Reference landscape: West Usambara mountain

1. Introduction

The West Usambara Mountain ranges is found in North East Tanzania, and forms part of the Eastern Arc Mountains. With elevation ranging from 900 – 2250 meters above the sea level they occupy about 80 % of Lushoto District in Tanga Region (Figure 1). More than 80 % of the population of Lushoto District (estimated at 726,278 (NBS, 2012)) reside in the West Usambara Mountains making it the most densely populated (104 person/ km^2) in the country. The importance of the West Usambara mountains as well as efforts in conserving them has been given a lot of coverage since early 1900's (Pfeiffer, 1990; Iversen, 1991; Stroud, 2000).

Figure 1: Location of West Usambara Landscape

Suffice it here to note that these mountain ranges with their excellent climatic conditions have attracted not only farming communities but also tourists as well as providing various products to populations and industries within and outside the West Usambara. Several streams originating from the West Usambara feed for example the Umba River, which crosses to Kenya. Water from this watershed is widely used for irrigation in the adjoining lowlands and in generation of hydro-electricity (Iddi, 2000). The West Usambara is also home for different plants and animals several of which are endemic to the area thus having an important role at national and global level in the conservation of biodiversity.

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The landscape information comes from among others, Soil Erosion Control & Agroforestry Project (SECAP), which was funded by GTZ, the Africa Highland Initiative (AHI)……..

It was prepared by IITAs research team led by Dr. Freddy Baijukya with support from the ToT facilitation team, with special focus on Tanzania side of the basin where the LCSA training was relevant.

2. Landscape description

2.1. Geography

The West Usambara land cape is made of large ranges of Precambrian metamorphic geologic formations of acid-gneisses, pyroxenes, and amphiboles. The mountain range was formed nearly two million years ago. These mountains were formed by faulting and uplifting creating the drainage system of troughs that form many watersheds, which provide water to most of the population of northeast Tanzania. The landscape is occupied by the rain forests, which due to a lack of glaciations and a relatively consistent climate has gone through a long term and unique evolution resulting in an impressive amount of endemism and an old-growth cloud rainforest.

2.2 Climate

The climate of West Usambara is regulated by the topography of its blocs. Related to topography, two factors largely influence the weather and climate, namely, the Indian Ocean and Intertropical Convergence Zone (ITCZ). The influence of the Indian Ocean is determined by the distance from the mountain blocs, which brings about differences in the amount of precipitation and temperature variations between the blocs. They are located some 70 km from the Indian Ocean. The ITCZ influence determines seasonality, variability, and reliability in terms of annual rainfall and variability in terms of annual temperatures between the mountains.

The place is characterized by warm and cold humid agro-climatic zones. The altitude ranges from 780 to 2010 m above sea level. Rainfall is bimodal, ranging from 690 to 1230 mm per annum. The long rains (“Masika”) occur from March to May (MAM), and short rains (“Vuli”) from October to December (OND). The steep sloping sides in the east are generally wetter (800 -1200 mm) than the gentle sloping western sides of all the mountains (400-800 mm). The distance from the Indian Ocean determines the amount of annual precipitation, not temperature as the latter is influenced locally with the changing altitude.

2.3 Land use and livelihood situation

West Usambara’s population is 492,441 with a population density estimated at 141 Sq. Km. The density is very high, more than two times that of Tanzania as a whole which is estimate to be 51 per Sq. Km. This situation has aggravated to land scarcity both for agriculture

Figure 2. Typical Agricultural land in West USambara Landscape

and human settlements. Signs of high population and land scarcity in West Usambara were there even before Tanzania got its independence in 1961. The problem of land scarcity in West Usambara is much complicated by the mountainous nature of the area, and existence of many forest reserves which are rich in biodiversity. Highlands and steep slopes that dominate the area have accelerated soil erosion leading to the decline in soil productivity. In the same way, the government has set aside nearly all-natural forests as reserves, as these forests are among the 6 earth's biological richest with higher conservation values. Such decision has restricted more expansion of crop land.

2.3.1 Livestock production

West Usambara has the second largest number of cattle in Tanga region and they are almost all indigenous. Goat production is moderate, however it has the largest population of sheep in the region. It has the smallest number of pigs in Tanga region and a moderate number of chickens. Although small, the district has the second highest number of layers in the region. Small numbers of ducks, rabbits and donkeys are also found in the district. The use of draft animals in the district is very minimal, and a small number of households practice fish farming.

2.3.2 Crop production

West Usambara is moderately important for maize production in the region with a planted area of over 51,000 ha, however the planted area per household is the lowest in Tanga region. Paddy rice production is not important with a planted area of only 900 ha and the production of sorghum is very small. Cassava production is moderate accounting for 21 percent of the quantity harvested in the Tanga region. It has a large, planted area of Irish potatoes (15,000 ha) and it is the only district in Tanga region that grows this crop. The production of beans is much higher than in other districts in Tanga region with a planted area of 25,000 ha. Oilseed crops are not important, and no groundnuts are grown there. Vegetable production is important, where it has the largest planted area with tomatoes, cabbage and chilies (1,600 ha, 750 ha and 450 ha respectively) than other places in Tanga region and accounts for 65 percent of the tomato production, 89 percent of the cabbage production and 60 percent of the chilly production in the region. Compared to other areas, West Usambara has a moderate planted area with permanent crops which is dominated by coffee (2,000 ha), tea (1,000 ha) and bananas (1,000 ha).

