



Making REDD work for communities and forest conservation in Tanzania

Improving agricultural practices in the context of REDD readiness in Lindi Rural District, Tanzania:  
a review of current agricultural practices and recommendations for project interventions.

June 2012



## **Executive summary**

### **Background**

The Tanzania Forest Conservation Group in partnership with the Community Forest Conservation Network of Tanzania (MJUMITA) is implementing the project 'Making REDD work for communities and forest conservation in Tanzania'. The project aims to reduce greenhouse gas emissions from deforestation and forest degradation in Tanzania in ways that provide direct and equitable incentives to communities to conserve and manage forests sustainably. The project will achieve this by supporting the development of a Community Carbon Enterprise hosted within the existing Network of Tanzanian communities engaged in participatory forest management. The project is a 5 year project started in 2009 and financed by the Norwegian Ministry of Foreign Affairs.

This agricultural development strategy has been developed to provide guidelines on how to simultaneously improve agricultural productivity; avoid deforestation due to shifting agriculture; and increase resilience to climate change. Therefore the objective for this assignment was to develop a strategy and work programme for the project that will effectively support women and men farmers in the project area to improve their livelihoods; become more resilient to climate change and halt deforestation and forest degradation.

### **Approach and methodology**

A combination of methods was adopted including extensive document review, individual and group interviews with stakeholders from the community level to the national level and on-site field observations in ten villages and sub-villages in Lindi rural district. The team adopted participatory approaches in problem and solution identification to recommend agreeable and feasible strategies for their effectiveness, efficiency and sustainability. The team comprised three agricultural experts from Naliendele Agricultural Research Institute in Mtwara and a team leader – Baruani Mshale – an expert on participatory forest governance from the school of natural resources and environment at the University of Michigan (Ann Arbor, USA).

### **Structure of report**

Following the introduction and methodology sections, the report is divided into five chapters focusing on: site description (chapter 3); existing opportunities for improved agricultural productivity in the area (chapter 4); problems faced by farmers and how they address them (chapter 5); potential strategies for improving agricultural production in the area (chapter 6) and; a proposed program work (chapter 7).

### **Site description**

This agricultural development strategy covers 17 villages which are proposed for inclusion in the REDD readiness project implemented by TFCG and MJUMITA in Lindi region. Site description covers bio-geo-physical features, socio-economic characteristics, agricultural practices and the general situation in the area. The biogeophysical conditions described in the report influence the types of vegetation and crops that survive in the area. Generally, Lindi rural district is a relatively dry area with nutrient-poor iron-rich soils. The recommendations and strategies contained in this report reflect on the types of crops and livelihood strategies supported by the pre-existing biogeophysical conditions of the area. In terms of socio-economic characteristics, the majority of villagers (100%) are primarily small-scale farmers with a few supplementing crop farming with livestock keeping and small businesses. Major food and cash crops cultivated in the area include sesame, maize, rice, sorghum, pigeon peas and vegetables. Slash and burn shifting cultivation is the common practice to avoid weeds, seek more fertile soils, avoid problem animals and insect pests.

### **Existing opportunities**

The table below summarizes the important opportunities available in the area for improved agricultural production.

Agricultural Aspect	Opportunities
Crops	<p>The soil and weather/climate conditions support sesame, cassava and maize cultivation in all villages.</p> <p>Lowland paddy rice farming is possible in Rutamba ya sasa, Kinyope and Ruhoma.</p> <p>Villages along the Milola road cultivated cashews in the past and the conditions favored the crop but market changes (prices) and lack of inputs (pesticides and insecticides) affected farmers decision to continue cashew farming.</p> <p>Vegetable farming is possible in seasonal wetlands especially in Kinyope, Rutamba ya sasa and Ruhoma.</p>
Farming Techniques	<p>Improved farming techniques especially for paddy rice and vegetable farming are already being practiced around Kinyope, Rutamba and Ruhoma following projects by the Aga Khan Foundation and Concern.</p> <p>Proximity to Lindi town and existence of Naliendele Agricultural Research Institute provides further opportunities to farmers in accessing modern farming technologies, improved seeds and other agricultural inputs. TFCG could facilitate more interaction with these actors (DALDO and NARI) e.g. through facilitating farmers' participation in agricultural exhibitions and facilitating field training visits by these actors to the villages.</p> <p>Some farmers in most villages have adopted modern farming techniques and have acquired technical knowledge on the application of agro-chemicals. These progressive/knowledgeable farmers could serve as change agents to their fellow farmers. TFCG could develop a strategy of engaging them in implementing this strategy. We identified them and the TFCG Agricultural Officer - Lindi has a list per village.</p>
Harvesting Methods	<p>No special opportunities were identified. Most current methods for all crops are sufficient.</p>
Storage Methods	<p>Most villages have warehouses that farmers have used for years to store cash crops such as cashewnuts and sesame. Most of these need some renovation and expansion given population changes and agricultural expansion in the area.</p>
Transportation	<p>Villages along the Milola road have better roads all year round hence transportation services to Lindi town to obtain agricultural inputs and to sell agricultural produce.</p> <p>Private buses and trucks are increasing in number hence more reliable transportation of people and agricultural produce. A few villages do not have this opportunity especially Kiwawa and Nandambi.</p>
Extension Services	<p>There are three ward agricultural extension officers. There are also some progressive farmers in each village with technical knowledge on various agricultural aspects who, with some support, could serve as para-extension officers.</p> <p>DALDO office and NARI are collaborating in improving extension services in the district using funding from DADP. They indicated that extension services has been identified as one of the strategic areas of intervention.</p>
Private Sector	<p>Private buyers (chomachoma): provide reliable markets for various agricultural produce especially sesame.</p> <p>Businesses in Lindi town sell agricultural inputs such as improved seeds and agro-chemicals needed by farmers. DADP funding could subsidize these inputs and hence make them more affordable.</p> <p>Transportation: readily available trucks/lorries and buses facilitate easy</p>

<b>Agricultural Aspect</b>	<b>Opportunities</b>
	transportation of people and crop harvests between the villages and Lindi town with the exception of Kiwawa village whose road is only passable during the dry season.
Marketing Options	<p>Marketing options are available for both selling within and outside the villages. For some villages such as Kiwawa, marketing options are constrained by the poor road especially during the rainy season.</p> <p>Generally there is a good market for most cash crops produced especially sesame, coconut and pigeon peas in some villages.</p> <p>Farmers have two main buyers: private buyers and selling through farmers' primary cooperative societies. Each has its own advantages and disadvantages.</p> <p>The advantages of private buyers include: they buy and pay in cash and that they reach the farm area and hence no transportation costs for the farmer. The downside with private buyers is that they mainly buy crops immediately after the harvest and therefore those farmers who for whatever reasons delayed harvesting, will miss out.</p> <p>On the other side, primary cooperatives buy throughout the season and pay a profit dividend at the end of the selling season. The downside is that farmers complain that they never know how much the dividend will be and hence are unsure how much they will make out of their sale.</p> <p>Farmers complain that in most cases both primary cooperatives and private buyers use inaccurate scales such that farmers lose out.</p> <p>With regard to vegetables: the local market within the villages is not sufficient to promote increased production. However, the road network makes it possible to increase vegetable production and sale in Lindi town. Processed vegetables (dried) could even be sold outside the region during the off-season.</p>

## Problems faced by farmers

Below we summarize the problems identified by farmers, current solutions adopted by farmers in dealing with the problems and our comments. We have organized these problems encountered and their corresponding solutions according to the main activities in the agricultural production process.

Activity	Problem	Solution by farmers	Other potential solutions
Land preparation	Poor working tools: small hand hoes and pangas limit the size of land that a farmer could cultivate and hence affect farm yield.	Continue working with small hand hoes to the extent possible. Whenever possible hire additional labour and / or request friends and neighbors to assist in farm preparation.	So much time is spent every year in cutting down trees, collecting and burning the slashed material since most farmers shift their farms annually. Strategies to encourage farmers to continue farming on the same parcel of land could have significant time savings to farmers and hence give them more time to attend their existing farms.
Planting / Sowing	Wild rats, birds (guinea fowls) and monkeys dig up the planted seeds and hence affect the area planted in each farm resulting in a reduced yield. Majority of farmers cannot replant those areas where the seeds were dug and hence will have a low farm yield. Inability to afford improved seeds makes farmers continue using traditional seeds and hence low productivity. Over 98% of farmers use traditional seeds.	Watching the field in the day time Storing more traditional / local seeds in anticipation that problem animals will dig them up. Use poisoned maize/rice bran	Wild-rats which are the biggest problem are encouraged by poor harvesting practices whereby not all the crop is taken out of the farm. Hence the remaining on-farm crops provide food for rats until the planting season such that rats reproduce and increase in number and hence cause more problems during the next season. Encouraging improved crop harvesting systems whereby the entire crop is removed from the field will reduce food available for rats and hence reduce the problem during the next season. Some team members shared their experiences from elsewhere where such an approach has greatly reduced the problem with wild rats.
Weeding	High weed infestation rate Since most farmers experience food shortage especially during February and March which coincides with weeding time, they tend to work as casual laborers to weed farms of those relatively well-off farmers within the village. Therefore, their own farms are left unattended and hence the yields in their own farms are reduced due to weeds.	Work partially in own farms but spend enough time to farms belonging to other farmers as casual laborers to supplement household harvest and income. Opening new farms and practicing shifting cultivation is successful as a way to avoid weeds.	The TFCG/REDD+ Agricultural extension Officer is currently piloting a conservation agriculture strategy that involves early farm preparation before the weeds have flowered and produced seeds such that weeds will not germinate in the next season. Theoretically it sounds very good. If practically successful, this will be a good strategy to deal with weeds instead of repeated spatial relocation of the farms or using herbicides. Socio-cultural aspects of the communities need to be considered as well to ensure effective adoption of early farm preparation in area where fire and late farm preparation is deep rooted.

<b>Activity</b>	<b>Problem</b>	<b>Solution by farmers</b>	<b>Other potential solutions</b>
Maturing stage /Watching	Crop-raiding by bush pigs, baboons, monkeys and elephants. Theft of green maize by people.	Use poisoned bait, traps (fixed arrows on ground) Guarding day and night Use dogs to harass vermin Sell green maize and avoid extra costs and time spent in watching over the farm	TFCG/REDD+ project staff should continue training local people on innovative and low cost strategies of dealing with problem animals especially monkeys and elephants. Efforts are underway but it is important to continue to monitor implementation progress and outcomes of such strategies and use best practices to encourage their wider adoption in the community.
Harvesting	There are no major problems mentioned here that would affect overall farm yield in most villages with the exception of Rutamba village where flooding in some parts affected rice harvests.	Use low yielding late maturing local variety (harvested on April – May) to ensure that the crop is ready for harvest at the beginning of the dry season	
Transportation	Lack of cash to pay for transport from the farm and from the village to the markets outside the village. This affects farmers' price options since they have to sell their crop to private buyers who already discount huge transport costs when they set their prices. Poor transport network	Pay transportation using the harvest not cash Use bicycles for transport	Various awareness raising campaigns and advertisement to private transporters could encourage improved transportation between the villages and Lindi town. If private buses and trucks owners learn about market availability for their transport services they may provide services to the area and hence offer better transport facilities to farmers and their farm produce. Establish a ward marketing centre where farmers can come with their produce and buyers and / or transporters can congregate in order to increase competitiveness and thereby assist farmers to negotiate a higher price.
Storage	Storage pest (rats and weevils)	-Keep cat against rats -Mix crop with ash	These storage facilities and practices are insufficient and result in food insecurity in the area and hence increased dependence on shifting cultivation. Farmers should be trained in better low cost storage techniques such as use of sisal bags and drying crops/seeds before storing them. The project could also investigate improved storage sacks.
Processing	Most agricultural products are sold raw without any processing with the exception of coconuts where the husk is removed.	Processing such as maize milling is mainly for household consumption and not for sale	Farmers could be trained in simple and low cost processing techniques to improve market quality of their products including: Drying and packing leafy vegetables Filtering and packing honey in small containers (if beekeeping is introduced) For maize, farmers could sell flour instead of maize grain and maize flour mills are already located in the villages.

Activity	Problem	Solution by farmers	Other potential solutions
Marketing	<p>Unfair treatment in measurements by buyers (an amount below 1kg is considered zero)</p> <p>Price being set by buyers and farmers obliged to sell</p> <p>Cooperative societies do not buy food crops</p> <p>When cooperatives buy cash crops they pay cash at a lower price than private buyers and do not tell farmers how much they will be paid as their dividend payment.</p>	<p>-Waiting for attractive prices beyond the harvesting period.</p> <p>-Selling the produce to private buyers at slight increment from the price offered by cooperative societies.</p>	<p>Forming farmers' groups could help farmers in negotiating better terms with buyers and also in addressing other market related problems such as transportation to the market. For instance, if several farmers rent a truck the individual costs will go down and hence get higher profits if sell agricultural products in Lindi town.</p>



Photo 1. Farmers discuss some of the weeds that have affected their farms with TFCG botanist, Moses Mwangoka.

*Mucuna gigantea* (Willd.) DC. Common name: Sea bean was most common in newly cleared shambas but was not found in fields that had been cultivated for a long time.

*Commelina benghalensis*: Common name: Tropical spiderwort or Bengal dayflower. this plant is native to Africa and Asia where it is associated with disturbed area. It readily forms pure stands that smother other small plants such as vegetables and grain crops. Widely used herbicides such as glyphosates have little effect on it. In the US where it has been introduced it is included on the Federal Noxious Weed list and is considered the most significant threat to the cotton crop. The leaves are widely used as fodder and the young leaves are eaten as a vegetable in Nepal.

## **Recommendations on project interventions to improve agriculture in the context of REDD readines**

Below is a list of general strategies for improved agricultural production in the villages in the context of REDD and increased resilience to negative impacts from climate change.

- Awareness raising about REDD + should be integrated into training events on improved agriculture. In this way farmers can link their REDD payments with the adoption of new agricultural techniques both conceptually and in terms of financing investment in inputs.
- Training should focus on those most dependent on slash and burn agriculture and poorer households.
- In areas with permanent and reliable sources of water such as rivers, lakes, dams, underground water etc farmers should be trained on methods of rainfall harvesting and irrigation systems for maximum production. These include Kinyope, Ruhoma and Rutamba ya sasa. Here the focus should be on encouraging farmers who currently practice shifting agricultural and have not previously practiced irrigation to adopt these techniques.
- In view of the limited number of field agricultural officers, efforts should be done to encourage farmers to organize in groups for easy and fast technology dissemination.
- After crop harvesting, all crop residues should not be burnt, instead farmers should allow crop and plant remains to undergo decomposition thereby releasing nutrients back to the soil.
- Harvesting should be done more efficiently to make sure that no food particles remain in the field.
- Strengthen the Research-Extension-Farmer linkages to bridge knowledge gap between Research and Extension and integrate REDD into the dialogue.
- There is a need to conduct TOT seminars to equip agricultural field officers with up to-date technologies who in turn will be responsible to train farmers in their respective areas and for them to understand the linkages with REDD.
- It has been found that when farmers establish perennial crops such as coconuts, cashew nut trees and citrus, farmers tend to have permanent settlement.
- Encourage women to establish production groups to facilitate credit services and link this with REDD payments.
- Introduce appropriate technology to reduce women's work load as they travel long distance in search of firewood and water.
- Encourage planting of fuelwood trees (firewood) to reduce forest clearing and forest degradation.
- Educate rural people on entrepreneurial skills to be able to take advantage of the existing potential of the available resources.
- Agencies /NGOs working to support development in rural areas should involve communities at grass root level to participate in decision making process to achieve sustainability in proposed project/activities.
- Efforts should be made to ensure that agricultural initiatives enhance REDD and do not promote agricultural practices dependent on forest clearance.

## **Program of work**

This section presents the proposed program of work for operationalizing this agricultural development strategy. The section includes the overall goal for the program, guiding principles and specific objectives according to the identified strategic areas of intervention. The goal of the agricultural strategy reflects the goal and purpose of the project.

**Project Goal:** to reduce greenhouse gas emissions from deforestation and forest degradation in Tanzania in ways that provide direct and equitable incentives to rural communities to conserve and manage forests sustainably.

**Project Purpose:** to demonstrate, at local, national and international levels, a pro-poor approach to reducing deforestation and forest degradation by generating equitable financial incentives for communities that are sustainably managing or conserving Tanzanian forests at a sub-national level.



**Agricultural Strategy Goal:** To support women and men farmers especially those from the poorest households to adopt agricultural practices that improve their livelihoods; do not cause deforestation or forest degradation; and make them more resilient to climate change.

**Guiding principles:** These principles reflect other, cross-cutting issues that are integral to the strategy in order to remain focused in light of the inter-linkage between avoided deforestation and improved agricultural production in the area.

