

## **Linking hydrology of traditional irrigation canals and socio-economic aspects of agricultural water use around Mt. Kilimanjaro**

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Traditional irrigation network around Mt. Kilimanjaro has been an important resource for both ecosystem functioning and agricultural production. However, a number of irrigation furrows can no longer maintain their discharge throughout the year and their future sustainability is uncertain. The actual efforts to improve the water supply were unsuccessful. We attribute this failure to a lack of information about the actual causes and extent of the problem. We suppose that there is a strong link between the socio-economic aspects like institutional and community management of the furrows and conflicts about water use.

Therefore, we conducted a study to determine the relationship between current hydrological patterns and socio-economic aspects of agricultural water use. We measured discharge at 11 locations along an altitudinal gradient on the southern slopes of Mt. Kilimanjaro. Additionally, we conducted focus group discussions with participants from 15 villages and key informants interviews ( $n = 15$ ).

We found that the mean discharge did not differ significantly between dry and rainy seasons (ANOVA,  $p = 0.17$ ). The overall discharge pattern indicated that furrows located in lower altitude had higher mean monthly discharge rate of  $65 \text{ l s}^{-1}$  compared to  $11.5 \text{ l s}^{-1}$  at the source area of the canals. This is due to the convergence of canals downstream. 41% of furrows were seasonal, 22% dry and only 37% perennial.

Despite of a seemingly better water resource availability downstream, water conflicts are a major challenge across the whole mountain communities. Key informants and group discussions reported poor management of water on the district level. The Rural Moshi and Hai District Councils operate on a top down approach that give less power to the local water management committees. However, the latter have been an important part of the traditional management system for decades. Since 1990, the district authorities are using 65% of springs from the catchment to abstract water for 8 big gravity pipe water projects for urban areas, for example. This abstraction of water amplifies several conflicts over water use between smallholder farmers, smallholder farmers and large irrigation schemes and between farmers and non-agricultural water users downstream.

Furthermore, encroachments in the Mt. Kilimanjaro National Park were reported. In particular, forest communities adjacent to the park are involved in illegal activities like logging, grazing, cultivation and cutting firewood. Since most irrigation furrow start in the park, ongoing forest disturbances could have direct impact on their hydrology. We attribute those encroachments to poverty, low environmental awareness, poor land tenure system and a lack of an effective forest patrol.

To resolve water use conflicts around Mt. Kilimanjaro, good governance practices including improved water distribution and resource management is required. This could be achieved through an integrated water resources management approach where both traditional and formal management institutions should work synergetically.