2.4 Population and livelihoods:

West Usambara has the largest number of households in the region and it has one of the highest percent of households involved in smallholder agriculture in the Tanga region. Most smallholders are involved in crop farming only, followed by crop and livestock farming. It has a very small number of livestock only households and no pastoralists were found in West Usambara.

The most important livelihood activity for smallholder households in West Usambara is annual crop farming, followed by off-farm income and permanent crop farming. However, the district

has the highest percent of households with no off-farm activities and the lowest percent of households with more than one member with off-farm income. Compared to other districts in Tanga region, the area has a relatively high percent of female headed households (26%) and it has one of the lowest average age of the household head. The average household size west Usambara is 4.7 members, which is average for the Tanga region region. The area has a comparatively high literacy rate among smallholder households and this is reflected by the concomitant relatively high level of school attendance in the region. The literacy rate for the heads of household is also slightly higher than most of districts in the region.

It has the smallest land area per household (less than 1 ha) and the allocated area is fully utilized indicating a high level of land pressure. The total planted area is greater than in other districts in the region due to the presence of good wet and dry seasons.

3. Challenges facing the Landscape

3.1 Climate related challenges

Over the years, the rainfall amounts have been declining (Mahoo et al. 2015, Nyasimi et al. 2017) and have become highly variable, characterized by intense storms (Ogada et al. 2020).

A study by Recha et al (2016) indicates recurrent drought, prolonged dry spells, and variable rainfall patterns with intense storms are the main climate related risks in Lushoto. About two-thirds of the rainfall occurs in the long rainy season (Masika) from March to mid-June, with one-third occurring in the short rainy season (Vuli) from October to December. Mean annual rainfall ranges from 900 to 1,300 mm, with an average of 102 rainy days. Long term daily rainfall data for West Usambara (1922–2012) from the Tanzania Meteorological Agency (TMA) shows a decreasing trend (Figure 1). Between 1981 and 2010, the trends show a decrease in rainfall amounts during Masika season and increased amounts during Vuli compared to the previous 30 years. This has negatively affected agricultural activities

3.2 Ecosystem related challenges

The main challenges in the landscape are soil erosion, farmland degradation and depletion of water sources. In the last 50 years more than 70% of the forest cover in the Usambara Mt. has vanished due to an increase in population and the associated need for farmland, firewood and woody construction material. The people have felled more trees and the effects are becoming a real impairment to sustainable rural development – besides the obvious loss of habitat and biodiversity. The steep hillsides where smallholder famers grow their crops are prone to erosion once deep rooting vegetation like trees are gone. When farmland erodes, farmers clear more land to grow their crops and this starts a vicious cycle. The roads carved into the hillside need to

be planted with trees on both sides to prevent erosion, but farmers try to extend their fields right up to the roads in order to make use of every inch of land (good soil). Then the land erodes, roads are not passable for days, sometimes weeks, and farmland is lost again. As if this was not enough the natural water sources increasingly run dry because of disturbance of the natural hydrological cycles that forests provide.

3.3 Production related challenges

The crops cultivated depend on household needs, but most are for subsistence and cash. The crops include maize, beans for food, Irish potatoes, and horticultural crops including carrots, cabbages, onions, and tomatoes. The farmers grow the Irish potatoes and horticultural products in the valley bottoms, which benefit from water from the forest. Despite the land size, agricultural productivities are limited by poor soil fertility and farming technologies, whereby harvests are low.

The risk of crop failure has increased in topographical areas that are not in the valley bottoms, especially when farmers sow seeds before the actual onset of the rainy season (Recha et al. 2016). Within the valley bottoms, there are streams used for irrigation of especially the horticultural crops. The smallholder farmers who are not in valley bottoms manage the risks of crop failure by growing traditional non-improved varieties of maize and beans. In 2011, only 12% of farmers were reported to have introduced one to two new crop varieties. Local livestock is largely kept under zero grazing, associated with tethering around the homestead due to small land sizes averaging about 0.3 hectares per household. Livestock feeding resources are mainly local cultivated fodder and crop residues. Limited livestock feed resources often leads to malnutrition, slow growth rates, high susceptibility to pests and diseases, low livestock market value and poor milk production. Other challenges include extreme soil erosion, land degradation and declining soil fertility. The cultivated soils have lost about 50% of soil organic carbon, and 34% of nitrogen (Winowiecki et al. 2015). The high poverty levels increase the vulnerability of farming households to climate-related risks.

4.4 Livelihood related challenges

Over the past 120 years the population in West-Usambara grew more than sixfold. A process of agricultural and environmental change, caused by a combination of population growth, increasing pressure on agricultural land and forests, reduction of soil fertility and increasing soil erosion. These causes many households to experience a food shortage for an average of three months on an annual basis.