- *Conceptual and practical linkages between the implementation of this strategy and REDD should be emphasized and accentuated at all stages;*
- *Contrary to many traditional agricultural strategies that aim to increase productivity, the goal of this strategy combines the aspirations of improving livelihoods, particularly of the poorest households; reducing deforestation and forest degradation; and increasing resilience to climate change. We recognize that strategies focused primarily on increasing productivity may not achieve the goals of this strategy. An over-emphasis on increasing productivity may risk marginalization of poorer farmers thereby making them more vulnerable to climate change and may cause increased deforestation as farmers expand into forest areas.*
- *The strategy aims to integrate ecological, social and economic sustainability considerations.*
- *Ensure that the technologies that are promoted reach the poorest and those most vulnerable to climate change.*
- *Ensure that women benefit as well as men from this agricultural development strategy.*
- *Ensure those more affected by REDD+ project benefit and adopt alternative livelihood strategies that do not result in deforestation and forest degradation.*
- *Ensure that the project supports activities that enhance resilience to climate change*
- *Continue raising awareness on the importance of forest conservation for sustainable livelihood and adoption of improved farming practices.*
- *Provide REDD payments as a way of covering farmers' opportunity costs for transitioning away from shifting cultivation.*

### **Key interventions**

The strategy revolves around five key interventions. These are:

1. *Promote conservation agriculture including minimum tillage, reduced use of fire, crop rotations and permanent organic soil cover.*
2. *Introduce alternative income generating activities, e.g. poultry and beekeeping keeping*
3. *Improve Extension Services through establishing and supporting existing para-extension officers in each village*
4. *Facilitate provision of direct agricultural inputs to farmers in a realistic and sustainable manner.*
5. *Enhance local farmers' capacity to deal with problem animals in order to reduce agricultural loss from crop-raid by wild animals. (birds, monkeys, baboons, elephants and bushpigs).*

## Proposed Monitoring and Evaluation Strategy

<p><i>Strategy Goal:</i> To support women and men farmers especially those from the poorest households to adopt agricultural practices that improve their livelihoods; do not cause deforestation or forest degradation; and make them more resilient to climate change.</p>	
<p><i>Main Indicator/s:</i> Extent of shifting cultivation assessed through: changes in proportion of farmers engaging in shifting cultivation changes in duration taken before shifting farmlands spatially</p>	<p><i>Main Target/s:</i> at least 30% of farmers from all wealth ranks report abandoning shifting cultivation (baseline: 100% of farmers engage in shifting cultivation currently) at least 50% of farmers from all wealth ranks report that it takes at least five years before they relocate their farmlands (baseline: it takes one year to relocate farmlands for sesame, hill rice and maize)</p>
<p><i>Key Intervention One: Promote conservation agriculture - minimum tillage, cover crops, inter-cropping and reduced use of fire</i></p>	
<p><i>Main indicator:</i> Proportion of farmers reporting adoption of minimum tillage, cover crops, inter-cropping and reduced use of fire</p>	<p><i>Main target:</i> At least 33% of farmers self-report adoption of minimum tillage, reduced use of fire or other CA principles (baseline: not established but the target was set paying attention to anticipated difficulties in adopting conservation agriculture)</p>
<p><i>Key Intervention Two: Introduce alternative income generating activities, e.g. beekeeping</i></p>	
<p><i>Main indicator:</i> Change in household income/well-being attributable to alternative income generating activities introduced by the project</p>	<p><i>Main target:</i> At least 50% of villagers especially women who have been supported in adopting alternative income generating activities report increased household income/well-being. (baseline: not established but the target was set paying attention to anticipated difficulties in project implementation)</p>
<p><i>Key Intervention Three: Improve Extension Services through establishing and supporting existing para-extension officers in each village</i></p>	
<p><i>Main indicator:</i> Number of extension and para-extension officers per ward and village Satisfaction levels with extension services among farmers</p>	<p><i>Main target:</i> At least one extension officer per ward and at least 5 para-extension officers per village by end of project (baseline: there are three ward extension officers who are not suitably qualified for their tasks and there are no para-extension officers in each village) At least 50% of farmers report satisfaction with extension services in the villages (baseline: over 90% of farmers report serious dissatisfaction with extension services currently)</p>
<p><i>Key Intervention Four: Facilitate provision of direct agricultural inputs to farmers in a realistic and sustainable manner.</i></p>	
<p><i>Main indicator/s:</i> Proportion of farmers reporting receiving various agricultural inputs from the project (improved seeds, fertilizers, insecticides, equipment; focusing on sesame and maize for all villages; and vegetable farming in rutamba, kinyope and ruhoma)</p>	<p><i>Main target/s:</i> At least 30% of farmers have accessed and applied agricultural inputs in all villages (baseline: less than 5% of farmers adequately access and correctly apply agricultural inputs) At least 50% of vegetable farmers in Rutamba, Kinyope and Ruhoma have accessed and applied agricultural inputs (baseline: less than 10% of farmers</p>

	adequately access and correctly apply agricultural inputs)
<i>Key Intervention Five: Enhance local farmers' capacity to deal with problem animals in order to reduce agricultural loss from crop-raid by wild animals. (birds, monkeys, baboons, elephants and bushpigs)</i>	
Main indicator: Changes in agricultural loss from crop-raid by wild animals	Main target: At least 50% of farmers report significant decline in crop-damage by problem animals by end of project (baseline: currently about 90% of food crop farmers report significant crop losses due to crop damage by problem animals)

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- Villagers and villagers in the ten villages and sub-villages visited during developing this strategy including Rutamba, Ruhoma, Nandambi, Milola, Kiwawa, Muungano, Mkombamosi, Likwaya, Kikomolela and Chikonji.
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## Acronyms

ASDP	Agricultural Sector Development Plan
DADP	District Agricultural Development Program
DALDO	District Agriculture and Livestock Development Office
FGD	Focus Group Discussion
MJUMITA	Mtandao wa Jamii wa Usimamizi wa Misitu Tanzania
NARI	Naliendele Agricultural Research Institute
MKUKUTA	National Strategy for Growth and Poverty Reduction
REDD	Reducing Emissions of greenhouse gases from Deforestation and forest Degradation
TFCG	Tanzania Forest Conservation Group
VSLA	Village Savings and Loan Association

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### **About 'Making REDD work for communities and forest conservation in Tanzania'**

This 5 year partnership project was launched in September 2009 by the Tanzania Forest Conservation Group (TFCG) and the Community Forest Conservation Network of Tanzania (MJUMITA). The project aims to demonstrate at local, national and international levels, a pro-poor approach to reducing deforestation and forest degradation by generating equitable financial incentives from carbon finance sources for communities that are sustainably managing or conserving Tanzanian forests at community level.

#### **Project Location**

The project is being implemented in two sites. The sites include 36 villages in 3 districts and 1 municipality. The total project area is 373,200 ha and the total forest area is 215,000 ha.

#### *Lindi Project Site*

Lindi Rural District and Lindi Municipality: 17 villages. Project area: 120,00 ha. Forest area: 75,000 ha.

#### *Kilosa and Mpwapwa Project Site (includes 9 villages primarily supported using other funds)*

Kilosa District: 13 villages. Project area 200,461 ha. Mpwapwa District: 5 villages. Project area 52,739 ha. Total forest area for Kilosa and Mpwapwa District: 140,000 ha.

## **1.0 INTRODUCTION**

### **1.1 Background**

The Tanzania Forest Conservation Group in partnership with the Community Forest Conservation Network of Tanzania (MJUMITA) is implementing the project 'Making REDD work for communities and forest conservation in Tanzania'. The project aims to reduce greenhouse gas emissions from deforestation and forest degradation in Tanzania in ways that provide direct and equitable incentives to communities to conserve and manage forests sustainably. The project will achieve this by supporting the development of a Community Carbon Enterprise hosted within the existing Network of Tanzanian communities engaged in participatory forest management. The project is a 5 year project started in 2009 and financed by the Norwegian Ministry of Foreign Affairs. In order for the project to be successful, it needs to address the various and interacting drivers of deforestation and forest degradation in Lindi.

An exercise was conducted in 2010 to identify the drivers of deforestation and forest degradation in Lindi. The exercise concluded that slash-and-burn shifting cultivation is the main driver of deforestation and forest degradation in the villages. In order to reduce the impact of shifting cultivation on forest resources, the project implementers decided to design strategies that will simultaneously reduce shifting cultivation, improve agricultural productivity and conserve forests. This agricultural development strategy provides detail on these strategies aimed at reducing the impact of slash-and-burn shifting cultivation on forest resources while contributing towards improving rural livelihoods and increasing resilience to climate change within the project area.

### **1.2 The objective for this assignment**

To develop a strategy and work programme for the project that will effectively support women and men farmers in the two landscapes to improve their livelihoods and halt deforestation and forest degradation caused by slash and burn shifting cultivation.

### **1.3 The policy and economic context of agriculture in Tanzania**

At the national level the Agricultural Sector Development Plan (ASDP) developed in 1997 and reviewed several times since then provides clear objectives and strategies on how the Government of Tanzania in collaboration with development partners aim to bring about development in the agricultural sector. The importance of agriculture in the economy and livelihoods of Tanzania is clear: it employs over 80% of the labor force in the country especially in rural areas and contributes about 44% of the gross national product (GoT Website: Kilimo). ASDP outline a number of factors constraining agricultural development in the country including: inadequate budget at the national and local government level to support agricultural development; continued dependence on rain-fed agriculture with less than 3% of agricultural produce coming from irrigated farmlands; continued use of crude traditional farm equipment and inputs; insufficient technical support to smallholder farmers particularly the collapse of extension services, among others. In line with the decentralization policies in development planning, a strategy was developed for ASDP implementation at the local government level called District Agricultural Development Program (DADP). DADP is financed by ASDP and ASDP is jointly financed through a basket funding by development partners in the agricultural sector and ministerial budget allocation from the Government of Tanzania. In developing this strategy, discussions were held with district officials responsible for DADP implementation in Kilwa district to identify opportunities available from DADP implementation for improved agricultural production in line with REDD+ goals in the area. Kilimo Kwanza emerged later on (around 2008) to provide the additional and highly needed political support for agricultural development in the country. Kilimo Kwanza then became a political and policy slogan for mobilizing support for ASDP/DADP implementation. Kilimo Kwanza enumerates ten pillars for agricultural development in the country to bring about a green revolution in the country.

The Government of Tanzania has demonstrated its commitment to develop the agricultural sector through other medium term and long term development plans. These include the adoption of Millennium Development Goals (MDGs) on food security and reducing extreme poverty by 2015. In order to bring about food security and reduce extreme poverty the government is committed to improve agricultural productivity in the country covering all activities throughout the agricultural

production chain. The National Strategy for Growth and Poverty Reduction (NSGRP phase one and two known as MKUKUTA I and II) focuses on two aspects and agriculture features well in both: Economic Growth on one hand and Poverty Reduction on the other hand. Over one half of MKUKUTA I (2006-2010) and MKUKUTA II (2011 -2016) focused on agriculture and agriculture-related aspects of economic growth and development in the country. MKUKUTA II for instance includes a focus on increasing mechanized commercial agriculture and continued support to small holder farming. This was in response to criticisms especially by civil society that the over emphasis on mechanized commercial agriculture in the country saw emergence of issues such as land-grabbing that left small-scale farmers further adversely affected by such development initiatives rather than improving their livelihoods. The five year development plan (2011 – 2016) which provides further detail on the “economic development” side of MKUKUTA II further elaborates strategies for agricultural development in the country. It is important to understand the linkage between MKUKUTA II and the five year development plan as the latter is a supplementary strategy to the former and not competing for meager resources in their implementation (finances, time and human resources in the respective government ministries, departments and agencies).

However, the situation of insufficient budgetary allocation especially for local government authorities continues to affect agricultural development in the country. For instance most DADP plans in the district remain underfunded and agricultural research and development institutions remain with minimal governmental support hence affecting their contribution in improved agricultural situations in the country. While development partners are honoring their commitment through the basket funding, the government of Tanzania is yet to fulfill its commitment on budgetary allocations to the sector ministries responsible for agricultural development including the Ministry of Agriculture and Food Security, Ministry of Livestock and Irrigation, Ministry of Higher Learning, Science and Technology, among others. Nevertheless the political commitment through Kilimo Kwanza is an important initial tender for agricultural development in the country.

Therefore there is potential to achieve sustainability for the initiatives proposed in this strategy beyond the lifespan of the TFCG/MJUMITA REDD+ readiness project phase when DADP resources are sufficient to continue the interventions introduced and supported through this project.

#### **1.4 Agriculture in the Context of REDD**

Between 1980 and 2000, over 55% of new cropland areas in the tropical zone came at the expense of primary forests, while another 28% of this expansion came at the expense of secondary forests. (Gibbs et al. 2010).

The Food and Agriculture Organization predicts a 34% increase in the world's population by 2050 with a corresponding growth in consumption patterns, resulting in a 70% boost in food demand by 2050. While yield increases can satisfy some of this demand, the expansion of agriculture into forest areas is inevitable. This large, future disconnect between REDD+ and agriculture must be reconciled (Kissinger 2011).

Whilst this is an agricultural development strategy, its goal is to integrate improved agricultural practices which reduce deforestation and forest degradation in such a way as to reduce forest clearance for croplands; to improve livelihoods and to increase farmers' resilience to climate change. Agriculture comprises crop farming and livestock keeping. In Lindi and specifically in the REDD villages, crop farming is practiced by almost all villagers. Therefore this strategy aims at reducing the impact of crop farming on forest resources. Slash and burn shifting cultivation is the common practice in Lindi. A forest patch, usually an old or regenerating forest is cleared and burnt before crops are planted. Majority farmers would abandon an area after one or two harvests and clear another forest area. The main reasons for moving elsewhere are to avoid weeds, pests and seek more fertile soils. This practice results in deforestation and forest degradation.

However, others have argued that shifting cultivation has been practiced for years and still forests have not completely disappeared since abandoned farmlands are left to regenerate (see Dove and Carpenter, 2008). However, recent and rapid changes in terms of human population growth and improved markets and prices for various agricultural products, including the introduction of cash crops such as sesame, have resulted in an unprecedented increase in shifting cultivation. This is



reflected in a 10 year historical deforestation rate of 1.97 %. This intensified agricultural production in terms of increased acreage, combined with harvesting of timber from the forests, have resulted in deforestation and forest degradation in these areas. Therefore, there is a need to design and implement deliberate and sustained efforts to address deforestation and forest degradation resulting from slash-and-burn shifting cultivation.

Reduced Emissions from Deforestation and Forest Degradation (REDD) is an international climate change mitigation strategy whose primary goal is to reduce emissions arising from consumptive forest uses and forest clearance for other purposes, e.g crop farming. Following debate at international level, many proponents of REDD seek mechanisms to ensure biodiversity and livelihood benefits apart from climate benefits. There is a clear trade-off between shifting cultivation and avoided deforestation. Shifting cultivation first removes carbon stored in plants particularly trees followed by loss of soil carbon since the soil is exposed to agents of decomposition and erosion after removing the vegetation cover. On the other hand, avoided deforestation generally implies continued farming on the same parcels of land year after year. In Lindi, farmers usually practice two kinds of agriculture. They have permanent fields in the valley bottoms where they grow some crops. They also practice shifting cultivation on the hill sides and plateau tops to grow maize, sorghum and sesame. In terms of shifting cultivation, people usually relocate their farms to avoid weeds, pests and seek more fertile lands. Therefore, continued farming on the same land implies decline in agricultural productivity from year to year. This agricultural development strategy sought to understand these trade-offs between shifting cultivation and avoided deforestation and to develop strategies to minimize trade-offs and maximize synergies between REDD+ and livelihood improvement goals.

The theory that increasing agricultural productivity per hectare will lead to reduced cultivated areas is known as the land sparing or Borlaug hypothesis. We recognise that in Lindi improving agricultural productivity will not necessarily lead to reduced deforestation. Interventions that aim to increase productivity by shifting to more cash crop production, mechanization and increased capital may result in an increase in deforestation. As such, this strategy should not be viewed in isolation but as part of the project's broader strategy to improve the sustainability of land and natural resources management within the project area. Other project initiatives, particularly village land use planning and community-based forest management, provide a critical 'policy context' within which this strategy will be implemented. Pirard and Treyer (2010) and Pirard and Belna (2012) provide a thorough review of the literature on the land sparing hypothesis in relation to REDD. Pirard and Treyer's conclusions are presented in Box 1.

### **Box 1. Agriculture and deforestation**

**Agriculture is central to REDD+** When over 83% of new cropland areas in the tropical zone came at the expense of natural forests over the 1980-2000 period, and when the food challenge is becoming increasingly urgent, the REDD+ mechanism must find the means to tackle this sector of activity.

**Changes in agricultural technologies have different types of consequences** Agricultural technologies can be changed in different ways with varying consequences for forest cover. For example, the consequences of intensifying labour or land differ considerably in terms of cultivated areas.

**Little proof exists in practice to confirm the Borlaug Hypothesis (land sparing )** This hypothesis indicates that an increase in agricultural productivity per hectare makes it possible to reduce cultivated areas (and therefore the impact on forests). However, not only is the confirmation of this hypothesis uncertain according to recent articles on the matter, but its translation into economic terms also shows that it has some serious limitations.

**Support policies are needed** In order to guarantee that agricultural land reforms work in favour of reducing deforestation and degradation, public support policies are needed. Most notably: (i) the dissemination of agricultural technologies, (ii) the harmonisation of sectoral public policies, (iii) Payments for Environmental Services (PES ), and (iv) changes in diets to act at the level of demand.

From Pirard and Treyer 2010

Pirard and Belna 2012 emphasise that intensification in itself does not necessarily result in land sparing, unless accompanied by specific policies and measures. They note that farmers tend to adopt extensive agricultural practices where land is abundant but where other factors of production such as capital and labour are more limited. So long as land remains abundant, farmers may prefer to continue practicing extensive agricultural techniques than to adopt new practices. Thus the abundance of agricultural land may prove a barrier to the adoption of new techniques. Again this highlights the importance of introducing the new techniques in the context of the village land use planning and community based forest management.

### **1.5 Agriculture in the context of climate change adaptation and increased resilience**

Climate models covering Tanzania are consistent in predicting an increase in average temperatures. There is more divergence in terms of predicted changes in rainfall. In part this reflects the 'natural' variability of rainfall patterns in Tanzania as well as the paucity of historical rainfall data.

Agriculture, particularly the rain-fed agriculture typical of most of the project area, is particularly vulnerable to climate change. Whilst different studies predict different impacts, not all of which are negative, it is clear that there is a significant risk that communities in the project area could face warmer temperatures and less predictable rainfall. Some farmers interviewed during project activities already talked about streams that had been permanent now being ephemeral and about the unpredictability of rainfall.

Various studies have proposed activities to increase resilience to climate change within the agricultural sector in Tanzania.

In the context of agriculture and food security, the National Climate Change Strategy and Action Plan recommends the following strategic interventions:

- a) Assessing crop suitability (cropping pattern) for different Agro-ecological zones
- b) Promoting appropriate irrigation systems
- c) Promoting early maturing and drought tolerant crops
- d) Enhancing agro-infrastructural (input, output, marketing, storage) systems
- e) Promoting appropriate indigenous knowledge practices
- f) Development of crop insurance strategy.

In a study of Climate change vulnerability and adaptation preparedness in Tanzania, Hepworth (2010) recommends 'support for autonomous adaptation through improving market access and inputs, decision options and economic/livelihood diversity; outreach activities to enhance management practices; adjustment to cultivars; enhance irrigation efficiency and/or expand irrigable area; enhanced pest and disease forecast and control; seasonal forecasting.' These strategies to increase resilience to climate change are also considered in this strategy.

## 2.0 METHODS

### 2.1 Village visits and consultations

We visited ten villages and in each village we conducted two focus group discussions (FGD), individual interviews, document review and field visits. Table 01 below summarizes the number of people consulted in each village. Since not all villagers in each village will be equally affected by avoided deforestation, we identified sub-villages in each village that may be more affected than others. For these identified sub-villages we ensured that they are invited to the focus group discussions, are selected for individual interviews and we conducted field visits for further learning. These are the sub-villages that are closest to the forest areas set aside for REDD+ project and their livelihoods are more dependent on forest resources and forest clearing than other residents within the village. Due to their remoteness, these sub-village are also home to some of the poorer and more marginalized households. As the project aims to demonstrate a pro-poor approach to REDD, the sampling aimed to include poorer farmers from the more remote sub-villages. Similarly, the consultation process aimed to include women and men and 40 % of those interviewed were women. A semi structured questionnaire was used for individual interviews (attached as an annex to this report). Half of the individuals for individual interviews were randomly selected while the remaining half was systematically selected targeting “progressive farmers”. Progressive farmers are those farmers whose harvest is higher and better compared to the majority of farmers in the village. We wanted to understand why a few farmers are more successful and how can others learn from them in improving agricultural productivity in each village. These progressive farmers have also been identified in this strategy as the entry points for provision of agricultural support in the area especially with regard to how to use various agro-chemicals. Most of these progressive farmers already have a good knowledge on the use of agro-chemicals and hence TFCG could work with them in a cost effective arrangement in reaching more farmers. A list of these progressive farmers was compiled for each village visited and the TFCG Agricultural Officer has the list.

