

Hydrological Response of Catchment Management in the North Ethiopian Highlands

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Catchment management in the developing world has been demonstrated to pay off in economic terms yet such studies rarely include detailed hydrological components. Changes in the hydrological response of the 200-ha May Zeg Zeg integrated catchment management area (near Hagere Selam, North Ethiopia) were studied for the period 2000-2006, before and after catchment management. The catchment management included various soil and water conservation measures such as the construction of dry masonry stone bunds on farmland and check dams in gullies, abandonment of post-harvest grazing on cropland and the establishment of woody vegetation on degraded rangelands. Measurements of rain depth and runoff discharge at the catchment outlet indicated a runoff depth of 5 mm or a runoff coefficient (RC) of 1.6 % in the rainy season of 2006. Combined with runoff measurements at plot scale, this allowed calculating the runoff Curve Number (CN) for various land uses and land management techniques pre and post implementation of catchment management. The pre-implementation runoff was then predicted using the calibrated CN values (taking into account stone bund construction and reduced grazing), as well as a ponding adjustment factor, representing the abstraction of runoff induced by the 242

check dams in gullies. Using the 2006 rainfall depths, the runoff for the 2000 land-use and management situation in the catchment, was predicted to be 26.5 mm. This corresponds to a RC of 8 %, which is in line with current RCs of nearby catchments. Monitoring of the water table in a piezometer in the upper valley bottom indicate a rise of ground water levels after catchment management. When the rise in water table after the onset of the rains (ΔT) is given relative to the water surplus (WS) over the same period, a large difference is seen between 2006 ($\Delta T/WS > 11.1$) and 2002-2003 ($\Delta T/WS = 3.4$). Emerging wells and irrigated fields are other indicators for an improved hydrological balance and water supply in the study area brought about by catchment management. Cropped fields in the lower gully system also indicate that farmers are less frightened for flash floods with destructive effects on their cropland. Due to greater soil water content, the period of water uptake by crops is prolonged. It is clear that this catchment management has resulted in a higher infiltration rate and a reduced direct runoff volume which has had a positive influence on the catchment water balance. Increased water availability leads to higher crop yield and crop diversification by the farmers.

Soil CO₂ Fluxes Following Wetting