***Title:*** ***Capacity building in sustainable land and water management for migrant and remaining youth at the slopes of Mount Kilimanjaro***

***Background***

In sub-Saharan Africa, climate change is already substantially impacting on crop yields through recurrent droughts associated with limited water availability and high temperatures (Lobell et al., 2011). Due to their reliance on rain-fed agriculture as a source of income and consumption, countries such as Tanzania are vulnerable to climate change as most local farmers have a limited capacity, technology and resources to adapt (Arndt et al 2012). Likewise, population growth has induced significant environmental changes on the slopes of Mt. Kilimanjaro over the recent decades. A land use change analysis from 1960s to 2000 by Soini (2002) shows the expansion of cultivation to marginal land, the disappearance and fragmentation of natural vegetation and appearance and expansion of settlements. Deforestation in terrains with high slope can result in enhanced soil erosion with negative consequences on water and soil resources. Therefore, considering a climate change scenario with variation in rainfall patterns and a continuous decline in soil fertility make it imperative for smallholder farmers to adopt new strategies aimed at generating sustainable sources of income through agriculture intensification. Only then, the land can attract and retain the youth again. This project will be conducted at the slopes of Mount Kilimanjaro (altitude 1800-2000 m) where farm sizes are very small (≤ 0.5ha) and farmers grow mainly coffee and bananas on clay soils of volcanic origin. The rainfall in the region is both orographic and bimodal but very erratic such that farmers have to rely on irrigation to reduce vulnerability. However, presently several of irrigation structures have been abandoned and there is need to either develop alternative options, e.g., high water use efficiency practices; or rehabilitate existing water harvesting and conveying systems.

Cattle, which are kept as a source of milk and meat, are an integral part of farming systems in the Kilimanjaro region. The cattle are kept indoors and feed through zero grazing.

**Need assessment**

Communities at the slopes of Mount Kilimanjaro have responded to complexities associated with climate change, limited water availability and land scarcity in several ways, such as clearing more forest land for agricultural purposes and increasing rates of groundwater abstraction for crop irrigation. These adaptation options have exposed more land to degradation, further reduced water availability in the Kilimanjaro region and consequently increased rural-urban migration, especially among the youth. This has caused both a surge of youth unemployment in cities and a reduction of youth labour to support smallholder agriculture It is of utmost importance that Tanzanian postgraduates acquire the knowledge and skills needed to develop new alternatives to the Land degradation and water scarcity problem in the slopes of mount Kilimanjaro. This project will provide a platform to blend knowledge from migrant and remaining youth to develop sustainable land and water management options for communities at the slopes of Mount Kilimanajaro.

**Objectives**

1. Development and introduction of improved water harvesting and irrigation technologies and techniques for optimization of water use;
2. Integration of crop-livestock systems and increased crop diversification to include high value horticultural crops requiring less water and land;
3. Development of knowledge-based decision support tools, by using Partially observable Markov decision process (POMDP), for smallholder farmers in the Kilimanjaro region;
4. Todevelop an understanding of soil water, carbon, and nutrient dynamics in the proposed horticultural crops by means of Crop-soil models for short and long term projections and analysis of climate change adaptation options.

**Description of proposed activities (include timeline- Gantt diagram**

**Expected outputs**

1. A pilot site (0.5 ha) where several water harvesting and irrigation technologies and techniques will be installed and introduced together with farmers.
2. Use of water stress management strategies like: New high valueed horticultural crops crop rotation, cultivation practices (tolerant crops/cultivars, stubble retention, inter cropping, conservation agriculture) will be practiced farming, in the 0.5-ha pilot site.
3. At least five postgraduate students in areas related to crop modeling, soil water, carbon and nutrient dynamics, will be trained which also include projection of future cropping system in respect to clanging climate .trained
4. The students are expected to test and document cropping systems, water, carbon and nutrient dynamics at the pilot site, in peer-reviewed journal articles.
5. **Impact and sustainability of approach**

More emphasis will be placed on developing low-cost and high impact technologies and techniques that mostly depend on locally available resources such as straw for mulching. Affordability will stimulate farmer adoption and continuity of developed options without external support. The project is unique in that it will target postgraduate students from the Kilimanjaro region and youth from the local community. This strategy will allow joint learning and sharing of knowledge, innovations, ideas and resources to improve understanding and modification of agricultural systems in the Kilimanjaro region. Thus this project will improve university-community linkages in the Kilimanjaro region. This approach could be scaled out to the rest of Tanzania.

**Complementarity with efforts supported by other donors**

**Other ideas**

4. Arrange a short course targeting postgraduate students of University of ABC with a focus to integrate measurements with modelling to understand crop growth in relation to soil water, carbon and nitrogen dynamics within the proposed system.

3. Assist postgraduate students of University of ABC to develop collaboration with community to develop and implement improved water harvest systems.

1. At least ...% of farmers in ABCD community of Kilimanjaro region will have drip irrigation system used for high value vegetable cultivation and they will continue the system after the project is finished.

We envisage that combining water harvesting and drip irrigation with soil plastic or mulch covers in high value crops is a potential win-win-win solution to the problem of water availability as it would lead to reduced soil evaporation, increased crop water use efficiency and improved productivity. Complementing water use efficiency, management of soil organic matter could also contribute toward increasing plant available water in soils. For capacity building and contributing towards science, postgraduate students from the south could integrate measurements with modelling to understand crop growth in relation to soil water, carbon and nitrogen dynamics within the proposed system.