**Table 1.** Number of Respondents for Individual and Group Interviews.

Village Name	Sub-village	Meeting group	Men	Women	Total
RutambayaSasa	Matepwe	Village Council	9	8	17
		Villagers/Farmers	15	12	27
		Individual interviews	6	3	9
Kiwawa	Nauwamba	Village Council	11	4	15
		Villagers/Farmers	13	11	24
		Individual interviews	6	4	10
MilolaMagharibi	Kipunga	Village Council	5	3	8
		Villagers/Farmers	15	6	21
		Individual interviews	5	3	8
Ruhoma	Mkundi	Village Council	10	9	19
		Villagers/Farmers	13	12	25
		Individual interviews	6	3	9
Nandambi	Umoja	Village Council	15	6	21
		Villagers/Farmers	14	12	26
		Individual interviews	7	2	9
Chikonji	Likabuku	Village Council	8	4	12
		Villagers/Farmers	11	7	18
		Individual interviews	5	3	8
Muungano	Kipunga	Village Council	9	8	17
		Villagers/Farmers	13	10	23
		Individual interviews	4	4	8
Mkombamosi	Likonde	Village Council	6	4	10
		Villagers/Farmers	14	9	24
		Individual interviews	5	3	8
Kikomolela	Kikomolela	Village Council	13	6	19
		Villagers/Farmers	12	13	25

Village Name	Sub-village	Meeting group	Men	Women	Total
		Individual interviews	5	5	10
Likwaya	Lumumba	Village Council	9	4	13
		Villagers/Farmers	12	13	25
		Individual interviews	5	4	9
<b>Totals</b>			<b>280</b>	<b>188</b>	<b>468</b>

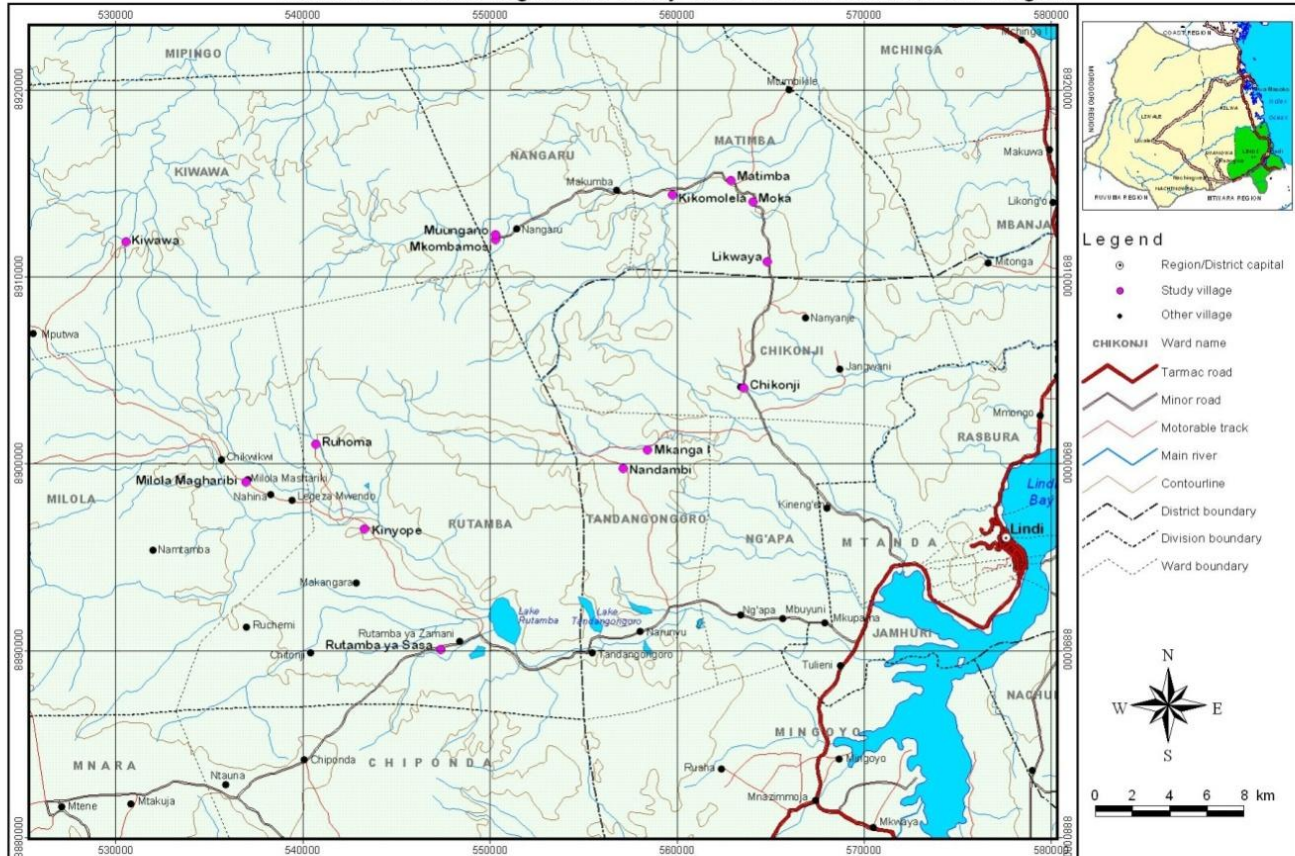
## 2.2 Literature review

The strategy also draws upon literature on conservation agriculture (Haggblade and Tembo 2003), improved small-scale agriculture linkages between REDD and improved small-scale agriculture (Kissinger, 2011; Palm et al. 2010). In addition, the strategy reflects lessons learned by the project team from a study tour to the Zambia Conservation Agriculture Programme to learn about conservation agriculture and to the Kilombero Plantations Limited rice farm to learn about the system of rice intensification for small-scale rice farmers.

### 3.0 SITE DESCRIPTION

This agricultural development strategy covers 17 villages which are part of REDD+ project implemented by TFCG/MJUMITA in Lindi region. Figure 01 below is a map of the site with the villages visited by the consultancy team indicated in pink dots. Site description covers bio-geo-physical features, socio-economic characteristics, agricultural practices and the general situation in the area.

Location of Redd Programme Study Sites in Lindi District, Lindi Region



### 3.1 Biogeophysical Conditions of the Site

These biophysical conditions influence the types of vegetation and crops that survive in the area. Generally Lindi rural district is a relatively dry area with nutrient-poor iron-rich soils. Below is a summary of the biogeophysical conditions of the site covering climate, temperature, rainfall and geological features. The recommendations and strategies contained in this report reflect on the types of crops and livelihood strategies supported by the pre-existing biogeophysical condition of the area.

- **Climate**

The climatic condition of the area is influenced by two major airstreams: the Southeast trade-winds in mid-year and the Northeast trade-winds during the turn of the year. These trade winds influence the onset and amount of precipitation in the project area.

- **Temperature**

The mean average temperature varies from 24.3°C in the coolest month and 27.5°C from September to December, the hottest months. But the mean maximum temperature is 30.5°C and the mean minimum temperature is 21.7°C (*these figures are zonal means*)

- **Rainfall**

The rainfall pattern is unimodal (one rainfall season) where about 85% of rainfall falls between December and April, and these are termed or defined as wet months though, more often a dry spell is experienced in the month of February. The average annual rainfall varies between 810mm-1090mm. The seasonal pattern of precipitation varies annually and there is a wide variation throughout the area. The rain days varies from 40-90 per annum (Mkamilo, 2004; Katinila et al 1998.)

- **Altitude**

Altitude ranges from 150m at lower areas/river valleys to 380m on the plateau tops.

- **Geology**

The geological formation is terrestrial Lower Cretaceous and Neogene Sandstone with some Jurassic inclusions. The soils, excepting Jurassic areas, are Sands, Loamy Sands and Sandy Loams. Geological formation types are Alluvium and Quaternary, Lower Cretaceous, None-Marine Neogene and Jurassic. (See *Geology map*)

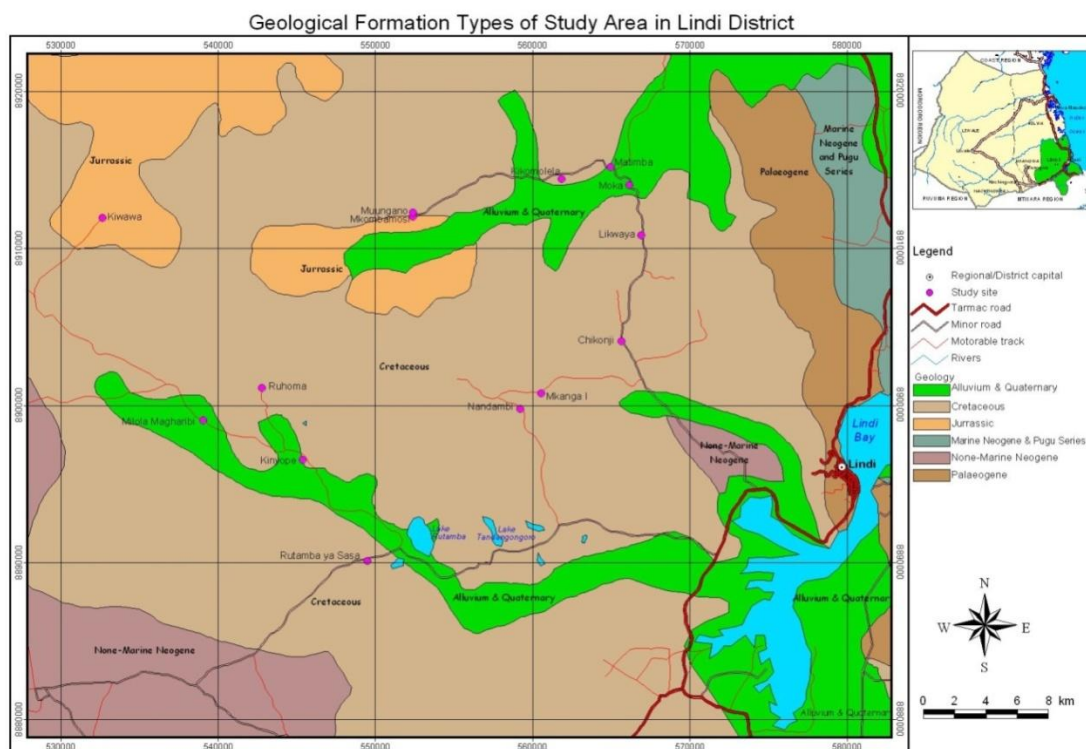
*Alluvium and Quaternary* is a strip of geological formation from the Marine coastal fringe deposition and includes local riverine and lacustrine alluvial formations.

*Lower Cretaceous* covers most of the area which is predominantly terrestrial arenaceous deposition during a marine regressive phase.

The neighbouring *None-Marine (Neogene) and Jurassic* formed from Marine deposition of limestone and various clastic sediments and marine transgression in the Miocene laid down a mixture of clastic and non-clastic sediments.

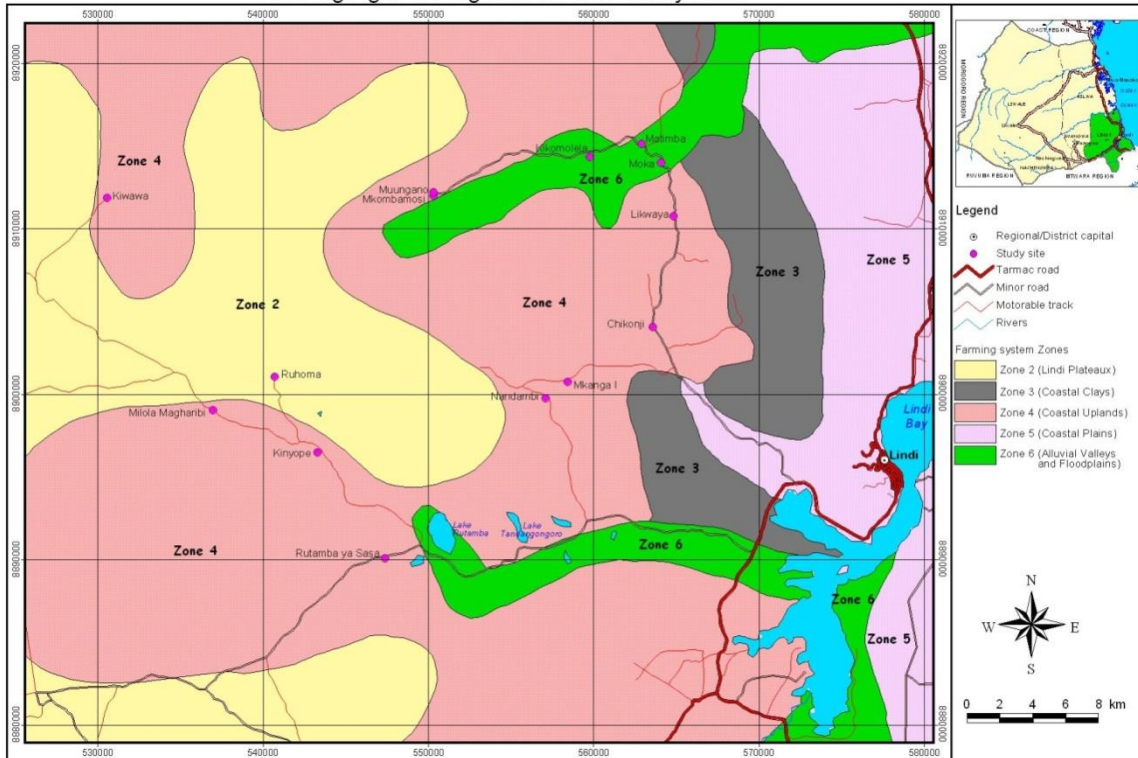
- **Landforms (Land Units)**

The Lindi Plateaux and Valleys is a landscape unit that covers most of the area of which is surrounded by the Lindi Plateaux Fringe, Lindi Ridge at the Eastern side, Mingoyo Plain and Mtwara Coastal Plain at the South-East side, Nambango Dissected Zone at the Northern side and strips of Rutamba and Nangaru Valleys. (See a map of Landscape units)





Farming/Agro-ecological Zones of Study Sites



### 3.2 Current Agricultural Practices

This section summarizes findings from field visits and farmers interviews conducted in the 10 villages. The section includes a description of current farming practices; crops cultivated; the nature and extent of shifting cultivation covering duration taken to shift farmlands and reasons for spatial relocation of farmlands.

- **Extent of farming and crops cultivated**

All villagers in the surveyed villages reported agriculture as the main livelihood strategy. Generally farmers could be categorized into three groups based on the harvests from farming. The top rank comprises about 10% of villagers and is characterized as the group that harvests enough food lasting up to one year, hires casual laborers to work on their farms and cultivates up to 15 acres in some villages but mostly about 7 acres in most villages. The middle income group has a harvest enough for about nine months, uses their own labor in farming and cultivates up to 5 acres. The middle income group comprises between 40% and 60% in most villages. The lower income group gets crop harvest enough for about 6 months, uses own labor and usually cultivates one acre. Elderly men and women and widows comprise the majority of the lower income group while young men with large sesame fields and coconut plantations fall in the top income group.

The main factors causing differentiated harvests are farm size, labour power and agricultural inputs. Those who have enough labour can cultivate more acreage and usually can afford some agricultural inputs and hence higher agricultural productivity. Generally crops cultivated in the area are the same given similarities in agro-ecological characteristics as presented in earlier sections. However, variations at a small scale such as land form (hill bottom versus hill top), soil fertility and socio-cultural and historical factors further influence the types of crops cultivated in each village. Table 02 below presents the types of crops cultivated in the 10 surveyed villages. Importance was determined in terms of proportion of villagers cultivating that particular crop and economic earnings from the sale of that crop. Importance determination was done through a focused group discussion where participants debated over which crops in each village are most important as cash and food crops.



**Table 2.** Types and importance of crops cultivated in the study area.

Village Name	% farmers	Cash crops (in order of importance)	Food crops (in order of importance)	Farmsize
Rutamba	100	Sesame, coconut, cashewnuts, pigeon peas	Maize, rive, sorghum, cassava	Average: 3 acres Maximum: 5 acres Minimum: 0.5 acres
Ruhoma	100	Sesame, cashewnuts, pigeon peas, cow peas	Maize, sorghum, cassava, hill rice	Average: 2 acres Max: 5 acres Min: 0.5 acres
Kiwawa	100	Sesame, cow peas, cashewnuts, pigeon peas	Sorghum, maize, cassava, hill rice	Average: 2 acres Max: 15 acres Min: 1 acre
Milola	100	Coconut, sesame, vegetables, pigeon peas	Maize, hill rice, sorghum	Average: 3 acres Max: 20 acres Min: 1 acre
Nandambi	100	Sesame, cow peas, cashew nuts, sugarcane	Maize, cassava, hill rice, sorghum	Average: 1.5 acres Max: 5 acres Min: 0.5 acres
Chikonji	100	Sesame, cashew nuts, pigeon peas, cow peas	Sorghum, maize, cassava, cow peas	Average: 1.5 acres Max: 5 acres Min: 0.5 acres
Likwaya	100	Cashew nuts, groundnuts, cow peas, sesame	Sorghum, maize, cassava	Average: 2.5 acres Max: 5 acres Min: 1 acre
Kikomolela	100	Sesame, cashew nuts, coconut, pigeon peas	Sorghum, maize, cassava, hill rice	Average: 3 acres Max: 10 acres Min: 1 acre
Mkombamosi	100	Sesame, coconut, cow peas, pigeon peas	Sorghum, maize, hill rice, cassava	Average: 2.5 acres Max: 8 acres Min: 1 acre
Muongano	100	Sesame, coconut, cashew nuts, tomatoes	Maize, sorghum, cassava, hill rice	Average: 2 acres Max: 10 acres Min: 1 acre

- **Where cultivated and duration taken to shift**

Slash and burn shifting cultivation is the common practice in the area. While generally slash and burn shifting cultivation leads to deforestation and forest degradation, it is important to understand how shifting cultivation differs depending on crop types and other factors. Table 03 summarizes forest types usually cleared for each type of crop and duration taken before shifting to another place. These forest types are in Kimwera tribal language terminologies as defined below (we visited these types and took pictures to better understand them and our description below attempts to capture local meanings): Types of forests cleared differs between crop types since different crops have different weed and fertility tolerance levels. Duration taken before shifting differs clearly between crops. Clear cut is usually practiced but three tree species are left on the farm: mbuyu (baobab *Adansonia digitata*), mjale and mkunya (*Sterculia appendiculata*). No land tilling during the first year.

- Kilemeh/Chilemaah – matured forest with large trees with little undergrowth (grass) (more than 10 metres)
- Usenge – a young regenerating forest with tall elephant grasses and over hanging branches. (up to five metres in height)
- Nyecha – a young regenerating forest with less grass and herbs (up to five metres)
- Fukutu – an abandoned farmland with scattered bush growth and a few shrubs (up to a maximum of 2 metres)

- Fundu – a recently abandoned farmland (less than two years) with tree saplings generally less than a metre tall

REDD+ project zone includes forest type referred to as Kilemeh and hence those crops that are cultivated in cleared kilemeh are likely to affect REDD+ success.

