation. Soil erosion risk is estimated using the PESERA (Pan European Soil Erosion Risk Assessment) model coupled with a sediment delivery ration to be able to calculate sediment input into the reservoir. PESERA is a physically based raster model adapted to semi-arid conditions and large, data-sparse catchments. It combines data on topography, soil, land use and climate to estimate erosion risk in t/ha/month for representative years. As it considers feedback between climate, soil, and land use it is especially suited to analyse Global Change effects on soil erosion risk. Those effects are evaluated by comparing the current situation with a number of scenarios which describe climate and socio-economic development.The basic model run is set up using topographic data from the SRTM (Shuttle Radar Topography Mission) digital elevation model, maps of soil properties regionalised based on own field work, land use information from a Landsat TM scene, and climate data regionalised from meteorological stations. As measurements of surface runoff are extremely difficult in those dry environments, calibration was performed by comparing model results with results from a study using the hydrological model SWAT (Soil and Water Assessment Tool). A mean current erosion rate of 19.2 t/ha/year for the whole catchment and 28.7 t/ha/year for the catchment of the reservoir is calculated. Thereby erosion hotspots are identified in the High Atlas and Antiatlas Mountains, the intra-mountainous basins feature low erosion rates. Scenarios of climate change based on the downscaled results of the regional climate model REMO show a slight increase in soil erosion, although precipitation decreases. This effect is due to a trend towards more intense events combined with a reduction of protective vegetation cover. Scenarios of socio-economic development mainly regarding different pasture management and afforestation indicate that human activities are able to compensate the mean increase in soil erosion risks which is due to climatic impact. Nevertheless, as Climate Change impairs the whole catchment and management options are only feasible on a local scale, Global Change will lead to a general increase in soil erosion risk and a related decrease in soil quality.