Geophysical Research Abstracts, Vol. 9, 05044, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-05044

The Frankelbach catchment – a field laboratory to understand the effects of land-use changes on the water balance of low mountain range headwater regions

M. Seeger (1), M. Johst (1), S. Seeling (2), M. Casper (1)

(1) Physical Geography, University of Trier, Germany, (2) Department of Remote Sensing, University of Trier, Germany (seeger@uni-trier.de / Fax: +49 651 201 3976)

During the last decades, significant shifts in catchment dynamics had to be observed as a consequence of both, climate and land-use changes. Whilst the first is hardly predictable, the second is nowadays used as a tool for mitigation of natural disasters like floods or droughts. As part of the WaReLa-Project (Water Retention by Land-Use), a set of land-use measures have been applied with the goal of preventing small and medium catchments from low magnitude and high frequency flood events.

The present study is carried out in the headwater catchment of Frankelbach (Saar-Nahe Bergland, Rhineland-Palatinate, Germany), which has been threatened by flashfloods recently. It covers approx. 7 km^2, forming smooth rigdes and relatively flat areas on the higher parts, and steep slopes forming a narrow and partially deep valley. The upper areas are under actual intense agricultural use, but it is evident, that during the last 40 years, some parts of the ploughed areas have been transformed to extensive pastures or even into forest. The latter transformation process has been accelerated now with the purpose of water retention. This land us dynamics caused that the forested areas are not limited to the steep valley sides any more, but nowadays they are invading the flat upslope areas and for this they represent the dominating land cover.

In addition, a widespread transformation of the unpaved forest roads has been performed with the goal of conduction of concentrated runoff onto areas that might enable reinfiltration. A last set of retention measures corresponds to small retention basins built into the brooks.

For understanding the effectivity, the function and the sustainability of the retention

measures, deep knowledge on runoff generation and its distribution is necessary. Mass transport has to be understood as well, because sediments in runoff are an indicator of runoff sources and pathways and they may lower water retention capacity of selected measures.

Aim of the study is to understand and quantify the effects of the measures mentioned above on runoff and mass transport as well as on spatial distribution of processes.

For this, a variety of measurements are carried out within the catchment. The basis is built by four flumes located to build a nested catchment system. Beside runoff, temperature, conductivity and turbidity of the runoff water are measured and automatic samplers gain water samples for analysis of nutrients and suspended sediments. Additionally, on two sites soil moisture is measured with high spatial and temporal resolution with a multiple head TDR-system.

For supporting the measurements, detailed mapping of land cover, soils and runoff relevant areas is performed within the catchment.

First results of the measurements will be presented. They indicate that the runoff is mostly produced on the flat agricultural areas on the top of the catchment as surface runoff or fast interflow, and then concentrated within the steep forest areas. For this, it can be recognised that the actual catchment structure is not able to retain runoff and floods or muddy flows may occur with high frequency.