**Table 3.** Types of forests cleared per crop type and duration before shifting for the main food and cash crops.

(We focused on these as these are mentioned by the local communities as the most important crop farming systems that affect forest conservation in the area)

Crop type	Forest type cleared	Duration before shifting (years)
Sesame	Mostly in Nyecha but there is an increasing habit to clear dense forests (Kilemeh)	1
Maize	Mostly kilemeh but in villages with less dense forests, Nyecha is also preferred	2
Cassava	Mostly in mafukutu: regenerating forests of less than 3 years	4
Hill rice	Mostly in Kilemeh	1
Sorghum	Mostly in Nyecha but there is an increasing habit to clear dense forests especially in intercropping maize and sorghum	2

### Why do people relocate their farmlands spatially?

Farmers stated that the main factors that drive them to relocate their farms included: to avoid weeds; to seek more fertile soils; and to avoid pests and other problem animals. There is also a cultural element in that shifting agriculture is the traditional form of agriculture that has been handed down from one generation to the next.

However, as the site description depicts, the area is generally characterized by nutrient poor soils. NARI studies have reported that nutrient deposition following burning makes the soils relatively more fertile for a short while (one season) but after repeated farming that added fertility is lost. To determine whether a soil patch is more fertile than another, local people use indicator grass species. For instance, where Kindatala grows, it depicts a soil type that is not favorable for any crop. But where Nambore grows, it indicates a fertile soil favorable for crops. From the analysis and discussions, weed avoidance came out as the main reason for shifting cultivation although other authors have also pointed to the preference for more fertile soils and avoidance of areas affected by the sesame flea beetle as an incentive to clear forest in the context of sesame cultivation (Anon, 2006).

If farmers are to transform their cultivation practices to abandon shifting cultivation, it is important to understand local people's motivations for practicing shifting cultivation, its reasons and whether they perceive it as having any adverse effects on forests. Local people observed that contemporary shifting cultivation destroys forests unlike shifting cultivation practices in the past. Participants to the focus group discussions were asked to give and discuss the reasons making contemporary shifting cultivation destructive to the forests distinguishing it from slash and burn shifting cultivation practiced more than 100 years, and the following were the reasons pointed out:

- Rapid population growth especially in the last 30 years which has necessitated increased agricultural production of food crops to meet local food demands. Villagers pointed to increased acreage for maize and hill rice farming as a strategy adopted by villagers to support their families.
- Improved farming technologies enabling people to cultivate large areas in a short time period. This is mainly through the use of bush-knives to debark trees instead of cutting them down

especially in preparing farms for sesame cultivation. This is commonly practiced by young men more than by elderly women and men.

- Improved markets for cash crops particularly sesame since the early 1990s. This has caused an influx of youth engaged in sesame cultivation. Youth are perceived to have more energy and hence clear bigger forest areas.
- Improved transportation to the market following roads and bridges construction hence making sesame cultivation more economically viable.
- Collapse of the main cash crop, that is cashew nut, and introduction of alternative cash crop that is more destructive to forests, sesame, especially in the last 15 years.

### **3.3 Description of extension services in the area.**

Extension services are crucial for improved agricultural productivity particularly in encouraging farmers to adopt improved farming methods such as improved seeds, fertilizers and pesticides and their correct application. While at the Ministerial and district levels extension services are identified as one of the priority areas for improved agricultural productivity, the situation on the ground leaves much to be desired. At the time of developing this strategy, there were only five extension officers in the area covering over 20 villages. Two of them were available for interview during our field visit. The discussion covered aspects of professionalism, modality of service provision, general experience, challenges and recommendations for improved extension services in the area. The aim was to understand the current situation with extension services and assess whether the situation is an opportunity or challenge in developing this strategy. In general the inadequate extension services in the area are a challenge and we have proposed use of para-extension services as a mechanism that TFCG/MJUMITA could use in providing agricultural support to farmers. Below is a detailed situational analysis of extension services in the area.

- **Professionalism of extension services**

Naliendele researchers observed that it is important to understand the professionalism of existing extension officers since they differ: some are more versed in certain crops or livestock keeping while others are more capable of assisting farmers in other aspects. One of the Officers interviewed is a holder of Certificate in Agrovet and Diploma in Animal Health while another is having both a Certificate and a Diploma in Land Use Planning. All of them are expected to equally deliver knowledge on crop and livestock production to appropriate individuals. Despite the general knowledge on agriculture that each Officer may have they have specific competencies and strengths that do not always match with the farmers' needs. Farmers reported that they are not satisfied with the extension officers' services.

- **Methods of extension**

Extension officers are expected to provide individual as well as group consultations to farmers in addressing various agricultural problems. However, farmers expect extension officers to make regular visits to individual farms to identify and advise farmers on how to deal with various problems. Farmers' expectations that extension officers should visit individual farms is a result of past experiences during Ujamaa period when extension officers visited individual as well as communal farms to enforce the minimum acreage policy. There was a policy shift in the 1990s that farmers have to report to extension officers if they have any problems in their farming practices. These days extension officers are supposed to introduce themselves in the villages and thereafter respond to farmers' needs as they are reported. However, this change in approach appears to be new among farmers and they do not like it. Naliendele researchers stressed that the best way to serve farmers is through responding to reported needs rather than making random visits to individual or group farms. The extension officers declared that serving individual farmers in their respective fields in sub villages is difficult. Current approaches used by extension officers in providing assistance to farmers are summarized below:

- ***Convey message to farmer groups through farmers field schools for some crops like cassava (although not cultivated in all villages).***

The extension officer appeared to have a particular interest in encouraging cassava farming in responding to food shortage and not focusing on other crops such as sesame, rice and maize. Farmers are unhappy with this and they wanted the officer to focus on all crops. Again, here is a discrepancy between what the officer sees the best strategy versus what farmers perceive as the real needs. This mismatch results to lack of cooperation and positive response between farmers and extension service officers. To avoid such mismatch, we have proposed that TFCG/MJUMITA use participatory approaches in identifying farmers needs and prioritizing on the best approaches. However, at times it is important to combine these participatory approaches with awareness raising and promotion strategies for certain strategies that have proven effective but have not yet been embraced by farmers.

- ***Convey message through sub village meetings.***

Again farmers' attendance in these meetings is very low hence only a fraction of farmers are reached. Various factors were reported for low attendance in these meetings including: organizing meetings in times that collide with other pressing socio-economic and cultural activities; the bad experience with meetings that they have not helped farmers achieve anything such that they see no reason as to why they should attend such meetings. However, villagers indicated that if they are well informed they are likely to attend these meetings. We therefore stress that these meetings are still important and could be good avenues for awareness raising and introduction of this agricultural development strategy in each village.

- ***Whenever a particular farmer directly reports a problem to the extension officer, the officer will attend individually.***

In practice this rarely happens since farmers do not report incidents but expect extension officers to make rounds to all farms. On the other hand, extension officers complain that lack of facilities such as motorcycles for transportation affects their desire to visit farmers.

- ***Convey message when subsidized inputs like fertilizer or pesticide (sulphur) are availed.***

Again few farmers get access to these inputs for various reasons including including lack of financial resources to buy the inputs and lack of technical knowledge on their application. Upon further investigation, this field visit found that most of the time these messages are given to farmers in a piece-meal, fragmented way. The package of information often focuses on a theoretical explanation of how to use the inputs but not combined with messages on how to improve agricultural productivity during other farm activities. For instance it appears that extension officers have given up raising awareness on better land preparation, planting and/or weeding techniques. Often, farmers complain that it does not help applying fertilizers if they have used traditional low-yield crop varieties.

- ***The officer demonstrating /working in his own field hoping that farmers will copy the good practice.***

Only few farmers have copied, majority do not copy for a number of reasons. Some claim that it is impossible to replicate what the officer is doing since they do not have access to the same resources as the officer has, in terms of technical knowledge, access to agro-chemicals and improved seeds. Others complain that improved farming practices are labor and time intensive such that they will not have sufficient time and energy to attend to other equally pressing matters. Whereas others stated that planting in lines as advised by experts requires up to 10 kg of maize seeds per hectare and they do not have enough seeds.

As currently implemented, all these approaches do not provide for an enabling framework for farmers to improve their farming. Therefore, this strategy includes recommendations for improved extension services and hence improved agricultural productivity.

- **Challenges faced by Extension Officers and recommendations for TFCG/MJUMITA**

Below we summarize challenges faced by extension officers that limit their effectiveness in contributing towards improved agricultural production in the area. Underneath each challenge is our recommendation on how TFCG/MJUMITA could contribute to addressing the particular challenge.

**Table 4.** Challenges faced by extension officers and recommended solutions.

Challenges faced by extension officers	Recommended solution
Low farmers adoption rate to improved farming techniques	Continued awareness raising and demonstration that improved farming techniques result in improved agricultural productivity. Traditional farming systems such as the use of a pole (likomanga) to dig holes for sowing seeds is deep rooted and requires sustained efforts to discourage such practices without shaming farmers. Using a few farmers who have adopted improved farming techniques and who have actually benefited from the practice is another way of encouraging wide spread acceptance of such practices among farmers.
Ignorance among farmers to prioritize agriculture more than other socio-cultural activities	Demonstrating that farmers could allocate more efforts towards improved agricultural productivity while attending to other socio-cultural events. E.g. increasing farm harvest will result to sufficient food for the household, cultural events and traditional ceremonies such as Unyago and also sufficient seeds for the next season. Currently, farmers retain only a small amount of seeds for the next season.
Lack of support facilities for extension officers including transportation, salary and sample inputs for demonstration	Since Mohamed already has a motorcycle, TFCG/MJUMITA could consider providing bicycles to about five para-extension officers so as to increase coverage. These five bicycles could be provided to the two extension officers already in the area. On agricultural inputs, TFCG/MJUMITA could purchase sample inputs that extension and para-extension officers will use for demonstration. In the future a fee-for-service could be introduced whereby farmers will contribute towards covering transportation and up-keep costs for extension and para-extension officers.
Expectation among farmers that extension officers should provide free agricultural inputs such as improved seeds, fertilizers and pesticides	Awareness raising on the roles and limitations of an extension officer. A field trip could be organized to elsewhere in the country where farmers will learn that extension officers are not input providers. This should be combined with strategies to avail agricultural inputs under subsidized prices. Initially TFCG and MJUMITA could subsidize these inputs while lobbying for speed-up in distributing subsidized agricultural inputs by the DALDO office using financial support from DADP and Ministry of Agriculture. However, TFCG/MJUMITA should not provide free inputs as this will be unsustainable beyond project phase.
Being few in number, extension officers are overwhelmed with activities. E.g. one extension officer serving over 8 villages.	The best strategy is to train para-extension officers. Mohamed could develop a draft training package focusing on the support to be provided by TFCG/MJUMITA on the four strategic intervention areas contained in the program of work section of agricultural development strategy. We recommend at least five para-extension officer per village. This approach is cost-effective since para-extension officers will be among community members and hence no technical fees or transportation charges needed as compared to bringing fully trained extension officers. During field visits to the 10 villages, we identified potential trainees and TFCG/MJUMITA Agricultural Officer (Mohamed) has a list of these potential para-extension officers.

### 3.4 Role distribution and challenges faced between household members

In this subsection we analyzed the distribution of roles among household members and assess whether such distribution results to unfair division of tasks between men, women and children. We further discuss whether such role distribution affects agricultural productivity in general. This

analysis enables identification of potential strategies that would result to a gender sensitive distribution of roles.

**Table 5.** Distribution of roles between household members along the agricultural production chain.

<b>Activity</b>	<b>Main responsibility</b>	<b>Challenges/barriers faced</b>
Farm preparation	Husband cuts down trees. Wife collects and burns all cut trees, branches, twigs and grasses. Children assist mothers.	Insufficient time allocated to farm preparation hence delayed preparation and subsequently reduced agricultural yield. Use of poor equipment such as bush-knives and small hand-hoes further affects the size of farm prepared.
Planting	All participate equally but the husband/father usually prepares the holes for planting seeds and the wife and children insert the seeds.	Lack of improved seeds and high seed prices affect overall productivity. In some villages, guinea-fowls, monkeys and rats dig up the seeds before they germinate.
Weeding	Husband and wife	Use of kingondora (small hoe) increases time spent in weeding. Farmers do not prefer to use the Ngwamba (large hoes) since they are heavy. Both small and big-hand hoes cause back pains and women complain more about this problem than men. Use of the small hoe slows the weeding process such that weeds get taller and even more difficult to remove. The next season, the family decides to clear a new forest area with less weeds.
Disease and pest control	Mainly the husband in spraying pesticides such as "kareti" in sesame fields	Inability to afford pesticides and other agro-chemicals combined with inadequate technical knowledge on their application further limits their usage. This further causes significant agricultural losses.
Vermin control	Mothers and children during the day (birds and monkeys) Fathers and occasionally mothers during the night (elephants and bush pigs)	Smaller households decide to cultivate smaller farms since they will not be able to watch over bigger farms. Lack of knowledge on appropriate techniques of dealing with problem animals further causes increased crop raiding by wild animals.
Harvesting and processing	Sesame harvesting is mainly done by men. Hill rice harvesting by women. Food crops harvesting by women.	Inadequate household labor results in poor harvesting practices such that wild animals continue raiding the crops while in the field. Also delayed removal of harvested crops from the field to the homestead further causes some losses.
Storage	The homestead storage facilities are mainly constructed by women but watching over them against theft is every household member's role	Poor homestead storage facilities result to theft and grain damage by rats and insects. This further reduces food security in the area.
Transportation	Men transport cash crops and women are prohibited from following their husbands to the market place	For those few in Rutamba and Kinyope attempting to transport coconut to Lindi town, they complain that transportation costs are very high thus affecting profits.
Marketing	Men sell and keep all revenues from sale of cash crops. Both men and women are involved in the occasional sale of food crops in case of a burning financial need.	The notion that selling sesame to private buyers "chomachoma" is illegal has affected the market opportunities available to farmers. This is a serious problem especially since farmers are clearly dissatisfied with the voucher system "stakabadhighalani"

### 3.5 Current agricultural situation per village

While the preceding sections cover the agricultural situation in the entire area, below are information specifically for each village. Information contained in this section is about 75% from field visits conducted in developing this strategy and about 25% from document review especially the report on the assessment of drivers of deforestation by Kate Forester and Baraka Samwel (2010). For more details see annex A to this report.

**Table 6.** Current agricultural situation per village.

Village	Special information
Rutamba ya sasa	Have permanent farm fields in the valley bottoms where rice is cultivated during the rainy season and maize and vegetables are cultivated during the dry season. Farmers need assistance in accessing improved seeds, fertilizers and insecticides for improved vegetable production. Farmers also need access to micro-credit schemes to get rid of existing unfair loan schemes with middle men and coconut and rice traders.
Kiwawa	Located further inland with an inaccessible road during the rainy season. This affects marketing and transportation options. Kiwawa farmers can only sell through the primary cooperative as private buyers cannot reach the village due to poor roads. Kiwawa farmers need special consideration in improving sesame production as sesame farming is the main driver of deforestation in the village. They recommend that permanent farm plots in the valley bottoms should not be part of REDD+ project area so that farmers would have areas to continue farming.
Milola Magharibi	Milola has a good road network and farmers can sell their produce through the primary cooperative as well as to private buyers. Milola is one of the villages with the highest rates of deforestation and farmers prefer clearing dense mature forests (kilemeh) instead of young regenerating forest (nyecha) as in most villages. Special provision of inputs focusing on sesame and introduction of alternative income generating activities could reduce effects of shifting cultivation on forest resources in this village.
Ruhoma	Part of Ruhoma bordering Kinyope shares the wetland that extends to Rutamba. This wetland/valley provides an opportunity for wetland rice farming and vegetable farming during dry season. Strategies in Ruhoma should aim to encourage increased productivity in rice and vegetable farming to increase household income and hence reduce villagers' dependence on shifting cultivation.
Nandambi	The permanent farm fields in the valley bottoms are not enough given the population size in the village and hence hill-side maize, rice and sesame cultivation become the main drivers of shifting cultivation. Awareness raising on the effects of shifting cultivation combined with provision of agricultural inputs especially insecticides to deal with flea-beetles affecting sesame yield would reduce shifting cultivation in the village.
Chikonji	Low agricultural productivity and lack of alternative livelihood strategies have resulted to a situation whereby about 95% of villagers engage in charcoal production especially during the month of February. Therefore strategies should aim to introduce and support alternative income generating activities to reduce dependence on charcoal production. About 95% of farmers cultivate in the permanent fields in valley bottoms which are dry and infertile hence low farm yield.
Muongano	Muongano is one the villages that heavily depends on forest products for food resources such as Ming'oko on annual basis especially between December and February which is the hunger period. Most proposed interventions in this strategy apply to Muongano especially training on improved farming practices and how to store sufficient food resources to last until the next season.
Mkombamosi	Sesame cultivation especially by young men is the main driver of deforestation and forest degradation. Therefore interventions should focus on extending the duration before farmers relocate their farmlands. This includes a combination of approaches including facilitating provision of high yield sesame varieties, insecticides to deal with flea-beetles and introduction of alternative income generating activities away from forest destructive practices.

Village	Special information
Kikomolela	The area in Kikomolela village can be divided into fertile low lands (bondeni) and less fertile uplands (mlimani). Unlike in other villages, hill rice cultivation is the main driver of deforestation and forest degradation in this village. About 95% of rice growers have fields in the hill sides whereas the remaining 5% work in the low lands.
Likwaya	Likwaya is one village where adoption of improved farming practices seems to be very difficult despite several trials by other organizations in the past including Concern and DALDO office. Farmers observed that they cannot afford more kilos of expensive seeds per hectare compared to the application of traditional seeds and therefore disagree with the extension officer's advice despite the fact the extension officer has practically demonstrated that modern farming systems increase agricultural yield per hectare.

### 3.6 Resources available to farmers from the District Agricultural and Livestock Development Office

In developing this strategy we conducted several individual and group interviews with officials of the district agricultural and livestock development office to understand the agricultural situation in the district and plans for agricultural development by the DALDO office. These interviews were combined with a review of documents obtained from the DALDO office. Below we summarize the important resources, opportunities and experiences from the DALDO office that TFCG/MJUMITA could take advantage of in supporting farmers in the 17REDD+ villages.

- **Funding availability and potential for Public-Civil Society Partnership in supporting villagers**

There is generally a good policy and guideline environment for improved agricultural productivity at the district level but implementation capacity is seriously limited. For instance the three approaches elaborated as part of the District Agricultural Development Program (DADP), namely Kijiji Mtoto, Kilimo kwa Kaya (minimum acreage to ensure food security) and Tamko la Ilulu – provide clear guidance and rationale for improved agricultural productivity but there are no resources for effective implementation of such approaches. DADP is constrained by insufficient financial resources. The number of villages receiving support from DADP has been reduced from 42 to 30 in three years and still they are viewed to be overwhelming and hence no significant achievements recorded. These projects are implemented in partnership with FAO and CONCERN. Kilimo Kwanza has no financial resources in place and therefore rely on DADP funding for its implementation. CONCERN Ardhi project focuses on facilitating land titling process in Likwaya and other villages but not on other aspects for improving agricultural productivity including provision of farm inputs and improving access to markets for farm produce. Kilimo Kwanza livestock keeping support aims to introduce modern livestock keeping in a number of villages. However, this has recorded little achievement. CONCERN introduced a goat keeping project in the past in some villages including Kinyope and Rutamba. Similarly this project did not live up to its expectations given some socio-cultural difficulties in adopting modern livestock keeping techniques such as building enclosures for goats. Local people have not built the enclosures (mazizi) for keeping their livestock and goats are left wandering outside. The project has collapsed and district government authorities aired their disappointment that local people did not care enough for the project's sustainability.

