

## **Assessing the variation in bund structure design and its impact on soil physical properties and hydrology in Koga catchment, Highlands of Ethiopia**

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Prolonged soil drying and severe moisture stress during the dry season, and soil saturation and erosion during the short rainy season are critical problems in the Ethiopian highlands. Large-scale implementation of bund structures has been used as soil and water management (SWM) strategy to fight these problems and establish a sustainable land management (SLM) system. However, many SWM practices are implemented with design flaws or without proper design and maintenance, and do not match conservation requirements. The quality of implementation and effects of bund structures on soil physical properties is not yet documented. Therefore, in this study, field investigations and laboratory analysis were carried out to evaluate the variation in bund structure design and its impact on soil-water retention, bulk density, porosity and soil depth. Results show that the dimensions and stability of bund structures, and consequently, the impacts of bunds varied widely. The widths and heights of bunds, and slope gradients were significantly correlated with infiltration rate and available soil-water content. Water holding capacity was 24% higher compared to that on untreated farms. Bunds with larger dimensions of top width (>85 cm) and height (>75 cm) showed 17 and 18% higher water holding capacity compared to fields with bunds having lower dimensions. In addition, results exhibited that the porosity and soil depth were significantly affected by the dimensions of bund structures and increased with increasing widths and heights of bunds. A 14.2% increase in porosity; a 41.2% increase in infiltration rate; and a 17.5% decrease in bulk density was found in soils of treated farms compared to those of untreated farm plots. Differences in particle size distribution and soil erodibility among widths of the bunds were low. It can be concluded that bund structure design varied substantially throughout the study area, which had impacted soil-water storage and soil physical properties. Bund structure design should be adapted to local biophysical settings at catchment level to enhance on- and offsite impacts.