Development and Application of a Soil Erosion Risk Model - The Case of the Bilate River Catchment Area, South Ethiopia

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The Bilate River originates in the Western Ethiopian Highlands and drains into Lake Abaya in the Southern Ethiopian Rift Valley. The catchment of 5,500 km² can be divided into different geomorphological units using relief parameters such as slope, altitude and curvature, as well as characteristic pedogenic attributes. The differentiation of parameter values results in three major geomorphological units: the almost flat *Rift Valley (1)*, the *Western Highlands* including separate *volcanoes (2)* with mountainous relief character, as well as *valleys* and *basins (3)* with smooth relief. Within these units, characteristic erosion and soil erosion features occur depending on various parameters influencing the development of erosion types.

Large-scale mapping of erosion and soil erosion damages as well as soil type and land use shows the different erosion types within the geomorphological units. For example, in the *Rift Valley (1)* horizontally extending erosion features like gullies or deeply eroded area-wide degradation types occur in accordance with smooth slopes, Vertisols or Andosols. In the *Western Highlands* and on *volcanoes (2)* linear erosion types and gullies smaller than in the Rift Valley are found on all slopes that are dominated by Nitosols and Luvisols. In contrast, only few erosion types exist in the *valleys* and *basins (3)*.

In order to model **potential erosion risk** (erosion under natural conditions) parameters of surface, soil and climate are to be considered. Subsequently, anthropogenic factors have to be incorporated to compute the **actual soil erosion risk**, which includes human impact. The model aims to reduce the complexity of the natural processes by introducing simpler, linear concepts rather than reflecting the complex, non-linear relationships of land forming processes. In addition, the limited availability of data constrains the complexity of the model, since data are only available as isolated point data and hardly any time series are complete. The model combines and qualitatively weighs factors influencing the development of dominant erosion types. These include natural factors such as slope, curvature, flow accumulation, soil characteristics, vegetation cover and climate, as well as anthropogenic factors. The model includes primary and secondary input data. Primary input data incorporate field mapping of erosion and soil erosion damage and land use. Secondary input data include relief data, FAO soil and terrain data, as well as the analysis of aerial photographs and satellite images.

Field mapping of soil erosion types was carried out in several sub-catchments which have been identified within the three geomorphological units to detect erosion processes in detail. The results generated on the sub-catchment scale form the basis for subsequent modelling of the erosion and soil erosion risk for the entire Bilate River catchment. The constraints of up-scaling, such as the loss of data and accuracy, are acknowledged. Nonetheless, the knowledge of erosion and soil erosion risk in this catchment has been identified as more important than computed soil loss estimates.