However there are some plans underway in allocating DADP funding to provide support for cashew farmers and potential for supporting food crop production to achieve food self-sufficiency in the area. Such plans include expanding the scheme of producing improved seed varieties and availing them to farmers at subsidized prices. This scheme is already underway in seven villages and TFCG/MJUMITA should keep close contact with DALDO office to take advantage of other emerging opportunities and areas of cooperation.

- **Extension services at the District level**

There are only 50 extension officers for 154 villages in Lindi rural district. At the ward level there are 29 agricultural experts for 30 wards. There is a general situation of competition for extension officers among the various NGOs implementing various rural development projects in Lindi Rural District



such as CARE, Aga Khan, Concern and DADP. To resolve the situation these NGOs and DALDO decided to train para-extension officers at the village level. CONCERN pioneered this approach but it could not continue post pilot phase due to insufficient funds. The trained para-extension officers could not undertake their activities since there was no funding to support them with transportation, up-keep allowances and providing them with inputs for demonstration. District government officials observed that the para-extension service program could work effectively if parallel improvement are undertaken especially initiatives aimed at availing important farm inputs to farmers and improving market accessibility. The District Extension Officer considers massive recruitment of professional extension officers as one way of resolving the situation while other actors work on improving other aspects of DADP. At the same time a more cost-effective approach of training local farmers as para-extension officers seems to be generally accepted by the officers and is likely to receive more attention in the near future.

#### **Challenges/barriers faced by extension officers include:**

- Local beliefs and witch-craft in some villages that discourage agricultural extension officers from working in those villages
- Inadequate transportation facilities especially roads that are impassable during the rainy season
- Lack of support infrastructure for extension officers further constrains deploying a sufficient number of extension officers to the villages, e.g. there is no housing for extension officers

#### **Potential ways of improving extension services**

The best strategy to convince local people is through an arrangement whereby every extension officer has a farm field class to demonstrate effectiveness of what he/she preaches. However, this proves difficulty for a number of reasons:

- Villagers are reluctant to volunteer working and learning from the farm field class (shamba darasa).
- Agricultural inputs such as seeds, fertilizers and insecticides availability are limited thereby limiting farmers' ability to implement what they have learned in the farm field classes. The section on agricultural inputs prioritizes these inputs and how TFCG/MJUMITA should go about availing them to farmers at affordable prices so that farmers can learn by doing by using those inputs on their own farms.
- Villagers expect to be paid allowances for attending farm field classes, in the absence of which they do not attend farm field class sessions.

The district officers observed that DADP seminars with sitting allowances attract higher participation than those without. Similarly, we observed that local people from the REDD+ project villages do not readily participate in project related events where there are no participation allowances provided. We faced problems getting sufficient numbers of people attending our information gathering exercises in the 10 villages and even where they attended we spent so much time clarifying that there are no sitting allowances and the reasons for such an arrangement. The TFCG Agricultural officer – Mohamed Namangaro – complained that farmers in Ruhoma village demanded payment for their labor in the farm field class in their village. Since villagers are paid “sitting allowances” for attending other REDD+ “training” sessions, this has created the expectation that they are going to get paid when trained on improved farming practices. Therefore, it should be made very clear to the farmers that there will be no payment in attending farm field classes while implementing this agricultural development strategy.

#### **3.7 The situation of cooperative societies in the district**

The District cooperative officer observed that farmers' primary cooperative societies in the district used to be more active during the Ujamaa period compared to the current situation. He noted that farmers have not been sensitized enough to join farmers' primary cooperative societies. The small number of members for each society causes a situation of inadequate financial capital for each primary cooperative society since the societies rely on members' contributions for its capital. Most villagers in the southern regions of the country are not motivated to join farmers' primary cooperative societies since there is no evidence of significant benefits to members and due to a history of weak governance. Currently members and non-members receive the same benefits and there are insignificant incentives for members to encourage non-members to join.

#### 4.0 OPPORTUNITIES

This section summarizes important opportunities that could facilitate improved agricultural production in the area and reduce the effect of shifting cultivation on forest resources. Section 4.1 summarizes the opportunities identified along the agricultural production chain whereas section 4.2 summarizes some additional opportunities identified at the district level. This separation clearly shows which opportunities are available at the district level that TFCG/MJUMITA could take advantage of and ensure sustainability of agricultural interventions post project phase. The tables below also explain which opportunities are available to which villages since there are some differences in certain conditions between villages.

#### 4.1 Opportunities for improved agricultural production along the agricultural production chain

**Table 7.** Opportunities for improved agricultural production along the agricultural production chain

Agricultural Aspect	Opportunities
<b>Crops</b>	<p>The soil and weather / climate conditions support sesame, cassava and maize cultivation in all villages.</p> <p>Lowland paddy rice farming is possible in Rutamba ya sasa, Kinyope and Ruhoma.</p> <p>Villages along the Milola road cultivated cashews in the past and the conditions favored the crop but market changes (prices) and lack of inputs (pesticides and insecticides) affected farmers decision to continue cashew farming.</p> <p>Vegetable farming is possible in seasonal wetlands especially in Kinyope, Rutamba ya sasa and Ruhoma.</p>
<b>Farming Techniques</b>	<p>Improved farming techniques especially for paddy rice and vegetable farming are already abundant around Kinyope, Rutamba and Ruhoma following projects by the Aga Khan Foundation and Concern.</p> <p>Proximity to Lindi town and existence of Naliendele Agricultural Research Institute provides further opportunities to farmers in accessing modern farming technologies, improved seeds and other agricultural inputs. TFCG could facilitate more interaction with these actors (DALDO and NARI) e.g. through facilitating farmers' participation in agricultural exhibitions and facilitating field training visits by these actors to the villages.</p> <p>Some farmers in most villages have adopted modern farming techniques and have acquired technical knowledge on the application of agro-chemicals. These progressive/knowledgeable farmers could serve as change agents to their fellow farmers. TFCG could develop a strategy of engaging them in implementing this strategy. We identified them and Mohamed has a list per village.</p>
<b>Harvesting Methods</b>	<p>No special opportunities were identified. Most current methods for all crops are sufficient.</p>
<b>Storage Methods</b>	<p>Most villages have warehouses that farmers have used for years to store cash crops such as cashew nuts and sesame. Most of these need some renovation and expansion given population changes and agricultural expansion in the area.</p>
<b>Transportation</b>	<p>Villages along the Milola road have better roads all year round hence transportation services to Lindi town to obtain agricultural inputs and to sell agricultural produce.</p> <p>Private buses and trucks are increasing in number hence more reliable transportation of people and agricultural produce. A few villages do not have this</p>

<b>Agricultural Aspect</b>	<b>Opportunities</b>
	opportunity especially Kiwawa and Nandambi.
<b>Extension Services</b>	<p>There are only three ward extension officers. There are also some progressive farmers in each village with technical knowledge on various agricultural aspects who, with some support, could serve as para-extension officers.</p> <p>DALDO office and NARI are collaborating in improving extension services in the district using funding from DADP. They indicated that extension services have been identified as one of the strategic areas of intervention.</p>
<b>Private Sector</b>	<p>Private buyers (chomachoma): provide reliable markets from various agricultural produce especially sesame.</p> <p>Businesses in Lindi town sell agricultural inputs such as improved seeds and agro-chemicals needed by farmers. DADP funding could subsidize these inputs and hence make them more affordable. In the meantime, TFCG could play DALDO's role by subsidizing these inputs to make them affordable.</p> <p>Transportation: readily available trucks/lorries and buses facilitate easy transportation of people and crop harvests between the villages and Lindi town with the exception of Kiwawa village whose road is only passable during the dry season.</p>
<b>Marketing Options</b>	<p>Marketing options are available for both selling within and outside the villages. For some villages such as Kiwawa, marketing options are constrained by the poor road especially during the rainy season.</p> <p>Generally there is a good market for most cash crops produced especially sesame, coconut and pigeon peas in some villages.</p> <p>Farmers have two main buyers: private buyers and selling through farmers' primary cooperative societies. Each has its own advantages and disadvantages.</p> <p>The advantages of private buyers include: they buy and pay in cash and that they reach the farm area and hence no transportation costs for the farmer. The downside with private buyers is that they mainly buy crops immediately after the harvest and therefore those farmers who for whatever reasons delayed harvesting, will miss out on this marketing option.</p> <p>On the other side, primary cooperatives buy throughout the season and pay a profit divided at the end of the selling season. The downside is that farmers complain that they never know how much the dividend will be and hence unsure how much they will make out of their sale.</p> <p>Farmers complain that in most cases both primary cooperatives and private buyers use cheating scales such that farmers loose out.</p> <p>With regard to vegetables: the local market within the villages are not sufficient to justify increased production. However, the roads network makes it possible for farmers from some villages to increase vegetable production and sale in Lindi town. Processed vegetables (dried) could even be sold outside the region during off-season.</p>

#### **4.2 Opportunities identified for improved agricultural productivity in the district.**

District officials (DALDO, Extension Officer, Community Development Officer, Cooperative Officer, and DPP) identified several opportunities for improved agricultural productivity in the district. This agricultural development strategy takes into consideration these opportunities in proposing the program of work for TFCG/MJUMITA REDD+ project.

**Table 8.** Opportunities identified by DALDO office for improved agricultural production in the district.

<b>Opportunity</b>	<b>Description</b>
<b>Good roads network</b>	Facilitates transportation for agricultural extension officers to the villages, supplying agricultural inputs, transporting crops to the market, etc. This facilitates reliable transportation of these important services and inputs to the farmers for improved agricultural productivity.
<b>Political support for agricultural development in the south of Tanzania</b>	There is a nation-wide change in the general perception towards development in southern part of the country. This includes the Southern Agricultural and Development Corridor Program. District officials are hopeful that such changes will avail more opportunities for improved agricultural productivity in the area. TFCG will have to keep a close follow-up with DALDO and NARI to take advantage of such opportunities when they arise. KILIMO Kwanza provides further political support at the national level.
<b>Existence of other state and non-state actors working to improve agriculture in the district</b>	Continued interventions by different stakeholders focusing on different aspects of agricultural development and working in different villages including Aga Khan Foundation, CARE, CONCERN, JICA and PEMWA. While opportunities for collaboration between TFCG/REDD+ project and projects implemented by these other NGOs are not very clear, their presence in the villages have provided a generally promising atmosphere for potential collaboration and sustainability of the projects. For instance, TFCG could identify para-extension service officers from the 17 REDD+ villages and collaborate with the Aga Khan Foundation and CONCERN in training them since these two other NGOs provide training on extension services. Furthermore, a general finding from the experience by past projects implemented in the area indicated their failure was mainly due to ignorance of socio-cultural aspects of the communities. Future projects will have to pay sufficient attention to such aspects as whether communities are interested and have the capacity and experience to engage in a particular project/program.
<b>Existence of NARI in the area</b>	The process of developing this agricultural development strategy closely involved three researchers from Naliendele and TFCG could further explore opportunities and possibilities and facilitating agricultural improvement through its partnership with NARI. Possible strategies could include facilitating availability of improved seeds, fertilizers, insecticides and extension services from NARI to the 17 villages.
<b>Availability of locally produced improved seeds</b>	High seed prices especially for improved seeds were identified as another challenge discouraging adoption of improved seeds. The TFCG REDD+ project could facilitate provision of improved seeds at reduced prices. Some villages are already involved in producing improved seeds that are sold at reduced prices since they are produced locally at lower costs. Such villages include Rondo, Ulipondo, Mchinga, Mkwajuni, Narunyu, Mtwalongo, Nimba, Mtegu and Mnara. Since local farmers have rejected some seed types in the past, it is important to produce seed types that are locally preferred. Seed production in the named villages has taken this concern into consideration and therefore it is highly likely that local farmers will easily accept these improved seeds.

## **5.0 PROBLEMS, CURRENT SOLUTIONS BY FARMERS AND RECOMMENDED STRATEGIES**

Below are some production constraints experienced by farmers throughout the production chain beginning at the field preparation through marketing and sale of agricultural produce. Since suggestions for addressing the problems differ depending on crop type and activity along the value chain, we have decided to include the suggestions alongside the problems for easy readership of this document instead of making these as two separate sections.

### **5.1 Field/land preparations.**

- **Problems faced by farmers**

Poor farm tools/equipment used by farmers especially by women in preparing the land for sowing/planting are insufficient and do not match with the work load involved especially tilling on hard clay soils. These tools cannot penetrate deeper to up-root and expose roots of perennial weeds and weeds of grass species that propagate through under-ground rhizomes. About 96% of farmers (n=86) reported using a small hand hoe; 30 % a big hand hoe and 90 % a bush-knife in farm preparation. The number of small hand hoes per household corresponded with the number of labourers per household whereas most households do not own big hand hoes. Farmers agreed that big hand-hoes are better than small hand-hoes since they help them cultivate bigger areas in less time and hence increase agricultural productivity. However, the majority observed that they could not use big hand-hoes due to their high prices and also energy required in using them. Women especially categorically rejected the idea of using big-hand hoes claiming that they would break their backs and not their culture. Women also observed that the small hand-hoes limits the amount of time spent in the field since working more hours causes serious back-pains when using small-hand hoes (vingondola).

Farm preparation using the equipment listed above results in many stumps and roots of big trees being left in the cleared area reducing the cultivatable area thereby contributing to reduced productivity.

After forest clearance, fire is usually used to burn the trees, branches and grasses ready for planting. At this stage sometimes farmers delay preparation hence crop yield will be affected as well. Reasons causing delays in farm preparation included lack of equipment, sickness, earlier on-set of rainfall and attending other social events such as weddings, initiation and funeral ceremonies. Delayed burning results in the tree branches getting wet following rain which will not burn completely. This problem seems to be very common such that they have local terminologies for farms that were burnt later in the season and thus affecting the harvest subsequently. These farms that did not burn effectively and hence less area available for crop farming are called “gonea” in kimwera.

- **Options to improve farm preparation and hence agricultural yield.**

In the context of conservation agriculture, minimum-tillage and retention of crop residues can reduce the use of fire and the frequency of shifting farmlands.

One other options that was discussed was the use of tractors or power tillers as these have been promoted through Kilima Kwanza however a number of issues were highlighted in relation to mechanized land clearance:

#### **Challenges/limitations on the use of tractor in land preparation.**

- Most farmers do not have the cash available to pay for the fuel and other costs associated with running the tractors and even if they do, the return on their investment would be higher from investing their money in improved seeds and other inputs rather than on a tractor.
- Running cost for the machines in terms of fuel and lubricants, tear and wear service and repair plus salaries to operators are too high to justify owning a tractor.
- Excessive use of tractor destroys the physical and chemical properties of the soil resulting in loss of soil nutrients and water holding capacity.

- High moisture content in low land rice (paddy) limits the use of tractor as it might get stuck on the muddy or clay soils. However power tiller can be more efficient in working in area with high moisture content especially in low land (valley bottom) rice production.
- The focus of this strategy is on the farmers cultivating close to the forests, these areas often have limited accessibility and so are inappropriate for either tractors or power tillers.
- Shifting cultivation results in many stumps and roots of big trees being left in the cleared area making tractor use increasingly difficult. To make use of tractor in ploughing or harrowing the area should be free from stumps and roots of cut down trees to allow smooth tractor movement. This limits their usefulness in the priority areas targeted in this strategy.
- Cultivation along excessive slopes may limit use of tractor in farm operations. NB. Any slope or gradient above 5% do not qualify use of tractor. Most cultivated areas in the villages visited on hill-sides making it difficult to use tractors and power tillers.
- Use of tractor is cheaper in block farms or farms that are closer rather than scattered farms. Most farms in the visited villages are scattered and small in size. On average a household has about two plots of about 2 acres each located on different parts of the village.

Overall tractors and power tillers are not recommended as an effective investment and it is not recommended that the project invest in these.

### **The Principles of Conservation Agriculture**

CA offers farmers an array of practices, but at its core are three interlinked principles that can be applied in a variety of combinations to meet the needs of resource poor farmers:

- continuous minimal mechanical soil disturbance,
- permanent organic soil cover,
- diversified crop rotations of annual crops and plant associations of perennial crops.

Conservation agriculture is more than a zero-tillage-based cropping system. Farmers following the CA principles use low-cost tools and equipment and traditional crop varieties without herbicides or herbicide-tolerant varieties.

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**Adopting minimum tillage conservation agriculture in farm preparation:** the basic principles of Conservation Agriculture are outlined in the box above. In relation to the principle of continuous minimal mechanical soil disturbance, this requires some shifts in the farm preparation techniques from those currently practiced in Lindi. Key techniques to promote in this context are minimum tillage, crop residue retention, and zero burning. These farming preparations, combined with the use of improved seeds, appropriate agro-chemicals and improved markets and other services jointly completes the conservation agriculture package for Lindi.

### **Challenges in adopting minimum tillage conservation agriculture and avoiding use of fire**

Farmers in Lindi rural district already use minimum tillage whereby during the first year after forest clearance seeds are planted without tilling the land. In subsequent years and especially for maize and sorghum farming, the soil is tilled. Therefore, adopting minimum tillage appears not to be major stumbling block.

However, avoiding the use of fire in farm preparation will be very difficult among farmers. As explained by TFCG/MJUMITA agricultural officer and NARI experts, avoiding the use of fire in farm preparation involves slashing down grasses and weeds before flowering following short rains in October to prevent seed deposition on the ground such that grasses/weeds will not germinate during the rainy season which is the crop season as well. In this way, the grasses/weeds buried in the soil would decompose releasing nutrients back into the soil hence increase soil fertility for crop

production and also reduced grasses/weeds growth which reduces competition for nutrients between crops and weeds/grasses. However, the use of fire in farm in farm preparation is a deep rooted cultural practice and will take time to transform.

## 5.2 Planting/sowing

### Problems

- Insufficient traditional seeds for most households

Farmers complained that they lose a significant amount of seeds after planting due to problem animals such as monkeys, rats and birds (guinea fowls) which dig-up and eat the seeds. Most farmers without sufficient seeds fail to replant and hence reduced agricultural yield.

- Difficulties in accessing and utilizing improved seeds.

Currently improved seeds (for maize and sesame especially) are sold at very high market prices. Cooperative members in Milola and Kiwawa have accessed subsidized improved seeds through their farmers' primary cooperative society. Furthermore, failure to adhere to principles and practices of crop husbandry and field management e.g. timely planting, adoption of recommended planting spacing, timely weeding, use of fertilizer, timely pest and disease control, use of improved seeds etc. further affects crop yield

- Destruction of germinating crops

Problem animals and insect pests combined with unexpected dry spells usually affect germinating seeds (seedlings) in most villages. Most farmers opt to repeat the planting exercises to gape fill destroyed crops further exhausting limited stock of reserved seed materials.

### Common practice at farmer level (mechanism used to solve the problem)

- They camp (establish a hut) at the field to provide maximum security to field crops during the day and night.
- Farmers prefer random planting rather than adopting row planting because they believe that the use of proper planting spacing demands more seeds per unit area and labor consuming compared to random planting.
- A few farmers use Guacho to tackle sesame flea beetles. This is only practiced by a few farmers who have access to the chemical and for those who do use this, they do not always apply the correct dose with a tendency to apply less than the recommended dose.

