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Integrated approaches to restore gullies in land prone to soil piping: innovations from the drylands of northern Ethiopia

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Multiple on-site and off-site effects of gully erosion threaten sustainable development, which is especially evident in dryland environments. To control soil erosion by gully erosion, various soil and water conservation measures have been developed, of which check dams are the most common. Where soil piping occurs, soil and water conservation measures have limited effect on gully stabilization, and check dams easily collapse. Therefore, new integrated approaches are needed to control gully erosion induced by soil piping. Here, a subsurface geomembrane dam is proposed as an innovative measure to reduce subsurface flow in soil pipes near gullies. Application of such a dam in Northern Ethiopia, resulted in a decrease of gully erosion rates in Vertisols, and a rising water table in the intergully areas near the gully channel. The consequence of this effect for agriculture near gully channels is the reduction of soil desiccation and hence, increased crop yields in the intergully areas near the gully channels. With the gully filling and stabilizing, runoff water could be diverted into adjacent land, offering additional benefits to the local communities. Here, the runoff diversion was done into a vegetation protection site, in order to enhance biomass production, especially tree growth. Moreover, a water collection pond was created to make water available in the prolonged dry season. These interventions support additional economical activities such as beekeeping and the establishment of a tree nursery. With the multiple on-site and off-site benefits of the integrated approach, local communities have a better guarantee of investment return and livelihood improvement, increasing their support to gully rehabilitation schemes.

Keywords: Crop, Subsurface dam, Soil and water conservation, Tree growth, Vertisol, Dryland.