



Assessment of gully erosion by linking photogrammetric methods and field measurements

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In the Ethiopian Highlands, numerous processes lead to land degradation thus decreasing soil productivity. The objective of this study is to assess the gully erosion in an agriculturally used watershed in the northern Amhara region of Ethiopia. The study uses two different methods to measure the development of four active gully reaches within one system: 1) manual recording of various cross sections using tape measurements and 2) application of close range photogrammetry. Fieldwork was conducted from June to September 2012.

Overlapping photographs, taken with a non-metric digital camera, were taken as input data for a detailed photogrammetric analysis. The goal was to assess the applicability of this rather new remote sensing method in the given domain. In addition, the total soil loss due to gully erosion was evaluated for different reaches of the gully system in a catchment of 34 ha.

In order to provide comparison and backup data, as well as for verification purposes, the field work was designed to incorporate manual plumb line and tape cross section measurements. Both methods were applied at the beginning, the middle and at the end of the rainy season. The work uses geo-referenced buried stones to retrace the location of 22 cross sections at four gully reaches. These marks were also necessary to add a consistent outer orientation to the dense surface point clouds resulting from photogrammetric analysis. The control points are then excluded from the photogrammetric reconstruction process and used for error estimation. The software package Photomodeller Scanner® allows for the derivation of surface models from point clouds. Comparing the surfaces from different points in time for a specific gully reach reveals the volumetric soil loss in this area.

The manual measurements of 22 cross sections show an increase in area of up to 136%. At the top most active gully reaches this relates to a soil loss of greater than 17 m³ within a 21 m long gully segment. The interpretation of the stereo photos is still in progress – no data is yet available. One interesting aspect of this data deals with vegetation. There was almost no vegetation cover affecting the photogrammetric survey at the beginning of the rainy season, however this changed over the course of the survey. A comparison of manually measured cross sections with digitally derived ones, will give some indication of the influence of vegetation on the photogrammetric approach.