### Suggestions

- As a way of adapting to climate change, farmers should opt to use short term crop varieties that mature within the short period of higher moisture availability. The DALDO office can advise on the availability of short term improved seed materials.
- Farmers should use high yielding varieties for maize, rice, sesame and millet.
- In order to increase resilience to climate change, farmers should concentrate on cultivating **drought resistant crops** to improve household food security for example; cassava and millet/sorghum.
- Approach to low level of technological up-take. Establish Demonstration plots at strategic points where farmers would have opportunity to learn more about aspects of crop husbandry and recommended practices to gape fill what they lack in crop production and field management. This will tackle the problem of limited number of agricultural field officers.

## 5.3 Pest and diseases

- **Shortage of appropriate inputs to control pest and diseases.**

Few farmers have pesticides available in the quantity that is needed and at the time that is needed. Most farmers can not afford pesticides and even where they do have cash available, the limited supply options mean that it is difficult for the farmers to access the required inputs at the time when they need them.

- **Lack of technical know-how among farmers in the application of agro-chemicals**

Poor and inappropriate methods of pest and disease control due to inadequate knowledge and understanding on the nature of pests and diseases development and when to intervene continues to affect agricultural productivity in the district. Spraying rates are not followed for example, time of application, mixing ratio, and recommended dose rates. As a result farmers under-dose the applications/spraying.

- **Failure to weed on time accelerating breeding and multiplication of pest and diseases.**

Due to a general situation of food insufficiency in the district, poorer farmers spend more time working as casual laborers during the months of February and March to earn a small income for sustaining their families. This practice reduces the amount of time allocated to weeding individual farms which further affects the total yield from the farm. About 75% of respondents in all villages indicated that their food supply lasts for between 6 and 9 months every year. Therefore they work as casual laborers in the farms owned by the relatively well-off households which constitute about 5%. In Muungano village, the situation is different since about 95% of villagers engage in charcoal production during February and March to supplement the meager farm produce.

### **Suggestions**

- Stockists /suppliers of inputs should make arrangements to supply their products soon after harvesting or when farmers have more purchasing power. We suggest that supply centers should be at the village office or through private small shops or through identified progressive farmers in each village.
- Where they exist, conduct awareness campaign to encourage farmers to register as members to the Primary Cooperative Society to increase their accessibility and affordability of inputs and credit schemes offered to members.
- Encourage farmers to form groups (economic groups) to benefit from NGOs and various Agencies that support rural communities when people are well organized in groups rather than as individual farmers.
- Educate farmers on the right use of chemicals e.g. recommended type of chemicals, methods of applications, time of applications and recommended dose rates; safe handling and disposal of chemicals should be stressed to avoid pollution to water sources and health risks.

### **5.4 Harvesting and processing.**

Theft of crops whilst still in the field; and difficulties in transporting produce from the field to homestead or market centers are some of the challenges mentioned by farmers.

**Shortage of labor** the family is the main source of labour for agricultural activities. For most annual crops, harvesting begins in June and extends up to August for crops with short growing periods such as legumes and cereals. However for crops such as cassava which require more processing, harvesting may extend up to October. During the rest of the year, other activities take priority such as cultivation of vegetables, pest and disease control in cashew farms, processing and marketing of harvested products. In Lindi, traditional ngomas take place soon after harvesting. These demand a lot of resources in terms of time and food and distract labour from the farms.

Current harvesting practices risk sustaining pests. Many farmers leave some of the sorghum and maize in their fields as they only select the best produce. The food that has been left attracts rats, monkeys and baboons and serves as an important source of food for these animals thereby sustaining their populations. Farmers argued that it is impossible to collect every grain from the field. However, they agreed that these left-overs cause more problems in the subsequent season.

Processing: There are no facilities or technologies available for processing the main cash crops, that is, sesame and cashew nuts. With regard to coconuts (where they are found) farmers remove the husks at a very low cost hence there is no significant income generated from coconut processing. For most other crops, there is no processing apart from packaging, that is, weighing and putting the crops into sacks.

### **How farmers solve those problems.**



Collective/communal working alternating among members to reduce workload. Anon (2006) describes this Lindi tradition as, 'Shared labour traditionally known as "Mkumi" is also used during the peak demand, for example, at the time of weeding of maize and planting of sesame. Hired labour is common to farmers with resources, e.g. in exchange of seed, food, or cash.'

- Hire labor and pay in kind (some amount of produce are given to members who supplied their labor to perform a certain activity.)
- Middlemen go to the fields to buy the produce thus facilitating transportation of the produce.

### **Suggestions**

- Farmers should be encouraged to harvest their crops as early as possible to reduce the problem of theft.
- Farmers should be encouraged to harvest as much as they can to reduce the amount of leftovers which contributes in solving the pest problem and also ensuring an extra amount of food available for the household.
- For the income generating activities that are proposed for the area, such as beekeeping, farmers should be trained on honey processing and packaging to improve market value and hence a higher income.

### **5.5 Storage**

- Poor storage facilities and conditions that expose the produce to massive destructions by storage pests such as common rats, invertebrate pests such as maize weevils, rice weevils and grain borers.
- Poor handling and packing of the produce that result in damage of the produce both quantitatively and qualitatively e.g. use of plastic / jute materials.
- Shortage of chemicals to control storage pests. Not available on time.
- Produce stored damp thereby causing it to rot.
- Poor understanding of recommended dose rates for stored products.
- Shrinkage of the produce (reduction in weight) due to poor handling /treatment of the produce.

### **How they solve the problem.**

- Some use domestic cats to predate common rats.
- They use liquid and dust formulation chemicals to control storage pests.

### **Suggestions**

- Conduct household campaign to eradicate common rats. Several household units should fight together the war against eradication of common rats rather than working on individual basis.
- The produce should reach recommended moisture content before storing the produce to increase its shelf life.
- Use of storage chemicals should go hand in hand with training farmers how to construct simple airtight storage structures using locally available materials.
- Farmers should be encouraged to store their produce in sisal gunny bags to preserve quality of the produce.

### **5.6 Selling and Marketing.**

#### **• Low price offered by middleman and unfair deals.**

Middlemen play an important role in the value chain of various agricultural products due to their ability to reach more remote farms in order to reach resource poor farmers. However, in doing so they deny the Government to collect crop levy imposed on cash crops and also offer non-profitable prices to the farmers. Two cases in particular require immediate interventions: rice and coconut farming in Rutamba and Kinyope villages. The situation is such that, middlemen pay for the crop well in advance especially during the months of February and March when prices are low, food is scarce and the poor farmers are in high demand of food resources. The middlemen come to collect the produce at a later date when prices are good but they pay using the loans they advanced the farmers three months before. This has resulted to a situation whereby farmers continue owing money to these middlemen; spend a lot of time in the field and gain little profit. Similarly traders offer a low price for the produce at harvest time when there is high rate of supply. They are then able to

store the produce until the price rises and thereby make their profit. With improved storage facilities farmers could be capturing some of this profit by waiting to sell until such a time as the price has gone up.

- **Cheating weighing instruments by buyers**

The use of incorrect and unofficial weighing scales results in farmers being cheated over the weight of the produce.

### **Suggestions**

Farmers should be encouraged to sell their products both to private buyers (chomachoma) and through Village Primary Societies and get more benefit through 'StakabadhiGhalani' system that is already operating in many parts of the southern regions. TFCG should raise awareness among farmers that they have the right to decide where to sell their produce. TFCG should also assist in resolving the problem of cheating weighing instruments.

### **5.7 General reasons for poor crop performance and decreased farm productivity.**

In summary, the following were the factors influencing low agricultural production in the villages

- Unpredictable weather conditions. Weather and climate analysis from Naliendele and as reported by farmers indicate off-season rains (erratic rainfall), and times too much or too little rain which has a negative impact on the performance of field crops.
- Low level of technological uptake and utilization by the communities.
- Poor extension services to facilitate access to, acquisition and utilization of improved farming practices.
- Lack of credit hence farmers fail to improve agricultural productivity and fall into the hands of unfair credit arrangements as is the case with Rutamba and Kinyope coconut and rice farmers.
- Low level of commercial fertilizer use due to high costs of acquisition, limited availability and lack of knowledge on their application.
- Inadequate labor and late weeding which affects crop yield.
- Inadequate soil conservation measures resulting in loss of soil fertility which further encourages shifting cultivation.
- Crop raiding by wild animals such as elephants, monkeys and bush pigs.
- Poor tools and equipment which limit farm expansion such as bush-knife and extensive use of small hand-hoes which limits agricultural productivity while cause further health problems such as back pains
- Shortage of inputs; poor timing in availability of inputs; and high cost of inputs. More recently, the Government has warned about the prevalence of counterfeit agricultural inputs.

Below we summarize the problems identified by farmers, current solutions adopted by farmers in dealing with the problems and our comments. We have organized these problems encountered and their corresponding solutions according to the main activities in the agricultural production process.

**Table 9.** Problems faced by farmers, solutions adopted by farmers and consultants' comments along the agricultural production chain.

<b>Activity</b>	<b>Problem</b>	<b>Solution by farmers</b>	<b>Consultants' comments</b>
<b>Land preparation</b>	-Poor working tools: small hand hoes and pangas. Limit the size of land that a farmer could cultivate and hence affect farm yield.	Continue working with small hand hoes to the extent possible. Whenever possible hire and request friends and neighbors to assist in farm preparation.	So much time is wasted every year in cutting down trees, collecting and burning in heaps since most farmers shift their farms annually. Strategies to encourage farmers to continue farming on the same parcel of land could bring significant time savings to farmers and hence more time to attend their existing farms.
<b>Planting / Sowing</b>	Wild rats, birds (guinea fowls) and monkeys dig up the planted seeds hence affect the germination in each farm and hence reduce the yield. The majority of farmers cannot replant those areas where the seeds were dug and hence will have a low farm yield. Inability to afford improved seeds makes farmers continue using traditional seeds and hence low productivity. Over 98% of farmers use traditional seeds.	Use poisoned maize/rice bran Watching the field in the day time Storing more traditional/local seeds in anticipation that problem animals will dig them up.	Wild-rats which is the biggest problem is further propagated by poor harvesting practices whereby not all the crop is taken out of the farm. Hence the remaining on farm crops provide food for rats in between planting season such that rats reproduce and increase in number and hence more problems the next season. Encouraging improved crop harvesting systems whereby all the crop is removed from the field will reduce food available for rats and hence less of a problem during the next season. Some team members shared their experiences from elsewhere where such an approach has greatly reduced the problem with wild rats.
<b>Weeding</b>	High weed infestation rate Since most farmers experience food shortage especially during February and March which coincides with weeding time, they tend to work as casual laborers to weed farms of those relatively well-off farmers within the village. Therefore, their own farms are left unattended and hence declined yield due to weeds infestation.	Work partially in own farms but spend enough time to farms belonging to other farmers as casual laborers to supplement household harvest and income. Opening new farms (shifting) in succeeding year to avoid weeds.	The TFCG/REDD+ Agricultural extension Officer – Mohamed – is currently piloting a conservation agriculture strategy that involves early farm preparation before the weeds have flowered and produced seeds such that weeds will not germinate in the next season. Theoretically it sounds very good. If practically successful, this will be a good strategy to deal with weeds instead of repeated spatial relocation of the farms or using herbicides. Socio-cultural aspects of the communities need to be considered as well to ensure effective adoption of early farm preparation in area where fire and late farm preparation is deep rooted.
<b>Maturing</b>	Crop raiding by wild animals like	Use poisoned bait , traps	TFCG/REDD+ project staff should continue training local people

<b>Activity</b>	<b>Problem</b>	<b>Solution by farmers</b>	<b>Consultants' comments</b>
<b>stage / Watching</b>	bush pigs, baboons, monkeys and elephants. Theft of green maize by humans	(fixed arrows on ground Continued guarding day and night Use dogs to harass vermin Sell green maize and avoid extra costs and time spent in watching over the farm	on innovative and low cost strategies of dealing with problem animals especially monkeys and elephants. Efforts are underway but it is important to continue to monitor implementation progress and outcomes of such strategies and use best practices to encourage their wider adoption in the community.
<b>Harvesting</b>	There are no major problems mentioned here that would affect overall farm yield in most villages with the exception of Rutamba village where flooding in some parts affected rice harvests.	-Use low yielding late maturing local variety (harvested on April – May) to ensure that the crop is ready for harvest at the beginning of the dry season	Poor harvesting procedures results in some of the crop being left in the field. This provides food for crop raiding animals in between farming seasons.
<b>Transportation</b>	-Lack of cash to pay for transport from the farm and from the village to the markets outside the village. This affects farmers' price options since they have to sell their crop to private buyers who already discount huge transport costs when they set their prices. -Poor transport network	-Pay transportation using the harvest not cash -Use bicycles for transport	Various awareness raising campaigns and advertisement to private transporters could encourage improved transportation between the villages and Lindi town. If private buses and trucks owners learn about market availability for their transport services they are likely to flock the area and hence better transport facilities to farmers and their farm produce.
<b>Storage</b>	-Storage pest (rats and weevils)	-Keep cats against rats -Mix crop with ash	These storage facilities and practices are insufficient and result in food insecurity in the area and hence increased dependence on shifting cultivation. Farmers should be trained in better low cost storage techniques such as use of sisal bags and drying crops/seeds before storing them.
<b>Processing</b>	Most agricultural products are sold raw without any processing with the exception of coconuts where the husks are removed.	Processing such as maize milling is mainly for household consumption and not for sale	Farmers could be trained in simple and low cost processing techniques to improve market quality of their products including: Drying and packing leafy vegetables Filtering and packing honey in small containers (if beekeeping is introduced) For maize, farmers could sell flour instead of maize grain and maize flour mills are already located in the villages.
<b>Marketing</b>	-Unfair treatment in measurements	-Selling the produce with	Forming farmers' groups could help farmers in negotiating better

Activity	Problem	Solution by farmers	Consultants' comments
	<p>by buyers (an amount below 1kg is considered zero)]</p> <ul style="list-style-type: none"> <li>-Price being set by buyers and farmers obliged to sell</li> <li>-Cooperative societies do not buy food crops</li> <li>-When cooperatives buy cash crops they pay cash at lower price than private buyers and do not tell farmers about the quantity of payment in the second payment to be done shortly.</li> </ul>	<p>oppressed measurements.</p> <ul style="list-style-type: none"> <li>-Selling the produce at oppressed prices</li> <li>-Waiting for attractive prices beyond the harvesting period.</li> <li>-Selling the produce to private buyers at slight increment from the price offered by cooperative societies.</li> </ul>	<p>terms with buyers and also in addressing other market related problems such as transportation to the market. For instance, if several farmers rent a truck the individual costs will go down and hence get higher profits if sell agricultural products in Lindi town.</p>

## 6.0 RECOMMENDATIONS

Below is a list of recommendations for improved agricultural production in the villages.

- Agencies /NGOs working to support development in rural areas should involve communities at grass root level to participate in decision making process to achieve sustainability in proposed project/activities. Farmer's participation should therefore begin early in problem identification stage using PRA. The idea is to avoid top-down approach making people passive rather than active participant in development programs. In particular there is a need to reach out to women and poorer farmers.
- In areas which have permanent and reliable sources of water such as river, lakes, dams, underground water etc farmers should be trained on methods of rainfall harvesting and irrigation system for maximum production. These include Kinyope, Ruhoma and Rutamba ya sasa.
- In view of limited number of field agricultural officers, efforts should be done to encourage farmers to organize in groups for easy and fast technology dissemination.
- After crop harvesting, all crop residues should not be burnt, rather allow crop and plant remains to undergo decomposition thereby releasing nutrients back into the soil.
- Harvesting should be done more efficiently to make sure that no food particles remains in the field. All edible materials should be collected to prevent rats and wild animals from feeding on the materials left in the fields. This is important to reduce rate of their multiplication that reach peak during planting/sowing time making heavy attack to sown seeds.
- Strengthen the Research-Extension-Farmer linkages to bridge knowledge gaps between Research and Extension. There is up-to date information and new research findings not yet known to farmers eg currently released crop varieties and recommended chemicals to control pests and diseases in cashew farms.
- There is a need to conduct TOT seminars to equip agricultural field officers with up to-date technologies who in turn will be responsible to train farmers in their respective areas.
- It has been found that when farmers establish perennial crops such as coconut, cashew trees and citrus tend to have permanent settlement. We suggest that emphasize in planting cashew trees in cleared area be given importance as a move to halt shifting cultivation.
- Women are becoming increasingly key stakeholders in agricultural activities and are as productive as men if given the same resources and opportunity eg land, credit, time seminars and workshops. Experience obtained from a female who headed a household. We suggest that participation of women in seminars, workshops and meeting is important and may change the system of production. (Base on FAO report that, women produce about 80% of the basic food staffs in Africa.
- Encourage women to establish production groups to facilitate credit services.
- Introduce appropriate technology to reduce women work load as they travel long distance in search of firewood and water. We suggest the use of stove that use less firewood and improvement on social services such as piped water would lessen the burden women experience in rural areas.
- Encourage planting of fuel trees (firewood) to reduce forest clearing.
- Educate rural people on entrepreneurial skills to be able to take advantage of the existing potential of the available resources. Eg commercial gardening involving cultivation of horticultural crops such as carrots, egg-plants, okra, cucumber etc.

## 7.0 PROGRAM OF WORK

This section presents the proposed program of work for operationalizing this agricultural development strategy. The section includes the overall goal for the program, guiding principles and specific objectives according to the identified strategic areas of intervention.

### 7.1 Goal

To support women and men farmers especially those from the poorest households to adopt agricultural practices that improve their livelihoods; do not cause deforestation or forest degradation; and make them more resilient to climate change.

### 7.2 Guiding principles

These principles emphasize on other and cross-cutting issues that the strategy should pay attention to in order to remain focused in light of the inter-linkage between avoided deforestation and improved agricultural production in the area.

- *Conceptual and practical linkages between the implementation of this strategy and REDD should be emphasized and accentuated at all stages;*

Contrary to many traditional agricultural strategies that aim to increase productivity, the goal of this strategy combines the aspirations of improving livelihoods, particularly of the poorest households; reducing deforestation and forest degradation; and increasing resilience to climate change. We recognize that strategies focused primarily on increasing productivity may not achieve the goals of this strategy. An over-emphasis on increasing productivity may risk marginalization of poorer farmers thereby making them more vulnerable to climate change and may cause increased deforestation as farmers expand into forest areas.

- *The strategy aims to integrate ecological, social and economic sustainability considerations.*

This will require adoption of a combination of approaches that foster community ownership and participation and meaningful collaboration with other stakeholders in the area especially the DALDO office and NARI.

- *Ensure that the technologies that are promoted reach the poorest and those most vulnerable to climate change.*

Given the overall purpose of the REDD readiness project to demonstrate a pro-poor approach to REDD, it is important that interventions retain a focus on the poorer households.

- *Ensure that women benefit as well as men from this agricultural development strategy.*

Special consideration should be made to facilitate women's access to and utilization of various project support including their participation in group projects such as alternative income generating activities projects.