A CCAFS survey in 2011 (Lyamchai et al 2011) established that households in Lushoto, only 4% are ‘food secure’ all year Long. 7% access enough food for their families for at least 10---11 months of the year. 26% of These households struggle to get enough food to feed their family

for 3---4 months/year, 27% Face 5---6 food deficit months, and over one---third deal with more than 6 food deficit months per year where one main meal is consumed in a household.

3.5 Institutions/governance related challenges

- Initiatives are led by donor funded projects that sometimes have a short lifespan before impact is realized.
- There is limited private sector involvement in the area. Most of the landscape activities are entirely led by government institutions (e.g. TARI, TAFORI) and District Councils (e.g. Lushoto District Council)
- There are few community based organisations (CBOs) to mobilize people. Where there are CBOs, there are capacity gaps such that people need more education on landscape management.

4. The Intervention

4.1 Tree/Agroforestry management related

Tree farming is important in West Usambara (with 600,000 planted trees annually) and is mostly Grevillea with some Pinus, Cyprus and eucalyptus. The highest proportion of households with erosion control and water harvesting structures is found in west Usambara and is mostly terraces. However, it also has the highest number of vetiver grass strips, water harvesting bunds and tree belts than other areas in Tanga region.

The Kizanda Environmental Group in Mayo under leadership of Mr. Magogo who is a retired forest specialist and the Pentecostal Church Conservation Group in Yoghoi under Priest Johana Mtangi have chosen their weapons to fight for sustainability: afforestation and apiculture. Planting trees on roadsides and on farms to control erosion, to secure future supply of fire and construction wood and to protect the water sources in combination with beekeeping will lead in their eyes to the immediate and mid-term solution of their villages' problems. If farmers plant trees and thereby forsake to grow crops on the spot where the tree is growing this tree needs to have as many additional values besides erosion control as possible. Therefore, especially ornamental trees whose flowers bees feed upon will be planted next to the roads. The farmers who become trained in beekeeping will then produce honey that eases the families income situation to such an extent that they don't rely entirely on their crop production or even the vending of coal and firewood any more. The remaining trees will be planted as little plantation forests that provide the fire and construction wood in the future, whereas the trees planted on community land around the water sources will be declared as protected forest under village law. And then eventually all these measures will contribute to a longer life of the remaining areas of undisturbed natural forest that is loaded with an unseen variety of species in the Usambaras.

4.2 Water management related

- Started irrigating;
- Introduced micro-catchments;
- Introduced improved irrigation;
- Introduced improved drainage

4.3 Soil Management related

- Stopped burning crop waste;
- Introduced crop cover;
- Introduced ridges or bunds;
- Introduced mulching;
- Introduced terraces;
- Introduced stone lines;
- Introduced contour ploughing;
- Introduced rotations;
- Started using or increased use of mineral/chemical fertilizer;
- Started using manure/compost.

Ecosystem approach applicable

- The objectives of management of land, water and living resources are a priority of the local community
- Management of sections of landscapes decentralized to the lowest appropriate level.
- Conservation of Usambara ecosystem structure and functioning, to maintain ecosystem services.
- The management undertaken at increasing spatial and temporal scales or the long term.
- Considers all forms of relevant information, including scientific and indigenous and local knowledge, innovations and practices.
- Involving all relevant sectors of society and scientific disciplines.

Institutional approach

Lushoto District Council, Tanzania Agric Research Institute (TARI), international agricultural research organisations (CGIAR) , and local community based organisations (CBOs) partnership through action research approaches is facilitating the testing of improved crop production practices, land and water management that integrates agroforestry, and institutional innovations. From 2012, vibrant CBOs have been established, and members trained, and are empowering their communities through collective action.

Created Mechanisms for Rewards/ PES Payments for Ecosystem Services

There was a PES project on the Usambara Mountain, that is source of Zigi River which supplies 100% of the water needs of the City of Tanga. Over the years, the Usambara Mountains have suffered from degradation attributed to human activity, thus threatening the continued supply of the watershed services. The degradation prompted the implementation of a PES scheme banking on the readiness of the communities to participate in the project through implementation of various improved land-use practices including tree planting, terrace farming and grass-strip farming, as well as the willingness shown by other stakeholders including the Tanzanian government and major downstream water users (Sang et al 2017)

5. Benefits

- ***Households in are diversifying their crop choices***. By 2020, about 90% of the households were introducing at least one new crop variety. The increased adoption and use of new resilient bean and maize varieties is attributed to the multiplication of the drought tolerant *JESCA* and *Lyamungo-90* bean varieties, and *Situka* and *Lishe* maize varieties through community seed bulking.
- ***Community seed banks have emerged for storage and distribution*** of seeds to farmers the following season. The number of farmers using the resilient seed combined with improved agronomic practices has increased.
- ***By integrating trees on-farm***. In 2011, only 59% of households reported to have made some tree and agroforestry management related changes and only 22% were producing or purchasing tree seedlings. This has since changed significantly after the establishment of three tree nurseries. Community members are diversifying their livelihoods and are responding to a policy by the Lushoto District Council of a 10% tree cover on all farms.