- *Ensure that the project supports activities that enhance resilience to climate change*

Given high rates of poverty and dependence on small-scale agriculture, many people in the Lindi landscape are particularly vulnerable to negative impacts of climate change on food security. As such, the project should seek to integrate interventions that will also help to improve resilience to climate change such as promoting more drought-resistant seed varieties.

- *Ensure those more affected by REDD+ project benefit and adopt alternative livelihood strategies that do not result in deforestation and forest degradation.*

Since REDD+ aims at avoiding deforestation and forest degradation and since some community members are more dependent on forest resources than others, then to ensure sustainable forest management, it is important to pay attention to the special needs of those communities residing adjacent to forests.

- *Ensure those more affected by REDD+ project benefit and adopt alternative livelihood strategies that do not result in deforestation and forest degradation.*

The biggest challenge to effective implementation of this strategy is its acceptance by the communities. This acceptance involves both verbal and practical acceptance. Adopting improved farming systems normally implies abandoning some traditional farming and livelihood strategies. There will always be a moment of rejection/inertia but with continued awareness raising and demonstrated impacts, local people are likely to practically accept improved techniques.

- *Provide REDD payments as a way of covering farmers' opportunity costs for transitioning away from shifting cultivation.*

Integrate mechanisms by which REDD payments can be used to help farmers to transition to more sustainable agriculture. For example, by linking REDD payments with microfinance, farmers could be assisted to save their REDD revenues to purchase agricultural inputs.

### **7.3 Strategic objectives**

These are called strategic objectives since they take into consideration existing agricultural challenges in the area; opportunities that are available in the area; cost-effectiveness; and sustainability. Five strategic objectives have been formulated. Interventions under each strategic objective are guided by the principles identified above.

- *Strategic Objective One: Promote conservation agriculture including minimum tillage, reduced use of fire, crop rotations and permanent organic soil cover.*
- *Strategic Objective Two: Introduce alternative income generating activities, e.g. poultry and beekeeping keeping*
- *Strategic Objective Three: Improve Extension Services through establishing and supporting existing para-extension officers in each village*
- *Strategic Objective Four: Facilitate provision of direct agricultural inputs to farmers in a realistic and sustainable manner.*
- *Strategic Objective Five: Enhance local farmers' capacity to deal with problem animals in order to reduce agricultural loss from crop-raid by wild animals. (birds, monkeys, baboons, elephants and bushpigs)*

### **7.4 Strategic Objective One: Promote conservation agriculture including minimum tillage, reduced use of fire, crop rotations and permanent organic soil cover.**

#### ***Rationale***

As described earlier, the type of slash and burn shifting cultivation practiced in the surveyed villages results in deforestation and forest degradation. Several factors make current shifting cultivation more destructive to forests than shifting cultivation practiced in the past, especially before 1980s. These factors include impacts due to climatic changes (droughts, floods and erratic rainfall), better market prices, improved market access following roads and bridges construction, increased local population and emergence of new farming practices. Therefore, if the situation is left unchecked, agriculture and forest conservation cannot continue to coexist in the area in a sustainable way. However, conditions under which the two can coexist were discussed with local communities. These include adoption of conservation agricultural practices such as minimum tillage, reduced use of fire in preparing farms, soil conservation techniques, crop rotations and permanent organic soil cover. Conservation agriculture combined with modern farming systems such as planting in lines and use of appropriate inputs and improved seed, will increase agricultural productivity and increase the number of seasons that a farmer can cultivate a given plot of land.

#### ***Challenges/barriers in achieving this strategic objective***

Local people observed that farming is an economic as well as a cultural practice with deep socio-historical roots. Adopting new farming technologies will face strong resistance initially. Furthermore local farmers stressed that the rate of adoption will depend on who and how the new farming systems are introduced. Generally we observed a tendency of not believing that their fellow villagers



who have attended a one day or one week training have learned enough material to effectively pass the knowledge on to others. Therefore, TFCG/REDD+ project staff have to be patient in introducing these alternative farming practices.

**Opportunities for adoption of conservation agriculture**

Since local people are slowly learning the important interdependency between agriculture and forest conservation, this provides a good starting point. Furthermore, the REDD+ project with its associated benefits have introduced new and meaningful ways of valuing the forest by the communities. Communities are realizing the importance of conserving forests and lands/soils. This community involvement presents the most important opportunity for their sustained adoption of conservation agriculture practices. Furthermore, past initiatives/interventions by other NGOs such as Concern have demonstrated benefits of adopting modern farming techniques such as planting in lines and not randomly as is practiced currently. What remains is a slow process of demonstrating that with modern farming techniques, local farmers will increase their yield without expanding and/or spatially relocating their farms. In this way, local farmers will realize increased agricultural productivity following conservation agricultural strategies while reducing impacts on forests.

**The focus of conservation agriculture**

While conservation agriculture is a broad approach comprising several approaches, this is defined in Lindi district to include minimum tillage, reducing use of fire, soil conservation techniques, permanent organic soil cover, crop rotations and avoiding use of tractors. We mention tractors specifically because local farmers repeatedly requested for tractors as a way to assist them. However, both the TFCG Agricultural Officer and experts from Naliendele stated that the soil and crop types cultivated in Lindi District are not suitable for the use of tractors. Additionally tractors will bring in more costs such as fuel, drivers/operators and frequent repairs. The hilly terrain/topography makes it difficult to use tractors for most part of the District.

**Specific activities**

- Establishing farm field classes in five villages for demonstration including inviting villagers from other villages to visit and learn from the farm field classes
- Providing training sessions and training materials to farmers on the agreed conservation agriculture practices
- Training para-extension officers on the identified conservation agricultural strategies and deploy them to train more local farmers

**Activity Calendar**

Activity	Timing							
	2012				2013			
1.1 Establish farm field classes in five villages								
1.2 Train farmers on conservation agriculture								
1.3 Train para-extension officers								
1.4 Conduct quarterly M & E visits in each village								

**7.5 Strategic Objective Two: Introduce alternative income generating activities, e.g. poultry and beekeeping keeping**

**Rationale**

The alternative income generating activities proposed here are aimed at promoting livelihood diversification at the household level to reduce household’s dependence on shifting cultivation and forest products. Therefore, these alternative income generating activities have an indirect impact on forest conservation. If communities have diversified livelihood/income sources, then they will likely reduce the extent of slash and burn shifting cultivation and also reduce dependence on forest products such as charcoal burning, pole-cutting, timber logging and firewood collection. Therefore it is justifiable for the project to invest its resources in promoting alternative income generating activities.

### **Challenges/barriers for adoption**

- Lack of technical knowledge on poultry keeping, beekeeping and on how to run small businesses (business and entrepreneurial skills)
- Lack of credit and micro-financing services in the villages
- Resistance by some farmers to adopt alternative income generating activities
- Belief/expectation among local communities that TFCG should and will support them 100% in implementing the identified alternative income generating activities
- Lack of availability of improved poultry.

### **Opportunities**

- Local communities desire to improve their livelihoods
- Some community members have technical knowledge on poultry and beekeeping and other alternative income generating activities
- Potential for establishing VICOBA exists if sufficient training and awareness raising is provided

### **The Focus**

- Poultry
- Beekeeping
- VICOBA
- Vegetables growing in some villages

### **Strategies for their effectiveness and sustainability post project phase**

- Use participatory approaches in identification and selection of alternative income generating activities
- Ensure that local communities have adequate technical knowledge on how to undertake the identified income generating activities
- Periodically monitor and evaluate progress with implementation of alternative income generating activities to ensure that challenges/barriers to their success are addressed in time
- Ensure participation of both men and women
- Use locally available knowledge and experience in promoting these groups

### **Activities**

- Establish and support poultry keeping groups in 5 villages
- Establish and support beekeeping groups in 5 villages
- Establish and support VICOBA in 10 villages

### **Activity Calendar**

Activity	Timing							
	2012				2013			
2.1 Establish and support poultry keeping groups in 5 villages	■	■	■	■	■	■	■	■
2.2 establish and support beekeeping groups in 5 villages	■	■	■	■	■	■	■	■
2.3 establish and support VICOBA in 10 villages	■	■	■	■	■	■	■	■
2.4 Conduct quarterly M & E visits in each village	■	■	■	■	■	■	■	■

## **7.6 Strategic Objective Three: Extension services – para extension officers in each village**

### **Rationale**

All stakeholders consulted in developing this strategy stressed on the importance of field based agricultural extension officers for encouraging adoption of improved farming techniques. Such improved farming techniques will increase farm yield per hectare hence reducing acreage needed in ensuring food security in the project area. However, the number and performance of extension officers is very weak at present. There are only 4 villages with extension officers for all the 17 project villages.

**Challenges**

Several challenges limit effectiveness of extension services in the villages including:

- Lack of support infrastructure for extension officers including transportation and housing
- Lack of agricultural inputs to demonstrate and supply to the local farmers
- Lack of collaboration from villagers in accessing extension services

**Opportunities**

There are some opportunities that exist that could be used in improving extension services in the villages:

- Several villagers pointed out that where a serious and committed extension officer is in place, they have generally been successful in promoting adoption of improved farming practices
- Local people are willing to collaborate with extension officers in improving their livelihoods
- There are some villagers who possess some appreciable knowledge on improved farming practices such that they could be used as trainers for others
- Existence of potential collaborators including District Agricultural and Extension Officer, the NGO Concern and NARI. TFCG could collaborate with these stakeholders in identifying and training para-extension officers. DALDO office has a plan of improving extension services in the District.

**Specific activities**

- Identify potential trainees for TOT on para-extension services from the 17 villages
- Develop and provide TOT for para-extension officers
- Develop and promote knowledge sharing mechanisms between villages to duplicate best practices
- Develop and implement a memorandum of understanding with DALDO office on improving para-extension services in the REDD+ project area (the aim is to maximize on use of DADP funding).

**Activity Calendar**

Activity	Timing					
	2012			2013		
3.1 Develop and provide TOT for para extension officers						
3.2 Promote knowledge sharing systems between villagers						
3.3 Collaborate with DALDO office in supporting para-extension officers						
3.4 Conduct quarterly M & E visits in each village						

**7.7 Strategic Objective Four: Facilitate provision of agricultural inputs (improved seeds, fertilizers, pesticides, markets) covering sesame, maize and vegetables**

**Rationale:**

Lack of access to and technical knowledge on the application of various agricultural inputs continue to affect agricultural productivity in the area. These services and inputs are usually provided by farmers’ primary cooperative societies and/or private suppliers. Since the situation of cooperative societies is very weak in the area and since it is not feasible to improve them within the REDD+ project time frame, then TFCG/MJUMITA could use the proposed mechanism in facilitating farmers’ access to and utilization of various agricultural inputs. Annex 2 provides detail on the types of inputs per crop and villages that TFCG/MJUMITA could facilitate their provision. The remainder of this section summarizes the mechanism of facilitating availability of these inputs to farmers.

**Mechanism for providing inputs**

The proposals below avoid direct provision of these services/inputs by TFCG/MJUMITA since that will not be sustainable especially beyond the project lifetime. Therefore, enhancing the capacity of local actors such as primary cooperatives, private shops, knowledgeable/experienced individuals, extension officers and para-extension officers will be a sustainable strategy in the long run. TFCG/MJUMITA should aim to avail these services/inputs in a more realistic approach, that is, at

subsidized prices similar to what the government would have subsidized instead of providing them at very low prices and hence cause a continued dependence by farmers on TFCG/MJUMITA. TFCG/MJUMITA could take several approaches in facilitating provision of agricultural inputs to farmers as follows:

- Where there are farmers primary cooperatives such as in Milola Magharibi and Kiwawa, TFCG/MJUMITA could discuss with the cooperative leaders and channel inputs through the cooperative societies. In this way all farmers intending to access these inputs will be able to do so since the cooperative societies serves both members and non-members. Furthermore, this approach will be sustainable even in the absence of TFCG/MJUMITA at the end of the REDD+ project.
- Where there are no primary cooperatives but there are private shops and knowledgeable/experienced individuals, TFCG could work closely with them in availing the inputs to farmers at subsidized prices. A tentative list of potential individuals who have accessed these inputs from Lindi before and possess adequate knowledge on their application was compiled and TFCG/MJUMITA Agricultural officer has the list. These individuals could be used as agents to supply these inputs and make this endeavor as a business initiative that they continue even beyond the project lifetime.
- In villages where there are no such individuals, private shops or primary cooperatives such as Mkombamosi, Ruhoma and Muungano, TFCG/MJUMITA could use the trained para-extension officers in facilitating provision of these inputs to farmers.

### ***Challenges / barriers***

- In villages where there are no such local actors/agents identified above, it will take some time before the trained para-extension officers could facilitate availability of such agricultural inputs and services
- Farmers expect TFCG/MJUMITA to provide free inputs and services for improved agricultural production and hence informing them that they will have to share some costs will receive some resistance initially but with sufficient clarification farmers will understand the rationale of the approach
- Financial inability to purchase various inputs and accessing certain inputs would limit the extent of access and utilization of various agricultural inputs by farmers. However, provision of these services at subsidized prices combined with efforts to provide micro-credits and favorable loan schemes would eventually enhance farmers' purchasing power in accessing and applying various agricultural inputs and services.

### ***Opportunities***

- There is high demand from farmers for agricultural inputs and services in order to improve agricultural productivity
- Presence of private businesses/enterprises trading various agricultural inputs will complement efforts by government agencies and cooperative societies in availing these inputs to farmers
- The various inputs (improved seeds, crop varieties, fertilizers and insecticides) and the technical knowledge on their applications are available in Lindi and Mtwara and TFCG/MJUMITA could play a facilitating role in availing these inputs and services to farmers. In tapping this opportunity, TFCG/MJUMITA could work closely with DALDO office and NARI where technical knowledge is based.

### ***Strategic activities***

- Jointly develop a plan with Lindi DALDO office for improving para-extension services in the village
- Collaborate with district cooperative officers and Naliendele experts in raising awareness and encouraging farmers to join and establish farmers' primary cooperative societies
- Promote three primary cooperatives in delivering farm inputs to demonstrate functioning and usefulness of a primary cooperative to farmers

## 7.8 Strategic Objective Five: Provide assistance in dealing with problem animals: birds, monkeys, baboons, elephants and bushpigs

### Rationale:

Crop-raiding by wild animals was mentioned by most farmers as the main cause of crop-loss. Local farmers also relocate their farms to other areas where they perceive that there are less wild animals. In so doing they clear more forests resulting in increased deforestation. Therefore, supporting local farmers in dealing with problem animals will indirectly reduce the extent of shifting cultivation through reducing crop loss. Furthermore, since TFCG has already begun training farmers on techniques of dealing with problem animals, TFCG will then continue with the same activities in the context of agricultural-REDD+ interaction.

### Challenges

- Adopting new techniques of dealing with problem animals will prove difficult since people tend to trust techniques that they are familiar with and which they have applied for years
- Shortage of materials/equipment such as dirty diesel/oil and chilli-peppers might make it difficult to effectively apply this technique in dealing with elephants
- Local people feel that district government authorities should take control of wild animals to prevent crop-damage by wild animals

### Opportunities

- Since most farmers experience significant losses in crop harvest due to problem animals, they have expressed interest to learn and apply alternative techniques in dealing with problem animals

### Strategies/Actions

- Train local farmers on various techniques to discourage wild animals from entering their farms
- Facilitate availability of materials and equipment needed to implement the various techniques identified.
- Raise awareness on the importance of collecting all crop after harvest to ensure that there is no food for rats and other wild animals in the farms between farming season

### Activity Calendar

Activity	Timing							
	2012				2013			
5.1 Train farmers on various techniques of dealing with problem animals								
5.2 Provide materials and equipment for dealing with problem animals								
5.3 Raise awareness on better harvesting systems								
5.4 Conduct quarterly M & E visits in each village								

## 7.9 Agricultural strategy monitoring and evaluation framework

**Table 10: Proposed monitoring and evaluation framework for the agricultural development strategy**

<ul style="list-style-type: none"> <li>• <b>Strategic Goal:</b> Reduce the impact of slash and burn shifting cultivation on forest conservation while improving agricultural productivity</li> </ul>	
<b>Main Indicator/s:</b> Extent of shifting cultivation assessed through: <ol style="list-style-type: none"> <li>changes in proportion of farmers engaging in shifting cultivation</li> <li>changes in duration taken before shifting farmlands spatially</li> </ol>	<b>Main Target/s:</b> <ol style="list-style-type: none"> <li>at least 30% of farmers report abandoning shifting cultivation (baseline: 100% of farmers engage in shifting cultivation currently)</li> <li>at least 50% of farmers report that it takes at least three years before they relocate their</li> </ol>

	farmlands (baseline: it takes one year to relocate farmlands for sesame, hill rice and maize)
<ul style="list-style-type: none"> <li>• <b>Strategic Objective One:</b> Promote conservation agriculture including minimum tillage, reduced use of fire, crop rotations and permanent organic soil cover.</li> </ul>	
<b>Main indicator:</b> Proportion of farmers reporting adoption of minimum tillage and reduced use of fire	<b>Main target:</b> At least 33% of farmers self-report adoption of minimum tillage, reduced use of fire and at least one other conservation agriculture technique (baseline: not established but the target was set paying attention to anticipated difficulties in adopting conservation agriculture)
<ul style="list-style-type: none"> <li>• <b>Strategic Objective Two:</b> Introduce alternative income generating activities, e.g. poultry and beekeeping keeping</li> </ul>	
<b>Main indicator:</b> Change in household income/well-being attributable to alternative income generating activities introduced by the project	<b>Main target:</b> At least 50% of villagers especially women who have been supported in adopting alternative income generating activities report increased household income/well-being. (baseline: not established but the target was set paying attention to anticipated difficulties in project implementation)
<ul style="list-style-type: none"> <li>• <b>Strategic Objective Three:</b> Improve Extension Services through establishing and supporting existing para-extension officers in each village</li> </ul>	
<b>Main indicator:</b> <ol style="list-style-type: none"> <li>1. Number of extension and para-extension officers per ward and village</li> <li>2. Satisfaction levels with extension services among farmers</li> </ol>	<b>Main target:</b> <ol style="list-style-type: none"> <li>a. At least one extension officer per ward and at least 5 para-extension officers per village by end of project (baseline: there are three ward extension officers who are not suitably qualified for their tasks and there are no para-extension officers in each village)</li> <li>b. At least 50% of farmers report satisfaction with extension services in the villages (baseline: over 90% of farmers report serious dissatisfaction with extension services currently)</li> </ol>
<ul style="list-style-type: none"> <li>• <b>Strategic Objective Four:</b> Facilitate provision of direct agricultural inputs to farmers in a realistic and sustainable manner.</li> </ul>	
<b>Main indicator/s:</b> Proportion of farmers reporting receiving various agricultural inputs from the project (improved seeds, fertilizers, insecticides, equipment; focusing on sesame and maize for all villages; and vegetable farming in Rutamba, Kinyope and Ruhoma)	<b>Main target/s:</b> At least 30% of farmers have accessed and applied agricultural inputs for sesame and maize farming in all villages (baseline: less than 5% of farmers adequately access and correctly apply agricultural inputs) At least 50% of vegetable farmers in Rutamba, Kinyope and Ruhoma have accessed and applied agricultural inputs (baseline: less than 10% of farmers adequately access and correctly apply agricultural inputs)
<ul style="list-style-type: none"> <li>• <b>Strategic Objective Five:</b> Enhance local farmers' capacity to deal with problem animals in order to reduce agricultural loss from crop-raid by wild animals. (birds, monkeys, baboons, elephants and bushpigs)</li> </ul>	
<b>Main indicator:</b> Reduced crop loss from crop-raiding by wild animals	<b>Main target:</b> At least 50% of farmers report significant decline in crop-damage by problem animals by end of project (baseline: currently about 90% of food crop farmers report significant crop losses due to crop damage by problem animals)

**Appendix 1: Types of agricultural inputs per crop and per village recommended to be provided**

A. Sesame

ITEM/ Product	Type/Variety	Recommended Rate kg/ha	Price TAS/kg	Recommended place	Reliable source
Sesame seed	Lindi- 02	3-5 kg/ha	4,500	Lindi, Kilwa, Rutamba, Kineng'eneetc	NaliendeleMtwara and FRGs

B.

**Use of fertilizers and pesticide in sesame production.**

Item / Product	Type	Recommend ed Rate kg/ha	Price TAS/kg	When to apply.
2. Fertilizer	Phosphate	40kg/ha	Check with stockist at Lindi town.	Applied before Planting or sowing
	Nitrogen	45kg/ha	Check with stockist at Lindi town	Applied as basal application after thinning. (3-4 weeks after planting)
3. Pesticide	Karate	5ml/liter	Check with stockist at Lindi town	After germination to control insect pests

The Naliendele institute has recently developed three improved sesame seed varieties: Naliendele-92, Ziada-94 and Lindi-02. Of these, Lindi-02 is the variety that is most preferred by farmers and is the most highly recommended for use in the project area.

Use of karate and fertilizer is more effective than applying only one of them. Similarly, application of fertilizer is important for Gaucho treated crops; hence, farmers are highly advised to combine Gaucho, Karate and Fertilizer for effective control of flea beetles.

In each district participating in sesame production, Naliendele has established on-farm Farmer Research Groups (FRGs) for seed production and multiplication. NARI monitors these farms and they are a reliable source of sesame seed. Therefore, the district councils and other growers are encouraged to purchase sesame seeds from Naliendele, FRGs or from the Agricultural Seeds Agency who get the seeds directly from reliable sources. Sesame seeds from NARI have been treated (seed dressed) with Gaucho to control sesame flea beetle.

## **Appendix 2: Village Specific Agricultural Information**

### **A. Rutamba**

Farmers in Rutamba village rarely rely on food aid at anytime during the year although there is food shortage during the month of February. Rutamba has a wetland / valley which allows farmers two planting seasons every year. Villagers plant rice in the valley during the long rains and plant maize and other crops in the valley during the dry season. Despite such a supportive climate and weather environment, farmers in Rutamba ya Sasa do not benefit much from farming due to unfair trading and loan arrangements with middlemen.

Middlemen/traders accumulate most of the benefits. These traders lend local smallholder farmers money during February and March on agreement that they will pay back in crops and not cash. They would agree on the price per 100kg bag in advance of harvest. For instance, this year they loaned Tsh 11,000 per 100kg bag of rice. However, the market selling price for 100kg bag was observed to be Tsh 40,000. In this arrangement the farmers lose Tsh 30,000 per 100kg bag of rice relative to if they had sold their harvests directly to buyers in the market. But since they took cash loans from traders, they can not sell in the open market and are forced to sell to the trader who provided them with the loan. Therefore, farmers are caught in this never ending trap year after year. A similar situation was observed in the coconut business where traders pay coconut tree owners in advance and come to collect the coconuts at a later date. By which time coconut prices have gone up but the farmer is paid based on an old lower price agreed upon six months before. Significant losses are reported here as well.

Some interventions could be useful in getting the smallholder farmers out of this trap. Such interventions could include introduction of alternative credit and micro-financing schemes such as SACCOS, VICOBA, VSLAs.

For sesame which is the main cash crop in Rutamba village, farmers face two main problems. First one regards insects (*mbarapatwa/vibaruti*). They use several insecticides including Kareti, Ninja and Selecron. While these insecticides are generally available and affordable to the farmers, their usage remains low and ineffective. Most farmers confirmed that they have never received any technical training on their usage and they have only learned from their neighbors or by trial-and-error in estimating the right dilution level.

One strategy could be to facilitate availability of these insecticides and at more affordable prices, encourage local farmers to buy and apply them in their farms. Simple brochures combined with a few group training on the proper usage could be useful in facilitating effective usage of these insecticides.

While weeds are also a major problem affecting sesame and other crops productivity and is the major factor driving spatial relocation of farms, dealing with requires a combination of strategies. These include application of herbicides and practicing minimum tillage conservation agriculture. This type of conservation agriculture includes no tillage, no burning and early preparation of farms before the weeds/grass produce flowers and seeds.

In terms of market opportunities, for most crops, farmers have two selling options: to the private buyers/traders (*chomachoma*) and/or to the farmers' primary agricultural cooperative society. The two usually differ in terms of buying prices offered with *chomachoma* generally paying more and on cash basis.

### **B. Kiwawa**

**Sesame and Flea-beetle (*Mbarapatwa/Vibaruti*):** Unlike in other villages, in Kiwawa village the majority of farmers have monoculture sesame farms (over 80%) and shift every one year. This results in a high rate of deforestation and forest degradation caused by increased sesame production. A combination of approaches could assist in halting this trend including: providing inputs that would encourage continued sesame farming on the same parcel of land especially insecticides and high-yield sesame variety (Lindi-02). Farmers stated that apart from avoiding weeds they



relocate their farms every year to avoid flea-beetles (mbarapatwa/vibaruti). They decide to farm far away from each other to prevent flea-beetles from spreading to their farms easily. This results in many small areas being cleared deep in the forest.

**REDD+ and Farming:** Villagers recommend that valley bottom areas should not be included in REDD+ project zones so that they will have areas to cultivate maize and wetland rice.

**Farmers' primary cooperative society:** Similar to Milola Magharabi, Kiwawa has a farmers' primary cooperative society that needs serious improvements for it to benefit farmers in terms of availing agricultural inputs and improved market for farm produce. Currently only two crops are traded in the cooperative society: cashew nuts and sesame. Farmers observed that they would benefit more if the cooperative society also traded in other emerging cash crops such as pigeon peas, cow peas and dried cassava (makopa). At present the cooperative society does not provide agricultural inputs other than occasionally selling insecticides for sesame (kareti) and cashew nuts (morphidan). However these insecticides do not satisfy demands. The cooperative secretary said that, they estimate needs before the farming season by asking those who anticipate buying insecticides and they also buy a few extra kilos and liters just in-case other farmers decide to buy as well even though they did not indicate their interest before. To check the willingness to buy inputs from the cooperative society, we asked participants to the focus group discussion whether they have ever bought inputs from the society before and how many are willing to buy inputs from the society in the future. Only two of the 26 participants to the focus group discussion stated that they wanted to buy insecticides from the cooperative society but they were finished. This indicates that most farmers like to complain about the non-functioning of cooperative societies without actually accessing them and utilizing their services. This presents an opportunity that farmers are likely to join and strengthen these cooperatives if there is a clear demonstration of their usefulness in assisting farmers in improving their agricultural production. Therefore, TFCG REDD+ project could consider improving farmers' primary cooperative societies as one strategy especially in ensuring sustainability of this agricultural development strategy post project phase.

**Agricultural problems faced in Kiwawa village:** While these problems are reported in other villages, Kiwawa deserves a particular attention given its geographical location. Kiwawa is one of the remote villages with a road accessible by cars only during the dry season. This road situation affects transportation of agricultural produce to Milola and subsequently to Lindi. The only marketing option available to Kiwawa farmers is selling through the MilolaMagharabi farmers' primary cooperative society's branch in Kiwawa. Private buyers do not go to Kiwawa village due to poor road condition. This situation results to unfair prices offered by the cooperative society since Kiwawa farmers do not have an alternative market. Furthermore Kiwawa is surrounded by a degraded forest which provides ample habitat to problem animals including monkeys, baboons, elephants, bush-pigs and others. These results in significant crop losses. Crop specific problems in Kiwawa village include:

Sorghum: poor storage facilities such that rats destroy most of the stored crop.

Solution: improving storage facilities: vihenge

Maize: problem animals especially baboons, monkeys and bush-pigs

Solution: improving farmers' ability to deal with problem animals by training them on these techniques.

Rice: rats dig seeds after planting and birds and monkeys invade farms after the crop has matured but before harvest.

Solution: training farmers on better planting and harvesting techniques to deprive rats and other vermin of food in between farming season.

### **C. Milola Magharibi**

Milola is one of the villages with the highest levels of slash-and-burn shifting cultivation with about 75% of villagers practicing shifting cultivation. Contrary to Kiwawa, in Milola the good road encourages increased agricultural production especially of the main cash crop – sesame – hence

encouraging deforestation and forest degradation. As in other villages, farmers especially young men clear large areas of forests for increased sesame production and relocate their farms every one year to avoid weeds, insects (flea-beetles) and problem animals. Therefore, assistance in dealing with these common problems would slow down the speed of relocating farms and hence halt deforestation and forest degradation arising from shifting sesame cultivation.

Most farmers are not interested in joining the farmers' cooperative society since they have not seen any difference in the benefits enjoyed by its members when compared with non-members. The cooperative was established in the 1990s for cashew nut buying but cashew-nut production has declined in the village which has also affected the functioning of the cooperative. Currently two crops are traded in the cooperative society: cashew-nut and sesame.

#### **D. Ruhoma**

Part of Ruhoma bordering Kinyope shares the wetland that extends to Rutamba. This wetland/valley provides an opportunity for wetland rice farming and vegetable farming during the dry season. Strategies in Ruhoma should aim to encourage increased productivity in rice and vegetable farming to increase household income and hence reduce villagers dependence on shifting cultivation. The section on vegetables farming in this agricultural strategy targets Ruhoma specifically. Currently, shifting cultivation is very high and expanding rapidly. Furthermore clarification should be provided to Ruhoma farmers regarding REDD+ forest borders as villagers complain that they are unaware of the borders and fear that they are left with no area for farming, settlement and other uses. There is a real threat that farmers are likely to revert back to intensified shifting cultivation if they do not receive immediate benefits and support from the REDD+ project.

#### **E. Nandambi**

Nandambi is one of the villages with the highest rates of shifting cultivation. The hilly landscape in Nandambi further result in shifting cultivation whereby hill bottoms are more fertile than hill sides and hence those farming in hill sides tend to spatially relocate their farms every season in search of more fertile soils. The farming area available in hill bottoms is not enough for all farmers. Other factors causing shifting cultivation reported in other villages also apply in Nandambi including the need to rats, weeds and insects. Villagers identified shifting cultivation for maize, hill rice and sesame as the main drivers of deforestation.

While the extension officer is seen as being not supportive, villagers rely on traditional ways of information and technological sharing. For instance, Mr. Mustafa Musa Likokola was mentioned as the most informed villager on how to use various insecticides and he usually trains others on how to properly use the insecticides.

#### **F. Chikonji**

Only about 5% of farmers in Chikonji practice shifting cultivation. However, deforestation and forest degradation is very high due to a unique interaction between shifting-cultivators and charcoal producers. Over 95% of villagers in Chikonji engage in charcoal production to supplement the low agricultural yield. The 95% of farmers who do not practice shifting cultivation farm in flat lowlands which have less fertile soils resulting in low yields. Poor farming techniques combined with problem animals, insects and villagers' lack of priority on agriculture necessitate engaging in charcoal production to supplement their incomes. Therefore, the agricultural strategies in Chikonji should aim to improve agricultural productivity to reduce household dependence on charcoal production since it is charcoal production that causes deforestation and forest degradation and not shifting cultivation.

The situation is further aggravated by a serious water shortage in the village. Farmers are forced to sell their little farm produce in exchange for water further necessitating the over dependence on charcoal production.

#### **G. Muungano**

Every year there is food shortage in this village and the most serious recent food shortage was in 2009 when most residents survived on food aid. They depend on forest resources especially Ming'oko and Angadi in times of serious food shortages. Therefore, forest conservation for them

also means conserving their important food resources. They have traditional beliefs/myths that are applied in protecting the most valuable forest patches in the village. One such patch is called Makalang'o. The myth goes that there is a female Ginn / spirit by the name Khadija who hurts those intending to clear the forest for cultivation or mining purposes. The reference to mining in this context reflects a history of coal mining in the village.

The farmers' primary cooperative society was established in 2010 and focuses on sesame only. Only 2 of the 27 participants to the focus group discussion are members of this cooperative society. Others state that they will join when they see real benefits to those who are members and when the process of buying on cash and paying an additional dividend/profit later is made clearer.

Transportation of sesame from sub-village farms to the village centre for sale is the main challenge especially since the labor force at the household level is very low. Alternatively they prefer private buyers who follow them to their farms and avoid transportation costs among farmers. There is no agricultural extension officer in Muungano village.

#### **H. Mkombamosi**

An interesting reason as to why shifting cultivation destroys more forests these days than in the past is the fact that sesame cultivation is more productive and profitable nowadays than in the past since there are less ngaji (land snails). In the past, land snails were abundant and very destructive to sesame. But some type of birds came to the area called Makopola that ate most of the snails and later on drought set in that further killed the land snail populations. These days sesame yield has gone up in the absence of snails and people are interested to engage in sesame production. This, combined with improved markets, prices and transportation has resulted in an unprecedented rate of deforestation due to sesame cultivation in the village. Potential strategies to prevent the adverse effects of sesame production in the village are to address those factors causing farmers to spatially relocate their farmlands. These factors include avoiding weeds, insects and problem animals. These strategies are further explained in the program of work including sesame varieties proposed and insecticides to be provided to farmers.

#### **I. Kikomolela**

The area in Kikomolela village can be divided into fertile low lands (bondeni) and less fertile uplands (mlimani). Unlike in other villages, hill rice cultivation is the main driver of deforestation and forest degradation in this village. About 95% of rice growers have fields in the hill sides whereas the remaining 5% work in the low lands. Farmlands are shifted every one year searching for fresh areas to increase yield and avoid weeds. Sesame cultivation is the opposite of rice cultivation in Kikomolela. About 95% of sesame farmers work in lowlands whereas the remaining 5% work in the hill sides. Farmers in Kikomolela village prefer young regenerating forests (nyecha) for sesame farms and old-growth forests (kilemeh) for hill-rice farming. Maize farming has an insignificant impact on forest resources in this village whereby about 50% of maize production is located in lowlands (bondeni) and 50% in highlands (mlimani). Therefore, hill rice results in deforestation on the hill sides, more than any other crop. The lower slopes and the valley floor have more fertile black soils and water (soil moisture). The mid to upper slopes have less fertile sandy soils which are generally dry.

While there is an agricultural extension officer in the village, villagers are dissatisfied with his services and claim that he is not qualified for the position. His name is Said Chande Mkingire. Local people argue that since he is not from the area, he does not understand the farming practices in the region since the socio-cultural and agro-ecological conditions between this region and the area where he comes from are very different. They also say that the agricultural extension officer is trained in livestock keeping and not in farming. Dr. Mshana of NARI agrees that generally Kikomolela needs a more suitably qualified extension officer than the one they have at present.

#### **J. Likwaya**

Likwaya is one village where adoption of improved farming practices seems to be very difficult despite several trials by other organizations in the past including Concern and the DALDO office. Villagers prefer using traditional seeds and traditional planting systems since modern farming in

lines and using improved seeds is expensive, time consuming and requires more seeds per hectare. Farmers observed that they cannot afford more seeds and therefore disagree with the extension officer's advice despite the fact the extension officer has practically demonstrated that modern farming systems increase agricultural yield per hectare. For a few who have adopted modern farming practices have obtained up to 800 kg per hectare while traditional farming systems produces a maximum of 300kg per hectare.

We identified one major issue being the lack of confidence among local farmers on the expertise of para-extension officers. These para-extension officers are local people from the same communities who have demonstrated ability and desire to apply modern farming practices. They received training through a training program organized by CONCERN and were distributed among the villages to support their fellow villagers. Local people stated that they would only trust the technical advice if it was given by qualified technician from outside the village. Upon further investigation it was revealed that those received training exhibited some arrogance, lack of proper knowledge and were at times unable to confidently explain the modern farming practices to their colleagues. Participants observed that, in the future there need to be a careful process of selecting these para-extension officers and not just looking at whether they have some knowledge already. Important considerations should include their positions in the society as respectable individuals, ability to learn and ability to communicate clearly and confidently to farmers on the application of improved farming systems.

Moreover farmers in this village prefer selling their crops to the farmers primary cooperative society and not private buyers since the private buyers use cheating scales. Therefore they encourage the cooperative society to include sorghum in its crops apart from sesame, cashewnuts and pigeon peas. Out of the 24 people present in the meeting, only 4 are members with 3 indicating interest and the rest stating that they will never join since the difference is that those who are members pay a membership fees and they don't but both can sell their crops at the same prices. However, they agreed that without joining the cooperative society, they will not be able to influence decisions made.

### Appendix 3: Themes and Questions for Focus Group Discussions

- **FGD with village council members**

General introduction: the facilitator introducing the discussion covering the background, objectives and methods to be used.

Individual Introductions: the team of consultants introducing themselves followed by individual self-introductions of all participants covering names, sub-committee serving, when joined Village Council for the first time and political party affiliation (optional).

Discussion on agriculture

What percentage of villagers engages in farming?

If we put farmers into different wealth/poverty groups, how many groups would you have in this village and what factors/indicators would you use to assign people to these groups?

Facilitating a discussion that will help fill the following table

<i>Crop type</i>	<i>Mixed with</i>	<i>Food crop rank</i>	<i>Cash crop rank</i>	<i>Type of forest/vegetation cleared</i>	<i>Duration before shifting</i>	<i>Reason for shifting</i>

Discussion on shifting cultivation

Is shifting cultivation bad for the forest? Why yes/no? Noting how many participants say yes/no?

How is current shifting cultivation different from shifting cultivation practiced 40 or more years ago?

Why do people relocate their farms?

Is it possible to continue farming on the same land? What is needed to make people continue farming on the same parcel of land?

Facilitate a discussion to fill the following table on an annual crop calendar

Crop Type	Farm activities undertaken in each month (1=Jan, 2=Feb, 3=March, etc)											
	1	2	3	4	5	6	7	8	9	10	11	12

Now we would like to discuss on (a) the distribution of roles in farming, (b) reasons for such distribution of roles and (c) whether the distribution is fair between men and women?

Farm activity	Roles of each household member (father, mother, boys, girls)	Reasons for such distribution	Perception of fairness in roles distribution
General decision making: where to farm? Which crops to form? Etc			
Farm Preparation			
Planting			
Weeding			
Disease control			
Pests control			
Harvesting			
Transportation/carrriage			
Selling			
Financial decision			

making			
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Now we would like to discuss on the various problems/challenges that farmers face in your village that affect farm productivity in general and for specific crops?

<b>Farm activity</b>	<b>Problems/challenges faced</b>	<b>How farmers deal with the problems?</b>	<b>How can the situation be improved?</b>
Farm Preparation			
Planting			
Weeding			
Disease control			
Pests control			
Harvesting			
Transportation/carriage			
Selling			
Financial decision making			

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